AUTHOR   Balzer, A. L.; And Others
TITLE   A Review of Research on Teacher Behavior Relating to
                Science Education.
INSTITUTION   Association for the Education of Teachers in
                Science.; ERIC Information Analysis Center for
                Science, Mathematics, and Environmental Education,
                Columbus, Ohio.
SPONS AGENCY   National Inst. of Education (DHEW), Washington, D.C.f
PUB DATE   Dec 73
NOTE   522p.
AVAILABLE FROM Ohio State University, Center for Science and
                Mathematics Education, 244 Arps Hall, Columbus, Ohio
                43210 ($6.50)

EDRS PRICE   MF-$0.65 HC-$19.74
DESCRIPTORS   *Bibliographies; Classroom Observation Techniques;
                *Educational Research; Instrumentation; Literature
                Reviews; Reference Materials; Research; *Research
                Reviews (Publications); *Science Education; *Teacher
                Behavior

ABSTRACT
        This monograph, published as the first Yearbook of
the Association for the Education of Teachers in Science (AETS),
focuses on three areas of the research literature relating to teacher
behavior. The first section presents a review of studies concerned
with instrument development for the analysis of teacher behavior in
science classrooms. The second section deals with research on
teaching involving the systematic observation of classroom behavior.
Documents published or made available between 1960 and 1971 are
reviewed, with an emphasis on studies dealing with teacher behavior
in science classrooms. The third portion of the monograph examines
teacher behavior studies in fields other than science education.
Common findings emerging from the research reviewed in this section
indicate that teachers dominate classroom talk, and students seldom
initiate verbal interaction. Each section includes a summary
discussion, a set of recommendations that should be valuable in
guiding future research in the area of teacher behavior, and an
extensive bibliography of the studies reviewed. In all, over 1,300
research studies relating to teacher behavior are listed in the
bibliographies. (JR)

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A REVIEW OF RESEARCH ON

TEACHER BEHAVIOR

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PREFACE

AETS Comments

The Board of Directors of the Association for the Education
of Teachers in Science enthusiastically endorsed the idea of a
Yearbook series at their annual meeting in March of 1973. During
the months that have followed, major efforts of a Feasibility and
Production Committee headed by David H. Ost of California State
College, Bakersfield, the AETS Executive Committee, the staff of
ERIC/SMEAC, and the authors of this volume have resulted in this
first AETS Yearbook. AETS in cooperation with ERIC/SMEAC is pleased
that the first Yearbook is a reality with this volume and that plans
have advanced significantly for Yearbooks for 1974 and 1975 as well.

AETS recognizes three of its members, Patricia Blosser, Tom
Evans, and LeVon Balzer, who have been able to complete this signifi-
cant volume so promptly. It is fitting that this first effort con-
centrate upon a review of the past research efforts involving and
affecting teacher education in the sciences. Certainly a review of
the literature regarding instruments for assessing teacher behaviors
will be of value to all members and other professionals as well. A
review of the research in the area of teacher behaviors is a logical
starting point for all discussion and all future planning. And, as
is too often the case, relevant research regarding teacher behaviors
in general should not be overlooked. Something can be learned from
a look at significant research centering upon other content fields.

Future Yearbooks will focus upon topics that seem of particular
relevance during a particular year. Each President and his Executive
Committee will invite members to participate in writing papers re-
lated to the selected topics. Completed papers will be distributed
to an Editorial Review Board. These papers may be used as the basis
for presentations at the annual meeting. Interested members will
discuss a given paper with the author while the presiding officer
acts as a discussion leader. The authors will be central figures in
each discussion. They will be asked to submit a final paper to the
Yearbook Editorial Review Board.

Each fall an AETS - ERIC/SMEAC Yearbook is planned. Such a
Yearbook series should serve the professional community as a means
of identifying current issues in Science Teacher Education, as a
scholarly analysis of such issues, as suggestions and directions
for future research and practice.

Fred W. Fox of Oregon State University has accepted the assign-
ment as editor for the 1974 Yearbook. The Editorial Review Board
for 1974 will be headed by David H. Ost.

O: ce again, the AETS officers and the members congratulate Patricia Blosser, Tom Evans, and LeVon Balzer for making the First Yearbook a reality and a most significant contribution to the profession. Everyone looks forward to future Yearbooks and a new service to members and all teacher educators.

Robert E. Yager, President
Association for the Education
of Teachers in Science

ERIC/SMEAC COMMENTS

The ERIC Information Analysis Center for Science, Mathematics, and Environmental Education (ERIC/SMEAC) is pleased to cooperate with the Association for the Education of Teachers in Science (AETS) to produce this publication. This publication brings together considerable data related to teacher behaviors that were not available in one publication before.

ERIC/SMEAC and AETS are cooperating on a second publication at this time. We invite your comments and suggestions regarding this publication series.

Robert W. Howe
Director, ERIC/SMEAC

Editor's Comments

This document is the result of many hours of work, not only on the part of the three authors but also of other individuals who helped in the typing of the rough drafts as well as the preparation of the final product. Special recognition should be given to Dr. Stanley L. Helgeson who assisted in the editing and proofing of the final product. The document was typed in final form by Mrs. Sue Helgeson whose assistance is also gratefully acknowledged.

Patricia E. Blosser
Editor

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SCIENCE INSTRUCTIONAL BEHAVIOR:

INSTRUMENT DEVELOPMENT AND BASIC DATA TRENDS

By

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INTRODUCTION

The material for section I is based on abstracts, papers, published articles, dissertations, books, and nonpublished reports. These documents were assembled with the aid of an ERIC computer search and through a review of the journals in science education, documents on teacher behavior and interaction analysis, and NARST program abstracts and papers from 1969, 1970, and 1971. Major sources used in addition to the documents identified by computer search were Dissertation Abstracts volumes 1 through 31 (1935 through June 1, 1971); Mirrors for Behavior, volumes 1 through 14, A, B, A Supplement, and B Supplement; Classroom Interaction Newsletter, volumes 1 through 7, issue 1 (1965 - 1971); Journal of Research in Science Teaching, volumes 1 through 8 (1963-1971); Science Education, volumes 44 through 55 (1960-1971). Other sources utilized in the search were The Science Teacher, School Science and Mathematics, The Journal of Educational Research, Science and Children, Review of Educational Research, Journal of Experimental Education, The American Biology Teacher, and BSCS Newsletter. A summary of the numbers, types, and emphases of documents used is given on page 3 of this section.

Section I provides a brief review of instruments developed, the procedures for instrument development, and procedures for encoding used in science classroom behavior and interaction studies. Also presented is a summary of descriptive information, provided by these studies, about science classroom behaviors at the elementary, secondary, and college levels. Specifically, an attempt has been made to provide the following areas of information (insofar as this information was provided in the documents reviewed): (1) Theoretical framework, rationale, or goals underlying instrument development, (2) Method of instrument development, (3) Description of instrument, (4) Encoding procedures, (5) Instrument reliability, (6) Instrument validity, (7) Data from classroom use of instrument.

Due to the number of instruments and studies, it was not possible to reproduce and report entire instruments in original form. Instead, instruments have been summarized in outline form for brevity, preserving original sign, category, and subcategory titles and organization. The reader interested in a detailed study of a given instrument should consult the reference cited.

1

Trends in the data generated by the research are identified, with implications for future research, for future practice in education of science teachers, and for future teacher classroom practice. Specific recommendations summarize these implications. Studies in non-science areas and related specialized fields, such as nurses training and engineering, have not been included in this section.

No attempt is made here to provide a comprehensive review and appraisal of all the research on teacher behaviors and classroom interaction. Even at this level of detail, this would be a task well beyond the scope or intent of this document, and a number of reviews and research status appraisals are already available in the literature (4, 6, 27, 31, 52, 88, 98, 99, 123, 139, 140, 161, 182, and others).

Teacher effectiveness studies also are not reviewed in this section. These studies are reviewed in the section by Evans. Studies which focus on the effectiveness of techniques for changing pupil behavior or measuring levels or changes in pupil abilities are not included here either. Emphasis here is restricted to instrument development and generation of descriptive data concerning science teacher and pupil behavior and interaction.

A survey of the research in science education reveals that numerous recent studies have continued to focus on comparisons of teaching methodologies and their effectiveness. Some studies also have continued research on relationships between teacher characteristics, traits, or personalities and effectiveness. Except where such descriptions arise from an analysis of behaviors, they are not reviewed in this section. Emphasis is placed on methodologies of instrument development and their design.

REVIEW OF CLASSROOM BEHAVIOR STUDIES IN SCIENCE EDUCATION

In the pages that follow approximately ninety studies of classroom behavior and interaction in science are reviewed. For many of these studies, several documents were reviewed and are cited in the bibliography of this monograph. The usual procedure for reviewing a study was to utilize the following sequence of coverage: (1) Theoretical framework, rationale or goals, (2) Method of instrument development, (3) Description, (4) Encoding, (5) Reliability, (6) Validity, (7) Usage data. For some studies, the reviewer was unable to obtain one or more of the above items of information, and they were therefore omitted.

Types of Documents

Documents studied in the course of reviewing the literature for this portion of the monograph could be grouped into six major types: abstracts of doctoral dissertations, papers presented at national and regional meetings, articles published in professional journals, doctoral dissertations, books, and various nonpublished reports. More sources than one were usually utilized by this reviewer in reviewing a given research study. Such documents often complemented each other while obviously referring to the

same basic research study. Many other research documents were also obtained but not cited, often because of duplication with other reports by the same author (already cited). Such documents are listed in a separate section in the bibliography.

Research Emphasis of Documents

TABLE I

RESEARCH EMPHASIS OF DOCUMENTS CITED[a]

Research Emphasis	No. Documents
Instrument Development (Sci. Ed.)	98
Descriptive Data (Sci. Ed.)	74
Teacher Effectiveness (Sci. Ed.)	17
Behavior Change (Sci. Ed.)	40
Correlational (Sci. Ed.)	24
Research Review and Perspectives	21

a   A single document may have more than one research emphasis.

Table I presents the number of documents, according to the major research emphasis. Very few documents included only a single research emphasis. In this section, only the first, second, and last areas of emphasis of Table I (Instrument Development, Descriptive Data, and Research Review and Perspectives) are reviewed in detail. The other areas are reviewed in detail by Evans in Section II of this document.

The studies have been grouped according to the following instrument descriptions and research emphasis: Rating Scales, Indirect Source of Data, Student Behavior, Questioning, Inquiry and Nature of Science, Communications, Cognitive or Structural, Affective, Multidimensional. These groupings are for convenience only, and certainly are not mutually exclusive. For example, the reader may get a good sample of studies with an affective emphasis by reading the "Affective" grouping in this review, but studies in other groupings also include attention to affective behaviors. Similarly, not all of the multidimensional instruments are in that group. Some studies with a major emphasis in one of the other areas have been placed in those areas. There are also a few rating scales grouped with other instruments according to major emphasis.

Rating Scales

Rating Scales differ considerably from most of the other groupings of instruments in that the observer is required to make a judgement regarding how much or how well certain behaviors or types of behaviors are portrayed. Because of this characteristic, no attempt has been made to include all rating scales in this review. Those included have a fairly strong behavioral orientation. The "Indirect" studies utilized a more indirect source of data in that data were obtained by asking pupils or (occasionally) teachers for a description of classroom behaviors. All the other groupings of instruments utilized the observer as the direct source of data, and observations were encoded into the instrument directly or from audio or videotapes. The important procedural distinction here is that in the "Indirect" group, teachers or pupils report their perceptions or recollections of classroom behaviors whereas in the direct procedure, the data are encoded as observed at the time they are happening or from a record.

Some observational instruments are organized in such a manner that two or more different dimensions of behavior are encoded. In some of these instruments, the dimensions may be set up in such a way that behavior of different dimensions are encoded into different categories or groups of categories, while in other cases behaviors may be coded into two or more dimensions (such as cognitive behavior and communication method) simultaneously. Instruments with this characteristic have been grouped here as "Multidimensional."

R. D. Anderson and others (13) developed a verbal and nonverbal observation instrument called the Teaching Strategies Observation Differential (TSOD). The authors specified the "educational objectives and approaches to learning generally encouraged through the modern curriculum projects" as the frame of reference for the development of the instrument (13:2).

The TSOD was developed to provide a rating of the teacher's style along a continuum with the extremes of expository-direct and inductive-indirect. At the expository extreme the teacher is the interpreter, explainer, and describer. At the inductive extreme, the teacher places the student in direct contact with the environment without the teacher's interpretation. The TSOD was developed in three versions. In all three versions a rating of teaching style is given for each one minute time interval.

The "alpha" version of the TSOD provides for the encoding of a sequence of events in three major groupings and a rating of teaching style on a 9 point scale, inferred from the events encoded. The groups of events are (I) Instructional, (II) Managerial, (III) Other. The Instructional items are (1) Manipulates Environment, (2) Asks questions, (3) Listens to Student, (4) Responds to Student Questions, (5) Makes Statements of Fact, (6) States Opinion. Managerial items are (A) Rapport Maintenance (positive, negative, or neutral) and (B) Procedural Actions (verbal or nonverbal). Other items are (1) Uninterpretable, (2) Missing Data, (3) Silence. Hoyt inter-judge rating reliability was $r = .79$ for independently rated video tapes.

The "beta" version omits the provision for encoding a sequence of events. Instead a set of illustrative descriptor behaviors are given.

These are *illustrative and serve only as a guide to the rating scale*. The behaviors presented do not necessarily describe actual behaviors occurring at each point on the rating scale. Illustrative behaviors are given in the following areas: (I) Direct verbal (1-3 on the scale), (II) Direct Non-verbal (4 on the scale), (III) Indirect Verbal (5, 6 on the scale), (IV) Indirect Nonverbal (7, 8 on the scale), (V) Not specifically Related to Science Instruction (9 on the scale). The Hoyt inter-rater average reliability for seven pairs of raters was .94.

The "gamma" version is an adaptation to other subject areas and also allows the focus of observation be shifted from the teacher to selected students. The categories are (I) Non-educational Activities, (II) Direct Verbal, (III) Direct Nonverbal, (IV) Indirect Verbal, (V) Indirect Nonverbal. Here, the categories are defined and the examples are given in terms of the behaviors of both teachers and students. Hoyt inter-rater reliability was reported as .88.

Studies by Struthers (173), Anderson and Horn (12) and James (73) have utilized the TSOD and are reviewed by Evans in a later section of this report.

Ashley (14) studied the impact of an inservice education program on teacher behavior. The inservice program was designed to enhance teacher behavior in the use of Science - A Process Approach. Ashley hoped to: (1) Identify strategies of teaching which were an integral part of a curriculum sequence emphasizing cognitive behavioral outcomes, (2) Design a Classroom Observation Rating Form (CORF) to sample these strategies, (3) Evaluate the impact of an inservice program on use of these strategies, (4) Analyze teacher attitudes and their relationship to teacher behaviors, (5) Analyze the relationship between years of experience and grade level assignment and teacher behavior.

The CORF is comprised of four categories of strategies as follows: (1) Teacher-Student Interaction and Student Behavior (student orientation vs. teacher directed), (2) Teacher Responses and Actions (degree of teacher pattern of sensitivity to student experiences, abilities, interests, and thorough planning), (3) Specific and Personal Teacher Traits (pertaining to whether teacher is positive in approach to discipline, self-control, enthusiasm, and knowledge), (4) Physical Aspects of the Classroom Environment (attractiveness and student-centeredness of learning environment).

The strategies of categories 1 and 2 were gathered from teachers who had experience in teaching Science - A Process Approach. These strategies were considered by the teachers to be effective and in keeping with the program's rationale. The strategies of category 3 pertain to teacher characteristics and classroom environment and were derived from the work of Ryans. Category 4 was included to provide information on nonverbal aspects of the classroom. Further theoretical framework for instrument development was not provided in the document reviewed (14).

Strategies are stated in a bipolar manner, with Behavior A being the more consonant with the rationale of the Curriculum (Science - A Process Approach) and Behavior B constituting the negative counterpart. Scoring

is accomplished by comparing algebraically the total number of strategies observed in each behavior group. The CORF scores which result are measures of the use of the various behavior types.

Three trained observers conducted the observations of the 23 teachers. Reliability of the information was determined by computing intraclass correlations for the four category scores and one total score on each CORF completed by two observers. The averaged intercorrelation reliabilities were reported to be .95 for Category 1, .96 for Category 2, .95 for Category 3, .90 for Category 4, and .97 for the Total Score. Pooled rating reliabilities were reported to be .97, .98, .97, .95, and .99 respectively.

The use of the CORF in the inservice program and the associated data regarding behavior changes are reported by Evans elsewhere in this document.

Esler (47) described preliminary findings of a study in progress which is designed to ascertain differences between old and new curricula. Four teachers were involved, of which two were CHEM Study teachers and two were described as participating in "intermediate" and comparatively "traditional" programs. To categorize classroom activity, Esler devised a classification scale based upon the extremes of the discovery approach and the didactic approach. These approaches were operationally defined in terms of types of behaviors of the learner and the teacher. Topics of classroom activity (of which twenty to twenty-five were found in a forty-two minute class) were assigned a total of five points to be distributed in some way between the two approaches. For each topic, activities were apparently described in behavioral terms along with the distribution of points. The points were then converted to percentages for individual teachers and groups of teachers.

Esler reported that the average percentage of discovery of all the CHEM Study classes observed was about 54 percent and about 8 percent for the non-CHEM Study classes. Reliability and validity data and procedures were not discussed in the report.

Steinbach (170) reported the development of the Teacher Performance Competency Scale (TPCS). He indicated that the need for such an instrument resides in the fact that interaction analysis instruments such as that of Flanders measure only the quantity of various kinds of interaction, but not the quality.

The TPCS is a 61-point scale with bipolar representations which provide a measure of teacher performance competence. The major items of the TPCS and the polar positions on the scale of each item are as follows: (1) Maintaining Teacher-Pupil Interaction (pupil or teacher dominated --- mutual participation), (2) Developing Teacher-Pupil Rapport (pupil or teacher bored or antagonistic --- teacher and pupil enthusiastic), (3) Pacing the Lesson (emphasis on lesson --- lesson geared to pupil need), (4) Presenting the Lesson with Clarity (general confusion --- clear presentation), (5) Using Plans (disorganized presentation --- presentation appeared logical), (6) Using Behavioral Objectives (no obvious objectives --- achieved objectives of lesson).

The position of the mark on the scale is measured from the left so that larger values indicate greater competence in each skill. A cumulative score is not determined.

Reliability of the TPCS was determined by having two experienced teachers analyze a series of videotaped lessons, rating them individually. These were later viewed together by the observers, discussed, and subjected to a composite rating without reference to the previous rating. Separate ratings were then analyzed in relation to the composite ratings. Steinbach reported that a Pearson product moment correlation for each item was listed, but these data were not reported in the document reviewed (170).

Indirect Instruments

Gary J. Anderson (7) reported the development of the Learning Environment Inventory (LEI). This instrument is reported as an expansion and improvement of The Classroom Climate Questionnaire devised by Herbert Walberg who has also been extensively involved in research involving the LEI.

The LEI is designed to provide a measure of the social climate of a class as perceived by the pupils in it. Anderson reports that the 15 climate dimensions included were selected on the basis of concepts previously identified as good predictors of learning, concepts of relevance to social psychological theory and research, concepts similar to useful theory and research in education, or concepts intuitively considered relevant to the social psychology of the classroom.

The fifteen climate dimensions of the instrument are as follows: (1) Cohesiveness, (2) Diversity, (3) Formality, (4) Speed, (5) Environment, (6) Friction, (7) Goal Direction, (8) Favoritism, (9) Cliqueness, (10) Satisfaction, (11) Disorganization, (12) Difficulty, (13) Apathy, (14) Democratic, (15) Competitiveness. Justifications for the inclusion of each scale are included in the report.

Each of the 15 LEI scales includes seven items, since six or seven items were found to be necessary for internally consistent ratings. Items were prepared and refined through the use of judges. The LEI contains 105 statements. Students express agreement or disagreement on a four-point scale. A measure (alpha reliability) is given for each scale of the extent to which an individual respondent responds similarly for each item on the scale. A measure of intraclass correlation is also given for each scale and indicates the extent to which pupils in the same class respond similarly and the extent to which the scale discriminates among classes. Scale means and standard deviations based on more than 1000 individual subjects are included in the report.

The LEI has been used in numerous research studies by Walberg, Anderson, and others in relation to Harvard Project Physics using classroom climate as the dependent variable and investigating relationships with various independent variables. These studies are reviewed by Evans in Part II.

Anderson (7) also reported development by Walberg and Anderson of several instruments for use with elementary children. The My Class Inventory is designed for use with 8-12 year olds and includes items in the scales: (1) Satisfaction, (2) Friction, (3) Competitiveness, (4) Difficulty, (5) Cohesiveness. This instrument and another for use with six to eight year olds were still in developmental stages when the report was written.

Barnes (23) developed a student checklist (called the Biology Laboratory Activity Checklist or BLAC) to determine the nature and extent of laboratory practices in high school biology. The rationale and objectives of the BSCS (Biological Sciences Curriculum Study) materials were used as a basis of the instrument. The list of laboratory activities was constructed in such a way that some items were included which were recommended by BSCS and judged to contribute positively to BSCS objectives as well as other items that were discouraged by BSCS or judged as practices contrary to BSCS objectives.

Sixty items were prepared (30 BSCS positive and 30 BSCS negative) and grouped into four categories as follows: (1) Pre-laboratory Activities, (2) Laboratory Activities, (3) Post-laboratory Activities, (4) General Reaction to the Laboratory. These items were submitted to a panel of judges familiar with BSCS laboratory activities and rationale. The judges rated each item as contributing positively, negatively, or as having no value, and the BLAC was revised accordingly. The validity of the instrument was based on the fact that each item had been based on statements by individuals who participated in BSCS development and that each item was verified by a panel of judges familiar with BSCS.

Reliability of the BLAC was established through a pilot study of 10 biology classes. A t-test comparing BLAC data was computed for two classes of each of five teachers. The t-test was not significant at the .05 level of confidence in any of the five instances.

Barnes also used the BLAC to study the nature and extent of laboratory instruction in high school biology classes using different curriculum materials (24). Three groups of classes were studied with regard to the conformity of laboratory activities to those recommended by BSCS. The groups consisted of classes of teachers who had used BSCS for five years, those using BSCS materials for the first time, and classes using non-BSCS materials. The major objective of this aspect of the study was to detect types of laboratory practices in a variety of classes and to determine their correspondence to practices recommended by BSCS.

Barnes found a significant difference among the three experimental groups in degree of conformity of laboratory practices to those laboratory practices recommended by BSCS. The experienced BSCS group had a mean BLAC score of 39.25, the inexperienced group had a mean of 33.46, and the non-BSCS group, 28.87. A score of 60 would indicate highest conformity with BSCS.

He reported also (25) a significant relationship between the degree to which laboratory activities conform to those recommended by BSCS and the laboratory facilities available. A significant relationship between the degree to which laboratory activities conform to laboratory activities recommended by BSCS and the degree to which there is teacher acceptance of BSCS objectives was also identified.

Kochendorfer (85) developed a student checklist (called the Biology Classroom Activity Checklist or BCAC) to determine classroom teaching practices in high school biology. The BCAC was designed for the purpose

of determining the extent to which classroom practices conformed to the practices recommended in BSCS literature, and as practices contributing toward attainment of BSCS objectives. The items of the checklist were constructed in such a way that some items were included which were recommended by BSCS and judged to contribute positively to BSCS objectives while other items were discouraged by BSCS or judged as practices contrary to BSCS objectives.

Fifty-three items based on statements of BSCS rationale (26 BSCS positive and 27 BSCS negative) were formulated in terms of student viewpoint and grouped into the following seven sections: (A) Role of the Teacher in the Classroom, (B) Student Classroom Participation, (C) Use of Textbook and Reference Materials, (D) Design and Use of Tests, (E) Laboratory Preparation, (F) Type of Laboratory Activities, (G) Laboratory Follow-up Activities. These items were submitted to five judges who were selected for their knowledge of BSCS philosophy. Ratings and comments of the judges were considered in rewriting the BCAC. The reliability of judgmental ratings was computed using Guilford's method. Intraclass correlation among judges was .84 and correlations between individual judges and the authors of the instrument ranged from .88 to .95.

Students respond to BCAC statements as either "true" or false". Scores are computed as percentages of correct responses. Scores thus have a potential range of 0 to 100, with higher scores indicating greater agreement with BSCS.

The reliability measure of the BCAC was based on the assumption that all variance in the intraclass scores represented error variance and that interclass variance expressed true variance. The reliability coefficient using the Horst formula was .96.

Kochendorfer defended the validity of the BCAC by referring to the .84 correlation among judgmental ratings of instrument items and the .84 correlation coefficient between class mean scores of the laboratory portion and the classroom portion of the BCAC.

Kochendorfer also used the BCAC to study the classroom practices of high school biology teachers (86). The mean BCAC scores (based on a maximum of 100) of classes of three groups of teachers were as follows: teachers with a mean of five years experience teaching BSCS, 65.70; teachers using BSCS for the first time, 57.34; teachers using curriculum materials other than BSCS, 50.04.

Kochendorfer pointed out that the groups were deliberately selected to provide populations expected to provide a variety of teaching approaches and methods. Statistically significant differences were reported in the classroom practices of the three groups of teachers, and a significant relationship was reported between the nature of classroom practices and gains on the Processes of Science Test by pupils. A significant correlation was also reported between the teacher's attitude concerning BSCS philosophy and rationale and the degree to which his classroom practices agreed with those advocated by BSCS.

Kochendorfer plotted the BCAC scores for each of the three groups of teachers against the seven sections of the BCAC (87). The greatest spread of scores among the three groups occurred in Sections B, C, and D (Student Participation in the Classroom, Use of Textbook and Reference Materials and Design and Use of Tests, respectively).

Bartos (26) used the BCAC as part of a model for evaluating stated goals of biological science as presented in BSCS and non-BSCS approaches. Twelve BSCS classes and 10 non-BSCS classes were studied. The student raw mean scores were as follows: BSCS, 31.1; non-BSCS, 24.6. The difference was significant at the acceptable level of confidence.

Bartos also reported collecting classroom and inquiry analysis data. Not including management (and perhaps some other categories), he found teacher output to be 76.76 percent and student output at 23.24 percent. Although the six teachers resembled the "typical" teacher in this regard, Bartos reported that BSCS teacher questions were more in the form of problems and the non-BSCS teacher questions were short, factual, and direct.

Jackson (72) prepared a modification of the Kochendorfer BCAC for use in an assessment of an inservice program in earth science designed to produce changes in teacher behavior and pupil achievement. In this study the modified BCAC is referred to by three titles (PK, TK_1, TK_2) depending on the usage of the instrument. The instrument was completed by the students (PK), by the teacher indicating how he thought he was teaching (TK_1), and by the teacher indicating how he thought he could have been teaching if he could have controlled such features as class size and purchased materials to make class situations more favorable to his style of teaching (TK_2).

The earth science adaptation of the BCAC gave a mean coefficient for the reliability of the test averaging .62 by the Kuder-Richardson Formula 20. The instrument is composed of the same seven main sections as the Kochendorfer BCAC. The BCAC has a total of 53 items; the PK - TK_1 - TK_2 instrument, 64. Most items of the two instruments are similar though the latter instrument contains 11 additional items.

The eleven additional items present in the PK - TK_1 - TK_2 instrument and their numbers are as follows: (9) My teacher gives the answers to all our science questions, (10) My teacher takes some time in class to ask questions that are not answered by the textbook, (19) The teacher always tells us what should have happened when a demonstration doesn't work, (26) We have reading assignments in the textbook about every day, (27) The teacher provides us with information about our local surroundings that isn't in the textbook, (35) Many of the activities in lab help me get correct answers on tests, (36) If I learn everything in the textbook and teacher handout materials I can answer all the science test questions, (45) My teacher encourages me to do laboratory work that helps me find answers to my own questions, (62) We are given time to evaluate our own laboratory work, (63) We are encouraged by the teacher to find ways to do experiments that we think would work best, (64) The teacher often stops our lab work and tells us the answers before we are finished because we run out of time.

As mentioned, the major study in which this instrument was used by Jackson was a behavior change study, hence it is reviewed by Evans elsewhere in this document.

Sagness (145) reported a study of outcomes of a science preservice teacher education project. The study included use of an instrument to determine the nature of classroom activities which teachers feel should be used in secondary science classrooms, and also an instrument to determine the activities which teachers do use. The BCAC by Kochendorfer (85) was modified for this purpose and renamed the Science Classroom Activities Checklist: Student Perceptions (SCACL:SP). Revision of the BCAC included a rewriting of statements to make them applicable regardless of the science discipline. The seven sections of the instrument developed by Kochendorfer were used, but some statements were added as needed to improve validity and reliability. The resulting instrument has 60 items, compared to 53 in the BCAC of Kochendorfer.

The added items of the SCACL:SP and their numbers are as follows: (13) My teacher often asks us to explain the meaning of statements, diagrams, graphs, etc., (17) The teacher tries to be certain that we understand the general objectives (purposes) of a lesson before we begin work on the lesson, (23) We often read in sources of science information (books, magazines, etc.) other than our textbook, (25) Our teacher does not like us to question information contained in our textbook, (32) We are often tested on our ability to perform skills; such as make observations, the interpretation of data, etc. which we have learned in our laboratory activities, (33) Our tests generally do not contain problems which require the use of mathematics in their solution, (34) Sometimes we are given problems for which we must think up and state ways of looking for solutions, (35) Occasionally we are given information on completed research and asked to evaluate the procedures used by the researcher for looking for solutions to the problem, (36) We seldom have the opportunity to discuss in class the questions that are asked on our tests, (53) Our laboratory often consists of thoroughly learning the names of specific structures and specific sequences of events, (60) We students spend time in the interpretation of graphs and tables of the data that we collect. Four items of the Kochendorfer instrument were deleted in the SCACL:SP.

Since Sagness also desired to determine the nature of classroom activities which teachers felt should be used, two additional dimensions for the instrument were developed. One of these assesses the nature of activities teachers feel should be used, and the other assesses the activities the teachers feel they do use. These dimensions constitute another checklist, called the Science Classroom Activity Checklist: Teacher's Perceptions (SCACL:TP). The form of the SCACL:TP used in the study pertained only to activities the teachers felt should take place. It was composed of 60 items very similar to the items of the SCACL:SP.

Validity of the instrument was established in that the four science education faculty members who were asked to respond to it and the developer reached 100 percent agreement concerning practices which contributed positively to contemporary science education objectives. Item analysis information was gained in a quasi-pilot study that involved assessing changes in

teacher views and behaviors in an in-service program. A test-retest procedure and teacher feedback were also used for assessing reliability and validity. Test-retest Pearson product moment reliabilities for revised SCACL forms ranged from .743 to .841. Kuder-Richardson 20 and 21 reliabilities on the same forms ranged from .704 to .841.

The study in which these instruments were used was a correlational study of behavior change. These aspects are reviewed by Evans.

Brown (32) used the SCACL:SP and SCACL:TP in a study of selected outcomes of two preservice teacher education programs in secondary school science education. An additional instrument, called the Checklist for Assessment of Science Teachers (CAST) was developed in two forms and used. The CAST was designed to assess characteristics of science teachers as follows: (1) student-teacher relations, (2) classroom activities, (3) teacher's personal adjustment. The form completed by pupils (CAST:PP) assessed only the first two areas; the form completed by supervisors (CAST:SP) assessed all three. The CAST is more accurately described as a supervisory rating form and attitude inventory than a behavioral instrument and will not be reviewed in detail here. Reliability, validity, and readability procedures and results were given by Brown. The major portion of this study concerns a comparison of outcomes of two teacher education programs, and is reviewed elsewhere in this document.

Korth, Czelen, and Moser (90) reported a study of the relationship between measures of teacher-pupil verbal interaction and student assessment of classroom practices. Measures of teacher-pupil verbal interaction were obtained through use of a modified form of Parakh's System of Interaction Analysis. The degree of modification of this instrument and reliability procedures and data were not presented in the document reviewed. The predominant activity was coded every four seconds for approximately twenty to thirty minutes of each taped classroom session.

Measures of student assessment of classroom practices were obtained through use of a modified form of the Kochendorfer Biology Classroom Activity Checklist, called the Science Classroom Activities Checklist (SCAC) as modified. This instrument contains 55 true-false questions organized into seven sections as in the Kochendorfer instrument.

Ten junior high school teachers were drawn at random from a population of 42 teachers. Classroom periods were also selected utilizing a random numbers table. A single class session was tape-recorded for each teacher (for subsequent analysis using the Parakh Modified Interaction Analysis System) and the Science Classroom Activities Checklist was administered the following day.

Numerous data are given in the report, of which only a portion can be mentioned here. Interaction analysis data indicated that a mean of 80.3 percent of all verbal communication was teacher talk. This was composed of 61.2 percent teacher statements and 19.1 percent teacher questions. By contrast, pupil responses to teacher questions took 15.9 percent of the time and pupil-initiated communication (self-initiated statements and questions) 3.7 percent. The amount of teacher talk varied from 64.6 percent

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to 97.3 percent. The average score on the SCAC was 27.6 out of a possible 55 points.

The Pearson-product moment correlation was used to establish relationships between sections of the Science Classroom Activity Checklist, based on the student data, and between each section and the mean of all sections. The correlations between sections A-G and the mean ranged from .64 to .90, except for Section D (Design and Use of Tests) with a mean of .27.

The Spearman Rank Correlation Coefficient was used to determine relationships between scores obtained by the two instruments. The correlation between percent of teacher talk and average total score on the SCAC was -.79. The correlation between average total score on the SCAC and various diagrams of the interaction analysis system by percentage were as follows: -.89 with Teacher Statement, .90 with Teacher Questions, .62 with Pupil Volunteered Response to Teacher Question, .34 with Pupil Self-Initiated Statement, .89 with Pupil Required Response to Teacher Question, .37 with Pupil Question. Thus there was a positive correlation of SCAC scores with percent of time on teacher statements, and no significant relationship with pupil self-initiated statements and pupil question, though these last events made up less than 4 percent of the total verbal score.

The verbal interaction data were also expressed in terms of The Six Set System of Moser and Feldgoise. Based on this system, the mean percentages of time spent in the three output modes were: Lecture 64.9 percent, Lecture-Discussion 33.7 percent, Inquiry 1.2 percent.

Pempek (125) has designed several instruments to be used in a study of the effectiveness of a teacher training project. One of the classroom behavior instruments used in the study was an indirect one, relying on the responses of students for a description of teacher behavior. The checklist (called the Student Activity Check List or SACL) is comprised of 30 statements which describe things occurring in the science classes. Students are asked to respond by marking: (A) Always, (B) Almost Always, (C) Sometimes, (D) Rarely, (E) Never. In the study, the instrument was administered to fourth, fifth, and sixth grade students.

Pempek compiled a list of desired teaching objectives of the AAAS - SAPA (Science - A Process Approach), ESS (Elementary Science Study), and SCIS (Science Curriculum Improvement Study) and then constructed the checklist accordingly. The checklist was administered to a fifth grade class and revised on the basis of suggestions made by the teacher. It was then administered to 300 students in nine classes and items which reliably rated the teachers and discriminated among teachers were selected as the tentative form of the instrument. This form of the SACL was sent to a jury of elementary science professionals to ascertain validity based on jury responses as to whether or not the instrument could be used to ascertain classroom behavior of teachers. Further details of the procedures for determination of validity, discrimination, and reliability were not provided in the instrument design section of the study reviewed.

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The other teacher behavior instrument designed as part of this study is the Teacher Observation Schedule. This is a direct observation instrument and is reviewed in the "Inquiry" section of this paper.

Schmedemann (148) developed the Teaching Strategy Inventory for Teachers (TSI) as part of a study of the influences of curriculum differences and selected teaching strategies on the cognitive preferences of elementary school science students. The TSI is a forced-choice inventory of 20 items to be completed by teachers and through which teachers reveal their use of certain teaching procedures.

Three groups of teachers and their sixth grade students were utilized in the study. The experimental group used ESS materials in their classrooms and had participated in summer workshops concerning use of the materials and understanding of the underlying philosophy.

No meaningful differences among groups of students were found, based on student completion of the Cognitive Preference Measure developed by the investigator.

Items of the TSI to be used in the analysis of data were determined by a Guttmann Scalogram Analysis, which was conducted after the teachers involved in the study had completed the inventories. Six of the items were found to be scalable, and the reproducibility of the six item scale was 0.86. The scale of six items was administered to the classroom teachers and to nine graduate students in science education. The responses of the graduate students were compared with those of the three groups of teachers involved in the study and tested for significant differences by the chi-square method. No statistically significant differences were found. Schmedemann indicated that the reproducibility of the TSI may not be high enough for use in relation to measurement of cognitive preference.

Student Behavior Instruments

Abruscato (3) developed an observational system to assess the classroom behavior of junior high school science students. The instrument, called the Student Communication Analysis (or SCAN) system, was developed inductively from videotapes taken in various junior high school science classrooms. A Master List of Student Behaviors was developed from these videotapes and was utilized as a framework within which the students' role in classroom communication was studied. No restrictions were placed on the nature of classroom activities. Two major sections of behaviors were thus developed as follows: (1) Communicative (Symbolic), (2) Non-communicative (Non-Symbolic). Communicative behaviors were found to be either Initiating or Responding, and Non-communicative behavior were Active or Passive. Both Initiating and Responding were categorized as instruction related or not instruction related. The above groupings were referred to as Major Sections and Major Subsections of the SCAN. Within the Communicative section, categories were developed on the basis of whether behaviors were verbal or non-verbal, and these categories had numerous subcategories. Numerous categories of Non-communicative Active behaviors were also developed as follows: play behavior, non-class related reading, non-class related writing, doodling, wandering gaze, glance, look, adjusting

apparel, grooming, and other. Non-communicative Passive categories developed were:head on desk, eyes closed, fixed vacant stare, and other.

Data were gathered by a point time sampling technique, since it was desired that student behaviors of this study and teacher behaviors (of a companion study) be observed at the same point in time. The behavior of each of six students was sampled every five seconds. Encoding of behaviors from the videotapes was then repeated for each student to be studied.

Inter-observer agreement was determined through use of the Scott formula for inter-coder agreement. The investigator trained an individual (11 = .88) and also a group of four (11 = .79 - .82) in the use of the SCAN. Observer stability (again using the Scott formula) figures were as follows: the investigator, .96; the individual trainee, .91; the group trainee #2, .89.

Two exploratory studies were carried out using the SCAN. The first subproblem was an investigation of the existence of possible relationships between student behaviors and teacher behaviors. The second subproblem involved a percentage description of student behaviors.

The study of the first subproblem utilized the Spearman Rank Order Correlation Test. Abruscato found that student behavior variables and teacher behavior variables were generally related. For example, only three of the thirty-nine student behavior variables were found not to show a significant positive or negative correlation with teacher behavior variables. (at the .10 level of confidence).

The descriptive study (second subproblem) was based on eight lecture-discussion class sessions. Data in major sections and subsections were as follows:

    Instruction Related Initiating, 1%;
    Non-Instruction Related Initiating, 2.7%;
    Total for Initiating Behavior, 3.7%;
    Instruction Related Responding, 75.2%;
    Non-Instruction Related Responding, 2.6%;
    Total for Responding Behavior, 77.8%;
    Total Communication Behavior, 81.4%;
    Total Active Non-Communicative, 12.8%;
    Total Passive Non-Communicative, 3.9%;
    Total Non-Communicative Behavior, 16.6%;
    Behaviors not coded (approx.), 2%.

Three laboratory sessions were also studied. Abruscato found 96 percent of all observed behavior to be involved in the communication process. Sixty percent of all observations were classified as "doing a task," and only .2 percent were non-communicative behaviors.

Aylesworth (15) reported using the "Inventory of Problem Solving Practices" by Obourn (115) in a comparison of expressed attitudes toward problem solving of science teachers with their classroom methodology. From this inventory, Aylesworth developed a checklist, converting teacher-oriented phraseology to questions about student activities within the

problem solving procedure. Theoretical framework and method of instrument development were not detailed by Aylesworth in the document reviewed.

The questions of the checklist are grouped according to the following headings: A. Sensing and Defining Problems, B. Correcting Evidence on Problems, C. Organizing Evidence on Problems, D. Interpreting Evidence on Problems, E. Selecting and Testing Hypotheses, F. Formulating Conclusions. Reliability and validity were not discussed in the document reviewed.

Twenty observations were scheduled, including twelve biology classes, four chemistry classes, and four physics classes. A tape recorder was used for word-for-word transcriptions along with appropriate notations of nonverbal behavior. Aylesworth also pointed out that the checklist was taken into the classrooms by the observer, and a tally was made when behaviors on the list were observed. Some items on the list were unobservable, and teachers were asked to estimate occurrence of these behaviors.

Aylesworth reported that observational evidence indicated that the most frequent problem solving procedure directly taught was the area of sensing and defining problems, which was seen on 63 percent of the classroom visits. The percentage of visits in which other areas were observed is as follows: Correcting Evidence on Problems, 40 percent; Organizing Evidence on Problems, 38 percent; Interpreting Evidence on Problems, 48 percent; Selecting and Testing Hypotheses, 34 percent; Formulating Conclusions, 31 percent.

Dyasi (41) investigated student affective behaviors associated with the learning of science. Twenty gifted students were observed in classroom and laboratory situations. Affective behaviors were studied in the following major aspects of science learning: (1) students designing experiments, (2) collection of experimental data, (3) analysis of collected data. The situations and associated behaviors under each of the above aspects which were recorded were as follows: stress, absence of reward, review of content, change or topic.

Data were collected by direct observation, interview, and written instrument. Observational data were obtained on four students at a time and summarized in anecdotal form.

Dyasi reported that student behaviors indicated involvement in terms of expenditure of energy, expression of excitement, persistence in carrying out activities, and good working habits. He found also that students who showed involvement in experimental design generally also did so in laboratory investigations and discussions of implications of data. He noted that the level of activity of the majority of students was not influenced by the teacher's words of praise. Under situations of stress, students exerted themselves and rarely sought the help of the teacher. Dyasi reported that an attempt to arrange the observed behaviors in a hierarchical scheme was not successful. A conceptualizing scheme based on a time-behavior pattern was suggested.

Eggan (45) developed an instrument for the description of student non-verbal (kinesic) behavior. The initial phase of instrument development involved obtaining videotapes of students (8th, 9th, 10th grade) in normal lecture-discussion science classroom situations. The videotapes were studied and the nonverbal behaviors of students were noted in handwritten descriptions. These descriptions taken together with reported results from the professional literature were organized into a catalog of behavioral cues. The instrument was thus a result of a combination of inductive and deductive methodology having the features of comprehensiveness and a strong conceptual framework. The inductive technique was considered to be particularly important in avoiding prior decision-making regarding what the relevant study factors were.

There are thirteen categories of behavior in the observation instrument. They are as follows: 1) Forward Lean, 2) Sideways Lean, 3) Body Orientation, 4) Head Orientation (a) (Horizontal Head Swivel), 5) Head Orientation (b) (Vertical Head Orientation), 6) Head Orientation (c) (Head Tilt), 7) Gaze Direction, 8) Head Movement, 9) Facial Expression, 10) Gestures, 11) Manipulation, 12) Arm Symmetry, 13) Interactions. Cues, Criteria, and explanations for coding are included in the instrument.

Since behaviors measured by this instrument are actually signs in most cases, definitions are quite precise, and observer inference is minimized, thus contributing to the validity of the instrument. Additional evidence was given supporting validity in that behaviors were recorded in an environment familiar to the subjects and inferences of motives or effects of behaviors were not required. Reliability was estimated by obtaining measures of interobserver agreement between the researcher and another researcher with similar research experience using the Scott's formula. Coefficients of interobserver agreement ranged from .61 for Category 3 (Body Orientation) to .99 for Category 2 (Sideways Lean). Coefficients for all categories except number 3 were .78 or higher. Eggan pointed out that most disagreements were due to errors of timing rather than disagreements of classification as such.

Encoding was based on the five second interval. The videotape was played once for encoding into a particular category with symbols being encoded which represented a particular cue. Each tape was thus played once for each category of the observation system. The data were recorded and tallied on data sheets and kept as a master record of all the behavior. Data were tallied both as duration and frequency measures.

The second part of the study was an investigation of the relationship between measured nonverbal behaviors exhibited by students and their attitudes toward their teachers. This aspect of this study is thus reviewed elsewhere in this document.

Felen (49) investigated problem-solving processes of students in grades one through twelve. An information theoretic model was developed and used in the investigation in which students were expected to physically manipulate an electric circuit problem. Their connections were recorded in sequence on 8 x 8 matrices (based on various components of the problem) which were grouped according to "successful" and "unsuccessful" for each

grade level. The matrices were treated as Markovian chains, and information theoretic concepts and statistical tests were applied.

The chi square test was used to determine significant differences in relative uncertainties of the first and second wire clip connections for successful and unsuccessful students at each grade level. There was a significant difference between the groups at grades 1, 2, 5, 7, 8, 9, 10, and 12. There were also significant differences when the values of relative uncertainties of the two groups of students in grades one through twelve were examined. Successful students were found to display lower relative uncertainties for the second wire clip connection, lower equivocation measures, higher amounts of transinformation, and lower numbers of various pole connection patterns than unsuccessful students. Felen further reported that it was possible to focus on certain transition periods indicative of a formal operations level characteristic, these appearing in grades four and ten through twelve.

Ferrence (50) developed the <u>Laboratory Interaction Analysis Instrument</u> for quantifying and qualifying student verbal interaction in the laboratory. Attention was focused on students working in small groups in biology laboratories. The initial form of the instrument was designed with 18 categories. The instrument was redesigned and refined through the use of 24 trial tapes. A final category system of 12 categories resulted from these revisions.

The categories of the instrument are as follows: (1) Questions-Terminology, (2) Questions-Procedure, (3) Questions-Observation, (4) Discussion-Terminology, (5) Discussion-Procedure, (6) Discussion-Observation, (7) Reading, (8) Assignment of Tasks, (9) Negative Answers, (10) Irrelevant Discussion, (11) Teacher Talk, (12) Silence. Three-second time intervals were used in the encoding process.

Reliability measurements for the instrument were accomplished by training (in nine 40-minute sessions) 12 teams of observers and having each team analyze a 30 minute segment of biology student discourse. Each of the 12 tapes was also analyzed by the researcher. The criterion for success in in the reliability portion of the study was a Scott coefficient (as modified by Flanders) of 0.75. Scott coefficients were calculated for all possible pairs of analyses that had been made of each tape, and the investigator also did a second analysis of each tape one month after his first analysis. Three student-observers were dropped from the study.

Scott coefficients were calculated to measure inter-observer agreement between student-observers and the investigator. Of the 44 pairs of student observers, six pairs attained inter-observer agreement with the investigator of 0.75 or above. The other 38 pairs achieved a Scott's coefficient of 0.74 or below. Scott's coefficients were also calculated for determining inter-observer agreement between the analysis of the student-observers who analyzed each tape. In this case, 25 student-observer pairs of a total of 62 student-observer pairs achieved Scott's coefficients of 0.75 or better. Reliability coefficients between the two analyses of the tapes by the investigator were all above 0.75, with 5 of the 12 analyses yielding results above 0.90 and 11 of the 12 above 0.80.

The validity of the instrument was established on the basis of relationships between student verbal behavior as determined by the instrument, and task orientation as determined by total scores assigned by a panel of judges to student laboratory group reports. Agreement among the judges was determined by use of the Kendall's coefficient of concordance.

Verbal discourse of 75 small groups was recorded on magnetic tape, which in turn was analyzed, by use of the instrument, by the investigator. Written group reports were evaluated by five experienced biology teachers, the total scores being considered a measure of task orientation for that particular student group. A Spearman rho was used to determine correlations between task orientation and percentages of interaction classified under each category of the instrument, and also between task orientation on day one and day two.

Ferrence reported reliable use of the instrument by trained observers and reliable evaluation of group reports by the teachers. He found significant positive correlations between task orientation and Teacher Talk, Questions-Procedure, and Discussion-Procedure. Other significant positive correlations were between Discussion-Observation, Reading, Assignment of Tasks, Irrelevant Discussion, Teacher Talk, and Silence on day one and the same categories on day two. A significant negative correlation was found between task orientation and Irrelevant Discussion. No significant correlation was found between task orientation on day one and task orientation on day two.

Spangenberg (166) used the Laboratory Interaction Analysis Instrument developed by Ferrence (50) in a study of verbal interaction of college students at work in a zoology laboratory. The categories of this instrument are given in the review of the work of Ferrence (above). Reliability estimates were based on inter-observer agreement, which was calculated using Scott's reliability coefficient. Observer stability using the Scott's coefficient was also calculated. Spangenberg stated that inter-observer agreement figures and stability figures above .70 were considered positive signs of investigator analysis reliability. Twelve of the 14 inter-observer agreement efforts (analysis of two identical segments of two tapes) provided results of .70 or above and all 7 of the observer stability efforts (analysis of two identical tapes at one week intervals) resulted in coefficients of .80 or higher.

Student interactions were audiotaped as they worked at their laboratory benches. Each laboratory team was taped five times. Two tapes of one hour duration were recorded during the three hour lab; one was initiated 15 minutes after the lab commenced and the other after 1 hour and 45 minutes had elapsed. From each two hour tape four ten-minute segments were selected (on the basis of certain criteria) for analysis.

Spangenberg presented the mean percentage of student time spent in the categories as follows: Questioning, 6.52 percent; Lesson Centered Discussions, 30.12 percent; Teacher, 9.07 percent; Silence, 43.22 percent; Irrelevant Discussion, 8.53 percent; Reading, 2.19 percent.

Relationships between attitude toward the course, academic achievement, and the kind and amount of verbal interaction in the laboratory were also studied. This aspect of the study is reviewed elsewhere in this document.

Horn (69) reported modification and use of a checklist concerning student affective behaviors originally described by Eiss and Harbeck (46). Horn described the instrument as having three major categories: (1) Argues, (2) Asks, (3) Explains. Two additional categories are: (4) Unrelated discourse, (5) Uninterpretable discourse. Subcategories for more detailed descriptions of behavior are listed in each of the major categories. The checklist as modified is called the Risk-Taking Verbal Observation Scale.

The instrument was used as a measure of student risk-taking. Horn defended this usage in that the risk in such situations was the greater opportunity to express an inaccurate and/or unacceptable statement. A greater number of such responses made was thus taken as an indication of greater risk-taking behavior.

Reliability determination was made by having three observers classify 50 student responses selected at random from audiotapes. All three observers agreed on 84 percent of the items, and two-thirds of the observers agreed on 16 percent of the items. There was no total disagreement on any items.

The major portion of the study utilized the instrument as a measure of the dependent variable of risk-taking. Various independent variables were investigated in relation to risk-taking. This aspect of the study is reviewed elsewhere in this document.

Kendall (79) developed an instrument for classification of scientific behaviors. The literature of science and science education since 1900 was surveyed for statements suggesting behaviors pertaining to an understanding of science and an attitude toward science. The initial list was modified on the basis of actual classroom trial usage. It was then used in a study of two groups of classes that exhibited either a majority of the behaviors or few of the behaviors, to examine the effectiveness of these behaviors in promoting an understanding of science and a positive attitude toward science. This major aspect of the study is reviewed elsewhere in this document.

Mitchell (102) developed an observational technique to study relationships between student behavior, student interest in science and social science, and achievement. According to Mitchell the instrument is a behavior scale with ten categories which are also dichotomized into larger modules of attentive and non-attentive behaviors for exploration of larger behavior patterns. Mitchell reported that the behavior scale was valid and has established reliability. Procedures for establishment of validity and reliability were not provided in the document reviewed.

The sample population was made up of the top and bottom ten percents of two fifth grade classes, based on interest scores on a standardized interest inventory. Classrooms were videotaped and data were processed in matrix form. Mitchell found a relationship between inventoried interests and the larger modules of classroom behaviors as well as between classroom behavior and achievement as indicated by awarded teachers' marks.

Mitias (104) developed an instrument for the study of patterns of problem-solving behavior among prospective science teachers. His purpose was to empirically investigate how a fairly homogeneous sample of such individuals solve problems under a minimum of experimental conditions. Interest in this problem stemmed from an apparent conflict between Dewey's point of view and that of empirical psychologists regarding problem-solving processes. Hence, Mitias was interested in whether there are several patterns of problem-solving behavior and whether such behavior is related to the major science field of the participant and the type of problem to be solved.

According to Mitias, the observational system was developed before collecting experimental data. The following are reported by Mitias as the categories of the system: (1) Goal Clarification, (2) Situation Analysis, (3) Procedure Planning, (4) Procedure Execution, (5) Random Manipulation, (6) Irrelevant Behavior. Data were recorded on a time unit basis (15 seconds) and analyzed in terms of sequence, frequency of each category, and number of categories per minute. Subjects worked together in pairs to solve the "cylinder problem" and the "disc transfer problem."

Mitias found four patterns of problem-solving regarding the sequence dimension, and also variations in the frequency and number dimensions. Pairs of individuals also presented different patterns of problem-solving when changing from one problem to the other. The differences among the three subsamples of individuals (majoring in the biological sciences, comprehensive sciences, and physical sciences) was not found to be significant at the .05 level.

Parakh reported a study (119) in which relationships among teacher behavior, pupil behavior, and pupil characteristics are described. In this study a system of 36 categories was developed using four modes of pupil participation: (Q) Questions, (S) Self-Initiated Statements, (V) Volunteering Information, (R) Replying to Teacher's Request. These four modes are combined with the following nine kinds of utterances to comprise the 36 categories: (D) Defining, (F) Fact-stating, (X) Explaining, (E) Evaluating, (N) Explicitly referring to the Nature of Science, (L) Indicating Lack of Knowledge, (P) Suggesting Problem-Solving Procedures, (R) Dealing with Classroom Routines, (U) Unclassifiable.

The modes of pupil talk were determined on the basis of careful observation of pupil talk in biology classes. The nine kinds of utterances had been identified in a previous study by Parakh, reviewed elsewhere in this document.

Designation of a category is by a combination of two letters---the first for one of the modes and the second for one of the nine utterances.

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Sequence is also preserved by use of numerical subscripts. Verbal behaviors
are coded on seating charts, transferred to punch cards, and processed to
yield: (a) the number and percentage of utterances in each of the categories
and various groups of categories, (b) the number and percentage of pupils
who participate in the various categories. Each instance when a pupil speaks
and uses one mode and one kind of utterance is tallied as a single behavioral
event. Shifts in category due to change in mode or utterance are also tallied.

Reliability of the system was estimated on the basis of inter-observer
agreement. A percentage of agreement was calculated on the basis of the
formula developed by Osgood, Saporta, and Nunnally (116). Results ranged
from 50 percent to 100 percent with a median of 77 percent in a class of 23
students and 88 percent in a class with 14 students.

Two classes each of eight biology teachers (6 of which were using BSCS
materials) were observed for four days. Each pupil utterance was categorized
into one of the 36 categories and coded on the seating chart. Teacher-
pupil interaction was also tape-recorded and subsequently analyzed using
Parakh's 45-category system (reviewed elsewhere in this document). Data on
various pupil characteristics were also obtained for a study of relation-
ship between and among pupil characteristics, pupil behaviors, and pupil
achievement.

Numerous findings are reported by Parakh, only a few of which are
mentioned here. He reported that in the average class, the teacher talked
78 percent of the time, pupils talked about 17 percent of the time, and about
eight pupils accounted for about three-fourths of the pupil-talk. Class-
room discourse was found to be highly structured by the teacher, consist-
ing largely of factual, explanatory, and definitional exchanges. Participa-
tion by pupils in the four modes was as follows: Volunteering 50 percent,
Replying to Teacher's Request 29 percent, Questioning 15 percent, Self
Initiated Statements 5 percent. Frequencies of the five most frequently
used kinds of utterances were: Explanations 40 percent, Facts 27 percent,
Definitions 13 percent, Other (mostly class routine) 15 percent, Evalua-
tions 4 percent. Other major findings were that teachers' lecturing was
negatively related to pupils' responses, and that teachers' questioning
was negatively related to pupil questions, but positively related to pupil
responses. High ability and male sex were positively related to pupil par-
ticipation, and pupil participation was positively related to pupil achieve-
ment.

Raftor (132) reported plans to use a checklist of problem solving
abilities in a study designed to determine the relative effectiveness of
two methods of teaching a course in physical science to college students.
Although this was to be primarily a methods and effectiveness study, it is
mentioned here because the checklist was used to provide evidence of dif-
ferences between the two methods of instruction (lecture-demonstration and
problem solving).

The checklist includes 64 specific abilities of students in problem
solving. These are grouped into the following major areas of the checklist:
(A) Perceiving a Problem, (B) Relating to Previous Experience, (C) For-
mulating Hypotheses, (D) Testing the Hypotheses, (E) Deriving a Conclusion,
(F) Application, (G) Other Related Abilities. Theoretical framework,

instrument reliability and validity, and descriptive data were not given in the document reviewed.

Steiner (171) reported development and use of the Observational Record of Affective Behavior (ORAB) and the Biology Student Behavior Inventory (BSBI) for evaluating student performance as specific in 18 affective domain behavioral objectives for teaching inquiry processes in biology.

The ORAB provides for the identification and measurement of frequency of six student inquiry behaviors as they occur in the classroom. The BSBI consists of four subscales which provide measures of four categories of affective behavioral objectives studied: (1) Curiosity, (2) Openness, (3) Satisfaction, (4) Responsibility.

Further details about the instruments, validity, and reliability were not reported in the document reviewed. The instruments were used in a study of relationships between teacher practices and student performance of selected inquiry process behaviors in the affective domain, which is reviewed elsewhere in this document.

Trexler (177) used an observational schedule in a study of the relationship between sixth-grade children's testimony regarding their conservation behavior and their conservation behavior as observed. Trexler provided a rationale for the content of the observational schedule by stating that justifiable urban conservation activities should involve the everyday natural and processed resources that the children encounter daily.

Selection of behavioral items for the instrument was based on conservation and conservation education literature and existence of the experiences in urban classroom environments. The class was observed for two weeks for selection of classroom experiences which the author felt would lend themselves to observational techniques. The schedule and recording forms were then formulated, used on a trial basis, and revised. The resulting observation schedule lists eighteen statements of conservation behavior. For each statement, procedures for data collection and examples of negative student behavior are given. The eighteen statements are as follows: (1) I waste paper, (2) I take care of my color crayons, (3) I clean my water color brush after using it, (4) I waste time during arithmetic study-periods, (8) I waste time during free-period study-periods, (9) I make marks in my arithmetic book, (10) I bend the pages of my arithmetic book, (11) I tear the pages of my arithmetic book, (12) I clean out my water-color box after using it, (13) I turn off the water faucet, in the classroom, when no one is using it, (14) I walk on the dirt area when going to the playground, (15) I put a newspaper or protective covering on the counter when I stand on it, (16) I put a newspaper or protective covering on a chair when I stand on it, (17) I turn off the lights when the class leaves the room, (18) I close the door when going from the inside to the outside or from the outside to the inside.

Reliability of judging behavior was determined with regard to the wasting of time by finding the numerical value of the product moment coefficient based on data obtained by two observers. The coefficient on this item was found to be 0.92. The other items were not checked since it was

thought that they were specific enough that the judgement involved would not be important.

Attention was given also to consistency of behavior of individuals observed and sampling requirements. Trexler stated that the former was handled by attempting to insure that situations being observed were made up of only a particular situation. The meaning of his statements on this is not entirely clear, but the suggestion seems to be that consistency was controlled in the design, rather than measured. The matter of sampling was handled by having all behaviors of the child toward a specific situation observed, and 50 percent of the child's behavior regarding wasting time.

Waltz (183) developed an instrument concerning high school chemistry laboratory behaviors judged to influence scientific understanding and attitude development. The instrument consists of eighteen behavioral practices drawn from the scientific literature of 1900 to the present. The number of students in each laboratory class observed who engaged in each behavior was recorded and expressed as a percentage of the total number of students in the classroom. Further details of instrument development, composition, procedure for use, and descriptive data resulting from its use were not given in the document reviewed.

Washton (184) proposed a classification of pupil questions as a basis for eventual development of a taxonomy of pupil questions for creativity. He suggested five major groupings as follows: (1) Factual questions, (2) Questions related to scientific principles or laws, (3) Questions related to the ability to transfer or make applications, (4) Spontaneous questions of curiosity, (5) Questions that are genuine problems that need to be solved. Since this was a proposal for further development of a taxonomy, detailed instrument development procedures and usage data were not provided in the document reviewed.

Questioning Instruments

Blosser (30) developed the Question Category System (QCS) to be used in a study of the development of effective questioning skill by prospective secondary school science teachers. The criteria to be satisfied by the instrument are listed by Blosser as: (1) that the system be teachable, (2) that it cover the variety of questions asked in science classes, (3) that it could be used by preservice teachers to analyze their own questioning behavior and that of other teachers.

The tentative QCS was developed, tested with experienced teachers and student teachers, modified, and then used to analyze videotaped lessons. It was submitted for criticism to graduate students, eight student teachers not involved in the study, the researcher's major advisor, and a specialist in instruction. It was then revised for use in the remainder of the study.

The Question Category System has four major categories: (I) Closed Questions, (II) Open Questions, (III) Managerial, (IV) Rhetorical. Closed Questions may be further categorized as either (A) Cognitive-Memory, or (B) Convergent Thinking. Cognitive-Memory may in turn be further identified as (1) Recall, (2) Identify or Name or Observe. Convergent Thinking

questions may be further identified as: (1) Associate and/or Discriminate; Classify, (2) Reformulate, (3) Apply, (4) Synthesize, (5) Closed Prediction, (6) Make "Critical" Judgement.

Open questions may be further categorized as either (C) Divergent Thinking, or (D) Evaluative Thinking. Divergent Thinking questions may be further identified as (1) Give Opinion, (2) Open Prediction, (3) Infer or Imply. Evaluative Thinking may be (1) Justify, (2) Design, (3) Judge A (matters of value, linked with affective behaviors), (4) Judge B (linked with cognitive behaviors).

Three science educators were trained in the use of the QCS. These judges were supplied with the video tapes and necessary equipment for analysis as well as typescripts. Final classification of questions was based on the agreement of the judges. Audio taped lessons were classified by the investigator. Rater reliability was calculated for the judges and also for the investigator, using the Guilford method. The averages for the judges ranged from .70 to .73 and those of the investigator were .90 to .92 for the three levels of categories.

The major study in which the instrument was used by Blosser was a behavior change study and is reviewed elsewhere in this document.

Bruce (33) utilized the Teacher Question Inventory designed by Harris and McIntyre in an investigation of relationships between SCIS teachers' attitude toward teacher-student relationship and question types. In this instrument, as used in this study, there are two levels of questions. The "Lower level" questions are: (a) Recognition, (b) Recall of fact. The "Higher Level" questions are: (a) Demonstration of skill, (b) Comprehension, (c) Analysis, (d) Synthesis.

Bruce stated that reliability coefficients were calculated by the use of Scott's coefficient and that the average coefficient was .87. It was not clear in the document reviewed whether this coefficient pertained to observer stability, inter-observer agreement, or a reliability coefficient as defined by Medley and Mitzel (99).

The study by Bruce in which the instrument was used pertained to behavior change and correlation between behavior and other variables and will be reviewed by Evans.

Porterfield (131) used an adapted form of the Teacher Question Inventory by Harris and McIntyre in a study of questioning behavior of reading teachers while teaching reading. Porterfield gave the nine levels into which questions are classified when using the instrument as the following: (1) Recognition, (2) Recall, (3) Demonstration of Skill, (4) Translation, (5) Interpretation, (6) Analysis, (7) Synthesis, (8) Opinion, (9) Attitudes or Values. Validity and reliability procedures concerning use of the instrument in this study were not discussed in the documents reviewed.

Eight second and eight fourth grade reading teachers who had participated in a SCIS training program and sixteen second and fourth grade reading teachers not trained in this fashion were selected for the study. Data were collected by tape recorder from two complete reading lessons for each

reading group in each of the 32 classrooms. Composite tabulations were determined for each question category and differences in observed proportions were analyzed using the normal standardized score.

Numerous significant differences (at the .05 level) in the data between the two groups of teachers are reported by Porterfield. The SCIS teachers asked a significantly lower proportion of recognition and recall questions, but a significantly higher proportion of translation, interpretation, analysis, synthesis, opinion, and attitude questions. There was no significant difference in demonstration of skill questions.

Over 70 percent of the questions of the non-SCIS teachers were recognition or recall, while about 50 percent of the SCIS teachers' questions were recognition or recall. None of the other categories of questions (except opinion questions, at 11.06 percent) reached 10 percent for the non-SCIS teachers, with synthesis questions lowest at .07 percent and attitude questions at .59 percent. In the SCIS teachers, translation questions were 10.35 percent, opinion questions were 15.40 percent, and analysis questions 11.19 percent. The lowest portion of questions was also synthesis at 1.87 percent and attitude at 2.05 percent. Porterfield stated in his conclusions that he assumed the teachers transferred the theoretical and practical use of questions and questioning from the SCIS inquiry-discovery instruction to the area of reading instruction.

In a study of SCIS and non-SCIS teachers, Wilson (187, 188) focused on questions being asked by teachers. Wilson emphasized the importance of the kinds of questions being asked and suggested that the art of questioning is the essence of discovery teaching. The instrument used for classification of teacher questions was the Teacher Question Inventory by McIntyre and Harris. The instrument enables classification of questions on a hierarchial order derived from the Taxonomy of Educational Objectives (29). Questions were classified as: (1) Recognition, (2) Recall, (3) Demonstration of Skill, (4) Comprehension, (5) Analysis, (6) Synthesis. Wilson stated that all the questions of a cognitive nature asked by the teachers during the science lessons were applicable to one of these six categories. Reliability or observer agreement procedures and results were not reported in the document reviewed.

Thirty teachers were studied, one-half of them having been trained in the use of the SCIS approach. The matching group had not received training in any of the "new" science projects, were strongly textbook oriented, and did not espouse the inquiry-discovery approach. Further details on the nature and extent of the training of SCIS teachers were not provided in the document reviewed.

Wilson found that the lower level questions (recognition, recall, and comprehension) were recorded a significantly larger proportion of times for the traditional science teachers group than for the "new" science teachers group. Higher level questions (analysis and synthesis) and demonstration of skill questions were recorded a significantly larger proportion of times for the "new" science teachers group. In addition, Wilson reported that the "new" science teachers asked 49 percent more questions in general than the other group. Comparisons between the two groups were made using the Z score, with the confidence level set at 0.05.

Butler (34) used a question analysis system, in conjunction with the Flanders Interaction Analysis Category system, in a study of IPS teachers. The review of this study is included in this document with other studies using the Flanders system since the data reported from use of the two instruments are rather intricately interrelated.

Johnson (75, 76) reported development of the Questioning Dissector Grid. The instrument was developed for use in a study of a model for improving in-service elementary science teacher questioning behavior. Johnson reported that the categories of the instrument are as follows: (1) Routine-Management Questions, (2) Memory Questions, (3) Observation Questions, (4) Information Processing Questions, (5) Evaluative Questions. The instrument is a two-dimensional grid enabling a plotting of questions asked in sequence and according to the five categories. Reliability and validity procedures were not described in the documents reviewed.

Kleinman (80, 81, 82) conducted a study pertaining to the kinds of questions asked by teachers. Her main purposes in this study were to ascertain the kinds of questions asked by general science teachers, to determine the relationship to students' understanding of science, and to determine the relationship to pupil and teacher behavior.

The observation form contains seven question categories and also a listing of bipolar adjectives used in describing teacher and pupil behavior. These four pupil behaviors and eighteen teacher behaviors are rated on a five-interval scale from low to high. Pupil behaviors given are: (1) Apathetic-alert, (2) Obstructive-responsive, (3) Uncertain-confident, (4) Dependent-initiating. Teacher behaviors listed are: (1) Partial-fair, (2) Autocratic-democratic, (3) Aloof-responsive, (4) Restricted-understanding, (5) Harsh-kindly, (6) Dull-stimulating, (7) Stereotyped-original, (8) Apathetic-alert, (9) Unimpressive-attractive, (10) Evading-responsible, (11) Erratic-steady, (12) Excitable-poised, (13) Uncertain-confident, (14) Disorganized-systematic, (15) Inflexible-adaptable, (16) Pessimistic-optimistic, (17) Immature-integrated, (18) Narrow-broad. The categories of "Lower type questions" are: (1) Neutral, (2) Rhetorical, (3) Factual. The "Higher type questions" are: (1) Clarifying, (2) Associative, (3) Critical Thinking, (4) Values.

Kleinman stated that the average rank intercorrelation for three judges in this study ranged from .85 to .90. Stability measures were based on consistency or stability of teachers' behaviors. The average of six correlations for six teachers who were observed three times each by one observer was .57.

Most of the seventh and eighth grade general science teachers from five school systems were observed (twenty-three teachers in all). These were observed once, then the three high teachers and the three low teachers (in terms of the frequency of critical thinking questions asked) were observed twice more.

A Nomograph for the Test of Significance of Differences of Proportions was used to test for significant differences between the two groups of teachers on the question categories. A t-test for significance of differences

between means of independent samples was used to compare pupils of both groups of teachers by grades, ability levels, and sex. Pupils' understanding of science was measured by use of the Test on Understanding Science, Form Jy.

Kleinman reported that the high teachers asked fewer questions than the low teachers and that they asked significantly fewer rhetorical and factual questions. The high group asked almost four times as many high-type questions as the low group. She also reported that teachers who asked more critical thinking questions also asked more neutral, clarifying, and associative questions than the others. Only one value question was asked in the thirty-five observations. Kleinman felt her data revealed a relationship between the use of critical thinking questions and the behavior of pupils, and also reported a trend toward higher behavior ratings for the high teachers. She also concluded that seventh and eighth grade boys and girls of high ability achieved a better understanding of science under teachers who asked critical thinking questions than under those who did not.

Kondo (89) studied the questioning behavior of teachers using SCIS. Four first grade teachers were studied while teaching the same sequence of four SCIS lessons. Relationships among the questioning behaviors of the teachers were studied as well as relationships among behaviors in the different types of lessons.

Behaviors were tape-recorded and analyzed in terms of: (1) Complexity (based on question-response-comment units), (2) Question Type (Routine, Cognitive-Memory, Convergent, Evaluative, or Divergent), (3) Teacher Reaction (to responses or to her questions), (4) Transition Probabilities.

Kondo found that there was a fairly consistent pattern of questioning by the teachers across the four lessons, but that differences in complexity of questioning patterns were relatively striking between individual teachers. Percentages of routine and cognitive-memory questions were found to be influenced by the lesson being taught (but not by whether it was an Invention Lesson or Discovery Lesson) and by how it was approached. The approach was found to have the greatest influence on the types of questions asked. About one-half of all the questions asked were convergent and the percentage was fairly uniform across all the lessons. The relative frequency of evaluative questions was low in all lessons, as was the percentage of divergent questions, although the latter were highest in invention lessons. Teacher reactions were found to differ vastly between individual teachers.

Moriber (110) studied types of questions asked by college science instructors. He supported the importance of types of questions asked to the learning process by reference to the work of Gagné and of Bloom. The Sanders system based on the "Bloom Taxonomy" was chosen as the instrument for the study. Moriber gave the following as the categories of the Sanders instrument: (1) Memory, (2) Translation, (3) Interpretation, (4) Application, (5) Analysis, (6) Synthesis, (7) Evaluation.

Validity and reliability considerations concerning the use of the instrument in this study were not reported in the document reviewed, except for the comment that portions of tapes were often replayed several times to

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ensure that questions were properly categorized. It was also mentioned that the categories tend to merge into each other, with the result that different teachers may not agree on question placement but that categories used are usually adjacent ones, thus minimizing difficulty.

Four college instructors of an integrated physical science course for non-science students were observed for five consecutive weeks. Their lessons were taped and subsequently analyzed using the Sanders system. These "graduate instructors'" student ratings were studied before the research and the instructors were fully advised of the purpose of the study. Each of the instructors taught a weekly two-hour lab class, of which the first half was a structured lesson providing background material and the second hour involved students performing the experiment. The lessons taped were thus about 50 minutes in length. Conferences were held with each teacher after the lesson. The use of higher level questioning was discussed and encouraged.

The data showed that the vast majority of questions asked were at the memory level. There were very few (7 of 600) at the synthesis and evaluation levels. In the course of the study, none of the teachers increased their higher level questioning, and two of the four decreased it. The second highest portion of the questions was at the "Interpretation" level.

Rowe (142) reported some findings on wait-time and rewards as instructional variables. Based on classroom visits in cities, suburbs, and rural areas, she reported that teachers allowed children an average of one second to start to answer a question. She reported observing that in classrooms where speculation, conversations, and arguments over meaning of evidence occurred, wait times seemed to be three seconds or longer. In addition, she reported finding that, if teachers were asked to identify their five best and five poorest students and then were examined as to wait times, the five best students got two seconds but the bottom five got only 0.9 seconds. The bottom five received more praise, though incorrect responses received a response of "good" about as often as correct responses.

Snyder (161) studied verbal question-asking as a method of inquiry. One hundred and fifty gifted seventh and eighth grade students and their five science teachers were studied. Subject matter content, training of teachers in the use of the content materials, and ability and grade level of the pupils were controlled.

Oral questions were tape recorded in class and transcribed. Written questions were obtained by having students write questions on 3 x 5 cards at the end of each class day during the data-collection periods. Based on the proportions of the kinds of questions asked, comparisons were made of the teachers, classes of students, teachers as a group and students as a group, and individual teachers and their specific classes.

Teachers exhibited similarities as well as differences in questioning behaviors and there were considerable changes in teacher behavior from one unit to the next. However, individual teacher behavior changes showed no consistent pattern from unit to unit, nor did individual class behavior changes. Teachers were found to be similar in the relative usage of different categories of questions. Differences in questioning between

different classes of students were less great than differences between teachers. Snyder found no consistent similarities in teacher behaviors and class questioning behaviors.

Staley (168) developed the Audio-Tape Analysis Instrument for use in a study of comparative effectiveness of microteaching and other paradigms on preservice teacher performance. The major portion of this study concerns behavior change and teaching effectiveness and is reviewed elsewhere in this document, but a few words are appropriate here concerning the provisions of the instrument.

Part I of the instrument provides for teacher talk/student talk data and ratio recording, and teacher wait-times after questions and before responses to the child's comment. Part II provides for recording of lower order questions, higher order questions, neutral response, no opportunity for response, and other types responses. Part III provides the means to measure achievement of the objectives of the lesson.

Different sets of raters were used for each part of the instrument. Rater reliability for Part I was calculated using an analysis of variance procedure for incomplete sets of ratings, with a resultant value of .84. Part II was similarly calculated with a result of .90 and .98 for two sample lessons. No reliability estimates were made for Part III.

Inquiry Instruments

Horine (68) developed the Complete Inquiry Index and used it in a comparison of inquiry activities in elementary science classes based on audio tape recordings. The index was developed from a review of behavioral objectives strongly advocated for science education. Horine supported the levels of the various categories of inquiry with statements from professional literature and compared several of them with categories of the Flanders system. Three inquiry indexes, called the Complete Inquiry Index, the Verbal Inquiry Index, and the Revised Inquiry Index were developed. They are expressed as numerical index values to be used to compare pupil inquiry levels. Tallies by number are made at three-second intervals. The weighted tallies are summed and the total divided by the number of tallies to obtain the index.

The following are given as the categories and corresponding levels of the Complete Inquiry Index by Horine: Level 0: Criticism, Silence, and Confusion; Level 1: Directions; Level 2: Lecture; Level 3: Teacher Warmth; Level 4: Teacher Question; Level 5: Pupil Response; Level 6: Pupil Comment; Level 7: Pupil Question; Level 8: Pupil Experiment. Horine suggested elsewhere in the study that Level 4 (Teacher Question) be divided into two categories as follows: Closed Teacher Question, Open Teacher Question.

The Verbal Inquiry Index is computed in the same manner as the Complete Inquiry Index, except that Pupil Experiment (Level 8) is omitted. The Revised Inquiry Index is like the Verbal Inquiry Index except for the omission of reading and/or extended viewing activities (otherwise included in Level 5, Pupil Response).

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Reliability measures were obtained on the basis of four persons serving as analysts. The reliability coefficient on the verbal portion of the instrument was reported as .9 ± .1, while on the nonverbal portion it was .8 ± .2. Procedures for calculating reliability were not presented in the reliability discussion of the report reviewed.

In regard to internal validity, Horine stated that it was possible to ascertain time spent in experiments of silent viewing activity from audio tape records based on audio signals before, during, and after such activity.

The instrument was used in a study comparing inquiry in ten classrooms using Science - A Process Approach with 12 classrooms in which Concepts in Science was being used. Classrooms of grades two, three, and four were studied. Indices were calculated, percentages of pupil experiment time and reading and/or extended viewing time were ascertained, and a two-way analysis of variance was used to test for numerous significant differences among grade levels and between curriculum programs.

Horine found that the mean Complete Inquiry Index was 5.059 and that there was a significant interaction between effects associated with grade level and effects associated with curriculum program in producing deviations from the mean. No such differences were found in the Verbal Inquiry Index (which omits "Pupil Experiment"), however. The Revised Inquiry Index, which also omits reading and/or extended viewing, showed significant differences between grade levels. The mean percentage of time spent in pupil experiment was 29.81 with a significant difference in favor of the process group over the concepts group (15.02 percent vs. 48.47 percent). The mean percentage of class time spent in reading and/or extended viewing was 11.90 percent with 20.50 percent for the concepts group and 1.60 percent for the process group.

Miller (100) developed the Science Classroom Interaction Instrument (SCII) as part of a study to investigate the cognitive and affective behavior of selected groups of ninth grade physical science teachers and to study longitudinal effects of a training program on teacher verbal behavior. Miller pointed out that instruments that were available gave little attention to the tentative nature of science concepts, relation of science to other areas of the curriculum, integration with technology, and development of higher level thinking processes. These needs led to and guided the development of the SCII. The instrument thus incorporates some characteristics commonly associated with "new curricula," affective and cognitive behaviors, and is restricted to verbal behavior of teachers (primarily) and students. The categories are considered mutually exclusive, but comprising an inclusive system.

The 25 categories of the SCII are as follows:

(1) Accepting feelings, giving praise or encouragement
(2) Acceptance or use of student response
(3) Irrelevant teacher verbalization
(4) Supplemental question
(5) Question about the nature of science or scientists
(6) Question about the relation of science to other areas

(7) Questions which integrate science and technology
(8) Questions pertaining to a science concept at higher cognitive levels
(9) Question pertaining to a science concept at lower cognitive levels
(10) Informing on an absolute factual level about science concepts
(11) Informing on a conditional factual level about science concepts
(12) Informing on the nature of science or scientists
(13) Informing on the relationship of science to other areas
(14) Informing on the relationship of science to technology
(15) Giving directions, procedural orientations, goal setting
(16) Qualifying or correcting a student response
(17) Criticism or verbalization which seeks to show teacher authority in controlling classroom behavior
(18) Student response initiated by the teacher
(19) Student initiated response
(20) Student reading aloud
(21) Division of student interaction
(22) Silence for contemplation
(23) Directed activity
(24) Uncategorizable verbal behavior
(25) Confusion or chaotic verbal behavior

The three-second time interval is used when encoding, but all transitional behavior is encoded as well. Numerous ground rules for use of the instrument are given.

Validity considerations are based on the ability of the SCII to differentiate certain specified behaviors. Reliability measures were based on inter-observer agreement between the researcher and an experienced high school science teacher, utilizing the Scott method. Reliability was thus estimated prior to study of the teacher groups, after five weeks of encoding, and after eight weeks of encoding, with results of .702, .773, and .729 respectively, and an average of .735.

The remainder of the study in which the SCII was used focused on behavior change through a training program and is reviewed elsewhere in this document. Percentage data were provided for both a treatment group and non-treatment group, and several points of interest should be mentioned here. Questions and information about nature of science and scientists (Categories 5 and 12) were very low for both groups with the two categories jointly constituting well under 0.5 percent of the behaviors throughout the study, as measured. Similarly, relation of science to other areas (Categories 6 and 13) ranged from a total of about 1.1 percent early in the study (for the treatment group) to less than 0.2 percent for each group at the end of the study.

The Teacher Observation Schedule was designed by Pempek (125) to obtain data on subtle techniques of the teacher, often nonverbal, that were considered desirable, presumably from the standpoint of the teaching objectives of AAAS-SAPA, ESS, and SCIS. The instrument was one of several used in a study of the effectiveness of a teacher training project. After some usage, the original form of the TOS was revised to incorporate additional techniques of the teacher. Additional procedures of instrument development were not described in the document reviewed.

The categories of the TOS are as follows: (Q) Teacher asks a question, (X) Teacher explains, elaborates, summarizes, (D) Teacher gives directions, (M) Teacher demonstration, (B) Teacher answers pupil question, (R) Teacher responds to student question, but does not answer it, (A) Teacher attending or watching student actions, (F) Teacher positive reaction to student action, statement, or process, (P) Teacher negative feedback to student, (N) Teacher managerial tasks, (O) Teacher nonverbal, non-teaching activity.

The coding interval is five seconds. The totals of categories Q, R, and A are totaled for a measure of the intervals in which the teacher was engaged in behaviors considered desirable by the new curricula.

The major study in which this instrument was used concerned behavior change and is reviewed elsewhere in this document.

Smith (154, 155, 156, 157) developed a classroom observation instrument relevant to the Earth Science Curriculum Project. The instrument was developed specifically on the basis of ESCP philosophy, observation of ESCP teachers, and suggestions of curriculum writers for teaching ESCP. Sources used as a basis for writing behavior items were journal articles, ESCP News-letters, ESCP Teachers Guide-Investigating the Earth, Parts I and II, the text Investigating the Earth, and audiotapes of ESCP classes.

Behavior items were written in a manner consistent with ESCP philosophy, neutral, or inconsistent with ESCP philosophy and then distributed to seven judges (ESCP writers and trial teachers) as a means of determining content validity of the items. Items with an interquartile range greater than that of 51 percent of the items with the same median or with an interquartile range equal to or greater than could be obtained by chance were not retained. Ninety-one items were retained and placed in subcategories and major categories.

The major categories of the instrument are: (1) Developing Text Material, (2) Pre-laboratory, (3) Laboratory, (4) Post-laboratory Discussion. The subcategories of Developing Text Material are: (A) Teacher demonstrates . . . behaviors relative to the nature of earth science, (B) Teacher questions relative to student processes, (C) Teacher response to student questions, (D) Student process statements. "Prelaboratory" has the following sub-categories: (E) Teacher: Identification of problem for investigation, (F) Teacher: Directions on conduct of the investigation, (G) Student: Identification of the problem for investigation, (H) Student: Directions on conduct of investigation. The Laboratory category has the following subcategories: (I) Teacher: Identification of critical aspects of the investigation, (J) Teacher: Response to student questions about investigation procedure, (K) Teacher: Evaluation, (L) Student: Identification of critical aspects of the investigation. The subcategories of Post-laboratory Discussion are: (M) Teacher: Data Reduction, (N) Teacher: Interpretation of results of investigation, (O) Student: Data Reduction, (P) Student: Interpretation of results of investigation. The more specific items occur within these cate-gories, and all but 3 of the 91 items are cognitive in nature.

Reliability was estimated by training six observers and rotating them among three observer teams observing three ninth grade ESCP teachers.

Interobserver agreement was expressed as percentage agreement, and when all observations for all teachers were pooled, interobserver agreement was found to be 74 percent. Observations were taken for one 50-minute period per day for ten consecutive days.

Wilson and Renner (188) reported the study of SCIS teachers and non-SCIS teachers in terms of their provision of "essential science experiences" and the number of analytical thinking questions asked. The questioning aspect of this study has been reviewed on the basis of another report and is found in the section on questioning in this document.

The instrument used for a measure of essential science experiences is called the Teacher Observation Inventory and has the following five components: (1) Observation, (2) Measurement, (3) Experimentation, (4) Interpretation of Data, (5) Prediction. A description of each of the components is given by the investigators. Validity and reliability procedures concerning use of the instrument were not reported in the document reviewed.

Fifteen SCIS teachers and 15 non-SCIS teachers ranging from grades one to six were studied. The SCIS teachers had been trained to use SCIS methods and materials for science instruction. The non-SCIS teachers were taking the science curriculum from the science textbook, according to the investigators. Other special training or instructions given to either group of teachers, if any, were not reported in the document reviewed. Each class was observed twice for thirty-five minutes, using a tape recorder. The interval of time between the two observations was one week.

The z-score was used to test for significant differences between the correlated proportions with the level of significance set at .05. Significantly higher proportions of essential science experiences were found in measurement and in prediction for the SCIS teachers. The frequences of essential science experiences were higher in all five of the categories for SCIS teachers than non-SCIS teachers, according to the investigators, and the total number of these experiences was 2.15 times as high for the SCIS teachers as for the non-SCIS teachers.

Communications Instruments

Friedel (53) developed an observational procedure for describing teacher and pupil verbal and nonverbal classroom behavior. The behavioral record was obtained through the use of videotape equipment and direct observation of 13 classroom science teachers. The instrument was developed from narrative records of behaviors in 13 science classes and a theoretical framework based on a model of communications and a theory of interpersonal needs. Encoding of behaviors was accomplished by recording symbols every five seconds to indicate: (1) Sender, (2) Direct or Indirect Message Behavior, (3) Channel, (4) Receiver.

Sender categories described whether messages were sent by teacher, pupil, pupils, or audiovisual device. Twenty-nine categories described direct message behavior and five categories described indirect message behaviors. Channel categories expressed whether behaviors were verbal, nonverbal, or verbal and nonverbal. Receiver categories indicated whether

the receiver of the message was teacher, pupil, or pupils. For each direct message behavior, four symbols were recorded: the sender, the direct message, the channel, and the receiver. Indirect messages required three symbols: the sender, the indirect message, and the channel.

Inter-observer agreement data were based on fifteen five-minute randomly selected segments from twelve one-hour video tapes. The data represent agreement between the researcher and a trained observer. The overall coefficient for all of the above segments was .92.

Friedel reported that direct message behavior accounted for 64 percent of teacher behavior and indirect message behavior accounted for 83 percent of pupil behavior. The nonverbal channel was associated with the indirect message categories 100 percent of the time. Of the teacher direct message behaviors, 56 percent were impersonal and 44 percent were personal. Direct messages associated with experimental information constituted 5 percent as compared with 31 percent authoritative information and 14 percent drill.

Knoll (83) carried out a study of preservice teacher strategies in teaching the vocabulary of elementary school science. The language level was identified as one of eight, and the function of interaction was defined from the linguistic aspect according to six types of language exchanges. The function of interaction was also defined from the vocabulary standpoint in terms of twenty strategy categories. Hence, each interaction was classified on a continuum based on language levels and teaching techniques. Interactions were identified in terms of acts of participation. The elementary pupils observed were of grades one through six. Further details concerning the instrument used or details of its development were not provided in the document reviewed.

Though this study involved preservice teachers and thus might not be representative of the usual classroom, several findings may be of interest. The concepts represented by the words were taught at the inferred level in 80 percent of the situations. Words involved in 64 percent of the vocabulary teaching situations were presented by the teacher, and in 82 percent of these situations the teacher focused the class's attention on a particular word. The primary teaching techniques used most often were naming (18 percent), interpreting (15 percent), and short answer (59 percent). Of the pupil experiences with words, 27 percent involved saying the word, 17 percent reading, and 5 percent writing.

Streitberger (172) used a new observation system developed by H. D. Schalock (146) in a study of teacher influence behaviors and teacher-student interaction patterns in selected CHEM Study and traditional chemistry classes. With this system, teacher and student behavior is described in terms of a basic encoding unit called the interact. This is a message directed (a) from the teacher to a student or group of students or (b) from a student or students to the teacher. Interacts are coded in the order in which they occur, with series or chains forming an interactive exchange. The system is only concerned with those student interacts in which the teacher is involved, and the major portion of the system concerns descriptions of the teacher interact. An interactive exchange is a series of interacts based on the interact that opened the exchange. Interactive

exchanges may be initiated by the teacher, one student, a group of students, or a whole class in any one of four ways called flow patterns. Each of the flow patterns is described in the document reviewed.

Extensive details are provided concerning intercoder agreement. The basic procedure involved coding of segments of tape recordings by three independent coders. The results, upon showing high agreement, were averaged to form a standardized code for use in subsequent observer reliability determinations. Criteria for serving as a standard code ranged from 80 percent to 90 percent, depending on category frequencies. Based on trial reliability efforts, revisions of the system were initiated. Agreement among coders was then checked again as a validation procedure with satisfactory results. The investigator then proceeded to code all audio-recorded classroom interaction, again checking his coder reliability three times during the three-week coding period with satisfactory results. Streitberger pointed out that the instrument as used in this study thus did not constitute full use of the Schalock system. There are six large or first order categories of teacher behavior as follows: (1) Exposure to Information, (2) Precipitation of Performance, (3) Evaluation of Performance, (4) Socializes, (5) Interference, (6) Flow Pattern 2. Each of the first 3 large categories also contains other major categories as follows: 1. Exposure to Information: (a) Structures, (b) Guides, (c) Provides Solutions; 2. Precipitation of Performance: (a) Questions, (b) Directs; 3. Evaluation of Performance: (a) Positive Reinforcement, (b) Negative Reinforcement. Various teacher interact modifiers are also available in the system.

Student behavior is described in terms of initiating (Flow Pattern 3) and response behavior with the following five major categories: (1) Flow Pattern 3, (2) Class Response, (3) Group Response, (4) Unasked, One Student Response, (5) Asked, One Student Response. Further information is available in the student initiating and response categories through use of following subdivisions of "stating," "questioning," "silence," "nonverbal," and "affective" behavior.

Audio-recording equipment was arranged so that one microphone was connected to the recording equipment in the classroom and another microphone was used by the observer at the back of the room to record verbally the codes of nonverbal behavior being observed.

The duration of all coded interacts was timed in the study. This was accomplished by a kymograph whose steadily revolving drum was used to pull adding machine tape across a coding area at a constant rate. The average length of time required to complete a teacher or student interact was found to be about six seconds.

Data were tabulated by weighting interacts of six seconds or longer and processes in a 32 x 32 interaction matrix. An I/D teacher ratio, patterned after Flanders, was also determined.

Seven CHEM Study teachers and nine traditional chemistry teachers participated in the study. Each teacher was observed for five class periods. No significant differences were found between the two groups of teachers. Streitberger reported that the variability within each group was greater

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than between the two groups. The teacher-to-student verbal and nonverbal interaction ratio was found to be 3.7 to 1, quite close to that reported for secondary teachers in other reports.

About 3 percent of all interacts were student questioning behavior, and about 18 percent of all behaviors were response behaviors (total student behavior was about 22 percent). The teacher behavior was constituted of "Exposure to Information" (56 percent), "Precipitation of Performance" (17 percent), and "Evaluation of Performance" (4 percent). Most of this last item was positive reinforcement, at 3.4 percent. Streitberger also concluded that I/D ratios can be used to differentiate between teachers with respect to teacher-student behaviors and interaction patterns observed in chemistry classes.

Cognitive and Structural Instruments

O. R. Anderson (10) has developed procedures for the analysis of structure in teaching. He has also provided the basis in theory of these procedures (9) and has reported on structure in teacher-communicated science content (11). The major component of the theory undergirding the work of Anderson (9) seems to be the premise that periodicity in environmental stimuli is a major factor in the complex behavior of advanced organisms. He thus sees great significance to learning of periodic or repetitive stimuli such as those that occur in the language of man and the calls of animals, and suggests that in learning the repetitive arousal of responses in a sequence or close temporal occurrance brings about associations among the responses. From this, he suggests that young children should be provided with periodic stimuli to maximize their later acquisition of symbolic material.

Anderson's concept of structure in teaching is thus based on the assumption that learning will be facilitated when contiguous teacher statements contain some verbal material in common (11). The amount of structure in communication is defined to be proportional to the amount of linking between contiguous statements.

Space will not permit a complete listing of all terminology coined in the work of Anderson or of all concepts and relationships of structure considered by Anderson, but a few overall statements of procedure and instrumentation may be helpful.

In the study of teacher communicated science content (11), teacher communications were recorded on audiotape and then transcribed. The teacher communication was then broken up into discourse units (verbal statements equivalent to a clause) which were numbered. The verbal elements (technical terms) were then recorded as a sequence of code numbers in such a manner that each could be associated with the appropriate discourse unit. The result is a series of discourse unit numbers accompanied by the code numbers of verbal elements contained in each discourse unit. The consecutive pairs of discourse units are then analyzed and coefficients of structure are computed. Several coefficients of structure are defined in the report (11) and methods of computation are given. Weighted coefficients of structure are calculated for all pairs of discourse units, and these figures are used to plot a graph called a Kinetogram. A drop in the graph

shows that a break in the structure has occurred. Theme activity (presence of a dominant verbal element) and the rate at which new information is being presented can also be calculated and methods of computation are given.

Data from the analysis of three high school science lessons (animal classification, physical chemistry, and cell biology) are reported (11). These are presented as Kinetograms and tables of coefficients for Kinetograms. Interpretations of the data as they appear in the form of Kinetograms and coefficients are provided.

James J. Gallagher (54, 57, 58) reported the development of the Topic Classification System (TCS). This system was designed to focus on the cognitive realm and is constituted of three major dimensions judged to be of importance. The dimensions are the level of conceptualization, the style of thinking, and the instructional intent. The TCS was developed out of a seven-year period of research and supplements an earlier system by Aschner and Gallagher. The system is based on the theoretical work of Guilford pertaining to the structure of the intellect.

The dimension of instructional intent pertains to two major teaching goals: (1) Content, (2) Skills. The levels of conceptualization are: (1) Data, (2) Concept, (3) Generalization. The styles of thinking are: (1) Activity, (2) Description, (3) Explanation, (4) Evaluation-Justification, (5) Evaluation-Matching, (6) Expansion.

The encoding unit used in the "topic" and each "topic" is classified into all three dimensions of the TCS. The "topic" is the unit in which the focus of classroom discussion centers on a given action, concept, or principle. Gallagher pointed out that classroom discussions do not necessarily follow orderly sequences, so he chose to determine the status of a "topic" by a time minimum of 15 typewritten lines of script rather than its place in orderly or logical sequence. Classroom discussion is put into the form of typewritten script and then topic divisions are made as time divisions in terms of subject under discussion. Gallagher provided a detailed description of procedures for topic division (58).

The reliability data reported for the instrument were based on a comparison of total results of two teams of judges analyzing the same set of scripts. Numbers of topics and percentages of the whole within each subdivision of each dimension were presented as evidence that teams of well-trained judges were able to achieve satisfactory agreement on the major dimensions of the instrument.

James J. Gallagher (56, 59) used the Topic Classification System in a study of teacher variation in concept presentation utilizing only biology teachers who taught classes of high ability students using the BSCS Blue Version, Molecules to Man. All teachers were working in suburban situations and all had some training contact with the BSCS program. Furthermore, the study was focused on the concept of photosynthesis, thus attempting to control possible differences in teacher and student behavior that might be the result of the particular concepts being taught.

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From an operational standpoint, the data suggested that there was no such thing as a BSCS curriculum presentation in the schools, but rather individual teacher interpretations of BSCS. Gallagher found substantial differences among teachers with respect to "goals" and percentage of "skill topics" treated. He found a highly significant difference among teachers with regard to the level of abstraction. In the dimension of style, a fairly common pattern was revealed with a great emphasis on topics in the areas of "Description" and "Explanation." Few topics dealing with evaluation or decision-making of any sort were found.

A wide diversity of topics was considered by the teachers in this study, though the content under consideration in all cases was chapter nine of Molecules to Man. Gallagher concluded that each teacher will plan the strategy of presentation and the emphasis on the basis of his own knowledge, interests, and perceptions of student need, regardless of how the materials are organized and presented in a formal sense.

Gallagher studied also percentage of teacher and pupil talk, student performance, and student expressiveness. He reported that teachers talked about three to four times as much as students. He found a significant difference among teachers in amount of teacher talk per class but concluded that teachers generally kept the same proportion of teacher-student talk regardless of the type of topic discussed.

James J. Gallagher (59) also used the TCS in a comparison of topic classification across content areas. This study involved videotaping demonstration classes of academically superior children brought together in a training workshop for teachers of gifted students. The data reported below must thus be interpreted within this context. The sessions were videotaped, but due to difficulty in classifying scripts directly from the videotapes, transcriptions were made and used for subsequent analysis.

Science, social studies, language arts, and elementary instruction were the content areas involved in the study. Percentages of topics in the various subdivisions of the three dimensions are given for each of these groups.

In instructional intent, the groups were quite similar with the exception of the science group, which was much higher in "Skills" in relation to "Content" than the others. There were only four science classes, however, and these differences did not result in an analysis of variance reaching the .05 level of significance, though it approached that level.

Levels of conceptualization were quite similar with the "Concept" level, having the highest of topics in all groups. The greatest difference was at the "Data" level with the elementary group considerably higher than the others. None of the groups had many topics at the "Generalization" level. Social studies was highest at 10 percent and science next at 8 percent. There was no significant difference among the groups in this dimension.

There were also no significant differences among the groups in regard to "Cognitive Style." About 80 percent of the topics in the science group were at the "Description" or "Explanation" levels.

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James J. Gallagher also tabulated initiation and termination of topics. In science, 17 percent of the topics were initiated by student questions or statements and 73 percent by teacher questions or statements. No topics in science were terminated by student summary, 17 percent by teacher summary, and 83 percent by no summary.

As a result of the above studies and an additional non-science study not reviewed here, Gallagher reported the strong impression, from the data, of complete teacher dominance or control over class discussions. Other major observations are that topic style was mostly "Description" and "Explanation" (with science classes more so than the others) and that few topics were treated at the "Generalization" level of conceptualization. He suggested that the discussion technique places boundaries on the student, and that it may not provide adequately for development and presentation of generalizations and systems. He indicated that teachers need explicit instructions on how to develop skills in the classroom and that they generally did not, in these studies, know how to deal with the "Evaluation" level of style.

Kaiser (77,78) reported the development of a teacher observation instrument consistent with the Chemical Education Material Study, especially the CHEM Study view of chemical knowledge. Instrument development was accomplished by a qualitative content analysis written by the CHEM Study authors, formulation of a preliminary instrument, and subsequent use in a feasibility study. The feasibility study was constituted from observation of two teachers who had been extensively involved with CHEM Study. Ten hours of audiotape recordings were made. A theoretical model was developed from the literature analysis and the feasibility study depicting the CHEM Study view of chemical knowledge. The instrument was constructed as an intermediary between the model and the specific items of teacher behavior.

Kaiser indicated that the following are the four categories (and their subcategories) of the system resulting from the above procedures: (1) Source of Information; (a) phenomena students have worked with---laboratory, (b) phenomena with available data---demonstration, (c) only data---in text, or other written material, (d) simple assertion, (2) Teacher Pedagogic Technique (Teacher Role); (e) teacher as "keeper and giver of knowledge"---statements, (f) teacher provides process---modeling, statements, directing questions, (g) teacher asks questions requiring substantive answers, (h) teacher provides exhortation of justification, (3) Reference of Teacher Statement or Question; (i) observation---data, facts, (j) organization observations---regularities, (k) generalization---rule, law, principle, theory, (l) application of generalization---problem solving, explaining, (4) Teacher Statements or Questions---Time Reference; (m) past---recall, (n) present---current; (o) future---predict, (5) Teacher Statements or Questions---certainty; (p) assertions made or questions asked without reference to bounds (unqualified), (q) assertions made or questions asked about the bounds of an observation, regularity, or generalization (qualified) ---uncertainty, limitations, (6) Miscellaneous Cross Category.

Items of teacher behavior were written to represent one or more of the five major categories of the instrument. These items were verified as manifesting the curriculum author's intent by six judges. They were then abbreviated and arranged for use in the classroom. Each item was placed in a specific subcategory of one or more of the major categories.

Five graduate students in science education were trained to use the instrument and, working in pairs, observed each of two teachers one hour a day for ten consecutive days. The data were analyzed for observer agreement within pairs and were found to be within the investigator's acceptable levels of agreement on more than 80 percent of the occasions for all but two of the seventeen subcategories. Determination of acceptable agreement was based on a variable scale which allowed considerable disagreement at very low frequency levels but was more severe at high frequency levels.

J. Matthews (97) developed The Physics Teacher Content Analysis instrument as part of a study designed to describe physics teacher content instruction by PSSC teachers and non-PSSC teachers. Matthews indicated that his major interest in the study was description of content instruction and that a partially-developed instrument by James K. Duncan, The Ohio State University, for describing the behavior of teachers as they teach content was available. Eighteen videotapes of seven teachers in physics classrooms were used to modify and refine this instrument into The Physics Teachers Content Analysis instrument. The instrument was thus developed by a combination of deductive and inductive processes.

There are eight major categories of the instrument, as follows: (B) Background, (N) Naming, (D) Defining, (E) Examples, (A) Amplification, (R) Response (all actions of students as a result of content instruction by the teacher), (M) Miscellaneous, (I) Indeterminate. Matthews stated that two notations (Personal and Vividness) are used to further describe the quality of teacher instruction in each of the above eight categories. Subcategories in several of the categories are also provided.

A Data Recording Sheet including verbal, non-verbal and a combination of verbal and non-verbal behaviors was used. A three-second time interval was the unit used in encoding. This time interval was selected after trial usage of 3, 5, 10, and 15-second intervals.

Reliability was estimated by means of observer stability. Encoding for this purpose was done at one-week intervals and during final data collecting, using given randomly selected 10-minute segments of videotapes. Overall observer stability reliability was 84 percent.

Four PSSC teachers and four non-PSSC teachers were videotaped five total class periods each. Data were encoded on Data Recording Sheets and transferred to computer cards for matrix design. Matrix analyzing, the Spearman rank correlation coefficient, and the Darwin chi-square were used for analysis and interpretation of the data.

Matthews reported that 78 percent of the verbal content instruction by non-PSSC teachers was in the steady-state cells of the matrices. He found very little shifting from category to category while maintaining verbal behavior. At least 40 percent of the non-PSSC teacher time was spent presenting content instruction verbally. Many other verbal activities were performed also.

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PSSC teachers were found to present content verbally about 47 percent of the total time. They spent little time shifting categories. Large increments of time were spent in verbal activities other than content instruction. A small percentage (about one-eighth) of the total content instruction by PSSC teachers was non-verbal. Again, there was little time spent in making category transitions within nonverbal behavior.

Over one-half of the non-verbal behavior of the non-PSSC teachers included content instruction involving students. Little time was spent in making category transitions while presenting content nonverbally. About 29 percent of the content instruction by non-PSSC teachers was non-verbal.

The teachers of the two groups were similar (based on rank correlation) in percentage of time spent in the categories of the system and percentage of time in steady-state cells (71 percent for PSSC and 83 percent for non-PSSC). However, there was a low correlation between the highest 50 percent transition cells of the two groups. There were also some major differences in high frequency steady-state cells. PSSC teachers spent about four times as much class time defining as did non-PSSC teachers, and about one-half as much time in Examples-Abstract. PSSC and non-PSSC teachers both spent about 85 percent of their time in some form of verbal (or verbal-nonverbal combination) behavior. PSSC teachers used nonverbal behavior in presenting content about 51 percent of the total time compared with 72 percent for non-PSSC teachers. Content instruction cycles for the two groups of teachers were also described and found to be similar when teachers spent considerable time in a specific category. However, when teachers shifted categories, differences in instruction cycles were found.

Reynolds, Abraham, and Nelson (137) reported the development of the Classroom Observational Record (COR). Their intent was to develop a verbal interaction category system to deal primarily with cognitive behavior with the ease of application and the reliability as Flanders-type systems.

A central hypothesis of the development of the COR was that certain planned strategies must be employed if teachers are to be successful in contributing to the strengthening of problem-solving skills in pupils. The developers reported that the categories had been adapted primarily from the Bellack and Flanders system and recording procedures, primarily from the Flanders system. The encoding unit utilized was the "Move," defined as "any discrete verbal utterance having a single cognitive focus."

The COR has 20 categories of Moves and 2 categories of Non-moves. These categories occur in five major subdivisions as follows: (I) Structuring Moves, (II) Soliciting Moves, (III) Reacting Moves, (IV) Responding Moves, (V) Non-moves. Structuring Moves are divided into the categories, (0) Reviewing, (1) Informing, (2) Directing. Soliciting Moves may be (3) Recalling, (4) Collecting Data, (5) Processing Data, (6) Evaluating or Verifying Principles and/or Conclusions. Reacting Moves are as follows: (7) Accepting, (8) Rejecting, (8') Rejecting Personal Behavior, (9) Calling for Clarification, (10) Calling for Evidence or Explanation, (11) Calling for the Opinion of Another Person, (N) Answering a Raised Hand, (R) Repeat. Responding Moves are (3') Recalling, (4') Presenting Data, (5') Processing Data, (6') Evaluating or Verifying Data, (K) I Don't Know.

Non-Moves are (12) Silence, (Z) Confusion.

Data are encoded on a tally sheet of two columns (teacher moves and student moves) every three seconds. Tallying procedures for a continued move and a changed move are provided. The tally sheet thus provides a sequential record of Moves. Observer agreement, using the Medley and Mitzel method, is reported to be from .64 to .99 for the 22 categories. Coefficients of discrimination ranged from .68 to .99.

Nelson, Reynolds, and Abraham (112) have reported paradigms depicting various kinds of classroom verbal interactions. They point out that the COR is able to detect various sequences of verbal interaction comprising such paradigms. Essentially, patterns of interaction can be sketched from the sequence evidence on the tally sheet, and these patterns can be compared to desired strategies derived from the paradigms.

Studies utilizing the COR (Abraham, Nelson, and Reynolds (2), and Abraham and Nelson, (1), and Nelson (111)),are reviewed by Evans in Section II.

Solomon (164, 165) developed a taxonomy for the classification and measurement of image-provoking cognitive behaviors of science teachers. The instrument, called the Taxonomy of Image Provocation Profile (TIP), is to be utilized in twelve 2-minute observation periods during each visit to the classroom.

The major levels of the TIP are as follows: (0) Provokes no imagery, (1) Uses concrete to provoke imagery, (2) Uses representation to provoke imagery, (3) Uses abstraction to provoke imagery. Level (0) may be: (.0) Uses concrete without imagery, (.00) Uses abstract without imagery. The other three levels have five subdivisions each as follows: (.10) Provokes visual image, (.20) Provokes auditory image, (.30) Provokes organic, kinesthetic, or tactual image, (.40) Provokes olfactory image, (.50) Provokes gustatory image.

Solomon stated that the initial instrument was developed on the basis of classification of developmental levels from the standpoint of imagery and subsequent field-testing of the instrument. A pilot reliability study was undertaken. Solomon reported that reliability, validity, and the ability of the instrument to discriminate between teachers were supported. Specific procedures and data concerning these findings were not reported in the documents reviewed.

Talley and Solomon (174) reported use of the TIP and the Florida Taxonomy of Cognitive Behavior (FTCB) in a study of cognitive teaching behavior of a college science teaching faculty. Analysis of the data from the TIP and FTCB indicated that teaching style could be discerned along the dimensions of concrete-abstract and knowledge-evaluation. A majority of the behaviors were found to occur at the knowledge and abstract levels. Differences in cognitive level between laboratory and non-laboratory as well as science and non-science instruction were reported.

Tisher (176) reported a study of verbal interaction in science classes and compared verbal interaction in science classes of Australia and the United States. Classification of verbal behaviors was based on the techniques of Smith and Meux (152) and Nuthall and Lawrence (114). The Smith and Meux categories were used, but instead of the episode as the encoding unit (as in Smith and Meux), the incident was used (as in Nuthall and Lawrence). The episode is any question or demand by the teacher and all the subsequent verbal moves up to and including the final response.

The categories of the system used by Tisher are as follows: (1) Describing, (2) Designating, (3) Stating, (4) Reporting, (5) Defining, (6) Substituting, (7) Evaluating, (8) Opining, (9) Classifying, (10) Comparing and Contrasting, (11) Conditional Inferring, (12) Explaining, (13) Classroom Management, (14) Unclassified.

Tisher stated that coder reliability in his study was measured in terms of inter-observer agreement, with a coefficient of .91. The data of the study were obtained in nine eighth grade science classes in two high schools. Six lessons per class were tape-recorded and transcribed. The greatest percentages of initiating questions were Describing (29.7 percent) and Designating (32.5 percent). The next highest percentages were Stating (10.7 percent) and Explaining (8.6 percent). This compares with Smith and Meux episodes on science transcripts in the United States as follows: Describing, 31.4 percent; Designating, 17.0 percent; Stating, 3.2 percent; Explaining, 12.1 percent. Here, Defining was higher (6.1 percent) as was Comparing and Contrasting (4.6 percent).

Tisher found also that 95 percent of the time devoted to talking in lessons was taken up by teacher-talk, and that someone was talking for about nine-tenths of each lesson. He suggests that the Flanders law of two-thirds becomes a law of nine-tenths for verbal behavior in Australian classrooms. Teachers were found to demand more than recall from their pupils in 23 percent of the incidents.

Affective Instruments

Baker (16) used the Flanders System of Interaction Analysis (FSIA) in a study of the effects of Elementary School Science (ESS) materials on classroom instructional behaviors in sixth grade classes. He stated that the teachers were randomly selected and that behavioral data consisted of two thirty-minute audiotapes from each of 25 ESS teachers and textbook teachers. Statistical tools used were the Mann Whitney U Test and chi square. Details concerning specific instruction or training, if any, given to either group of teachers, were not reported in the document reviewed. Rationale for use of this instrument and observer agreement procedures, were not provided in the document reviewed.

Baker reported that the ESS teachers had significantly higher indirect teaching influence and student talk-initiated than had the textbook teachers, and significantly lower direct teaching influence, lecture, and student talk-response.

Butler (34) studied teacher verbal behavior in Introductory Physical Science (IPS) classes. Two instruments were used for collection of descriptive data concerning IPS teacher behavior. One was the FSIA and the other was a modified version of a question analysis system based on the work of Aschner and Gallagher. Questions were thus classified as: (1) Cognitive Memory, (2) Convergent, (3) Divergent, (4) Evaluative, (5) Procedural. Butler indicated that these instruments were selected in order to measure behaviors suggested by IPS philosophy. Based on IPS statements of philosophy, Butler suggested that IPS teachers should use indirect teacher influence, indirect and broad questioning, and should encourage considerable student freedom in intellectual and laboratory exploration.

Data collection was accomplished by audiotape recording the basic IPS instructional procedures of pre-lab briefings, labs, post-lab discussions, and "homework, desk, and lab" (H.D.& L.) assignments and problems. The investigator and an assistant analyzed the questions on the tapes and reached a mutual decision on the classification of each question, using the question classification system. The tapes were then analyzed by trained Flanders consultants unfamiliar with the goals of this study. Butler reported the interobserver reliability of the consultants as .85 - .90, using the Scott coefficient.

Question types were totaled and expressed as percentages. They were then expressed in terms of each of the four major aspects of the IPS instructional procedure (pre-lab, lab, post-lab, H.D. & L.). A Flanders matrix was also prepared for each of these instructional procedures for each teacher. Thirty minutes of data were obtained for each of ten teachers in each of these four instructional procedures, resulting in a composite of two hours for each teacher.

The IPS teachers talked 68.6 percent of the time in all activities. Student talk was 26.6 percent. The I/D ratio was .408 and the revised I/D .653. (The revised I/D is arrived at by omission of categories 4 and 5, questioning and lecturing, to minimize the effect of subject matter). Category 4 (Asks Questions) constituted 19.7 percent of the total, while Category 5 (Lecture) was 36.2 percent of the total. Other category percentages were as follows: (1) Accepts Feeling, .1 percent; (2) Praises or encourages, 7.8 percent; (3) Accepts or uses ideas of students, .4 percent; (6) Gives directions, 2.9 percent; (7) Criticizes or justifies authority, 1.5 percent; (8) Student talk-response, 12.3 percent; (9) Student talk-initiation, 14.1 percent; (10) Silence or confusion, 4.7 percent. It should be noted, with respect to the data from the Flanders system, that Butler indicated that during long periods of silence in lab work, encoding was suspended to avoid erroneous use of Category 10 (Silence or Confusion). This fact must be taken into account when interpreting the above figures.

The percentage of each type of question classified, based on a total of 1857 questions, was reported as follows: Cognitive Memory, 18.8 percent; Convergent, 45.5 percent; Divergent, 6.7 percent; Evaluative, 7.5 percent; Procedural, 21.4 percent. Convergent questions constituted the highest percentage of the questions within each of the instructional procedures of IPS except "lab" where procedural questions were the highest. In "pre-lab" and "H.D. & L.," cognitive memory questions were second from

the top and in "post-lab," procedural questions were second from the top. According to Butler's analysis, over three-fourths of all teacher questions were direct (cognitive memory, convergent or procedural). Butler concluded that teacher verbal behavior patterns in both the affective and cognitive domains were inappropriate for the type of course IPS was designed to be.

Campbell (37) used the FSIA to study cognitive and affective process development of junior high school low achievers and its relation to a teacher's interaction ratio. His was an effectiveness study and is reviewed by Evans.

Campbell found that the indirect method was superior in terms of affectiveness on both affective and cognitive levels for low achievers. In studying the interaction matrices for specific differences between the two groups of teachers (identified as significantly different at the .01 level, using the modified Darwin chi square), Campbell found they did not differ substantially in indirect behaviors but in direct behaviors. The indirect teachers had 3.20 "Directing" behaviors compared with 6.4 for direct teachers. "Criticizing" behaviors were .40 for the indirect, compared with 2.0 for direct teachers (expressed as percentage of column totals). Direct teachers spent 4.39 percent of their time in extended direct Area B, compared with 1.41 percent for indirect teachers. The 7-9 and 9-7 cells produced .42 percent for the direct group and .03 percent for the indirect group.

Collea (38) used the FSIA and a Verbal Behavior Q-Sort (VBQS) developed by Molchen (105) in a study of 25 first year sixth through twelfth grade science teachers. He studied relationships between changes, during the school year, in self-perceptions of teachers as measured by the VBQS and changes in classroom verbal behavior as measured by the Flanders system.

The major study reported by Collea was thus a correlation study and is reviewed elsewhere in this document. However, several general findings are of interest here. The science teachers (grades 6-12) increased their desire during the year to motivate students but decreased their desire for student participation in classroom activities. They increased their intentions to justify their authority while also increasing their desire to use more indirect behaviors. The teachers perceived themselves as more direct, and the classroom observation data also indicated that they were more direct. They also perceived themselves as motivating students less and having less student participation than at the beginning of the school year.

LaShier (93) reported use of the FSIA in a study of a Science – A Process Approach Cooperative College – School Science Project. Data on teacher-pupil interaction were gathered in 18 classrooms, prior to the summer institute, while the teachers taught an independently planned science lesson. The results indicated that 52 percent of the total class time involved teacher talk, 29.4 percent involved student talk, and 17.9 percent involved silent activities or confusion. Post-institute data were as follows: Silence or Confusion, 29.80 percent; Student Talk, 19.54 percent; and a slight reduction in teacher talk. Other aspects of this behavior change study are reviewed elsewhere in this document.

C. Matthews (95) used the FSIA in a study concerned mainly with behavior change and, in particular, with the relation of the behaviors of the cooperating teacher to changes in classroom verbal behaviors of secondary school science student teachers. As primarily a behavior-change study, it is reviewed elsewhere in this document. Some attention was given to descriptive data and is briefly reviewed here.

Eighteen student teachers and eighteen cooperating teachers were used in data collection for six 30-to-60 minute observations each. Two observations were made in the first two weeks, two in the middle, and two during the last two weeks of student teaching. Coding was done from tape recordings. Time intervals during which the teacher worked with individuals or small groups of students were omitted from the investigation.

Observer stability was calculated based on ten 20-minute samples coded within one week of the observation and recoded after an elapsed period of six months. Matrices were compared by means of the Darwin chi square test. Since the paired matrices were not significantly different in any instance, Matthews concluded that coding stability was great enough to match the sensitivity of the Flanders categories.

Matthews presented the following data as descriptive of both the student teachers and their cooperating teachers. Teacher talk was 80-85 percent of the matrix total, and teacher lecture was 50-60 percent of the matrix total. Teacher questions constituted 10-12 percent of the matrix total and were usually less than four seconds in duration. Subject matter content constituted about 65-70 percent of the matrix total. "Steady-state" interaction was almost entirely teacher lecture (total steady-state was 55-65 percent of matrix total and teacher lecture steady-state was 40-55 percent of matrix total).

Teacher acceptance and use of student ideas was 3-5 percent of the matrix total. Teacher criticism of students was less than 1 percent, as was also teacher praise of students. Teacher indication of understanding the feelings of students was essentially zero. Teacher statements were generally more direct than indirect, but omitting lecture and questions. Teachers were slightly more indirect than direct and reacted predominantly indirectly to student response talk.

Student response to teacher questions was 7-10 percent of the matrix total. Student talk initiation was 5-7 percent of the student talk, with 24-30 percent found to precede teacher lecture and 19-30 percent found to precede teacher acceptance of student ideas (though only 3-5 percent of the matrix total was teacher acceptance of student ideas).

Montague (106) used the FSIA to compare verbal behaviors of preservice teachers when teaching students and when teaching peers. Interobserver agreement among three coders, based on the Scott coefficient, was .879. The t-test was then used in conjunction with a correlation coefficient to detect patterns as well as the significance of any differences between the two situations. The study was also replicated the following semester.

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In both trials, Montague reported finding no significant differences in percentage of time in: 1) praising, using student ideas, lecturing, giving directions; 2) total teacher talk; 3) student talk, both solicited and unsolicited; 4) I/D and i/d ratios; 5) extended lecture. Total teacher talk in the groups ranged from 50.1 percent to 58.7 percent; I/D ratios ranged from .45 to .51; and i/d ratios ranged from .74 to .88.

Newport and McNeill (113) used the FSIA in a comparison of verbal behavior evoked by Science - A Process Approach and by textbooks. The study largely pertained to behavior change and is reviewed by Evans.

Thirty-one members of a summer science workshop were the subjects of the study. Each planned and taped a lesson, sixteen of which were taken from the SAPA program and fifteen from elementary school science textbooks. These lessons were all taped before the teachers received any special training related to the study.

When these data were analyzed (using a t-test), only 2 of 23 response measures were found to differ significantly. Teachers using textbooks were significantly more indirect (.05 level), and pupils of teachers in the textbook group spent a significantly greater (.05 level) percent of time in sustained talk than SAPA pupils.

In both groups, teachers talked about 64 percent of the time, textbook pupils talked 26 percent of the time, and SAPA pupils talked 21 percent of the time. Thus, someone was talking about nine-tenths of the time in these initial lessons before training. Silence or confusion constituted somewhat less than 12 percent of the total class time in both groups. Newport and McNeill indicated that this measure provided a rough idea of the percent of class time devoted to individual and group "investigations."

Rogers (138) used a modified form of the FSIA in a study of classroom verbal behavior as related to teachers' perceptions of pupils in fifth-grade science classes. Rogers reported that the instrument was selected because the direct - indirect dimension of teacher behavior formed the main focus of the study, and because of the desire not to use videotape in the classroom, the successful trial use of the FSIA, and the potential for comparing findings with other studies using the FSIA. Rogers had also initiated trial usage of the Revised Verbal Interaction Category System (RVICS) but decided against use of it because of difficulties encountered with simultaneous pupil-pupil interaction and teacher-pupil interaction. Since the latter was the main focus of the study, a pilot FSIA study was initiated and this instrument was eventually used in the study.

The FSIA modification by Rogers is constituted of the addition of five levels of questions as subcategories of Category 4 (Asks Questions) as follows: (a) cognitive memory, (b) convergent, (c) divergent, (d) evaluative, (e) routine. In addition, notes were made on activity control, materials use, and size of functioning unit. Flanders coding and matrix procedures were utilized, but with a 14 x 14 matrix.

Inter-observer agreement was calculated using Scott's coefficient, with a result of .86. Coder stability was .91. Four lessons in four

different classrooms audiotape-recorded during the pilot study provided the basis for these estimates. The coefficient here was based on category ratios, not interaction events.

The major part of the study by Rogers concerned verbal behavior as related to teacher perception of pupils. This aspect of the study is reviewed elsewhere in this document.

Snider (158, 159) used the FSIA in a study of physics teaching based on a sample of 17 high school physics teachers of the New York State Regents Physics Course. Over 120 periods of physics teaching provided the data, and a grand composite Flanders matrix was produced and analyzed. Teaching was also segmented into four major activities as follows: (1) Planned Demonstration, (2) Lecture, (3) Laboratory, (4) Recitation-Discussion. A composite matrix for each major activity was produced and analyzed.

Distribution of tallies in the matrix was found to be practically constant for observations taken in a particular type of activity, but the styles were found to vary from one major activity to another. The teachers were found to provide 82 percent of the verbal communication in the classroom, of which 73 percent was associated with direct influence. Lecturing accounted for 92 percent of the teacher directness. About 16 percent of the teacher talk involved questioning and about 8 percent acceptance and clarification of student ideas. The I/I+D was 27 percent and the revised I/I+D (removal of content component) was 65 percent. "Accepts feeling" was 0.3 percent and "Praises and Encourages" was 1.5 percent of teacher statements. Snider noted that the data indicate relatively little learning through discovery, and little or no teaching to cultivate student inquiry. Of teacher statements in laboratory, 19 percent were directions and commands. There was less praise and encouragement as well as acceptance and use of student ideas than any of the other major activities. There was also more teacher criticism in the laboratory than in any other major activity and more directness on extended influence. Also, there was more acceptance of narrow questions than of student-initiated responses.

About 49 percent of all the tallies of the Grand Interaction Matrix are in column 5 (Lectures), 12 percent in column 4 (Asks Questions), and 6 percent in column 3 (Accepts or Uses Idea). About 12 percent are in column 9 (Student Talk-Initiation), 4.3 percent in column 8 (Student Talk-Response), and 11 percent in column 10 (Silence or Confusion).

Snider (160) also reported a second study, using the FSIA in an investigation of verbal interaction in Harvard Project Physics (HPP) classes. Eighteen HPP teachers were observed by means of audiotape recording of classroom discourse. A grand matrix for "Total Teaching" and a grand matrix for "Laboratory" were produced. Figures in the matrix were presented as percentages of total tallies and the matrices were compared with those generated in the earlier study of the New York State Regents Physics Course (designated TP).

For the HPP, "Laboratory" was found to be about 21 percent of "Total Teaching" compared with 13 percent for TP. In the laboratory, HPP criticism was 0.5 percent, but TP criticism was 2.3 percent. In "Total Teaching,"

the figures given are 0.5 percent and 1.6 percent respectively. Among the other differences in "Total Teaching" between the two groups, the following are the more prominent: Accepts or Uses Student Ideas - HPP, 2.6 percent, TP, 6.2 percent; Lectures - HPP, 41.7 percent, TP, 49.1 percent; Student Talk Initiation - HPP, 17.6 percent, TP, 12.1 percent; Silence or Confusion - HPP, 17.9 percent, TP 11.1 percent. Snider stated that his data suggest that a relatively drastic change in high school physics curriculum and materials does not imply a drastic change in the teacher's pattern of inter- action.

Considerable additional data are provided in the report, of which only a few can be mentioned here. Again based on "Total Teaching," HPP Teacher Talk was 59.8 percent, compared with 72.6 percent for TP; ratio of Teacher Talk to Student Talk was 2.78 for HPP, 4.43 for TP; the percentage of 8-8 and 9-9 was 7.8 for HPP, 4.4 for TP; the percentage of content was 66.0 for HPP, 74.1 for TP. The percentage of Teacher Talk in the 3-3 cell (Accepts or Uses Student Ideas) was 0.8 for HPP, and 2.9 for TP and the percentage of Teacher Talk in the 6-6 cell (Directions) was 3.5 for HPP and 1.9 for TP. In many of the other characteristics of behavior studied the groups were very similar. For example, "Lecturing" accounted for 92 percent of TP teacher directness and 91 percent of HPP teacher directness.

Snider concluded that there appeared to be less praise and acceptance in HPP than TP teaching, but more continual student-initiated talk in HPP than TP. The TP teachers used much more criticism than the HPP teachers. The HPP teachers overall exhibited a more direct influence in the "Labora- tory" than TP teachers. Snider concluded that the pattern of teacher- student verbal interaction on the dimensions of directness of teacher in- fluence is quite similar for HPP teachers and TP teachers.

Urbach (179) reported development of the Interaction Sequence Graph. It is a method, based on use of the FSIA, for presenting behavioral events in graphic form in order to preserve duration of the behavioral event and its relationships to preceding and subsequent behavioral events. The hori- zontal axis of the graph is a time line and the vertical axis of the graphs shown in the following sequence of Flanders categories: 5 (Teacher Lectures), 4 (Teacher asks question), 3(Teacher accepts or uses student's ideas), 8 (Predictable student response to teacher question), 9 (Student-initiated response). According to Urbach, the other Flanders categories of teacher talk "are interspersed in the spaces within the upper and lower limits of the graph." (179:15)

Data obtained from classroom teaching were analyzed also in relation to certain sequences of behavior (such as the sequence of Flanders cate- gories 5-4-8) and the duration of those sequences. The sequences, their frequency, and duration were presented as summaries of graphs.

Three sophomore high school biology teachers were observed eight times for two consecutive periods. Urbach found that the lecture-question-answer (5-4-8) and question-answer (4-8) sequences were the only sequences "common" to the three teachers in every observational record. The teachers were found to differ considerably in the lecture portion of the 5-4-8 sequence. One teacher typically lectured for less than one minute at a time, another

usually lectured for one to two minutes at a time, and the other often lectured for two or more minutes at a time. The teachers also differed considerably in the time they devoted to the 5-4-8 and 4-8 sequences. For one teacher, these constituted about one-third to one-half of all the sequences, while another teacher used very little besides these two sequences. Urbach concluded that he had found more variability than similarity in patterns of verbal instructional techniques among the three teachers, but that each teacher exhibited a repeating pattern.

Wallace (182) used the FSIA to study sex education verbal interaction in high school human biology classes. Data were obtained by analysis of six tape transcriptions. Three groups of pupils were studied: Group 1 (girls and boys), Group 2 (girls), Group 3 (boys). Wallace found that the mixed group had more verbal interaction during the sex education unit than the segregated groups (boys or girls), and that the all-boy class did not have more verbal interaction than the all-girl class.

Caldwell (36) developed an instrument which provides a ratio of the time a teacher spends with indirect activities to the time spent with direct activities. There are six indirect activity categories as follows: (1) Open-ended Laboratory, (2) Structured Laboratory, (3) Group Projects, (4) Student Demonstrations, (5) Student Reports, (6) Student Talking. The categories of direct activities are: (7) Workbook Work, (8) Teacher Demonstration, (9) Lecture. Two categories are not considered as either direct or indirect: (10) Teacher Questioning, (11) General Havoc.

Encoding is accomplished by recording a numeral every five seconds. The indirect to direct time ratio thus obtained is the "activity ratio." A "laboratory ratio" which is the percentage of time spent in laboratory experiences and a "questioning ratio" which is the percent of time a teacher spends asking questions can also be calculated.

Procedures of instrument development, reliability measures, and validity measures were not provided in the document reviewed. The instrument was used in an evaluation of an inservice science methods course, so that aspect of the study is reviewed elsewhere in this document.

Egelston and Egelston (42, 43, 44) developed a category system for use in a study of two methods of managing high school biology laboratory experiments. Their desire was to compare inductive or discovery teaching with traditional methods. The authors made the interpretation that the inductive teacher should be mostly indirect (that is, exhibit behaviors of FSIA; categories 1-4).

Egelston and Egelston indicated that they judged the FSIA the most appropriate of those perused "for describing those behaviors which would typically differentiate teachers in high school biology laboratory sessions" (43:21). They reported finding that the Parakh system had too many categories for reliable use. They found it necessary, however, to modify the FSIA extensively since nonverbal teacher and pupil behavior during lab exercises were to be incorporated.

The completed Egelston system contains 17 categories as follows: Teacher-Indirect: (1) Praises, jokes, accepts feelings, (2) Uses or corrects students' substantive responses, work, (3) Asks questions, (4) Oversees or passively supervises students at work; Teacher-Direct: (5) Reprimands, shouts, uses sarcasm, (6) Demonstrates technique, process, (7) Lectures, (8) Gives directions, (9) Actively looks at students' work; Pupil-Independent: (10) Looks up information, (11) Manipulates equipment, writes, (12) Initiates, volunteers, questions, (13) Gives information or assistance to other students; Pupil-Dependent: (14) Responds to teacher's question, (15) Seeks assistance, (16) Receives assistance. The other category is (17) Miscellaneous.

Observers were trained for ten hours, using The Amidon Training Tape, Interaction Analysis Training Kit -- Level 1, and were reported to have "attained nearly one hundred percent accuracy" (43:22). Teachers participating in the study had been differentially instructed as to the use of "inductive" or "traditional" approach, but observers were not aware of the differential instructions.

The major study in which the Egelston system was used was a comparison of teaching method between the two groups of teachers who received differentiated instructions on whether to use the "inductive" method or the "traditional" method, resultant pupil behavior, learning climate, and pupil achievement. The data thus pertain to behavior change and teaching effectiveness, so this aspect of the study is reviewed elsewhere in this document. A few additional features of instrument usage and data collection should be mentioned, however. Teacher-pupil interaction data were collected mainly during the first few minutes of the lab or at the end of the activity in post-lab discussion of results and conclusions. At these times the observer encoded pupil behavior for the entire class. During the activity portion of the lab, a single student's behavior was coded every three seconds and teacher behavior was collected once every minute.

Five x five matrices were developed for data analysis by lumping behaviors of certain combinations of categories. The authors suggested that the face validity of the system was strengthened by the results of measurable differences in classroom behavior between the two methods. They noted also that the more direct the behavior of the teacher, the more dependent the behavior of their students.

Hall (61, 62, 63, 64) reported the development and use of the Instrument for the Analysis of Science Teaching (IAST). The initial form of the IAST reported (61) was constituted of two parts: a 26 category system of interaction analysis, and a 15 item sign system completed by the observer at the end of each observation period. Hall reported observer reliability estimates made during the data collection period with a mean value of .772, using the Scott coefficient "Pi."

In a subsequent report, Hall described the IAST (63). He reported that it is an expanded form of interaction analysis and is based on the work of Flanders, Hough, and others. Matrices as well as I/D and i/d ratios similar to those of Flanders may be calculated. The teacher behavior categories of the IAST are as follows: (0) Student recognition, (1) Accepts

feelings, (2) Does clarifying of student ideas, (3) Causes student to clarify, (4) Initiates background or review information, (5) Initiates new information and directions, (5R) Teacher reading aloud, (6) Gives management information and directions, (7) Asks closed questions, (8) Asks open questions, (9) Criticizes or rejects student ideas, (10) Gives confirmation, yes, no, okay, (11) Gives praise, (12) Teacher-controlled silence. The student behavior categories are: (13) Student response closed (cognitive and skill), (13R) Student reading aloud, (14) Student response open (cognitive and skill), (15) Student affective response, (16) Asks substantive question (closed), (17) Asks substantive question (open), (18) Asks procedural question (closed), (19) Asks question (open), (20) Overt silent activity, (21) Covert silent activity, (22) Division of student to student interaction. The other category is (23) Nonfunctional behavior. This reviewer was not able to find a description of the 15-item sign system portion of the IAST in the documents reviewed.

Hall used the IAST in a study of the teaching behaviors of three groups of second grade teachers and of the relationship between the curriculum vehicle and the teaching behaviors. The curriculum vehicle utilized in the study was Science - A Process Approach. According to Hall, the questions examined in this study were as follows: (1) If a school system installs a recently developed curriculum, does this curriculum in and of itself influence teaching behaviors? (2) What effect does the method of teacher training and supervision have on the teaching behaviors of teachers teaching a new curriculum?

Groups SuS and InS were teaching Science - A Process Approach for the first time. SuS teachers had a five-day summer workshop and a biweekly visiting science consultant throughout the school year. Group InS had in-service sessions during the year before installation of the curriculum and also received supervisory help from their school system science coordinators. NoS teachers were not trained in teaching a new curriculum and were teaching science programs similar to those taught by SuS teachers in previous years.

Hall reported that the SuS teachers differed significantly from the NoS teachers in their use of more teacher and direction statements, student overt activity, teacher talk per amount of student talk, and teacher closed questions per number of open questions. He reported that the InS teachers differed significantly from the NoS teachers in their use of more teacher and direction statements, student overt activity, and direct motivation and control teacher behaviors. Both the SuS and InS groups differed significantly from NoS teachers in their use of fewer student closed statements than NoS teachers.

The two principal conclusions drawn by Hall were: (1) Teachers teaching Science - A Process Approach have some different teaching behaviors from teachers not teaching a recently developed science curriculum. (2) The five-day summer workshop and biweekly visiting science consultant were more effective than in-service training during the school year and supervisory help from the K-12 school system science coordinator. He suggested also that in the classrooms studied, the time spent in student overt activity was gained by a reduction in the amount of student-talk time and that the role

of the teacher in the Science - A Process Approach classrooms appeared to have shifted from teller of substantive information to teller of directions and procedures.

Hall also reported versions of the IAST for use in the modification of teacher behavior (64). These versions of the IAST are called the "IAST base" and the "IAST v.2." The IAST base is a 14 category system which the teacher is trained in using, and the IAST v.2 is a 32 category system for use by the supervisor. Both of these forms of the IAST have the following major divisions: (1) Accepts feelings, (2) Praise, (3) Acceptance of student's statements, (4) Question, (5) Direction, (6) Initiate substantive information, (7) Justification of authority, (8) Teacher controlled silence, (9) Student statements, (10) Student questions, (11) Affective response, (12) Student activity, (13) Division of student-to-student interaction, (14) Nonfunctional behavior. The IAST v.2 differs from the IAST base in that the former provides for encoding of more specific categories within several of the 14 major categories listed above.

Hoffman and Druger (67) reported development of The Tape Analysis Instrument as part of a study of the relative effectiveness of two methods of audio-tutorial instruction in biology. The function of the instrument in this study was to determine whether the two strategies which were designed to be different (as expressed on audiotapes and guidesheets) were indeed different.

The researchers pointed out that the instrument is similar to the Flanders instrument and stated that it was necessary to develop this tool because no interaction analysis system was available by which audiotaped lessons could be evaluated. The instrument was designed to determine the directness or indirectness of a lesson as obtained from teacher input through tape manuscripts and guidesheets for each group.

Hoffman and Druger presented the following as the categories of the instrument: (1) "Warming the Climate," (2) Knowledge Questioning, (3) Use of Knowledge Questioning, (4) Analytical, (5) Guiding, (6) Lecturing, (7) Informational Directing, (8) Operational Directing, (9) "Cooling the Climate." Categories 1-4 are regarded as indirect and categories 5-9 are direct. Categories 5 and 6 are called "Information Giving," and numbers 7, 8, and 9 are "Control Statements."

Activities were analyzed on a sentence-by-sentence basis, and all activities were recorded. Matrices were developed from the category numbers and I/D and adjusted I/D ratios computed.

Reliability was measured through the use of the Scott's method based on ten taped lessons as encoded by three self-trained observers. Averages on the tapes ranged from .86 to .94.

Further details concerning encoding and validity were not provided in the report reviewed. The instrument was used in a study of the relative effectiveness of two methods of audio-tutorial instruction. This aspect of the study is reviewed elsewhere in this document.

Hunter (70) studied the verbal behavior of first grade teachers as they taught science. Eleven of the teachers had participated in a training program in one of six new elementary school science programs; the other eleven teachers (control group) were selected so that the classes matched the experimental group in ability levels. Each teacher was observed on two separate occasions.

The instrument used to observe verbal behavior was the Revised Verbal Interaction Category System (Revised VICS – Science). The categories of the instrument are as follows: (1) Lecture, (2) Directions, (3) Questions, (4) Praise, (5) Acceptance, (6) Rejection, (7) Response to Teacher, (8) Response to Pupil, (9) Initiation to Teacher, (10) Initiation to Pupil, (11) Pupil Talk while using Materials, (12) Silence, (13) Silence while using Materials, (z) Confusion. Questions were classified as (a) Cognitive Memory, (b) Convergent, (c) Divergent, (d) Evaluative. Praise behaviors and rejection behaviors were categorized as: (a) No Reasons, (b) Personal Reasons, (c) Rational Reasons. "Response to teacher" behaviors were either (1) Predictably or (2) Unpredictably.

Hunter reported that pupils of teachers in the experimental group used materials to a greater extent than pupils of teachers in the control group. She reported also that there was nearly three times as much discussion while using materials in the experimental classes as in the control classes. It was suggested that this was probably due to a greater availability of materials. She also reported that teachers in the experimental group spoke significantly less than teachers in the control group, and that pupils in the experimental group spoke significantly more than those in the control group. In all other respects studied, including the verbal patterns of teachers and pupils, the two groups did not differ significantly.

Hunter reported that pupils worked silently with the materials only about 1 percent of the time. Although teachers spent about 40 percent of their talk-time asking questions, about 95 percent of all questions asked were of the cognitive memory type, compared with .04 percent evaluative and 0.4 percent divergent. Praise was used about 4 percent of the total class time. Almost 98 percent of the praise statements were given without reasons. Most rejections (about 5 percent of the class time) were also given without reasons. Teacher acceptance statements constituted about 8 percent of the class time. Pupil-initiated talk to other pupils (except while using materials) constituted 0.02 percent of the class time.

Hunter concluded that since training verbal interaction skills has been known to change the verbal behaviors of teachers, this should be included in curriculum materials training sessions if authors and publishers of programs desire that certain kinds of thinking take place.

Rusch (143, 144) carried out an investigation of an instructional treatment designed to alter reacting behaviors of prospective secondary science teachers. Since this is a behavior change study, the main body of the study is reviewed elsewhere in this document. However, a few words are appropriate here concerning the instrument used.

The study focused on teacher verbal statements classified by Bellack as reacting moves, which are statements which modify or rate what has been said previously. Rusch stated that the instrument is an empirically modified version of the praise, acceptance, and rejection categories of the Revised VICS. He indicated that it was his initial intent to measure three types of praise (minimal reinforcement, praise for no reasons or personal reasons, praise for rational reasons) and two types of rejection (rejection for no reasons or personal reasons, rejection for rational reasons). Trial coding of audiotapes resulted in the following system: (1) Minimal reinforcement, (2) Praise, (3) Acceptance, (4) Rejection, (5) All reinforcement – acceptance pairs, (6) All rating behavior.

Reliability of the instrument was estimated by the intrascorer method using Scott's coefficient. The intrascorer reliability of the investigator, based on a random sample of all audiotapes, yielded a coefficient of .984.

Multidimensional Instruments

Balzer (17, 18, 19) and Evans (21, 48) inductively developed an instrument for describing secondary school biology teacher behavior. Their intent was to develop a reliable category system based on actual descriptions of teacher behaviors as well as a method of encoding for systematic observation of biology teacher behaviors. A compelling theoretical consideration which favors the inductive approach is that there is a danger that various (perhaps significant) classroom behaviors not implied by a particular theoretical framework and deductive instrument development are being overlooked. The authors argue that reliance on purely deductive methodology in observational instrument development is likely to provide an incomplete and misleading picture of science classroom behavior, since all observations must then be seen in terms of the theoretical model which is set up in advance.

The instrument (Biology Teacher Behavior Inventory) and the method of encoding were developed from videotape recordings of eleven biology teachers during regular classroom and laboratory presentations. The tapes were recorded over a two-month interval. Each behavior which influenced the teaching-learning situation was recorded on an individual index card. The cards were then grouped according to descriptive similarity and behavioral intent and, after numerous revisions, were used to identify and define the categories, subcategories, and subdivisions of teacher classroom behavior. The development of the category system thus proceeded inductively from a narrative list of behaviors to subdivisions, subcategories, and categories, and then to the refinement and completion of the Biology Teacher Behavior Inventory (BTBI).

The categories of the instrument are as follows: (1) Management, (2) Control, (3) Release, (4) Goal Setting, (5) Content Development, (6) Affectivity, (7) Undecided. Subcategories of management were (1a) Routine Management, (1b) Laboratory Management, (1c) Study Management. Control, Release, and Goal Setting had no subcategories. Subcategories of content development were: (5a) Teacher Centered, (5b) Student Centered. Affectivity behaviors were classified either as (6a) Positive Affectivity or (6b) Negative Affectivity. Both teacher-centered content development and student-centered content development may be further classified as: (5-1)

Procedures, (5-2) Knowledge, (5-3) Scientific Process, (5-4) Tentative-
ness of Knowledge, (5-5) Generalizations, (5-6) Articulation of Content,
(5-7) Facilitates Communication. Each subdivision is communicated in the
following ways: (a) states, (b) asks, (c) shows, (d) acknowledges, (e) clari-
fies.

Symbols representing the appropriate categories, subcategories, and sub-
divisions are encoded on a Data Record according to the appropriate one of
four expressional forms: verbal, nonverbal, congruent, and contradictory.
Thus the first dimension of the BTBI is constituted of the various categor-
ies, subcategories, and subdivisions of the instrument and the second dimen-
sion pertains to the four expressional forms in which teacher behaviors were
found to occur. Within content development, the third dimension of communi-
cation method is also available, based on communications that were found to
occur in the classroom. This communication dimension could be developed
for the other categories of the BTBI.

In this study, time intervals of ten seconds were used to condense the
massive data which resulted from the continuous account of teacher behaviors.
Encoding was actually accomplished on a second-by-second basis, however,
and data could be processed directly in this form.

Interobserver agreement between the two researchers was determined by
use of the Scott Index of Intercoder Agreement and was found to be 0.92,
based on fifteen five-minute segments drawn at random from the videotapes.
Interobserver agreement was checked again at the midpoint and at the end of
data collection and was found to be 0.95 and 0.93, respectively. The in-
strument thus met the requirements of a category system in that the cate-
gories are mutually exclusive and essentially exhaustive of all behaviors
influencing the teaching-learning situation (0.09 percent of all behaviors
were encoded as "Undecided").

Five videotape recordings were made of each of four BSCS teachers and
four non-BSCS teachers over a period of three months. The forty tapes were
analyzed using the BTBI and the previously described encoding process. Data
were converted to percentages and analyzed in various ways by non-parametric
statistical tests.

Data analysis revealed that over 44 percent of the time was spent in
management behaviors and that almost 50 percent was devoted to Content
Development. About 2 percent of the encoded behaviors were "Control" and
about 1.6 percent were "Release." Less than 1 percent were "Goal Setting"
and about 1.4 percent pertained to "Affectivity" (positive and negative).

Teacher-centered "Content Development" constituted 47.08 percent of
the total and student-centered "Content Development" was 2.78 percent. Of
the "Content Development" behaviors (which constituted about one-half of
the total) about 33 percent were at the "Knowledge" level, about 20 per-
cent were "Procedures," 12.5 percent "Scientific Process," and 6.5 percent
"Articulation of Content." It was found that these teachers spent about
5 seconds per class period on student-centered scientific process behaviors.
Behaviors addressed directly to the nature of science were limited to those
dealing with the tentativeness of knowledge, which constituted just over

0.5 percent of the content development behaviors. About 1.2 percent of the content development behaviors were generalizations or summarizations and about 26 percent were "Facilitates Communication."

About 1.38 percent of all the behaviors were in "affectivity;" 0.53 percent were positive and 0.84 percent were negative. Less than 0.1 percent of all the behaviors were placed in the "Undecided" category.

Perhaps the most surprising finding was that over 65 percent of all behaviors encoded included the nonverbal form of expression influencing the teaching-learning situation. About 39 percent of the behaviors encoded were strictly nonverbal, 26 percent were congruent, almost 35 percent were verbal, and .10 percent were contradictory. Thus about 60 percent of the behaviors included the verbal component. It should be mentioned that entire class periods were recorded and that no teacher's behaviors influencing the teaching-learning situation were deliberately omitted.

The Mann-Whitney U Test was used to examine the behaviors of the two groups of teachers (BSCS and non-BSCS) for significant differences. When this test was applied to each of the items of the BTBI, it was found that the two groups of teachers failed to differ significantly at the .05 level with respect to any of the categories, subcategories, or subdivisions. The subdivision "Scientific Process" most nearly approached significance with $p = .056$. It should be pointed out that the data represent behaviors unaltered, insofar as possible, by the design of the research. No efforts were made to encourage either BSCS teachers or non-BSCS teachers to teach in a certain way.

Using the Kendall Coefficient of Concordance, the behaviors of the teachers were examined for similarities. When this test was applied to the behaviors of the teachers based on the six major categories, the agreement among ranks of the eight teachers was found significant at the .01 level. When based on the seven subdivisions of "Content Development," the agreement was also significant at the .01 level, as was the case when applied to the subcategories and subdivisions of the various categories of the BTBI.

The Kruskul-Wallis one-way analysis of variance was used as a test of significant differences among teachers with respect to various items of the BTBI. Differences among ranks of the eight teachers for the five recording sessions were found to be significant at the .05 level for the following items of the BTBI: Management, Control, Release, Content Development, Affectivity, Laboratory Management, Scientific Process, Facilitates Communication, and Negative Affectivity. We thus have a situation in which there is significant agreement among teachers in the ranks of the various items of the BTBI, but a significant difference among ranks of teachers when examined on a number of the particular items of the BTBI. This means, for example, that the teachers studied were similar in greater usage of "Content Development" behaviors than "Control" behaviors, but differed significantly in that some teachers consistently displayed more "Control" behaviors than other teachers.

Hassard (65, 66) developed the Science Teacher Behavior Code and utilized it in a study of ninth grade earth science teachers. Instrument development was accomplished in an inductive fashion. Videotapes were made of a random sample of 16 junior high school science teachers from a population of 135. Earth science and physical science teachers were included. Each of the two groups was randomly sampled to insure representation. Sixteen videotapes were thus obtained and were utilized to observe and record classroom behaviors to be subsequently organized into the teacher behavior code. The behaviors were recorded on 3 x 5 cards and then organized into groups and subgroups of stacks. These groupings became the tentative categories and subcategories which were revised on the basis of trial usage of the tentative instrument on the videotapes.

The result of the above procedures is a category system composed of 5 categories, 29 subcategories, and 4 indices of teacher behavior. The five categories are: (1) Content Development, (2) Management, (3) Facilitating, (4) Climate, (5) Not Coded. Content Development (verbal) subcategories are: (a) Knowledge Question, (b) Process Question, (c) Evaluative Question, (d) Objectives, (e) Procedures, (f) Information, (g) Explanation, (h) Summary. Content Development nonverbal subcategories are: (a) Writes, (b) Demonstrates, (c) Gestures, (d) Points. Management subcategories are: (a) Administrative, (b) Media and Materials, (c) Assignments, (d) Proctors. Facilitating (verbal) subcategories are: (a) Repeats, (b) Clarifies, (c) Recognize, while nonverbal subcategories under "Facilitating" are: (a) Attending, (b) Silence, (c) Recognition. Climate subcategories are: (a) Positive, (b) Negative. The indices are obtained by combining the scores of teachers on various subcategories of the instrument, and they are as follows: (1) Teacher Climate Index, (2) Teacher Interaction Index, (3) Teacher Process Index, (4) Instructional Index of Teacher.

A point in time sampling technique was used, rather than a time interval technique, with sampling every five seconds. Interobserver agreement and stability reliability were calculated for the instrument and for each of the categories, using the Scott Index of Intercoder Agreement. Overall interobserver agreement was found to be .91 and overall stability was .93. Interobserver agreement and stability data were based on ten five-minute segments of teacher behavior. The time between first and second coding for stability data was one week. The researcher and another graduate student comprised the observers for interobserver agreement data.

The instrument was used to measure the classroom behavior of eight ninth grade earth science teachers (non-ESCP) during two class sessions. Hassard was interested in describing teacher behaviors, identifying similarities in behavior patterns of teachers, and identifying relationships between teacher and student behaviors as measured by the Science Teacher Behavior Code and the SCAN Observation System, (3) respectively.

Average percentages of teacher behaviors in each of the categories were as follows: Content Development, 64.0 percent; Management, 16.4 percent; Facilitating, 13.1 percent; Climate, 4 percent. An average of 25.7 percent of all teacher behaviors were Content development verbal information behaviors. The question subcategories compared as follows: Knowledge, 3.9 percent; Process, 2.8 percent; Evaluative, 0.3 percent. Content Development

behaviors that were strictly nonverbal comprised 14.4 percent of the teacher behaviors. The greatest percentage of "Facilitating" behaviors occurred in the nonverbal category "Attending" with 9 percent. Teachers showed about 3 percent positive behaviors and 1.1 percent negative behaviors in the "Climate" category. Average percentages for the forms of expression were given as follows: Verbal, 60.8 percent; nonverbal, 25.8 percent; verbal/ nonverbal, 13.2 percent.

The chi square test was used to test the significant difference of behaviors of each teacher from the average as measured in each category, subcategory, and index. Only a few of the major findings can be reported here. No significant differences were observed in the categories "Content Development" and "Climate." However, there were significant differences among teachers in regard to several subcategories of Content Development (procedures, explanation, writing content, gestures, points). Significant differences occurred also in the categories "Management" and "Facilitating" as well as in several subcategories of "Management" and the "Attending" subcategory of "Facilitating." There were no significant differences found in the subcategories of "Climate" nor in regard to the three forms of ex-pression. Significant differences were found for the Teacher Climate In-dex and the Instruction Index of Teacher.

Agreement among ranks of the teachers on categories, subcategories, forms of expression, and indices was computed using the Kendall technique. Agreement at the .05 level of confidence was reported for eight dimensions.

Fischler and Zimmer (51) developed an observational instrument for sci-ence teacher behavior. They indicated that the identification of behaviors should be related to the purpose of the observations, which in this case was the teaching of science to children of different ability levels. They specified that the nature of the way in which children of different ability levels learn helped identify behaviors included in the instrument. They suggested also that the teaching of science is different in significant aspects than the teaching of other subjects and that an examination of these differences helped identify the behaviors included in this instrument.

The instrument, utilizing observation by an eye witness, makes use of the time unit sampling technique. The instrument is a two-dimensional check-off sheet. Observed behaviors (defined in terms of overt action) are recorded in five-minute time intervals. The authors indicated that the initial instrument was refined on the basis of trial usage.

The instrument, called the Science Teaching Observational Instrument, is constituted of three major parts as follows: (1) Teaching Techniques, (2) Teacher's Questions, (3) Characteristics of Teaching. Teaching Tech-niques has five major subdivisions as follows: (1) Teacher Talk, (2) Teacher and Student Talk, (3) Teacher does something as well as talk, (4) Students do something besides discuss with the teacher and answer questions, (5) Purpose of the lesson. Teacher's Questions are classified into 5 types: (1) Recall Facts, (2) See Relationships, (3) Make Observations, (4) Hypo-thesize, (5) Test Hypothesis. Characteristics of teaching are classified into three groups: (1) Concrete-Abstract (a continuum referring to the method of communication used by the teacher to impart knowledge or under-

standing), (2) Practical-Theoretical (a continuum having to do with the subject matter taught), (3) Directed-Nondirected (applying only to student activities).

In addition to the above classifications, considerably greater detail is available in each of the areas of Teaching Techniques. Teacher Talk may be classified as: (1) Gives Directions, (2) Introduction, (3) Lecture, (4) Summarizes, (5) Explains. Teacher and Student Talk could be classified as: (1) Recitation, (2) Requests Questions, (3) Discussion. Instances where the teacher does something as well as talk are classified as follows: (1) Uses A-V Aids, (2) Demonstration, (3) Helps Individual Students. Instances where the students do something other than answer questions and discuss with the teacher are classified as: (1) One Student or Small Group to Class, (2) Individual or Group Work, (3) Laboratory Work. Purpose of the lesson could be classified as either (1) Review or (2) Evaluation.

With respect to "Teaching Techniques," the authors specify that the observer should try to determine which is the dominant technique for a given time interval, and that more than one technique should not be recorded for a given time interval. The exception allowed is when teachers divide the class into groups doing different activities. Numerous specific ground rules for using the instrument are provided.

Interobserver agreement and reliability determination were through use of a graphical method designed by Mosteller and Tukey which makes use of binomial probability graph paper. The scores for each category are plotted in a scattergram fashion and regarded as acceptable if all points lie with plus or minus two standard deviations. Fischler and Zimmer regard this method as advantageous in that it provides constant control of reliability when two observers are working, providing immediate indication where disagreements are occurring. In the study reported, the criterion for acceptable agreement between observers was met. It was found that about two weeks of observering was necessary for proper training of an observer. No data arising from use of the instrument were given in the report.

Moon (107) reported usage of the Science Teaching Observation Instrument (STOI) and the Flanders system in a study of SCIS teachers and behavior change (reviewed elsewhere in this document). He stated that two individuals were trained for lesson analysis in this study and that random samples of lessons previously analyzed were recorded by both individuals throughout the study for a measure of intraobserver reliability. The Scott coefficient was used, for both the Flanders system and the STOI. Moon reported that there were 16 such reliability checks and that all but two produced results ranging between .70 and .91. He did not indicate in the document reviewed whether one or both of the instruments provided the lower reliability results.

Moon indicated that some difficulty was encountered distinguishing between behaviors of categories eight and nine of the Flanders system (student talk-response and student talk-initiation), because of the diverse array of activities occurring simultaneously in the classroom. He suggested that a modification of the Flanders system might be in order for future studies which involve laboratory-oriented classroom activities.

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Altman (5) developed the Science Observation System (SOS) and utilized it in classes of grades 3 and 4 in inner-city and advantaged areas while SCIS Life Cycles lessons were taught. The raw data were obtained by means of an audiotape recorder and notes taken concerning non-verbal activities.

The SOS is a multidimensional system which was developed by modifying the observational system of Fischler and Zimmer according to concepts and procedures of Karplus and Thier, Flanders, Aschner and Gallagher, Bellack, and Jackson. Several forms of this instrument have been presented in the literature by Altman. The dimensions of the instrument are Communication Method, Classroom Procedure, Cognitive Behavior, Affective Behavior, as given in the reference previously cited.

The Communication Method Dimension includes Abstract categories as follows: Teacher Tells, Teacher Asks, Student Talk-Response, Student Talk-Initiation, Class Response, Student Writes/Reads, Audio-Visual Aids. The Concrete categories are: Demonstration, Lab Work-Directed, Lab Work-Non-directed.

"Classroom Procedure" categories are "Classroom Control," and "Management," plus "Opinion" categories "Feedback" and "Evaluation." There are also "Agenda" categories as follows: "Giving Directions," "Structure," and "Introduction."

"Cognitive Behavior" categories include "Level" categories as follows: Recall Facts, Make Observations, See Relationships, Hypothesis, Test Hypothesis. Other cognitive behavior categories are "Description" categories as follows: Explain, Explore, Summarize/Invent, Review.

The Affective Behavior categories are as follows: Praise-Idea, Praise-Person, Criticism-Idea, Criticism-Person, Admission, Humor, Muddles, Confusion. Additional categories are "Silence" and "Not Codable."

The SOS was especially developed for this study and the manner of development appears to be primarily deductive. Inter-observer and stability figures were not given in the documents reviewed but were reported to be sufficient to justify confidence.

Extensive descriptive results were given which compared the inner-city and advantaged classrooms. In both situations, lab work took about one-third of the class time, two-fifths of the time was devoted to talk, and one-tenth of the time was used for managerial routines. Data of the Communication Method Dimension showed that inner-city teachers talked 34 percent of the time compared to 40 percent for advantaged. Inner-city students talked 8 percent compared to 13 percent for advantaged. Thus total talk was 43 percent for inner-city situations, made up of 16 percent cognitive, 22 percent procedural, and 5 percent affective. For the advantaged, the total of 40 percent was made up of 19 percent cognitive, 16 percent procedural, and 5 percent affective.

Data from the Classroom Procedure Dimension showed that procedural activities took 32 percent of the total lesson time in inner-city situations compared with 28 percent in advantaged situations. Extensive data were reported in the Cognitive Behavior Dimension. Verbal cognitive

interaction took 16 percent of the total class time in inner-city situations compared with 19 percent in advantaged areas. Generally the data were similar for the two groups in this dimension except that more time was spent in the advantaged situations making observations (27 percent vs. 19 percent of the time in this dimension) and there was less time spent on recall of facts (34 percent vs. 39 percent). In addition, in the advantaged situations, less time was spent on "explain" (61 percent vs. 71 percent) and more was spent on "explore" (31 percent vs. 23 percent). Also, relationship categories showed that student talk-initiation occurred 34 percent of the time in the advantaged situations compared with 15 percent in inner-city situations. Both groups of teachers asked about twice as many "recall facts" and "see relationships" questions as observation, hypothesis, and test hypothesis questions.

Data of the Affective Behavior Dimension revealed that affective behavior took place 8 percent of the time in inner-city situations and 11 percent in advantaged situations, and that ideas were praised much more (nine times and seven times, respectively) than criticized.

C. Matthews and Phillips (96) have reported the development of the Science Curriculum Assessment System (SCAS). Theirs is an attempt to provide techniques to fulfill the following requirements: (1) test for more than recall, (2) provide evaluation that is non-program specific, (3) include data on student performance, teacher performance, and classroom environment. The SCAS is a system, then, for monitoring changes in children and teachers associated with implementation of a variety of new curricula. It combines interview techniques and theories of Piaget with techniques of classroom interaction analysis, providing information on the intellectual development of children, classroom behavior of teachers and children, and the child's interpretation of his environment.

The categories of the SCAS occur in two major groups: teacher behaviors and student behaviors. Teacher behaviors are categorized into one of ten categories. Behaviors of each category may be encoded in two ways: (T) interacts with more than six children, (S) interacts with less than seven children. The teacher behavior categories are as follows: (0) miscellaneous, (1) does not observe student behavior, (2) observes student behavior but does not respond, (3) accepts and/or encourages student behavior, (4) suggests alternative to student behavior, (5) rejects and/or discourages student behavior, (6) provides reprimand, criticism, ridicule, sarcasm of student for behavior, (7) asks questions, (not rhetorical), (8) gives information to students, tells what activity should be done, asks rhetorical question, (9) gives directions or information which tells how activity should be done.

Student behaviors are also categorized into one of ten categories, and behavior of each category may be encoded as either (L) Lesson Related, or (N) Non-Lesson Related. The student behavior categories are as follows: (0) miscellaneous, (1) observes teacher or student who demonstrates for teacher, (2) follows teacher's directions (or suggestions) as to how activity should be done, (3) does not follow any specific teacher direction regarding how an activity should be done, (4) responds to teacher question or request (by telling or showing), (5) initiates (or attempts to initiate)

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interaction with teacher; continues self-initiated interaction with teacher, (6) initiates interaction with another student, (7) receives ideas from another student (who is not demonstrating for teacher), (8) copies other student (or follows instructions of other student; must be preceded by "7"), (9) gives ideas to another student (not at the request of teacher). Three classroom observers form a team for SCAS classroom utilization. One member observes the teacher. Each of the other two observe six children each.

Phillips and Matthews (129) reported also that the SCAS includes a part which pertains to intellectual level as defined by performance on Piaget-type tasks. Each child is described in terms of his response to specific questions in an interview situation. The twelve tasks selected for initial trial were as follows: eight conservation tasks (amount, discontinuous substance, length, area, weight, displacement volume, number, perimeter), ordering, class inclusion, multiplicative classification, and perspective.

The authors reported success in training school personnel in the accurate presentation of SCAS interview protocols. Interviews were recorded on audiotape recorders and subsequently scored by trained personnel.

Matthews and Phillips (96) also reported two trial uses of the SCAS. The first trial usage was to monitor implementation of a science program (CSLE Level One). This study involved 15 first-grade teachers and six students selected randomly from each of the 15 classrooms. Feasibility Trial Two was to monitor implementation of Science - A Process Approach at grades one, three, and five in a city school system. The authors emphasized that these trials were not research investigations utilizing SCAS, but rather studies illustrating the use of SCAS for answering specific questions.

For the first trial study, a 30 x 30 matrix was constructed for teacher behavioral data and another such matrix was constructed for student behavior data. For each matrix, 74 "behavior scores" were computed for the teachers and also for each student. These 74 scores were computed as proportions of various important groupings within the matrix. Data were collected in two series and analyzed using the Friedman Two-Way Analysis of Variance by Ranks Test. Significant changes were identified and discussed. Interview data were also collected in two series and analyzed using the Friedman Two-Way Analysis of Variance.

Feasibility Trial Two was to monitor the implementation of Science - A Process Approach at grades one, three, and five in a city school system. The authors stated that the procedures and data analysis were similar to those utilized in Trial One. Findings of this study were not reported in the documents reviewed.

Bird (28) used the SCAS in a study of teacher dogmatism and teacher behavior. A group of 43 elementary school teachers enrolled in a AAAS inservice program was involved in the study.

Significant differences between groups were reported at the .10 and .05 levels for 16 SCAS behavior scores. These differences provided the following indications: open-minded teachers interacted more frequently with small groups of students than did the closed-minded teachers, and the latter

interacted more frequently with large groups of students (behavior scores 1, 2, 27, 31, 52); closed-minded teachers spent more time questioning large groups (scores 49, 72), giving information and asking rhetorical questions (scores 50, 73), giving directions on how to do an activity (scores 22, 51, 74), and suggesting alternatives to student behavior (scores 17, 69). Open-minded teachers spent more time giving information to small groups of students (scores 11 and 40).

For several years the staff of Mid-Continent Regional Educational Laboratory (McRel) has been involved in efforts to define inquiry, to prepare instrumentation for classroom analysis of inquiry behaviors, and to facilitate inquiry skills development in classrooms. An early concern was to develop an instrument to measure cognitive operations, especially questioning (8). An initial instrument was developed, revised, and named the McRel Instrument for Measuring Interaction Categories (MIMIC). As a new model of inquiry evolved at McRel, the MIMIC was revised and integrated with the modified Flanders system and renamed the Cognitive Operations Monitored in the Classroom (COMIC) instrument. The COMIC is thus seen as an instrument used to provide an indication of the cognitive nature of inquiry activities and to provide data complementary to that provided by the Flanders system.

The bases for classifying verbal behaviors of inquiry with the COMIC are logical content, temporal referent, and context. The content is what the statement contains; temporal referent refers to cues in time perspective, and context pertains to who is producing the knowledge. When the observer classifies, he does it on all three bases.

A three-second time interval is used, and the COMIC and Flanders interaction analysis are used simultaneously. The categories are as follows: (-) Unclassified Inquiry Statements: The "Blank" Category, (1) Statements of Facts and Information, (2) Statements of Relationships, (3) Verbal Predictions or Plans, (4) Statements about the Function of a Method of Logic or a Thought Product, (5) Verbalized Decision or Collective Judgement of a Group or Teacher, (6) Verbally Expressed Procedural Steps and Methods, (7) Statements of Sensory Observations, (8) Statements Unrelated to the Problem. Numerous ground rules to be used while coding teacher-pupil verbal behaviors with COMIC are provided.

Reliability measures were reported, based on the Scott coefficient. Estimates of reliability ranged from .70 in initial trials to .80 as experience was gained with usage and ground rules.

A further revision of the COMIC has been reported by McRel (8). This form is called the Revised Inquiry Analysis System, and involves coding in three major columns. The first is very similar to the nine major categories of the Flanders system of interaction analysis. Column Two has student counterparts to the teacher behavior categories of Column One plus: (8) Decision by Class Groups or Teacher, (9) Non-inquiry Talk by Class Members (Pupil or Teacher). The behaviors of Column Two are regarded as social-affective events. Column Three, dealing with cognitive events, is made up of the following categories: (1) Factual Information or Single Idea, (2) Comparisons and Generalizations, (3) Predicting and Planning, (4) Inquiry

into Inquiry Operations, (5) Inquiry into Inquiry Attitudes, (6) Present Procedures to Obtain Knowledge, (7) Sensory Observations, (8) Formulating Question or Discrepant Event, (9) Assessing Content, Goal, or Procedure. The categories of Column Three constitute a revision of the categories of the instrument discussed above. There are three special categories as follows: (1) Pupil Exchange, (2) Silence or Confused State, (3) Disruption.

Moore (108, 109) studied teacher and pupil verbal behavior and teacher procedural and evaluative behavior in relation to objectives unique to PSSC and non-PSSC curricula. Two sets of objectives were selected: one set consisted of those objectives unique to the PSSC curriculum, and the other set was composed of those unique to the non-PSSC curriculum. A model of teacher behaviors, consistent with a given set of objectives, was then developed for each set of objectives. Instruments for the recording of teacher and pupil verbal behaviors and teacher scheduling and testing techniques were then prepared on the basis of these models. The instruments were then used for the recording of teacher and pupil behaviors in classrooms in which one or the other of the two types of curricula was being used. Some data were obtained live, and some were obtained by use of audiotapes. Validity and reliability procedures were not described in the documents reviewed.

Encoding was accomplished by use of a multiple sequence category system which consisted of four columns of categories relating to the following: (1) Class Orientation, (2) Speaker and Type of Communication, (3) Content or Goal of the Communication, (4) Orientation to the Two Sets of Curriculum Objectives. Five-second intervals of time were used, and single-digit numbers were used to denote each column of the instrument. Moore stated that separate instruments were developed for teacher nonverbal scheduling and testing techniques. The scheduling behavior instrument was completed from teacher interviews.

Ten physics teachers, five of whom were using PSSC materials and five using non-PSSC materials, were observed five class periods each. Seven laboratory sessions were included in the total.

Moore reported that in non-PSSC classes, 22 percent of all class time was devoted to teacher and pupil verbal behaviors consistent with non-PSSC objectives, while behaviors consistent with PSSC objectives accounted for 3 percent of the class time. In PSSC Classes, 27 percent of the time was given to behaviors consistent with PSSC objectives and 8 percent to behaviors consistent with non-PSSC objectives. In non-PSSC classes, silence or confusion accounted for 16 percent of the class time; in PSSC classes, it was 13 percent.

Teacher or pupil verbal behaviors presumably consistent with both sets of objectives accounted for nearly 59 percent of the class time in non-PSSC classes and nearly 52 percent of the class time in PSSC classes. Teacher's talk accounted for 70 percent of the time in non-PSSC classes and 69 percent in PSSC classes. Pupil talk accounted for 14 percent of the time in non-PSSC classes and 18 percent in PSSC classes. In both groups of classes, teacher stating, asking for, or answering with a fact accounted for over 50 percent of the class time. Moore reported that all the non-PSSC lab sessions were used for verification, and that three of the four PSSC labs were used

for inquiry. Fifty-one percent of the non-lab time in non-PSSC classes was devoted to lecture, demonstration, and factual recitation, while in PSSC classes, the figure was 46 percent. Moore reported that in PSSC classes, the demonstrations were aimed at discovery to a greater degree than in non-PSSC courses.

Petit (127) used the verbal behavior instrument designed by Moore (109), an adaptation of the Kochendorfer BCAC (85), and an instrument derived from Bloom's Taxonomy in a study of the behaviors of PSSC and non-PSSC teachers and their effect on student achievement. Rationale for utilization of these instruments and reliability procedures were not described in the document reviewed.

Petit reported that PSSC teachers spent significantly more time asking or answering questions, hypothesizing, or generalizing and significantly less time defining terms than did non-PSSC teachers. PSSC teachers were also significantly higher in class discussion, student discovery of relationships, and asked oral and test questions at higher cognitive levels than non-PSSC teachers. They were significantly lower in supervised study, and verification of known conclusions and technology of consumer products than the non-PSSC teachers.

Petit also reported that there was little evidence of inquiry in the PSSC and non-PSSC classes because neither group spent much time on objectives related to the models or methods of science. Significantly larger percentages of PSSC than non-PSSC students perceived themselves having freedom in the laboratory, test questions at higher cognitive levels, and student-directed activities.

Parakh (120, 121, 122) carried out a two-phase investigation of teacher-pupil interaction in high school biology classes. The principal objectives of the study were to develop a reliable category system for first-hand systematic observation of teacher-pupil interaction in high school biology classes and to describe and analyze the characteristics and patterns of teacher-pupil interaction in those classes.

Parakh stated that the theoretical framework underlying his category system is taken from communication theory and social interaction theory. The classroom communication process is seen as giving and seeking information by teachers and pupils. The development of the instrument also included an inductive component, however, in that a heterogeneous sample of eight teachers was observed once per month each for four consecutive months for behavioral data for instrument development. The tapes and notes were studied and typescripts prepared. Repeated study of these records resulted in tentative categories and, eventually, the category system.

The classroom behavior of teachers is conceptualized along three inter-related dimensions: (1) Evaluative, (2) Cognitive, (3) Procedural. Other dimensions are: (1) Pupil Talk Dimension, (2) Silence, (3) Not Categorizable. The major categories of the Parakh system are as follows: Evaluative Dimension: (1) Teacher Praises, (2) Teacher Accepts, (3) Teacher Qualifies, Corrects, (4) Teacher Reprimands; Cognitive Dimension: (5) Teacher Demonstrates, (6) Teacher Gives Substantive Information, (7) Teacher

Gives Laboratory and Substantive Directions, (8) Teacher Asks for Substantive Information, (9) Teacher Looks; Procedural Dimension: (10) Teacher Asks Procedures, (11) Teacher Routine Directions, (12) Teacher Routines, (13) Teacher Supervises; Pupil Talk Dimension: (14) Pupil Asks for Substantive Information and Assistance, (15) Pupil Gives Information or Responds; Silence Dimension: (16) Silence; Not Categorizable Dimension: (17) Not Categorizable. In all, there are forty-five categories and subcategories in the dimensions above. Parakh stated that expressive nonverbal behaviors such as smiles, frowns, grimaces, and gestures are not included except to the extent that they are considered helpful in placing behavior into the categories of the system. Parakh pointed out that, although the number of categories is large, use of the system is not as difficult as it might appear because of the repetitive effect achieved by a combination of the following factors: (1) two sources of communication (teacher and pupils), (2) two ways of exchanging information (giving and seeking), (3) four logical operations of teaching (defining, fact-stating, explaining, evaluating). As these factors are repeated in the instrument, the number of categories increases, but without a corresponding increase in difficulty of use.

Reliability of the category system was estimated by inter-observer agreement using Scott's coefficient of reliability with results of .8 to .9. Parakh pointed out that there is very little question about fact validity of this instrument since the categories require very little inference.

The procedure for categorization is to record the number of the category most nearly represented every five seconds. By recording the numbers in rows, some information about sequence is retained. Categorization is accomplished on the basis of pedagogical function or operation rather than on the basis of inferences about the intentions or motivation of the speaker or actor.

Parakh reported that the end product of the first phase of his study is a highly reliable category system for first-hand systematic observation of teacher-pupil interaction in high school biology classes.

In the second phase of the study, the instrument was used in a description and analysis of teacher-pupil interaction (120). Aspects studied were: (1) Teacher Talk, (2) Teacher's Nonverbal Behavior, (3) Pupil Talk, (4) Teacher's Behavior in the Cognitive Dimension, (5) Teacher's Evaluative Behavior, (6) Teacher's Procedural Behavior, (7) Silent Pauses, (8) Patterns of Interaction, (9) Wide Differences in Teacher-Pupil Interaction.

Parakh reported that the "average or composite" teacher talked about 75 percent of the total class time in lecture-recitation-discussion classes, and about 50 percent of the total class time in laboratory classes. With respect to teacher's nonverbal behavior, the principal result reported was that the average teacher's pedagogically relevant nonverbal behavior accounted for about 8 percent of total time in lectures and 37 percent in labs. Pupil talk addressed to the teacher accounted for 15 percent of the total time in lectures and 13 percent in labs. Pupil responses and information giving constituted 12.4 percent of the time in lectures and 6.7 percent in labs. Teacher's evaluative behavior such as praising, encouraging, and accepting student performance and ideas constituted about 7 percent of the time in lectures and 3 percent in labs.

Parakh stated that pupil questions were seldom if ever praised or encouraged. He found that about 18 percent of the time in lectures and 40 percent in labs was devoted to teacher procedural behavior. Teacher's behavior in the cognitive dimension constituted an average of 54 percent of the total class time in lectures and 42 percent in lab. Information giving constituted 43 percent and 29 percent as compared with 11 percent and 13 percent devoted to information-seeking. Operations within the cognitive dimension that received attention were demonstrations, fact stating, explaining, defining, evaluation, asking for facts, asking for explanations, and asking for definitions. Parakh reported that teachers seldom asked pupils to give opinions, hunches, or evaluations (less than 0.1 percent) and that explicit references to the nature of science were virtually absent. He noted also that problem-solving behaviors occurred infrequently, comprising only about 0.6 percent of the time in labs and less than 0.1 percent in lectures.

Parakh reported that silent pauses made up about 3 percent of the class time in lectures. Teachers' questions accounted for about 11 percent of the time in lectures while pauses after the questions accounted for 1.2 percent of the total time.

Patterns of interaction in lecture-recitation classes were found to consist mostly of four categories accounting for 55 percent of the total interaction. Descriptively, this pattern was as follows: The teacher gave information, the teacher asked a question, the pupil responded briefly, and the teacher accepted the response or indicated that it was correct. Several variations of the above pattern were also reported. In laboratory classes, a larger variety of interaction patterns was found, with teacher behavior seen as largely responsive to pupil requests for information and materials. In addition, Parakh reported wide differences in interaction scores among the ten teachers.

The Parakh System of Interaction Analysis (modified) was also used in a study (90) of the relationship between measures of teacher-pupil verbal interaction and student assessment of classroom practices using a modified form of the Kochendorfer BCAC, called The Science Classroom Activity Checklist. This study is reviewed in the section "Indirect Instruments."

Rains (133, 134, 135) used the Classroom Interaction Management Analysis Record (CIMAR) developed by Schusler (151) in a study of teacher-pupil and pupil-pupil interactional differences between Inquiry Centered Science and traditional science in fourth and fifth grades. The instrument includes interaction categories, interaction codes, and activity codes. The interaction categories are as follows: (1) Questions, (2) Answers, (3) Statements, (4) Operational Statements, (5) Individual Help, (6) Supportive Statements, (7) Objective Control, (8) Negative Statements, (9) Attack, (10) No Response. Categories 1, 2, and 3 each contain subcategories as follows: (a) Factual, (b) Interpretation and/or Application. Category 5 has the subcategories: (a) Content Approach, (b) Feeling Approach. Categories 9 and 10 have the subcategories: (a) Individual, (b) Class. There are interaction codes for teacher, class, white boy, white girl, Negro boy, Negro girl, small group, and observer. There are activity codes for seat work, discussion, lecture, listening, group work, activity change, and

confusion. There are also spaces for recording proximity (desk-perimeter-aisle), voice (warm-cold-hostile), interaction, and noise level.

Interactions are entered by code and category. Observations last for 15 minutes and are divided into three-minute intervals. Interactions may also be transferred from the score sheet to a CIMAR matrix with a listing of interaction codes along the side and the interaction categories across the top. Columns and rows may be totaled with provision of the resultant information regarding categories and the types of interactors.

Rains stated that reliability was determined by sending 100 statements drawn from classroom observations by Schusler and a short form of the CIMAR to participants trained in use of the CIMAR. The participants were directed to categorize the statements. Rains reported that reliability for the CIMAR has been established at .72.

Data collection was by means of a cassette tape recorder. Testing of differences between the two methods was by the median test with chi square formula. The traditional method had significantly more (at the .05 level) teacher-pupil verbal interaction than the Inquiry Centered Learning approach. No significant differences were found in pupil-teacher or pupil-pupil interactions. Similarly, no significant differences were found between the groups in the various interaction categories. However, boy-girl interaction was found to be significantly higher in the Inquiry Centered Learning approach. Rains reported also that it was evident that there was more teacher-boy and boy-teacher interaction than girl-teacher and teacher-girl interaction. He further reported prevailing use of factual information by the traditional methods, and more operational statements group work by Inquiry Centered Science.

Ramsey (136) reported a study on the development of chemistry content by the teachers of CHEM Study in high schools. The major problems investigated were the description of interactive processes used by a group of chemistry teachers to develop content and the identification of teaching strategies used by those teachers. Ramsey stated that no suitable instrument existed for describing content development in chemistry, and that the decision was made to develop an instrument based on two others already developed and by referring to two kinds of records of chemistry content teaching (40 CHEM Study films and video and audiotapes of actual lessons taken during the pilot phase of the study).

The pilot study involved a total of fourteen video and fourteen audiotapes of two teachers. From the pilot study, audiotaping and use of a record sheet for teacher nonverbal behaviors and student responses were chosen as vehicles for data collection in this study.

Criteria for instrument development included ease of use, "live" recording, few broad categories with subsumed subcategories, focus on total effect of communication rather than verbal or nonverbal components, role of student and teacher, most meaningful coding unit, congruency with certain aspects of learning theory, congruency with science, potential modification for usage with all the sciences, and ability to describe content development patterns.

Through the procedures outlined above, The Content Analysis System for Chemistry (CASC) was developed. The Semantic Dimension pertains to intent of the teacher with respect to content being developed and includes four general categories: Miscellaneous, Background, Figure (key concepts or principles), Digression. The Syntactic Dimension pertains to the meaning of a content event as it appears to the observer and includes the following major categories: Management, Identify (identify of concept or principles), Exemplify (examples of figure in real or image form), Amplify (enlarging, explaining, integrating). Subcategories of "Identify" are: Designate, Define Operationally, Define Conceptually, Describe. Subcategories of "Exemplify" are: Concrete Examples, Abstract Examples, Analogous Examples, Personal Examples. Subcategories of "Amplify" are: Classify, Compare, and Contrast; Infer; Explain; Make Judgements. Provision is also made for describing roles of teachers and students in fulfilling content events as follows: Initiate (to bring transition from one content event to another), Supply (to complete a new content event). Ground rules for use of the instrument are also provided.

The unit of coding used is the "content event." A content event is considered to be complete when the meaning of the communication changes; that is, when the behavior can be classified according to another category of the system, or when the content of the communication changes, but the essential meaning stays the same. Audiotape recordings and notes taken by the investigator provide the behavior record for coding. Communication events are encoded on separate content event cards according to the three dimensions of the system.

Reliability was estimated by means of coder stability, which was found to average 82 percent for the seven classes recorded. Tapes for the reliability study were randomly selected, one for each of the seven teachers involved in the study, and recorded one week after the initial coding of all classes had been completed. These two sets of data provided the basis for estimates of coder stability.

Extensive data and data analyses based on nine non-laboratory classes of the seven teachers were reported, only a few examples of which can be mentioned here. Ramsey found that the teachers studied adopted a deductive teacher-oriented approach to teaching content. The teachers acted as information-givers. The amount of student involvement in the instructional process was small. The amount of student participation for a given teacher remained relatively constant and was independent of the content of the class.

The average number of content events in a class was around 100, and the variation from this mean was quite small. Ramsey also found that the variation among the teachers in percentage of content events in the 13 major subcategories was very small. From chi square values, a significant difference was found at the .01 level in "Analogous Examples" and at the .2 level in "Concrete Examples" and "Inferring." Ramsey suggested that the differences in inferring are probably due to teaching style, but that the examples differences may be due to content differences. Based on the value of the Kendall coefficient, agreement between rank orders of the numbers of events in each subcategory was significant at the .001 level. The average percentages of content events in the broad syntactic categories were as

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follows: Management, 3.1 percent; Identify, 44.4 percent; Exemplify, 17.1 percent; Amplify, 35.4 percent. Teachers initiated 90.2 percent of the events and students initiated 9.8 percent. Data were also processed in matrix form and transitions studied.

E. Smith (153) developed an observational system for reporting problem-solving behavior based on Piaget's description of such behavior. In addition to the Piagetian theoretical base, the instrument includes nonverbal behavior categories. Smith provided a detailed sequence of procedures used in the development of the systems. The major points given are (in summarized form): analysis of Piaget's description of child's processes in determining relationships —▶ review of other problem-solving behavior descriptions —▶ model —▶ description of basic moves or elements involved —▶ identification of useful categories from these moves —▶ observation of children determining relationships —▶ revision of category list —▶ category descriptions and guide rules —▶ observer training —▶ revision of guide rules and/or categories.

The observational system is composed of a list of behavioral moves organized into three major categories, as follows: (A) Substantive Logical Moves, (B) Instructional Moves, (C) Silence. Substantive Logical Moves are of 13 types, as follows: (1) Observes, (2) Manipulates, (3) Reports single observation, (4) Reports evaluation, (5) Offers hypothesis, (6) Gives experimental plan, (7) Gives prediction, (8) Gives interpretation, (9) Gives justification, explanation, (10) Gives accounting for explanation, (11) Gives empirical information, (12) Gives analytical information, (13) Other substantive logical moves. Moves 1-8 are Experimental Moves, 9-10 are Explaining Moves, and 11-13 are Other Substantive Logical Moves.

Instructional Moves are as follows: (14) Rating of Moves, (15) Personal, (16) Indicates lack of knowledge, (17) Gives routine directions or information, (18) Other instructional moves. Category 19 is "Silence." Subclassifications within various moves are also included in the instrument.

Coding with the system involves recording a five-digit code for each move as it occurs in either a live or videotape setting. The first digit designates person (instructor, subject or any other), and the second pertains to function (structing, solicitation, responding, or reacting). The third and fourth digits designate the "Move" and the fifth digit represents the subclassification of the move.

Reliability of the instrument was estimated on the basis of inter-observer agreement using the Scott coefficient. Results of these procedures were not reported in the document reviewed, however.

Vickery (180, 181) has developed a three-dimensional category system called the Science Oriented Observation Schedule. The researcher was interested in individualized and laboratory-centered instruction and thus undertook to develop a category system based on the Flanders technique, to quantify these aspects of classroom instruction. The three dimensions of the instrument are: Individualized-group, laboratory-nonlaboratory, and verbal-nonverbal. One of the criteria for instrument development was that the categories should be so chosen that the coded behaviors would be distributed approximately equally.

The dimensions and categories of the instrument are as follows: Dimension I: Individual and Class-Centered Teacher Behavior, (Category 1: Class-Centered Teacher Behavior, Category 2: Individual-Centered Teacher Behavior), Dimension II: Laboratory-Centered and Non-Laboratory-Centered Teacher Behavior (Category 1: Laboratory-Centered Teacher Behavior, Category 2: Non-Laboratory-Centered Teacher Behavior), Dimension III: Verbal and Nonverbal Teacher Behavior (Category 1: Verbal Behavior, Category 2: Nonverbal Behavior). Verbal behavior can be further categorized as (a) Direct Teacher Talk, (b) Indirect Teacher Talk, (c) Student Talk. Nonverbal behavior may be (a) Active, or (b) Inactive. An "uncoded category" was used when over half of the class was not engaged in instructional activity.

Teacher behaviors are encoded every five seconds in each of the three dimensions with the result that the teacher behavior is coded in the appropriate one of twenty categories within the three dimensional block, plus the non-instructional category. For a study of teacher behavior change, certain related categories are combined into groups, providing twelve indices of teacher behavior.

The Scott Reliability Index was used to measure reliability. Vickery stated that reliability, teacher stability, and inter-observer agreement were calculated with results in the .8 to .9 range (181).

Vickery also reported use of the instrument in a study involving 7th grade classrooms. One group of teachers was using ISCS materials for the first time and the other group was using a state-adopted commercial text. The teachers were observed six times over the period of one academic year. The researcher hoped to ascertain differences, if any, in teacher behaviors between the two groups of teachers and to test whether the two groups of teachers made non-random changes in their behavior in the course of the year of instruction. The Mann-Whitney U Test was used to examine for significant differences between the two groups and the Friedman Two-Way Analysis of Variance by Ranks was used to test for observed changes in behaviors over the period of the study.

Vickery reported finding a major difference in the degree to which the teachers of the two groups used teaching behaviors defined as individualized. The null hypothesis of no significant difference was rejected at the .01 level for all five teacher behavior indices reflecting individualized instruction. In each case, the group of ISCS teachers was higher in individualized instruction than the traditional textbook group. Unfortunately the description of the sample and of the materials used in this study did not include information about inservice or workshop preparation of the ISCS teachers. There was indication in the report that individual teachers had exercised little option as to whether or not they wished their school and classes to participate in the ISCS tryout of which the ISCS teachers of this study were a part.

A major difference (significant at the .01 level with only one exception) was also found between the two groups in laboratory-centered teaching behaviors. This was true for all three teacher behavior indices reflecting laboratory-centered instruction. There was a limited indication of differences between the two groups in teacher verbal behavior. Of the five

teacher behavior indices pertaining to verbal behaviors, one provided data enabling rejection of the null hypothesis of no significant difference (at the 0.5 level) for only the third phase of the study, though the first phase approached this level of significance. By the third phase of the study, Vickery found that over half of all ISCS teacher behavior was coded as laboratory-centered and almost 90 percent of all behavior was directed toward individualized instruction.

The second major problem of the study pertained to behavior change by the teachers participating in the study and is reviewed by Evans. Vickery reported significant non-random changes in teaching behaviors in only the ISCS group and that the changes were in the direction of increased use of teaching behaviors defined as individualized or laboratory-centered.

Wasik and Nicodemus (185) reported a study of effects of a workshop and the use of certain science materials on fifth grade science classroom practices. Although the study concerned primarily behavior change, it also included some instrument development and description of activities.

The teacher activities observed in at least five percent of all the observations of science lessons areas follows: (1) Working with students in ongoing activities, (2) Routine classroom management not directly concerned with teaching of science, (3) Listening to and/or observing students, (4) Observing student activities, (5) Talking and listening, (6) Talking, (7) Helping a student or small group when needed, (8) Directing lesson, referring to and following manual, (9) Other teacher activities not described above.

The pupil activities which consisted of at least five percent of all the activities (Total class with teacher, Group with teacher, or Groups without teacher) are: (1) Silent reading, (2) Reading and writing, (3) Writing, (4) Listening, (5) Listening and reading and/or writing, (6) Listening and observing, (7) Listening, observing, and speaking, (8) Observing and/or viewing other activities, (9) Observing and examining objects, (10) Observing and speaking in unison (choral speaking), (11) Experimenting and observing, (12) Making or constructing, (13) Student resting, (14) Routine classroom activities not directly related, (15) Other activities not described above.

Activities of teachers and students were studied using a time sampling procedure in which teachers in the different groups being compared were observed at the same point in time. An observer entered the classroom only long enough to observe teacher and student activities, leaving the room to record activities. If science instruction was observed, the observer returned at five-minute intervals for two more observations.

The authors stated that inter-observer reliability was not estimated in this study but that a similar later study, utilizing four observers, provided inter-observer reliabilities of 98 percent for number of activity groups, 85 percent for teacher activity, 88 percent for student activity, and 94 percent for type of material in use. Reliabilities were calculated as follows: Reliability = $[\sum_1^n$ (no. of observers in total agreement)/4] x 100; where n = number of observations. Theoretical framework and validity of the instrument were not described in the document reviewed.

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Three groups of teachers and their classrooms were observed: those involved in ESS workshops but with no materials, those with workshop experience and materials, and those with no workshop experience and no materials. Numerous data and some significant differences among groups were given in the report; only several major points of descriptive value will be repeated here. Percentages of classrooms visited operating as total classes ranged from 47.5 to 71.5 with the no workshop - no materials group the highest. "Work group" percentages ranged from 28.5 to 52.5 with the workshops - materials group the highest. The highest percentages of teacher activities for the no workshop - no materials teachers in whole class activities were: "Talking and listening" (29.3 percent), "Listening to and/or observing students" (19.0 percent), "Working with students in ongoing activities" (18.2 percent), "Talking" (12.6 percent). The teachers of this group when working with a student group showed the following percentages: "Talking and listening," 31.8 percent; "Helping a student or small group when needed," 18.2 percent; "Talking," 15.9 percent; "Other teacher activities not described above," 16.0 percent.

The highest percentages of pupil activities for the no workshop - no materials teachers in total class activities were: "Listening, observing, and speaking" (43.6 percent), "Listening and observing" (20.6 percent), "Listening" (8.7 percent). In these classrooms, children in a smaller group with the teacher exhibited the following activities: "Listening, observing, and speaking," 52.3 percent; "Listening," 9.1 percent; "Reading and writing," 6.8 percent; "Observing and examining objects," 6.8 percent. Also in these classrooms, children in groups without the teacher showed the highest percentages in the following activities: "Silent reading," 16.0 percent; "Reading and writing," 15.3 percent; "Experimenting and observing," 14.5 percent; "Other activities not described above," 16.8 percent. For the no workshop - no materials teachers, the authors reported that the children spent about 80 percent in listening activities in the whole class configuration and 60 percent in the activity groups associated with the teachers. Speaking by the teacher accounted for about 40 percent of the teacher activity, and the authors estimated that students listened to other students speak about 20-40 percent of the time in teacher associated groups.

DISCUSSION

In this section, various strengths and weaknesses, recurring themes, and data trends from the review of the preceding studies are presented. These aspects are discussed in three major parts as follows: (A) Numbers and Types of Studies, (B) Instrument development and Use, (C) Trends in the Data.

Number and Types of Studies

Level of Research Activity: A remarkable increase in the level of activity in the field of science teaching and learning behavior research is evident. Almost 60 percent of the documents reviewed and cited were found to be dated 1969, 1970, or 1971. Approximately ninety studies from 1960 through 1971 were included in the review.

Educational Context of Studies: The educational level of the studies reviewed is given in Table II. These figures are approximate since many of the studies span grade range combinations other than those listed. Nevertheless, the figures present a fairly accurate estimate of the relative emphasis of the studies reviewed at the various educational levels.

TABLE II

STUDIES REVIEWED CONCERNING SCIENCE CLASSROOM BEHAVIOR

EDUCATIONAL LEVEL	NO. STUDIES REVIEWED
K – 2	8
3 – 5	19
6 – 9	20
10 – 12	37
1 – 12	1
College	8
Student Teaching	3
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Clearly the greatest concentration of studies thus far is at the senior high school level with comparatively little attention focused on the primary grade and college levels.

Instrument Framework or Description: The number of studies reviewed based on instrument framework or description is given in Table III.

TABLE III

INSTRUMENTS DEVELOPED OR USED IN STUDIES

INSTRUMENT DESCRIPTION	NO. STUDIES REVIEWED
1. RATING SCALES	4
2. INDIRECT	10
3. STUDENT BEHAVIOR (ONLY)	17
4. QUESTIONING	12
5. INQUIRY, NATURE OF SCIENCE	5
6. COMMUNICATIONS	3
7. COGNITIVE, STRUCTURAL	8
8. AFFECTIVE	17
9. MULTIDIMENSIONAL	16
	91

Instrument Development and Use

Category Systems and Sign Systems: There is a great deal of confusion in terminology used in the studies. Medley and Mitzel (99) have distinguished between category systems and sign systems and have defined both. A category system is comprised of a set of categories which are mutually exclusive and jointly exhaustive of the aspect of classroom behavior being considered. A sign system, on the other hand, is a listing of acts or incidents which may or may not occur, and the only items encoded are those on the list. Many of the instruments developed or used are not being called by either name, and most of the rest are called category systems by the authors. Some of these instruments appear to be sign systems. It would be very helpful if researchers in the future would designate more specifically the manner of instrument development and the nature of the system developed. An example of the difficulties engendered is the fact that lack of this information contributes to the difficulty of interpreting much of

the descriptive data presently available. The reader often cannot tell whether data represent percentages of the whole, or of selected incidents under study.

Theoretical framework: In 1970, Balzer (19) reported that only five of the 20 studies reviewed at that time specified the theoretical frame-work on which they were based. This low figure is of special concern in classroom behavior instrument development since such behaviors can clearly be classified in a great many ways. Simply put, investigators who develop behavior instruments deductively (i.e., they decide the structure of cate-gories in advance and then classify behaviors into these categories) should state very precisely what concepts or theoretical bases gave rise to this particular arrangement of categories. This recommendation is still appro-priate today, though the situation appears to be improving. Less than half of the investigators said anything that this reviewer could interpret as a theoretical basis for instrument development or adoption. Among those who did so, the most common basis argued (for at least 10 instruments) concerned the philosophy and objectives of the new curricula. It should be added that the bases stated in the documents are often not really theoretical frame-works, but rather statements of need to the effect that no appropriate in-strument was available (to analyze biology content, for example), so a new instrument was developed.

The call for theory and models in science education is not new, but it is still appropriate. Pella (124) suggested in 1966 that science educa-tion was at a stage when its concepts were indefinite and the descriptions and operational definitions relating concepts to sensed data were badly needed. The difficulty of developing theoretical structure (even though tentative) in science education is thus quite understandable. The need, however, continues to be evident. The observation of Tyler (178) that con-ceptions of maps of the terrain that are employed in science education re-search are often not explicitly stated, though it is possible to tease them out, also appears to apply here. Some of the writers imply such conceptions but do not make them explicit.

Several considerations should guide the researcher interested in in-strument development for the analysis of classroom behavior and inter-action. First, we must continue to draw upon various disciplines as sources of models. Second, there must be a clear distinction between adopting the theoretical formulations of other researchers for convenience and the se-lective utilization of only those with convincing contributions in science education. Third, the researcher must ask whether or not there are addi-tional components within the domain of science education which are of un-usual implication to the science classroom. If the goals of science educa-tion are special in any respect, or unique, this should show up in instru-ments developed. Many of the studies reviewed do not show evidence of being based even partially on theoretical formulations of special co~cern in science education. This problem is also related to the appropriateness of instrumentation as discussed elsewhere in this section.

Some of the areas in which models for science classroom interaction might be developed are: (1) the nature of science, (2) processes and skills of science, (3) scientific attitudes, (4) scientific literacy or scientific

enlightenment, (5) inquiry, (6) concept development, (7) environmental education, (8) social responsibility in a technological age, (9) social implications of scientific knowledge, (10) the new science course improvement projects. Most of these topics have received considerable attention in the recent literature of science education, but models for teacher behavior and classroom interaction research and practice have been comparatively scarce.

As mentioned above, about ten of the studies reviewed utilized the philosophy and objectives of the new curricula as a theoretical basis, but in some of these studies the formulations were more of a comparative than basic nature. The studies of Smith (157) and Moore (109) are illustrative of research based on rather fundamental curricular considerations.

The other area listed above that is evident as a theoretical base in a number of the studies reviewed is "Inquiry." However, the nature of inquiry and models for classroom behavior have seldom been developed, the work of McRel (27) being the principal exception. Thus the overall impression is that inquiry components are included in various instruments in primarily intuitive and somewhat haphazard ways. Questions such as the following continue to face us regarding inquiry, as well as most of the other areas mentioned above: (1) What, if anything, are teachers and pupils doing with reference to this area in the science classroom? (2) What does our best thinking suggest they could (or should) be doing?

The above discussion suggests the continued need for well-defined deductive studies. That is, we appear to need studies in which the researcher specifies a well-defined theoretical framework and views the classroom interaction in terms of these prior considerations. In the past, some deductive researchers have modified observation instruments on the basis of trial usage in classrooms, thus adapting the instrument to actual classroom situations. The obvious danger of the purely deductive approach is that it may result in the failure to observe various (perhaps significant) classroom behaviors which are not implied by the theoretical framework. A partial answer to this problem may be provided by the inductive approach proposed and utilized by Balzer and Evans (21).

Inductive Methodology: This approach uses a general model of scientific research, placing emphasis on the acquisition of empirical data. The effort is to record and encode all classroom behaviors as they occur, insofar as possible, without prior decisions concerning a particular perspective or the exclusion of certain groups of behaviors. A difficulty in this approach is that no observer is able to be strictly empirical in the classification of behaviors; previous experience and biases will enter into the generation of categories from observed and described behaviors. In this sense, then, even this approach is not without an element of deductiveness. Nevertheless, the emphasis here is on obtaining data that are as free as possible from the application of pre-determined criteria.

About eleven or twelve of the studies reviewed either clearly contain an extensive inductive component or are based primarily on inductive methodology may do so with various degrees of emphasis on each component, but the balance should be carefully chosen in relation to the purposes of the study.

For example, one may choose to describe teacher behaviors when based on a particular theoretical framework such as communication theory. In this case, the instrument may be deductively developed, but tested in a pilot study to insure that it does indeed incorporate the behaviors actually exhibited by the teachers. Such a pilot study constitutes something of an inductive component and may result in modification of the instrument. The resulting data express the teacher behaviors which are identified in relation to a particular theoretical framework.

On the other hand, the researcher may be concerned primarily with obtaining a broadly inclusive and comparatively empirical description of teacher behaviors in the natural history sense. Here, an extensive catalog of behaviors is the primary concern and categorization should require an absolute minimum of inference. Once the broad, representative sample of behaviors has been obtained, a theoretical framework may be applied to assist in the development of a system. The result of this effort may be more inclusive and descriptive but less logical and neat than the example given above. Much more attention should be given in the future to the respective roles of these methodologies, and they should be much more carefully described since the data generated may differ accordingly.

One additional point should be made with respect to the inductive methodology. The sample from which the data for such instrument development or pilot testing are obtained should be as broadly representative of the population as possible. Where random selection from the general population under consideration is not possible, selection should be designed to be as broadly representative as possible. A pilot study based on one, two, or three teachers is not likely to contribute a sound inductive component to the study.

Appropriateness of Instrumentation: In a number of the studies reviewed, an existing instrument was adopted for use instead of development of a new instrument. When proper precautions are taken, this procedure may greatly increase the efficiency of the research effort. In addition, it appears that in order to even approach replication of studies in teacher and student behavior research, repeated utilization of a given instrument will be necessary.

However, several dangers are also evident. Considerations of theoretical framework and inductive-deductive methodology should be undertaken with as much care as if a new instrument were being developed. This generally does not appear to be the case in the studies reviewed. The most prevalent problem noticed in the studies reviewed is the use of an instrument which incorporates only verbal behavior when a significant proportion of the pertinent classroom behaviors (perhaps even hoped-for behaviors, in some studies) are nonverbal, such as pupils nonverbally doing science at their desks.

A second problem area concerns patchwork instrumentation. In several studies, an instrument was adopted but a desired feature was added to the adopted instrument. While this may occasionally be a satisfactory solution and an improvement on the instrument adopted there is again the danger that such additions or modifications do not have a sound theoretical frame

or inductive base. Instrument development and selection must include general research needs (such as the need for replicative studies), the purposes of the individual research project (such as the description of all the science behaviors exhibited by the pupils), and a clear and consistent theoretical framework and methodology for the instrument.

Methods of Recording: The process of capturing and recording the behaviors is usually one or a combination of the following: (1) audiotape, (2) audiotape plus written notes by observer, (3) videotape, (4) perceptions and/or assessments as reported by pupils or teachers, (5) direct observation and immediate encoding by observer. For generation of descriptive information, the most complete, direct, objective, and permanent record is generally the most desirable. Videotape seems to provide these features. However, audiotape or a single observer encoding behaviors directly may cause less classroom modification and still provide an adequate record, especially if nonverbal behaviors are not being studied. Adequate recording of pupil behaviors generally requires two or more video cameras or a system of random selection of students to be observed or a rotation scheme of some sort.

Direct encoding of behaviors into the categories or signs of a system by an observer appears to be the most efficient way of generating a record of behaviors but suffers the disadvantage of not providing a record of the raw behaviors, only the behaviors as encoded, thus prohibiting repeated observation of behaviors for increased encoding accuracy as is possible with audiotape and videotape records.

The most indirect of the methods relies on the perceptions, recollections, and sometimes assessments of behaviors by pupils or teachers. The major cause for concern here is that these individuals are the least likely to be in a position to provide objective data, since they are usually directly involved with the behaviors. However, researchers utilizing this method usually rely mainly on pupils as the source of data and point out that it is the pupils' perceptions of classroom events that matter, whether objective or not. In addition, these studies seem to be providing quite consistent measures of classroom situations in relation to certain independent variables. This method is highly efficient and may have considerable potential in spite of its apparent weaknesses.

Methods of Encoding: An audiotape, videotape, or typed transcript of such types constitutes a record of science teaching or learning behaviors. Conversion of this record to tallies or symbols representing categories or signs of a system is defined as the process of encoding. As mentioned above, this may be done directly by an observer, effectively eliminating the process of recording, but very often data are encoded from a record that can be replayed numerous times.

The unit of encoding may be a short time interval, a point in time, a "natural" occurrence, or a delayed time interval. Short time intervals used in the studies reviewed are usually three-ten seconds, and the predominant behavior during the interval is encoded. A point-in-time sampling technique involves encoding the behavior occurring at a given point during time intervals of a prescribed length and allows removal of some of the observer judgment involved in the time interval technique. The delayed time interval

technique usually involves even more observer judgment since the observer usually observes for a longer period of time (perhaps five minutes or more) and then encodes behaviors (perhaps in several different dimensions) judged predominant or representative over that interval of time. Balzer (17) and Evans (48), using videotape recordings, found it possible to encode teacher behaviors on a continuous (second-by-second) basis, thus essentially eliminating the subjective judgment of a predominant behavior during a time interval. Even here, the basis continues to be a time-unit one, since data are processed on a time basis.

In the use of the "natural" occurrence, the encoding unit is a carefully defined unit whose length may vary, such as a question, interact, or topic. Tallies or symbols encoded in this case represent the unit defined rather than a sample point-in-time or time interval. If wisely chosen and consistent with the major purposes of the study, the "occurrence" probably more accurately reflects the classroom flow of events in some studies than an arbitrary time interval.

The most prevalent encoding unit utilized in the studies reviewed is the short time interval, probably a reflection of the influence of Flanders. The researcher in this field should carefully consider the purposes of the study and the potential of modern videotape technology when selecting the unit of encoding, especially to minimize the use of observer judgment.

An additional comment is appropriate here concerning the task of encoding when utilizing a rating scale. This requires the observer to provide a weighting of behaviors which often becomes more a matter of recollection and judgment than objective description. Although rating scales have been included in this review, it is important to point out that the unit encoded (and information generated) is of a very different sort than is the case with the more objective observational systems. The following example will illustrate this point. The Esler (47) instrument is a scale with the extremes of discovery and didactic approach, and the observer decides how the points are to be distributed between the two approaches. By contrast, the Eggan (45) instrument describes student behavior in comparatively empirical terms such as "Forward Lean" and "Horizontal Head Swivel" which can be quite specifically defined to minimize observer judgment.

Validity and Reliability: A detailed analysis of the concepts and problems of validity and reliability is not made here, but several observations warrant attention. The reader is referred to Brown and Webb (31) and Medley and Mitzel (99) for more detailed treatments of these topics.

Brown and Webb (31) report that the question of validity of an observer's record of classroom behavior has seldom been raised. This observation also appears to apply to the studies reviewed here, as only about one-eighth of the researchers addressed themselves to this matter in the documents reviewed. In about one-half of these instances, the validation was based on the judgment of a panel of judges. The remainder utilized primarily an argument of face validity.

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Attention to reliability is much more common in these studies with inter-observer agreement receiving attention in about one-half of the studies reviewed, based on the documents reviewed. Of these, eight studies incor- porated attention to both inter-observer agreement and observer stability, and an additional four gave attention to just observer stability. Most com- monly, the Scott coefficient was used to calculate inter-observer agreement. Surprisingly, a few studies used tests for significant differences, and the lack of finding a significant difference was interpreted as evidence of in- ter-observer agreement or observer stability. Several "induct" studies used Kuder-Richardson 20 and Kuder-Richardson 21 formulas to estimate reliability.

The apparent limited attention to validity and reliability may be due in part to weaknesses in reporting, but it is cause for considerable con- cern. The reporting of observational instrument development or use should always be accompanied by evidence of observer agreement or stability and, if at all possible, validity considerations. As a minimum, the following guidelines should be followed. (1) When two or more individuals function as observers, inter-observer agreement calculations should be made to in- corporate all of the observers. (2) In studies involving prolonged data encoding, inter-observer agreement and observer stability should be calcu- lated periodically throughout the study. (3) When only one individual func- tions as the observer in a study, evidence of observer stability is of greater concern than inter-observer agreement. (4) Validity and reliability procedures and results should be reported. (A number of the studies reported "satisfactory results" but did not report data or criteria for acceptability.) (5) When an existing instrument is adopted for use, procedures insuring en- coding consistent with the instrument author's intent, or specific devia- tions, should be detailed. This is usually dependent on category or sign definitions, glossaries, and specific encoding rules of the instrument uti- lized. For a detailed treatment of this last point (which is really a validity problem), the reader is referred to Rosenshine (140). Brown and Webb (31) suggest the use of criterion scores to resolve this problem.

Evidence of inter-observer agreement has often been given as evidence of relative objectivity, and may indeed provide such evidence. However, whether or not this is indeed evidence of objectivity depends on the pro- cedures used in the particular study, since a limited number of observers clearly can also agree to instill a certain common bias (quite possibly unknowingly) in data encoding and still reach a high level of agreement. Similarly, while high validity requires a reasonably high level of inter- observer agreement, satisfactory inter-observer agreement cannot be taken to imply that validity requirements have been met.

Trends in the Data

As any student of classroom behavior research knows, an attempt to provide actual generalizations concerning behaviors based on the studies reviewed here will be a very risky business. Just the same, this reviewer repeatedly felt compelled to make such an effort, if for no other reason than that it should be possible to say something about behaviors after such an extensive review effort on the subject. The potential fallacies and necessary precautions involved in such an effort are numerous, however, and a few are mentioned below.

Difficulties and Precautions: The studies reviewed utilized a wide range of instruments which are composed of differing combinations of categories and signs and are based on various theoretical frameworks. Thus, while a number of different instruments may include categories which have a similar title (like "Management"), the actual definitions and behaviors included will vary widely, so that similar categories in different instruments do not represent precisely the same set of behaviors. Most of the other difficulties in making generalizations based on the descriptive data seem to stem in one way or another from this matter of comparatively few studies utilizing a common instrument or common category or sign definitions. Similarly, most of the studies do not provide adequate evidence that the researchers using the same instrument were in precise agreement on behaviors being encoded into the various categories or signs.

Not only do most of the studies utilize differing instruments, but they include and exclude a very wide range of classroom occurrences, and the exact inclusions and exclusions are not always specified in the available documents. The following questions are representative of the variations in the studies and will illustrate the point: Do the data represent teacher behavior, teacher-pupil interaction, or pupil behavior? Is the record a constant record of pupil behavior, or is it restricted to verbal behavior or to pupil-centered events? Do the data include nonverbal behaviors of the teacher and nonverbal interactions? Are managerial behaviors included? Are behaviors which appear pedagogically irrelevant included? Is the entire science class period included in the data, or are certain portions (like the first and last 10 minutes) always excluded from recording? Are certain aspects of the classroom routine (like testing or laboratory) selectively included or excluded? In the studies reviewed, the answers to these questions differ, so the data given generally do not refer to the same behavioral subsets even when the labels look the same.

Another fairly major problem area is the limited number of studies with an emphasis on descriptive data. It is a bit surprising that at this natural history stage in classroom behavior research, there appears to be some reluctance to engage in descriptive studies, but not more than about 21 or 22 of the studies reviewed have given a major emphasis to the provision of descriptive information. In a number of additional studies, there are comparisons of groups of teachers (typically "new curriculum" versus "traditional"), but data given are often comparative rather than descriptive, and the degree to which these persons were specifically trained, instructed, or grouped to show differences is not always clear. When the additional fact is considered that these studies include the elementary, secondary, and college levels, the paucity of data at a given level becomes even more evident.

At least one additional problem area should be mentioned. Many of the studies provide their descriptive data only within a special framework unique to the instrument used, resulting in the inability to compare results to any other study unless it is based on the same instrument. The best example is perhaps that involving the development and use of a scale, and the reporting that the "composite teacher" in a given study achieves a scale value of, let us say, 3.5. Ordinarily such a figure is quite meaningless unless many studies are performed utilizing that instrument. The

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Flanders I/D and i/d ratios are the only examples that come to mind where a genuinely extensive list of studies exists, so that I/D and i/d values now provide descriptive information of some value. Another example of the same basic problem is when behaviors are given only as percentages of dimensions or categories which are unique to the instrument being used. While this may be appropriate and may provide valuable insights, an additional procedure as simple as expression of behaviors as percentages of the whole may provide at least a partial basis for comparison with data obtained in other studies. Continued work in instrument development and descriptive data collection is clearly needed, and such studies will result in the necessity to express data in the unique terms of the instrument. However, adherance of all researchers to a very few common forms for expression of descriptive data would greatly increase the descriptive value of the data produced.

Similarities and Differences in Individual Teacher Behavior: Several researchers report finding significant differences among teachers based on behaviors. Kondo (89), in an elementary science study, reported that the approach and the lesson taught influenced the types of questions asked. Snyder (161), in a study on questioning in seventh and eighth grades, also reported finding considerable changes in teacher behavior from one unit to the next, but changes by the individual teachers were not consistent from unit to unit, nor on an individual or class basis. James J. Gallagher (56, 58) reported a wide diversity of topics treated by BSCS teachers, even though the chapter under consideration was controlled. Thus there appears to be a bit of a pattern developing which suggests that certain teacher behaviors vary with the chapter, topic, or unit being taught. They either do so in individual ways, or we have not yet discerned the patterns of change - if they exist.

Snyder (161) found that teachers differed more in questioning behavior than their classes differed in this regard. Urbach (179) concluded that the teachers he studied exhibited more variability than similarity in their patterns of verbal instructional techniques, based on interaction analyzed by the Flanders system. James J. Gallagher (56, 58) reported finding substantial differences among BSCS teachers in goals, skill topics treated, and levels of abstraction. He suggested that there is no such thing as a BSCS curriculum in the schools, but rather individual interpretations of BSCS.

Balzer (17, 18) found significant differences among individual teachers but not between BSCS teachers and non-BSCS teachers. The significant differences among teachers were in the categories of Management, Control, Release, Content Development, and Affectivity. The teachers also showed significant differences in the following subcategories: Laboratory Management, Scientific Process, Facilitates Communication, and Negative Affectivity. Hassard (65, 66) also found significant differences among teachers in regard to Management and Content Development, as well as Climate and Facilitating. In addition, he found significant differences in Content Development subcategories of Procedure, Explanation, Writing Content, Gestures, Points, and the subcategory "Attending" of the category "Facilitating." Teachers were also found to differ significantly based on the Teacher Climate Index and the Instruction Index. Ramsey (136) found

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significant differences among teachers in Analogous Examples, Concrete Examples, and Inferring and suggested that the differences in Inferring might be due to style and the differences in Examples to content.

The differences cited provide limited basis, at best, for generalization, and such attempts may be based as much on hunches as on objective data. However, preliminary indications are that individual teachers differ significantly in management, content development, facilitation of learning, levels of questions, levels of abstractions, provision of examples, and possibly climate (or affective) behaviors. Balzer (17) found significant differences in affectivity overall and negative affectivity and Hassard (65) found a significant difference in climate and the climate index, but not in the positive or negative subcategories of climate.

Some researchers also reported similarities in teacher behaviors. Snyder (161) reported finding teachers similar in relative usage of categories of questions. Urbach (179) found the Flanders category sequences 5-4-8 and 4-8 "common" to all observational records of each teacher studied. Snyder (161) reported that the distribution of tallies based on the Flanders system in the matrix was found to be practically constant for observations taken in a particular type of activity, though he found style to vary from activity to activity. James J. Gallagher (56, 58) reported finding a fairly common pattern of behaviors in the style dimension. Ramsey (136) found variation in percentage of content events in the 13 major subcategories to be small and agreement between rank orders based on subcategories significant at the .001 level. Ramsey also reported that the number of content events per class in the secondary chemistry classes studied was around 100, and that there was a quite small variation from this mean in the classes studied. Balzer (17, 18) found a high correlation among teachers in the relative usage of behaviors of the various categories, subcategories, and subdivisions of the BTBI. J. Matthews (97) found teachers similar in the percentage of time spent in the various categories of the instrument.

An overall pattern of findings regarding similarities and differences appears to be emerging. High correlations, in the relative usage of behaviors in major categories or even subcategories of several of the instruments being used, are being found among teachers. However, when teachers are compared regarding behaviors within a given category, they often differ significantly. For example, teachers may be found to be similar in devoting more behaviors to content development than affectivity, and still differ significantly in the amount and/or specific kinds of behaviors classified as affectivity. In addition, it appears that individuals differ more from each other than the groups of teachers being compared in various of the studies.

Verbal and Nonverbal Behaviors: Numerous early researchers assumed that verbal behaviors constituted an adequate sample of teacher behavior. The effects of these assumptions may be in evidence in the research reviewed here, as most studies addressed themselves to verbal behaviors only. A rough count indicates that less than 20 of the studies included any attention to nonverbal behaviors, and less than one-half of these included a real emphasis on the study of nonverbal behaviors. Eggan's study (45) was the only study devoted exclusively to nonverbal behaviors.

Dyasi (41) found student affective behaviors to include such aspects as good working habits and persistence in carrying out activities. Eggan (45), in a partially inductive study, described student nonverbal behaviors in terms of a sign system. Mitias (104) and Felen (49) described problem solving behavior patterns.

Hassard (65, 66) found that nonverbal teacher behaviors constituted 25.8 percent of total teacher behaviors, and that combination verbal/nonverbal behaviors constituted 13.2 percent in ninth grade earth science teachers. Nonverbal content development behaviors constituted 14.4 percent of all teacher behaviors. J. Matthews (97) found that PSSC teachers used nonverbal behaviors in presenting content 51 percent of the total time, compared with 72 percent for non-PSSC teachers. Several researchers reported that silence or confusion constituted from 10 percent to 20 percent of the behaviors in predominantly verbal behavior studies. La Shier (93) found a change from 17.9 percent at pre-institute analysis to 29.8 percent at post-institute analysis in elementary teachers using Science -- A Process Approach. Friedel (53) found that all indirect messages were nonverbal, and that 87 percent of the direct messages of the classroom were strictly verbal. Parakh (120) reported finding that teachers talked about 75 percent of the time and that in lecture about 8 percent of the behaviors were nonverbal, while in lab 37 percent of the behaviors were nonverbal. Balzer (17, 18) and Evans (48) found that more than 66 percent of all behaviors included nonverbal components judged to influence the teaching-learning situation.

The above findings cast doubt on the validity of the assumption that verbal behaviors constitute an adequate sample of teacher behavior in science classrooms. While it appears that science teachers talk most of the time and talk much more than do their pupils, it also appears that they do very much besides just use oral language. The extent and significance of nonverbal communication in the classroom appears to need much more research.

The Nature of Science: Parakh (120) reported that behaviors pertaining to the nature of science were virtually absent. Balzer (17, 18) and Evans (48) found behaviors concerning the nature of science to be limited to references to the tentativeness of knowledge, constituting less than 1 percent of the behaviors. Miller (100), in his study of ninth grade physical science classes, found that about 0.5 percent of all the behaviors pertained to question and information about science and scientists, and the relation of science to other areas generally constituted less than 1 percent of the behaviors.

From these limited data, it would appear that very little instruction specifically focusing on the nature of science may be taking place in science classrooms. The need for additional classroom interaction studies focusing on this major science education concern is apparent.

Teacher Oriented Versus Student Oriented Behaviors: Reflecting recent concern about active student involvement in learning experiences, numerous studies presented data in terms of teacher and student orientation. The form this presentation takes varies greatly among the studies, but a common example is the Flanders-type of comparison of teacher talk and student talk. A compilation of data along these lines follows.

Altman (5), in a study of third and fourth grade classes using SCIS materials, in inner-city and advantaged areas, made teacher talk and student talk comparisons. He found that inner-city teachers talked 34 percent of the time and students talked 8 percent of the time. Teacher talk was made up of 16 percent cognitive, 22 percent procedural, and 5 percent affective. Advantaged areas teachers talked 40 percent of the time and students talked 13 percent of the time. Teacher talk was comprised of 19 percent cognitive, 16 percent procedural, and 5 percent affective. Gallagher (57, 59) studied demonstration classes of academically superior children in a training workshop. He found that in science 17 percent of the topics were initiated by student questions or statements and 73 percent by teacher questions or statements. No topics were terminated by student summary, 17 percent were terminated by teacher summary, and 83 percent were terminated without a summary. La Shier (93), in an FSIA study of elementary teachers using Science -- A Process Approach, gave pre-CCSS institute and post-CCSS institute teacher talk and student talk comparisons. Pre-institute data based on an independently planned lesson showed teacher talk at 52 percent, student talk at 29.4 percent, and silent activities or confusion at 17.9 percent. Post-institute data, based on SAPA usage, showed a "slight reduction" in teacher talk, student talk of 19.5 percent, and silent activities or confusion at 29.8 percent. Newport and McNeill (113) compared verbal behavior in the use of SAPA and textbooks. In both groups, teachers talked about 64 percent of the time, with "SAPA pupil talk" at 21 percent compared with "textbook pupil talk" at 26 percent. Silence or confusion involved less than 12 percent of the total class time in both groups. Wasik and Nicodemus (185) reported that in the classrooms of fifth grade "no workshop-no materials" teachers, children spent about 80 percent in listening activities while in the "whole class" configuration, and 60 percent while in activity groups associated with the teachers. Speaking accounted for about 40 percent of the teacher activity, and students were estimated to listen to other students about 20-40 percent of the time.

Much more information is available at the junior high and senior high levels. Abruscato (3), studying junior high school students, found that 77:8 percent of the student behaviors were "responding" behaviors and 3.7 percent were student initiating behaviors (in addition, about 17 percent were noncommunicative behaviors and 2 percent were not coded). Korth, Czelen, and Moser (90), in a study of junior high school science classes, found that 80.3 percent of all verbal communication was teacher talk, made up of 61.2 percent statements and 19.1 percent questions. Pupil responses took 15.9 percent of the time and self-initiated pupil statements and questions made up 3.7 percent for a total of 19.6 percent. Butler (34) used the FSIA in a study of verbal behavior in IPS classes. The IPS teachers talked 68.6 percent of the time while student talk was 26.6 percent. The I/D ratio was .405 and the revised I/D .653.

C. Matthews (95) studied secondary school science teachers using the FSIA and found teacher talk to be 80-85 percent of the matrix total, teacher lecture 50-60 percent of the matrix total, and teacher questions 10-12 percent of the matrix total. Of all student talk, 5-7 percent was student talk initiation. Parakh (120), studying high school biology classes, found that the average or composite teacher talked about 75 percent of the total class

time in lecture-discussion-recitation classes and about 50 percent of the time in laboratory classes. Pupil talk addressed to the teacher accounted for 15 percent of the total time in lectures and 13 percent in labs. In a second study which focused on pupil behavior, Parakh (119) found that teachers talked 78 percent of the time and pupils talked 17 percent of the time. Pupil questions accounted for about 3 percent and pupil responses accounted for about 14 percent of the total time. The percentages of pupil participation in the four modes were as follows: Questioning 15 percent, Replying to teachers' request 29 percent, Voluntarily responding to a question or utterance 50 percent, Self-initiated pupil statement 5 percent. James J. Gallagher (56, 58) found that teachers in high school BSCS classes talked three to four times as much as pupils. Snider (158, 159) using the FSIA in a study of New York State Regents high school Physics classes, found that teachers provided 82 percent of the verbal communication in the class-room. The I/I+D was 27 percent, the revised I/I+D was 65 percent, and the ratio of teacher talk to student talk was 4.43 to 1. About 12 percent of the tallies were "Student Talk-Initiation" and 4.3 percent were "Student Talk-Response." In a separate study of Harvard Project Physics, Snider (160) found teacher talk to constitute about 60 percent of "total teaching." Moore (108, 109) studied PSSC and non-PSSC classes and found teacher talk to be 70 percent in non-PSSC classes and 69 percent in PSSC classes. Pupil talk was 14 percent and 18 percent, respectively.

In other studies the classroom orientation of events is presented in various other ways. Balzer (17, 18) and Evans (48), studying BSCS and non-BSCS teachers, found the teacher-centered content development behaviors constituted 47.1 percent of all the teacher behaviors compared with 2.8 percent for student centered content development teacher behaviors. Bartos (26) found teacher output to be 76.76 percent (excluding management) and student output 23.24 percent, in a study of BSCS and non-BSCS classes. Ramsey (136), in a study of the development of content by CHEM Study teachers, found that teachers initiated 90.2 percent of the "content events" while students initiated 9.8 percent.

Table IV provides a summary of the data presented in this section. This can only be an attempt to provide a representative and approximate set of figures and must be interpreted with all of the precautions already sug-gested on the previous pages. The data of the table are generalizations representing ranges in the studies reviewed.

Clearly, teachers talk very much more than pupils in the classroom, and, at least at the secondary level, pupils are very seldom in an initia-ting role when they do talk. Usually the instruction and the talk centers around specific requests of the teacher. Almost exclusively, pupils are responding to these requests. In addition to providing specific descrip-tive data, a number of the authors reviewed made statements very similar to the above. Attempts to change teacher and pupil behavior should include an analysis of the relationship of the attempted changes to this basic pre-vailing behavioral orientation and pattern.

TABLE IV

GENERALIZATIONS CONCERNING TEACHER ORIENTED

VERSUS STUDENT ORIENTED CLASSROOM BEHAVIORS IN STUDIES CITED

Description	Teacher Orientation*	Student Orientation*
Elementary	T. Talk: Approx. 50%	St. Talk: Approx. 20%
Secondary	T. Talk: Approx. 70%	St. Talk: Approx. 17%
Secondary Pupil Only	Reply and Respond: Approx. 80%	Initiate: Approx. 10%
Secondary Content Devel. Only	T. Ctrd: Approx. 95%	St. Ctrd: Approx. 5%

* "Elementary" and "Secondary" are percentages of total behaviors encoded. "Secondary Pupil Only" are percentages of pupil behaviors encoded, and "Secondary Content Development Only" are percentages of content development behaviors encoded.

The Level and Type of Cognitive Behaviors: Again, the descriptive information in elementary science is rather limited. Porterfield (130, 131), in a study of SCIS and non-SCIS teachers' questions, found that over 70 percent of the non-SCIS teachers' questions were recognition or recall and about 50 percent of the SCIS teachers' questions were recognition or recall. Synthesis questions were lowest for both groups at .07 percent for the non-SCIS and 1.87 for the SCIS group. Analysis questions were 3.55 percent for the non-SCIS and 11.19 percent for the SCIS. Translation figures and interpretation figures ranged from 3.5 percent to about 7.5 percent. Kondo (89), in another study involving SCIS teachers' questions, found that about one-half of the questions being asked by the teachers were convergent. The relative frequency of evaluative questions was low in all lessons, as was the percentage of divergent questions.

Horine (68) studied inquiry in elementary science classes and found that the mean percentage of time spent in pupil experiment was about 30 percent with a mean of 15 percent in the Concepts in Science group and 48 percent in the Science - A Process Approach group. Reading and/or extended viewing was 11.90 percent overall with 20.50 percent for the concepts group and 1.60 percent for the process group. Gallagher (57, 59) in a study of academically superior children brought together in a training workshop for teachers, found that about 80 percent of the topics in the science group were at the description or explanation levels. Hunter (70), in a study of first grade teachers in science, found that 95 percent of all the questions asked were of the cognitive memory type compared with a 0.4 percent evaluative and 0.4 percent divergent. Altman (5) found that third and fourth grade

classes in inner-city and advantaged areas had teachers who asked about twice as many "recall facts" and "see relationships" questions as observation, hypothesis, and test hypothesis questions. Explaining took 71 percent and 61 percent of the time spent in the cognitive dimension in the inner-city and advantaged situations respectively, compared with 23 percent and 31 percent for exploring and about 5 percent for "summarize/invent."

Table V summarizes the findings given above. These figures should be seen as approximations at this time. The data do not include all groups of statements and questions analyzed, but they generally represent percentages of all behaviors encoded. They are presented in this form to provide a summary view of the relative incidence of behaviors (usually presented as questions) at lower and higher cognitive levels.

TABLE V

LEVELS OF COGNITIVE BEHAVIORS IN

ELEMENTARY SCIENCE CLASSES IN STUDIES CITED

Description	Lower	Higher	
Usually Questions Asked	Recog., Recall, Descr., Explain: approx. 75%	Translation and Interpret:	< 10%
		Anal.:	< 10%
		Syn.:	< 5%
		Eval.:	< 1%

More information regarding the levels and types of cognitive behaviors is available at the secondary level. Korth, Czelen, and Moser (90) report that their study of junior high school teachers yielded the following data: Lecture,64.9 percent, Lecture-Discussion,33.7 percent, Inquiry,1.2 percent. Parakh (119) reported the following student utterances in high school biology classes: Explanations, 40 percent; Facts, 27 percent; Definitions, 13 percent; Evaluations, 4 percent; Other (mostly class routine), 15 percent. Hassard (65, 66), studying ninth grade earth science teachers, found that the question subcategories of content development compared as follows: Knowledge, 3.9 percent; Process, 2.8 percent; Evaluative, 0.3 percent. Friedel (53) found direct messages to compare as follows: Authoritative, 31 percent; Drill, 14 percent; Experimental, 5 percent. Streitberger (172), in a study of CHEM Study and traditional chemistry classes, found that teacher behavior (about 78 percent of all behaviors) was constituted of 56 percent exposure to information, 17 percent precipitation of performance, and 4 percent evaluation of performance.

James Gallagher (56, 59), in his study of BSCS teachers, found great emphasis on topics in the areas of description and explanation, and few topics dealing with decision-making or evaluation. Tisher (176), reported a comparison of verbal interaction in science classes of Australia and the United States. Tisher's Australia data for eighth grade classes showed the following: Designating, 32.5 percent; Describing, 29.7 percent; Stating, 10.7 percent; Explaining, 8.6 percent; Conditional Inferring, 7.2 percent; Comparing and Contrasting, 2.4 percent; Classifying, 0.8 percent; Opining, 0.7 percent; Evaluating, 0.4 percent. The United States counterpart for these data, from Smith and Meux transcripts was as follows: Designating, 17 percent; Describing, 31.4 percent; Stating, 3.2 percent; Explaining, 12.1 percent; Conditional Inferring, 8.8 percent; Comparing and Contrasting, 4.6 percent; Classifying, 3.2 percent; Opining, 2.2 percent; Evaluating, 2.4 percent. Butler (34), in a study of IPS classes, found questions distributed as follows: Cognitive Memory, 18.8 percent; Convergent, 45.5 percent; Divergent, 6.7 percent; Evaluative, 7.5 percent; Procedural, 21.4 percent. Thus, well over three-fourths of all questions were cognitive memory, convergent, or procedural.

Snider (158, 159), in a study of physics classes, found 49 percent of all matrix tallies in "Lectures," and in a separate study (160) of Harvard Project Physics classes, 41.7 percent. Balzer (17, 18) and Evans (48), studying BSCS and non-BSCS teachers, found that content development constituted approximately one-half of the teacher behaviors encoded in the classroom. Of these behaviors, 33 percent were "Knowledge" and about 20 percent were "Procedures." "Scientific Process" behaviors were 12.5 percent, "Articulation of Content," 6.5 percent; and "Generalizations and Summary," 1.2 percent; and "Tentativeness of Knowledge," 0.6 percent. "Facilitates Communication" was about 26 percent. These teachers spent about five seconds per class period on student centered scientific process behaviors. Moore (108, 109) found that in non-PSSC classes, 51 percent of the non-lab time was devoted to lecture, demonstration, and factual recitation while the figure in PSSC classes was 46 percent. All the non-PSSC labs observed were used for verification, while three of the four PSSC labs observed were used for inquiry.

Parakh (120), studying high school biology classes, found that the cognitive dimension constituted 54 percent of the total class time in lectures and 42 percent in lab. Information giving in these situations was 43 percent and 29 percent, and information seeking was 11 percent and 13 percent. Teachers asked for opinions, hunches, and evaluations less than 0.1 percent in lectures and about 0.6 percent in labs. Ramsey (136) studied the development of chemistry content by CHEM Study teachers and found they adopted a deductive teacher-oriented approach, acting primarily as information givers. Petit (127) studied PSSC and non-PSSC classes and reported finding little evidence of inquiry.

It appears that science teachers and pupils at the secondary level spend about one-half of the class time developing content and/or dealing with cognitive matters. This reviewer estimated that 75 percent of the cognitive behaviors at the secondary level were of the lower cognitive levels: facts, definitions, explanations, descriptions, designations, procedures, drill, and convergent thinking. Only 25 percent of the behaviors

were of the higher cognitive variety: use of inquiry, experimentation, opining, inferring, problem solving, comparing, contrasting, synthesizing, evaluating, divergent thinking.

It is also clear from the studies reviewed that lecturing continues to be the most common broad framework of behavior for teachers. Several authors cite figures around fifty percent of the behaviors encoded (usually only verbal) for lecture.

Very little information is available at the college level. Talley and Solomon (174) found a majority of the behaviors of a college science teaching faculty on a knowledge-evaluation dimension to be at the knowledge level. The majority of the behaviors along a concrete-abstract dimension were found to be abstract. Moriber (110) studied college physical science teachers and found only 7 of the 600 questions asked were at the synthesis and evaluation levels.

Clearly, more studies are needed at all levels which have more behavior descriptions in common, enabling cleaner behavior generalizations. Still, the overall picture of behavior at the cognitive levels is quite clear: very little time at all educational levels is given to all of the higher mental and scientific processes combined. If we select any specific one of these higher processes which we seem to value in science education (such as cognitive evaluation or experimental design development, to name two), we are likely to get essentially no behaviors recorded at all. Indeed, several of the studies reviewed report evaluation or judgment behaviors at less than one percent of the behaviors encoded.

One can only judge that this pattern may be due in part to the relative mental and/or social difficulty of dealing in the higher level processes, in addition to educational self-perpetuation of certain cognitive practices and exclusion of others.

Affective Behaviors: Behaviors under consideration here are of two rather different sorts--those behaviors which deal with attitudes and values as content considerations and those behaviors which themselves are affective in makeup. An example of the former group might be a value question asked by the teacher; an example of the latter might be a sarcastic statement by the teacher.

Kleinman (80, 81, 82), studying seventh and eighth grade questioning by teachers, found one value question in the 35 observations of the study. Porterfield (130, 131), in a study of second and fourth grade SCIS and non-SCIS teachers teaching reading, found 0.59 percent of the questions to be attitude questions for non-SCIS teachers and 2.05 percent by the SCIS teachers. Parakh (119) found that about 4 percent of the pupil utterances in high school biology classes were evaluative, including affective. The data consistently convey that classroom deliberations concerning attitudes and values are very unusual indeed.

Friedel (53) found 1 percent of the secondary science teacher behaviors to be positive reinforcement and 1 percent negative reinforcement. Balzer (17, 18) and Evans (48) found secondary biology teachers to show 0.5 percent

positive affectivity and 0.8 percent negative affectivity. Hassard (65, 66) found ninth grade earth science behaviors to include 3 percent positive climate and 1.1 percent negative climate. Streitberger (172) found 3.4 percent positive reinforcement and 0.6 percent negative reinforcement in his study of secondary chemistry classes. Parakh (120) reported that evaluative behavior constituted 7 percent of the lectures and 3 percent of the labs. Hunter (70) found that the first grade teachers studied used about 4 percent praise and 5 percent rejection. On the other hand, Altman (5), studying third and fourth grade classes, reports finding seven to nine times more praise than criticism with totals around 10 percent. In several additional studies at the secondary level based on the Flanders system, "Accepts Feeling" was less than 1 percent, "Praises and Encourages" was 1-2 percent, and "Criticizes or Justifies Authority" was 0.5 percent-2 percent. The major exception to the pattern reported was by Butler (34), who found 7.8 percent "Praises or Encourages" behaviors.

Thus positive and negative affective behaviors constitute a rather low percentage (1-4 percent total) of the behaviors in most studies,with somewhat higher figures in the elementary studies reviewed, an IPS study, and in the Parakh's study where affective behaviors are included in the somewhat broader evaluation concept. Overall the positive and negative figures appear to be about even, though the relationships differ rather sharply from study to study.

RECOMMENDATIONS

Research

1. Researchers should designate more specifically the manner of instrument development and the nature of the observational system and its usage. Without knowing if the instrument is a category system or a sign system, for example, an accurate interpretation of research data is impossible.

2. Researchers should be more careful in their use of the term "category system." A precise definition of this term has been formulated and is generally accepted in educational research. Inaccurate use of the term needlessly promotes confusion and makes accurate interpretation of research data impossible.

3. Researchers should state the theoretical framework on which instrument development is based. In the studies reviewed, less than one-half of the investigators provided any hint of theoretical basis for instrument development. As a result, the conceptual soundness of many of the instruments is neither evident nor convincing.

4. Adoption of an existing instrument for a research study should be done with more care than has characterized many previous studies. Appropriateness of the instrument to methodology and objectives of the study must be as carefully assessed as when an instrument is being developed. Adoption should not be used simply as a research short-cut.

5. Patchwork instrumentation (adoption of an existing instrument with slight additions or modifications for desired features) should be undertaken only with great caution. Problem areas include lack of consistent theoretical framework and inadequate inductive base.

6. When an existing instrument is adopted for use in a study, the researcher should state whether original category (or sign) definitions and encoding rules were utilized and how encoding training was accomplished.

7. Given the present state of classroom research, it appears desirable that the unit of encoding be kept as short as possible to minimize the roles of inference and memory by the observer. This is not to suggest that encoding units should always be time-interval based but that the unit be as short as possible, regardless of the base.

8. For descriptive purposes, rating scales appear to have only limited usefulness because the observer must provide a weighting or, sometimes, a value judgment concerning behaviors prior to encoding of data. This obviously restricts the objectivity as well as the descriptive value of the data.

9. Researchers should always clarify how the problems of validity and reliability are handled in their studies. Based on the documents reviewed, about one-eighth of the researchers did this for validity and about one-half for reliability. Several specific suggestions in this regard are provided in the "Discussion" section of this part of the monograph.

10. Researchers should state more specifically which behaviors (managerial? nonverbal? pupil? etc.) and which portions of the class period or school day are excluded or included in the data. Omission of this information makes interpretations and comparisons of data much more difficult and inaccurate than should be necessary.

11. Much more attention should be give to the respective roles of inductive and deductive methodologies in classroom behavior research. The most appropriate methodology should then be chosen in relation to the objectives of the study and the relationship should be carefully described.

12. Studies primarily inductive in methodology are needed. Use of this methodology has sharply increased in the past two or three years but primarily inductive studies still number only about a dozen. A major contribution of inductive studies is the provision of empirical data which may not be implied by the theoretical frameworks of deductive studies.

13. Deductively developed instruments should be tested in pilot studies to insure that behaviors actually exhibited are incorporated and that behaviors conceptualized actually occur. Pilot testing should be described to provide assurance that the instrument reflects actual classroom behaviors.

14. Teachers and classrooms used for inductive instrument development or deductive pilot testing should be as broadly representative of the population as possible. In some of the studies reviewed, only one or two teachers were used, providing data insufficient for generalizing.

15. Science education researchers should cease making the assumption that verbal behaviors or interactions constitute adequate measures of total behaviors or interactions. This is especially true in view of the observation that a major goal in science education currently appears to be that students shall independently and individually learn to do science rather than just talk about it.

16. Much attention is given in the literature of science education to inquiry and the nature of science. Yet, very few of the instruments used in the studies reviewed were based primarily on these concepts. If valid information on classroom behaviors pertaining to the nature of science and inquiry is to be generated, more attention must be given to instrument development and data generation on the basis of these concepts.

17. A standardized format for reporting descriptive data is needed. The wide range of scales, ratios, and percentages of different wholes which are currently used provides a major obstacle to meaningful data comparisons across studies. A reasonable minimum would be that all studies include an expression of major groupings of behaviors as percentages of the whole, including a clear description of what constitutes the whole.

18. More emphasis should be placed on behavioral studies in science classrooms at the primary grades level and the college level. Behavioral data at these levels are presently very limited.

19. Given a well-developed and defensible rationale, replication of research studies at the masters and doctoral levels should be encouraged. One basis for this recommendation is that more data generated by a given instrument are needed for descriptive and comparative purposes.

Teacher Education and Practice

Recommendations concerning teacher education and practice follow somewhat more appropriately from the research reviewed by Evans. However, the compilation of descriptive data accomplished in this review provides a basis for several recommendations.

1. Teacher education programs should be designed to sensitize prospective teachers to the prominence and possible significance of nonverbal behaviors. Videotapes of actual classrooms or of microteaching situations are possible vehicles for promoting this awareness. The videotaped libraries and computer storage and retrieval systems suggested by Evans in part two of this monograph would be useful.

2. Overall, most science class time continues to be spent in talk, with the teacher doing most of the talking. A similar finding is that most classroom behaviors are teacher-centered. If this pattern is to change significantly, more specific strategies of behavior training will probably have to be built into teacher education programs and applied. For example, it may be necessary to provide training in alternate strategies which promote student-talk initiation or which transfer problem solving responsibilities to students.

3. Behaviors pertaining expressly to the nature of science seem to be nearly non-existent in science classrooms. If the behaviors in the content and processes of the nature of science are to be realized in science classrooms, strategies for their development will have to be incorporated in teacher education programs.

4. Very few behaviors have been found in elementary, secondary, or college classrooms which pertain to either affective or high level cognitive considerations, especially synthesis and evaluation. If such experiences are to be provided in the schools, mechanisms for their incorporation must be provided in teacher education programs.

5. Neither behaviors of positive affectivity nor negative affectivity are common in science classrooms, and overall the proportion of each appears to be about even. Such data should be evaluated in the light of childhood and adolescent psychology to ascertain a beneficial balance for various developmental levels and social conditions.

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RESEARCH ON TEACHING INVOLVING THE SYSTEMATIC
OBSERVATION OF CLASSROOM BEHAVIOR, 1960-1971

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INTRODUCTION

Are specific types or patterns of teacher classroom behavior related
to criteria of effectiveness such as teacher ratings and student outcomes?
Can these behaviors be identified by means of the existing observational
systems? Do individual preservice and inservice teachers exhibit similar
or divergent patterns of behavior? How are these behaviors acquired?
Once behavior patterns are established, can they be changed? If behavior
patterns are amenable to change, what instructional methods or situational
factors are most effective for changing classroom behavior in predetermined
directions? What are the relationships between classroom behavior and such
variables as teacher attitude, personality, years of experience and age?
These questions have long dominated the thoughts and actions of teacher
educators and researchers, because their answers are essential requisites
for the establishment of effective educational programs at all levels.

An attempt to answer some of the aforementioned questions by investi-
gating the existing research forms the basis of this chapter. It is a
review and analysis of research on teaching and, except in a few instances,
is limited to those investigations which utilized a system for the system-
atic observation of classroom behavior. The exceptions include investi-
gations in which classroom behavior was measured by student perceptions
on such instruments as the Biology Classroom Activity Checklist (155) and
Science Classroom Activities Checklist (255). Major emphasis is placed
on science classroom behavior, although research in other subject areas
is included.

The use of systematic observation of classroom behavior in research
on teaching is not a new phenomenon. Horn (129) developed a system for
observing and coding classroom behavior as early as 1914. Coding refers
to the classifying and recording of behaviors into a category system. An
examination of the research literature, however, reveals that systematic
observation of classroom behavior has only recently become widely used in
research on teaching. Approximately 376 research documents, representing
305 investigations, were identified that were published or made available
between 1960 and including 1971. One hundred eleven of these investi-
gations were devoted exclusively to research on science teaching. The
number of investigations by date of publication for the 305 investigations
as a per cent of the total at three year intervals is shown in Figure 1.
Figure 2 presents the number of science education investigations by date
of publication as a per cent of the total [using only the 111 science
education investigations] at three year intervals.
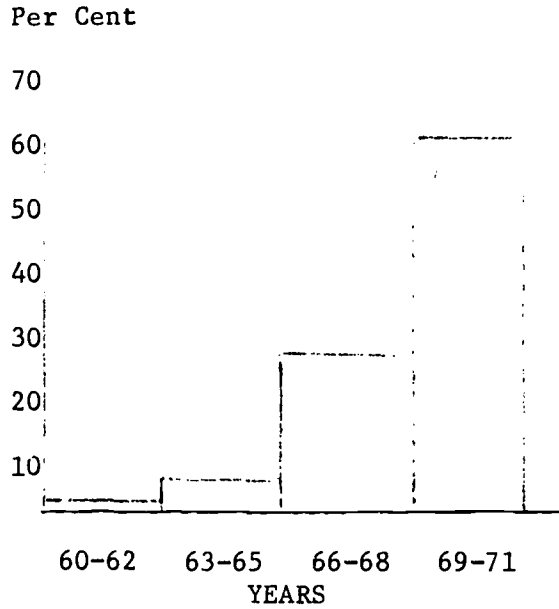
Figure 1. The number of investigations by date of publication for the 305 investigations, which applied systematic observation of classroom behavior in research on teaching, as a per cent of the total at three year intervals, 1960-1971.
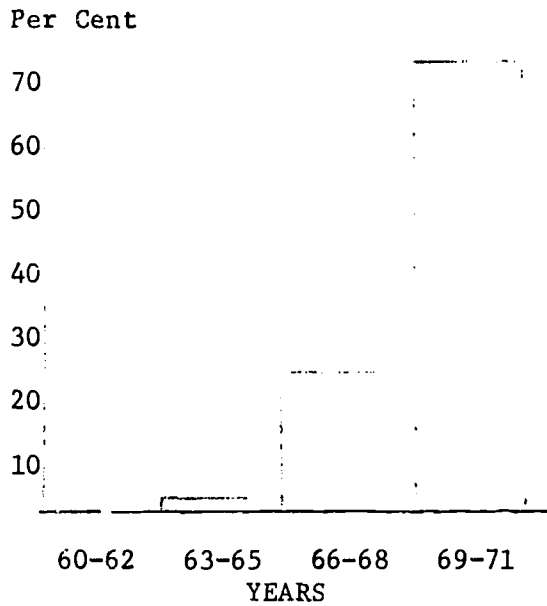
Figure 2. The number of investigations by date of publication for the 111 science education investigations, which applied systematic observation of classroom behavior in research on science teaching, as a per cent of the total using only science education investigations at three year intervals.

Figures 1 and 2 reveal that research on teaching involving the use of systematic observation of classroom behavior has been steadily increasing in science education and other subject areas since 1960. Approximately 62 per cent of the 305 investigations, including 70 per cent of the 111 science education investigations, were made available in the 1969-1971 interval. The percentages in Figure 1 for the 1960-1962, 1963-1965, 1966-1968 and 1969-1971 intervals represented 7, 26, 84 and 188 investigations, respectively. The science education percentages in Figure 2 for the same intervals represented 0, 4, 29 and 78 investigations, respectively.

Once the research documents were identified, they were classified into one of the major categories or subcategories of research on teaching. The criteria for this classification are presented in Table I.

TABLE I

CATEGORIES OF RESEARCH ON TEACHING INVOLVING THE
SYSTEMATIC OBSERVATION OF CLASSROOM BEHAVIOR

Categories of Research	Independent Variables	Dependent Variables
1. Teacher Effectiveness	Teacher Classroom Behavior	Student Gains, Teacher Ratings, Student Behaviors
2. Teacher Education		
a. Training Research	Methods Used in Attempts to Change Behavior	Classroom Behavior
b. Relationships	Variables such as Teacher Attitudes, Age, Personality, Years of Experience, Sex, Grades and Perception	

Table I shows that research on teaching involving systematic observation can be classified into the areas of teacher effectiveness, and training research or relationships, depending on the nature of the independent and dependent variables. In the teacher effectiveness category, teacher classroom behavior is the independent variable, and student gains, teacher ratings, and/or student behaviors are the dependent variables. The independent variables in the training research subcategory of teacher education research are the methods used in attempts to change classroom behavior while classroom behavior serves

as the dependent variable. In the relationships subcategory of teacher education research, classroom behavior is the dependent variable, and the independent variables include teacher attitude, age, personality, years of experience, sex, grades and perception.

This section of the monograph is organized into four parts. The first three correspond to the categories and subcategories of research on teaching presented in Table I, i.e., teacher effectiveness, training research and relationships. The final section, discussion, contains a summary, identifies a number of questionable research practices and offers suggestions for future research and practice.

Throughout the review three procedures are used that require further clarification. First, investigations that met the criteria for more than one section are included in each of the appropriate sections. The total number of investigations given in Figures 1 and 2 however, was obtained by giving each investigation a value of one even if it were included in more than one section. As a result, the total number of investigations in Figures 1 and 2 and the sums of the individual sections are not equal. Second, results are stated as being significant when the probability was equal to or less than the 5 per cent level, unless otherwise indicated. Third, when an instrument, course content improvement study, or interaction ratio is first presented, its acronym is included in parentheses. Only the acronym is used throughout the remainder of the review.

TEACHER EFFECTIVENESS

Educational researchers have long aspired to identify and predict teacher effectiveness. Efforts can be traced back to the beginning of the century when the efficiency movement in industry was at its height. The most common research design has been concerned with selecting a criterion or set of criteria, measuring the criterion, and correlating the criterion measurement with intelligence scores, academic marks, subject-matter preparation, and/or personality traits of teachers. The characteristics or behaviors of teachers, as measured by rating scales, and pupil achievement have been the most frequently used criteria of effectiveness. Reviews of this research have generally not been positive. They usually concluded with summary statements indicating that the existing research was conflicting and inconclusive.

Within the past decade, numerous investigators have included systematic observation of classroom behavior in their research on teacher effectiveness. The impetus for these investigations have come from many sources including work by Anderson (10), Withall (307), Ackerman (2), Medley and Mitzel (180), Ryans (254), Biddle and Ellena (24), Gage (101), and Flanders (93). Several reviews of this research have appeared, and they were distinctly more positive than the earlier reviews of research on teacher effectiveness. Based on summary statements by Kleinman (153), Soar (271), Campbell and Barnes (54) and Flanders (91), systematic observation appears the most promising technique to date for identifying teacher effectiveness.

During the period from 1960 through 1971, at least 64 investigations were concerned with attempts to identify relationships between observations of teacher classroom behavior and various criteria of effectiveness. The investigations included most academic areas, with 35 being devoted exclusively to science teacher effectiveness. In each investigation, the independent variable was teacher classroom behavior, and dependent variables such as teacher ratings and measures of student achievement, attitude, self-concept, classroom behavior and interest served as the criteria of effectiveness (see Table I). The investigations, described in 81 documents, involved students and teachers at the college, secondary and elementary school levels.

The review of these investigations is organized and discussed in six parts, each corresponding to a general type of design used by the investigators. The parts include: (1) Rating, (2) Correlation, (3) Ranking, (4) Role Playing, (5) Training and (6) Miscellaneous. At the end of each part is a brief summary containing the overall conclusions that were drawn from the view of the investigations.

Rating

In the following six investigations [Pankratz (215), Gold (112), Hoak (126), Talley and Solomon (285), Amidon and Giammatteo (9), and Tuck (290)], effective and less effective teachers were selected by means of student, administrator, supervisor and/or peer ratings of teachers. Two investigations [Pankratz (215) and Gold (112)] were devoted exclusively to science teachers, while the remaining four investigations [Hoak (126), Talley and Solomon (285), Amidon and Giammatteo (9), and Tuck (290)] included teachers who taught science and/or other subject areas. Once the teachers were identified, observations and comparisons were made of their classroom behavior. A major limitation common to all six investigations, and possibly the reason for the lack of consistent results, was the use of ratings to select effective teachers. Biddle and Ellena (24) have pointed out in an earlier review the general futility of using ratings as substitutes for measures of student achievement in teacher effectiveness research.

The results of companion studies in science education by Pankratz (215) and Gold (112) were inconsistent. Pankratz reported that the verbal behavior of effective physics teachers was significantly different from the verbal behavior of less effective physics teachers. The effective teachers used more praise and reward, more cognitive skill clarification and acceptance than the less effective teachers. The effective teachers used fewer requests and commands, used less criticism and rejection, and experienced less confusion and irrelevant behavior than the less effective teachers. The ratio of indirect to direct teacher statements (I/D ratio) was similar for both groups, but the ratio of indirect to direct teacher statements (i/d ratio), excluding teacher questions and lecture, was higher for the effective group. Gold did not find significant differences between effective and less effective biology teachers when he compared their I/D ratios, i/d ratios and mean total of time spent in each category of classroom interaction. In fact, he found the verbal behavior of the two groups to be remarkably similar.

Both Pankratz and Gold included five effective and five less effective teachers in their studies. The teachers were selected from a population of approximately 30 secondary school teachers who were ranked on a composite of three instruments: Teacher Rating Scale, Student Opinion Questionnaire and Teaching Situation Reaction Test (TSRT). Classroom verbal behavior was measured by means of a modified Flanders System of Interaction Analysis (FSIA).

Hoak (126) investigated relationships among principal, peer and pupil ratings and the classroom climate established by first year elementary school teachers. Twenty-five teachers were rated by 22 principals, 77 peers and 649 students with either the Teacher Appraisal Scale or "About My Teacher" instruments. Classroom climate was determined by means of Withall's Social-Emotional Climate Index, and correlations were computed among all four measures of teacher effectiveness. When effectiveness was defined in terms of a teacher's Social-Emotional Climate Index, Hoak concluded that there were not sufficient relationships between classroom climate and the ratings to warrant their use as appraisal measures in product evaluation.

The Florida Taxonomy of Cognitive Behavior (FTCB) and Taxonomy of Imagery Provocation (TIP) were used by Talley and Solomon (285) to study the cognitive classroom behaviors of 25 college faculty members. Eighteen faculty members were from the science department, and seven represented four other disciplines. The researchers computed a correlation matrix for the FTCB, TIP and several general variables such as age, years of teaching experience and rank. The college administration had ranked the faculty members on a five point scale ranging from master to ineffectual teacher. The results showed that administrative ranking of teachers was not significantly related to the measured teacher behaviors.

Amidon and Giammatteo (9) analyzed and compared the classroom behavior of 33 elementary school teachers selected as being superior and 130 elementary teachers selected at random using the Flanders System of Interaction Analysis (FSIA) during language-arts lessons. The comparisons revealed that the superior teachers talked less, used less criticism and direction-giving, were more accepting of student-initiated ideas, and used more indirect behaviors than the teachers chosen at random.

Tuck (290) compared the verbal classroom behavior of secondary school teachers rated as high or low on the degree to which they encouraged students to assume responsibility for their own learning. Ratings were obtained from administrators and instructional associates. Five teachers were randomly selected from each group, and their classroom behavior was measured with a modified FSIA. The verbal interaction data showed that the classroom behavior of the two groups was significantly different. Teachers in the high group talked less, allowed more student talk, demonstrated greater variability in verbal behavior, accepted feelings and ideas more, used less praise, asked fewer cognitive memory questions, asked for fewer direct pupil responses and were more indirect in their teaching influence.

Correlation

The general design used in the following 12 investigations
[Sharp (266), Wright and Nuthall (312), Solomon, et al. (272), LaShier
(163), Schmedemann and LaShier (261), Cook (68), Perkes (222), Steiner
(278), Kochendorfer (155), Spaulding (275), (276), and Beiderman (22)]
involved observing and coding teacher classroom behavior, applying the
criterion instruments and subjecting the data to correlational analysis.
All of the investigations except those by Spaulding (275), Spaulding
(276), Beiderman (22), and Solomon, et al. (272) were devoted entirely
to science teacher effectiveness. Seven investigations [Wright and
Nuthall (312), Solomon, et al. (272), LaShier (163), Perkes (222),
Steiner (278), Kochendorfer (155), and Spaulding (275)] reported signifi-
cant relationships, and five [Sharp (266), Schmedemann and LaShier (261),
Cook (68), Spaulding (276), and Beiderman (22)] reported no significant
relationships between the independent and dependent variables. Further
comparisons among the investigations with respect to specific teacher
behaviors and student outcomes were restricted because of the diverse
nature of the observational and criterion instruments.

Sharp (266) investigated relationships between student academic
achievement in high school biology classes and three predictor variables--
teacher classroom behavior, preparation and microscope use. The Nelson
Biology Test was administered to all students in November and again in
May. The FSIA was used to estimate the amount of teacher talk, amount
of student talk and ratio of direct to indirect verbal behavior. After
subjecting the data to a multiple regression program, Sharp concluded
that none of the predictor variables were significantly related to student
academic achievement.

A study by Wright and Nuthall (312) involved 17 teachers and student
teachers and 369 third grade students. Audiotapes were recorded during
three, ten-minute science lessons for each teacher and were coded with
a 28-item category system. The Nature/Science Concepts Test, Revised
Tomlinson Junior School Test and an achievement test were administered
following instruction. Achievement scores were corrected for intelli-
gence and prior knowledge and correlated with the teacher behavior vari-
ables. The results revealed significant positive correlations between
mean class achievement scores and the following teacher behaviors:
(1) review at the end of a lesson, (2) tendency to ask one question and
obtain the answer without repeating the question or supplying answers,
(3) asking closed questions, i.e., questions requiring a single state-
ment at lower cognitive levels, (4) redirecting a question to another
pupil, (5) use of thanks and praise, and (6) providing content-relevant
information at the end of an episode initiated by a question. These
results, according to the researchers, suggested a strong relationship
between precise and clear language on the part of a teacher and student
learning.

Additional evidence to support the conclusions drawn by Wright
and Nuthall (312) were reported by Solomon, et al. (272) in a study
involving American government classes at the college level. They found

that the tendency to lecture and teacher clarity and expressiveness were related to student gains in factual information.

LaShier (163) reported significant correlations of 0.51 and 0.56, respectively, between student teacher I/D ratio and gains in median achievement and class medians on the Michigan Student Questionnaire. The study included ten student teachers who taught a Biological Sciences Curriculum Study (BSCS) laboratory block on animal behavior to 239 eighth-grade students. I/D ratios were determined by means of the FSIA, and student achievement was measured with an instrument developed by the researcher.

An attempt by Schmedemann and LaShier (261) to find significant correlations between student scores on the Cognitive Preference Test and teacher warmth, demand and use of motivation was unsuccessful. Teacher behavior was determined from student perception of behavior, i.e., student scores on the Student Inventory, and teacher scores on the Cognitive Pref-erence Test. The study included 31 Physical Science Study Committee (PSSC) physics teachers and their students.

Cook (68) examined the influence of teacher verbal classroom behavior on student achievement in secondary school biology classes. The I/D ratios of eight teachers were determined for laboratory and discussion periods by means of a modified FSIA. These ratios were correlated with adjusted posttest means on the Watson-Glaser Critical Thinking Appraisal (WGCTA), Process of Science Test, Form A (POST) and BSCS Comprehensive Final Examination. Several positive correlations were reported between the teacher and student variables, but none were significant at the 0.05 level.

The Science Teaching Observation Instrument (STOI) was used in a study by Perkes (222) to code the teaching behavior of 32 junior high school science teachers. Student achievement was measured with Level Three of the STEP Test and Junior High School Science Achievement Test (JHSSA). Correlational analysis was computed between teaching behavior and mean class scores on the criterion measures. Based on this analysis, teacher-oriented activities such as talking, demonstrating and conduct-ing recitations, were shown to be positively related to student recall of factual material and negatively related to student application of scientific knowledge. Student-oriented activities, such as involvement in laboratory and discussion, hypothesizing, and use of applications, were found to be positively associated with student application of scientific knowledge and negatively associated with student recall of factual material.

Relationships between teacher classroom practices and student performance of selected inquiry process behaviors in the affective domain were investigated by Steiner (278). The population of the study included 43 high school biology classes. Teacher practices were identified with the Biology Classroom Activity Checklist (BCAC). Student performance was measured with two investigator-designed instruments, the Biology Student Behavior Inventory (BSBI) and Observational Record of Affective Behavior (ORAB). Correlational analysis between teacher practices and

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student performance revealed that 27 of 53 teacher practices were significantly related to student inquiry performance in the affective domain. In general, the highest relationships were found between student inquiry performance and those teacher practices which involved student participation.

A significant correlation of 0.30 was reported by Kochendorfer (155) between class mean gain on the Process of Science Test and teacher classroom activity, indicating that classroom activity was a significant factor in effecting changes in students' understanding of science. The classroom activity of 64 secondary school biology teachers was determined by means of student perceptions on the BCAC.

Spaulding (276) subjected observed teacher behaviors, measures of student development (achievement, creative thinking and self-concept) and various situational variables to a partial correlational analysis. Teacher-student transactions in 21 elementary school classrooms were coded with the Transaction Sample: Classroom (TSC) instrument. Student development was measured by administering standardized tests. Fourteen out of three hundred six partials were found to be significant. This number was fewer than would be expected by chance alone. Such results, according to Spaulding, cast doubts on the usefulness of the theory, design and statistical procedures used in the study.

In a second investigation, Spaulding (275) examined the effects of teaching method and style in superior elementary school classrooms on student achievement, self-concept and creative thinking. Seven teacher transaction patterns were identified, and these were correlated to student variables as measured by Sequential Tests of Educational Progress (STEP), Self Concept Inventory and Kaya Puzzles Test. Although Spaulding reported a significant relationship between all three student variables and placement in superior classrooms, only two significant relationships were found between student variables and teacher transaction patterns. Height of student self-concept was significantly related to one of four components of integrative teacher behavior and to a high degree of teacher private or semi-private communication with students.

Beiderman (22) computed correlations between teaching style and student achievement and did not find significant relationships between these variables. His study involved 72 elementary school teachers and 2099 fifth and sixth-grade students. Three classifications of teaching style were assessed by means of a modified version of a category system developed by Cogan (64). Student achievement in reading, arithmetic and spelling was measured with the Bijou-Jastak Wide Range Achievement Test.

Ranking

In each of the following 15 investigations [Ladd and Andersen (160), Kleinman (154), Tisher (287), Hastings (122), Snider (268), Yager (313), Campbell (53), Utgard (292), Wolfson (309), Schirner (260), Struthers (283), Flanders (92), Morrison (195), Powell (231), and Christensen (59)], a group of teachers was ranked on the basis of some individual or

combination of observed classroom behaviors. Teachers at each end of the continuum were assigned to high and low groups, and statistical procedures were usually applied to ensure significant differences with respect to the specified behaviors. The most effective teaching behavior or combination of teaching behaviors was then determined by comparing achievement and/or attitude of students taught by the high and low groups of teachers. Science teacher effectiveness was the focus in 11 investigations [Ladd and Andersen (160), Kleinman (154), Tisher (287), Hastings (122), Snider (268), Yager (313), Campbell (53), Utgard (292), Wolfson (309), Schirner (260), and Struthers (283)]. The remaining four investigations [Flanders (92), Morrison (195), Powell (231), and Christensen (59)] involved the effectiveness of teachers who taught in other subject areas.

Ladd and Andersen (160) examined the influence of the level of teacher questions in classroom discussions on student achievement. Audio-taped recordings were made of 40 ninth-grade earth science teachers as they taught specific laboratory discussion periods. Teacher questions were analyzed, using a modified Smith and Meux classification system. An inquiry ratio was used to rank the teachers. A median split resulted in a group of high and a group of low inquiry teachers. Two posttests, one consisting of 25 low and one consisting of 25 high level inquiry questions, were administered to approximately 1000 students. The achievement data revealed that students taught by high inquiry teachers performed significantly better on high, low and total achievement questions than students taught by low inquiry teachers. The researchers concluded that teacher questioning behavior strongly influenced student achievement.

An exploratory study by Kleinman (154) focused on the kinds of questions teachers ask and the influence of these questions on students' understanding of science. Twenty-three seventh and eighth-grade general science teachers were observed for one class period. The questions they asked were classified into the following categories: (1) neutral, (2) rhetorical, (3) factual, (4) clarifying, (5) associative, (6) critical thinking and (7) values. Three teachers who asked nine or more critical thinking questions were selected as a high group, and three teachers who asked no critical thinking questions were assigned to a low group. These six teachers were observed two additional times, and the Test on Understanding Science (TOUS) was administered to their students. After comparing the TOUS scores, Kleinman cautiously concluded that, within the limitations of her study, a positive relationship existed between frequency of critical thinking questions and students' understanding of science. She pointed out that the relationship may have been the result of factors common to teachers who asked more critical thinking questions rather than of the questions themselves.

One portion of an investigation by Tisher (287) was devoted to an exploratory study of the relationship between verbal teacher behavior and growth in student understanding in science. Behavioral data were gathered on nine eighth-grade science teachers by means of a modified Smith and Meux technique. Teachers were classified as high or low in warmth and as high, low, or medium depending on the frequency of their higher cognitive demands. A pre and post criterion science test was

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administered to the students. Residual scores were calculated for each student and interpreted as resulting from teacher behavior and certain pupil variables. Four hypotheses were tested using a two-way analysis of variance, and although all the hypotheses were not accepted, Tisher reported several significant and interpretable results. Included were the following: (1) low achievement-oriented students gained a greater understanding in science when taught by teachers rated high and less when taught by teachers rated low in warmth; (2) higher cognitive demands by teachers did not result in greater understanding in science by high and low achievment-oriented students; (3) recall gains by low achieving-by-conforming pupils were greatest when taught by teachers rated high and least when taught by teachers rated low in warmth; and (4) medium cognitive demands resulted in greater understanding in science by able students than did low or high cognitive demands.

In a study by Hastings (122) 10 fourth-grade teachers were assigned to either an indirect or direct group based on I/D ratios obtained from observations with the FSIA. Science forms 4B and 4A of the STEP test were administered to the students as pre and posttest measures of achievement in the inquiry skills of science. A comparison of class mean gains did not reveal significant differences in achievement by students who were taught by indirect and those who were taught by direct teachers. Similar results were obtained when the achievement of high and low ability students in the indirect group were compared to the achievement of high and low ability students in the direct group.

The relationships between teacher effectiveness and both flexibility and directness of teacher influence were investigated by Snider (268). The ratios of indirect to indirect plus direct teacher influence (I/I+D) were calculated from observations of 17 physics teachers with the FSIA. Teachers were grouped as high and low on these ratios for total teaching and for each of the following activities: planned demonstration, lecture, laboratory and recitation-discussion. Class mean adjusted scores on the Regents Physics Examination, 1965 (RPE) and class mean adjusted pre-post gain scores on the Cooperative Physics Test and TOUS served as the criteria of effectiveness. When all teaching activities were considered, no significant differences were found between students in the indirect and direct teacher groups. When just the lecture activity was considered, direct teachers were significantly more effective than indirect teachers in terms of student scores on TOUS and RPE. However, class mean adjusted gains on TOUS approached zero, suggesting that neither teacher group was really effective with respect to this criterion measure.

A modified FSIA was used by Yager (313) in a pilot study to compare the teaching outcomes between two secondary school biology teachers. Eighth-grade biology students taught by an indirect teacher achieved significantly more than students taught by a direct teacher on the WGCTA, TOUS and Silance Scale for Measuring Attitudes Toward Any School Subject. Students of the direct teacher achieved significantly higher on the Nelson Biology Test. Yager suggested teaching style as a possible explanation of the results, but he did not rule out the possibility of other factors being involved. He stated that the results should be interpreted as tentative, because the study involved only two teachers

and two sections of students. A further limitation was the use of Blue Version BSCS materials with eighth-grade students.

Campbell (53) studied the relationship between teaching style and the cognitive and affective development of junior high low achievers. Ten science teachers were assigned to either an indirect or a direct group based on observations of lecture-discussion activities with the FSIA. The mean i/d ratios of the indirect and direct groups were 3.14 and 1.32, respectively. Student cognitive and affective development was determined by pre and post measures on the STEP test, Scientific Curiosity Inventory and Scale of Scientific Attitudes. Based on an analysis of student scores, Campbell concluded that indirect teacher influence was superior to direct teacher influence for all areas tested. However, significant differences on the Scale of Scientific Attitudes and Scientific Curiosity Inventory were the result of losses in mean achievement rather than gains. Both groups scored less on the Scientific Curiosity Inventory, but students taught by direct teachers lost the most.

The influence of verbal teaching behavior used by geology recitation instructors at the college level on student achievement was examined by Utgard (292). The study included six instructors and 435 students. A composite score from three course examinations served as the achievement measure. Classroom behavior was coded with a modified FSIA, and the recitation instructors were divided into a high and low group depending on their I/D ratios. The data were analyzed by analysis of variance and correlation. SAT scores were shown to be an important factor in determining student achievement, but student achievement was not found to be significantly affected by the type of verbal behavior used by the recitation instructors.

Wolfson (309) found that chemistry and general science students taught by teachers with high I/D ratios achieved and retained significantly more than students taught by teachers with low I/D ratios. The study included four chemistry teachers, four general science teachers and 318 students. Classroom interaction was coded with the FSIA, and I/D ratios were used to divide the chemistry and general science teachers, separately, into high and low groups. Achievement was determined by administering either the Regents Examination in Chemistry of a standardized general science examination developed by the College Book Company. Retention was measured four months later by re-administering the same examinations. The achievement and retention data were analyzed with an analysis of variance and Duncan's New Multiple Range Test.

Schirner (260) investigated the effects of the type of earth science class, teaching style as measured by FSIA, and teachers' philosophical orientation on various student outcomes. I/D ratios were used to rank 17 teachers, and a high (indirect) group and a low (direct) group were selected. Student outcomes were measured by administering the following criterion instruments as pre and posttests: (1) TOUS, (2) WGCTA, (3) Test of Science Knowledge Part I (TOSK I), (4) Test of Science Knowledge Part II (TOSK II), (5) Earth Science Curriculum Project Final (ESCP Final), and (6) a self-constructed earth science test.

After comparing class mean scores on the criterion instruments, Schirner reported that students of indirect teachers achieved significantly higher scores on the ESCP Final than did students of direct teachers. No significant differences were found between indirect and direct teachers (average of all ratios) for the remaining five criterion instruments. Unfortunately, these results have little meaning because Schirner used students instead of classes as the units of statistical analysis.

One portion of the Boulder Elementary Science Project (283) was devoted to an investigation of relationships between teaching style and changes in student thinking. The classroom behavior of 20 upper elementary school teachers was videotaped and coded with the Expository-Inductive Observation System. The observational data were used to assign each teacher to one of the following teaching styles: (1) expository, (2) inductive and (3) indeterminate. Student adjusted difference scores were computed from pre and posttest measures on the Boulder Tests of Critical and Creative Thinking in Science. A one-way analysis of covariance with dichotomized pretest scores as the covariate revealed that students taught by either an expository or inductive teaching style made significant gains in critical and creative thinking. Students taught by an indeterminate teaching style showed losses in critical and creative thinking. The project director suggested that changes in student thinking could have been caused by the consistent pattern or apparent direction and organization of the expository and inductive teaching styles and the inconsistent pattern or lack of apparent direction and organization of the indeterminate teaching style.

Flanders (92) directed a two year research project whose purpose was to examine the influence of indirect and direct verbal teaching patterns of 16 mathematics and 15 social studies teachers on student achievement and attitude. He reported that students in classes taught by indirect teachers achieved significantly more in mathematics and social studies and scored significantly higher in attitude than students in classes taught by direct teachers. Greater achievement and higher attitude scores were associated with flexible patterns of teacher influence, i.e., periods of high and low i/d ratios, and flexible patterns of teacher influence were associated with a higher overall i/d ratio. Verbal teaching patterns were measured using the FSIA.

Morrison (195) reported that teacher reinforcement was not a significant factor in achievement by students who scored high or low on the Children's Internal-External Test. The study included 30 sixth-grade teachers and 910 students. Teacher reinforcement was determined with the FSIA, and student achievement was measured with pre and post administrations of the Metropolitan Achievement Test Battery.

Powell (231) conducted a long-term study of the influence of teacher verbal behavior on student achievement. Elementary school students were taught by the same teacher for three years and by a different teacher for one year. Multivariate composite scores were derived from FSIA matrices, and each of the nine teachers were identified as being either indirect or direct in their classroom influence. SRA achievement tests (grades 3 and 4) served as measures of effectiveness. Examination of

the third-grade scores revealed that students taught by indirect teachers for three years scored higher than students taught by direct teachers for three years. The fourth-grade scores showed that some students taught by direct teachers gained more during the fourth year than did the students who were taught by indirect teachers for three years. Powell concluded that achievement during the fourth year was not related to classroom climate. As a result, the findings only partially supported the hypothesis that indirect teacher influence would result in significantly more student achievement than direct teacher influence.

Christensen (59) explored relationships between teacher warmth and permissiveness and the achievement and affect-need of elementary school students. The study included 20 classes of fourth and fifth-grade students and 10 fourth-grade teachers. Student achievement and affect-need were measured with the Iowa Tests of Basic Skills and a cognitive-affective scale. Teacher warmth and permissiveness were determined from student perceptions of classroom behavior. After subjecting the data to covariance analysis, Christensen reported the following results: (1) growth in arithmetic achievement and vocabulary was significantly higher when students were taught by teachers who were high in warmth; (2) significant relationships were not obtained for permissiveness and affect-need; and (3) teacher warmth and permissiveness did not interact and produce greater student achievement.

Role Playing

The following 13 investigations [Nelson (202), Lauren (165), Citron and Barnes (61), Egelston (82) Norton (208), Brogan (40), Uricheck (291), Lawlor (166), Amidon and Flanders (6), Flanders (93), Schantz (259), Nelson (201), and Miller (185)] were characterized by role playing on the part of teachers as they instructed classes of students. Eight of the investigations [Nelson (202), Lauren (165), Citron and Barnes (61), Egelston (82), Norton (208), Brogan (40), Uricheck (291), and Lawlor (166)] were devoted exclusively to science education. The five remaining investigations [Amidon and Flanders (6), Flanders (93), Schantz (259), Nelson (201), and Miller (185)] included subject areas other than science. In each investigation contrasting roles, such as indirect versus direct or responsive versus directive teaching styles, were enacted by one or more teachers to different groups of students. Generally the roles were monitored with an observational instrument to ensure that the proper roles were enacted. Measures of student achievement, problem solving attitude and/or interest served as dependent variables and were the criteria of effectiveness.

Nelson (202) compared the effects of two post-laboratory discussion strategies on student learning of selected science principles and cognitive skills. Eight classes of sixth-grade students were taught science in an inquiry fashion by one of two teachers who were trained to use an inquiry approach in teaching science. The classes received similar pre-laboratory and laboratory instruction, but they were exposed to either a probing or non-probing strategy during post-laboratory discussions. The teacher asked only low level recall questions about observations in the non-probing strategy and told students what inferences could be

drawn and how to test the inferences. In the probing strategy, the teacher began with low level recall questions and gradually worked up to higher cognitive levels. Teaching strategies were monitored with the Classroom Observation Record. The dependent variables were determined by administering as pre and posttests the Inquiry Skills Measures and two multiple choice tests on different science principles. Class mean gain scores were calculated for each class and subjected to a three dimensional analysis of variance. The results showed that the non-probing strategy was more effective than the probing strategy for increasing student learning of science principles. The probing strategy was more effective for increasing the quantity and quality of student inferences.

Lauren (165) investigated relationships between student achievement and student reports of teacher-pupil interaction in order to determine the most effective climate for teaching slow learners in high school earth science classes. After receiving instruction in FSIA, each of two teachers played contrasting roles by being indirect in two classes and direct in two classes. Audiotaped recordings of classroom interaction were used to monitor the classroom behavior. Student perception of classroom climate and achievement were measured by administering a student survey and teacher-constructed tests to 177 students. An analysis of the data revealed significant positive correlations between student perception of classroom climate and achievement by slow learners and percentage of teacher indirectness (I/I+D ratios).

Although Lauren's findings suggest that indirect teaching was superior to direct teaching for achievement by slow students in earth science classes, the results must be interpreted with caution. Initial differences in student achievement were not controlled, and significant positive correlations were not found between perception of climate and other indices of climate such as I/D and i/d ratios. In addition, two of the indirect classes were actually direct according to the reported I/D ratios of 0.33 and 0.30.

A two-part investigation by Citron and Barnes (61) involved the use of interaction analysis to search for more effective methods of teaching high school biology to slow learners. Six biology teachers were provided with instruction in FSIA and assigned to certain teaching roles. Classes were monitored at monthly intervals to ensure that the correct treatment was being applied. During the first semester, students were subject to one of the following three teaching styles: (1) varying from indirect (high I/D ratio) to direct (low I/D ratio), (2) varying from direct to indirect and (3) a constant intermediate I/D ratio. Student achievement was measured by means of BSCS units or by teacher-constructed tests. The analysis showed that varying the I/D ratio from high to low was more effective, than the other two treatments, for student achievement in problem solving and total performance, provided problem solving was a major component of total performance. A constant I/D ratio was found to be more effective than varying the I/D ratios for student achievement in concept formation.

During the second semester, Citron and Barnes subjected students to constant I/D ratios. Classes with the highest achievement during the first semester were subjected to direct teaching, and those who were lowest in achievement were subject to indirect teaching. An intermediate I/D ratio was maintained throughout both semesters for those classes taught by an intermediate I/D ratio during the first semester. The results of the second analysis showed that constant indirect teaching had a more positive effect than direct teaching on student achievement in problem solving and total performance. No definite relationship was found between a constant teaching style and student achievement in concept formation as measured by change in class mean from group mean.

Egelston (82) compared the effect of two methods of laboratory teaching on student achievement at the secondary school level. Ten biology teachers taught a unit on cell physiology and nutrition; five teachers taught ten laboratory activities in an open-inductive manner, and five used a traditional approach. Observations with a Flanders-like category system developed by the investigator revealed that teachers in the open-inductive group were more indirect while teachers in the traditional group were more direct in their laboratory influence. An analysis of a pretest on knowledge of cell physiology and a brief quiz after each of ten laboratory activities did not support the hypothesis that an open-inductive method of teaching laboratory would result in higher student achievement scores. The control group scored higher on all ten quizzes before and eight out of ten quizzes after covariate adjustment.

The influence of indirect and direct teaching styles on student achievement in college chemistry at the United States Air Force Academy was investigated by Norton (208). Three classes of students were randomly selected and matched with three additional classes based on cumulative chemistry grades for the first eleven chemistry lessons. The two groups were subjected to either direct or indirect teaching styles. Knowledge and comprehension achievement was measured with test items selected from a list of existing standardized test items, and the FSIA was used to monitor teacher classroom behavior. No significant differences in achievement were found as a result of the two teaching styles. Norton reported that the better students at the beginning of the investigation scored higher on the achievement test during the investigation regardless of the teaching style. The converse was also true.

Brogan (40) studied the verbal classroom behavior in structured and non-structured classrooms in an attempt to determine the effectiveness of high school biology and chemistry teachers. Teachers role-played in the structured classrooms in order to establish indirect and direct teaching patterns. The teachers in the non-structured classrooms conducted their science lessons in their normal fashion. Six audiotaped recordings were made in each classroom, and these were coded with the FSIA. Pupil science interest, perception of teacher behavior and achievement served as dependent variables and were measured with the Reed Science Inventory, New York State Regents Examinations, BSCS Yellow Version Quarterly Test and final averages in science class. Analysis of the data revealed no significant trends or patterns between the I/D (defined and I/I+D) ratios generated in the study and the dependent variables.

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Uricheck (291) found that laboratory achievement in a college chemistry laboratory course for non-science majors was significantly influenced by the verbal classroom behavior of the instructor. The study involved four laboratory sections for each of two semesters. During the first half of the first semester, Uricheck taught sections A and B with a low I/D ratio and sections C and D with a high I/D ratio. Sections A and C were switched during the second half of the semester; i.e., section C was taught with a low and section A with a high I/D ratio. The procedure was repeated for four different laboratory sections the second semester. Achievement was measured with performance and pencil and paper tests, and classroom behavior was monitored with the FSIA. An analysis of mean scores showed that section C exhibited the greatest overall achievement. Section A showed a sharp drop in achievement. An initial high I/D ratio seemed to promote early achievement, but no advantage was found in maintaining the same I/D ratio throughout the course.

The effects of verbal reward on the problem solving behavior of 202 second-grade students were investigated by Lawlor (166). One-half of the students had participated in a Science Curriculum Improvement Study (SCIS) program during the first-grade. The students were randomly assigned to one of three treatments and to one of eight testers. As they dichotomously sorted and categorized objects on the basis of physical properties, the students received one of the following types of verbal reward: (1) neutral or no-overt-reward, (2) pertinent reward or rewards given only for acceptable solutions and (3) non-pertinent rewards or rewards delivered on a fixed time schedule. The testers recorded the number of rewards, perseverance time for each task and student descriptions of their sorting. Each testing session was monitored by the investigator and recorded on audiotape. An analysis of the testing sessions revealed that the number of responses, perseverance time, seconds per solution and number of acceptable solutions did not differ for the three treatment groups. Pertinent and neutral rewards both resulted in higher ratios of acceptance to total solutions (E ratio) than non-pertinent reward. Under neutral reward, Science Curriculum Improvement Study (SCIS) students worked quickly, and non-SCIS students worked slowly. This was reversed for pertinent reward. In neutral reward situations, boys and girls received similar E ratios. Girls had higher performance under pertinent reward, and both girls and boys performed poorly under non-pertinent reward. Lawlor concluded that non-pertinent rewards resulted in less efficient problem solving by students of both sexes than neutral and pertinent rewards and that pertinent rewards improved the problem solving efficiency of girls but not of boys.

Amidon and Flanders (6) investigated the effects of indirect and direct teacher behavior on the achievement of eighth-grade geometry students. One hundred forty students who scored in the upper twenty-five per cent of their treatment on a dependence-proneness test were selected from a group of 560 students. The students were provided with one of the following treatments: (1) indirect teacher influence and unclear goals, (2) indirect teacher influence and clear goals, (3) direct teacher influence and unclear goals, and (4) direct teacher influence and clear goals. The same teacher role-played in all treatments, and geometry achievement was measured with a pre and post achievement test.

Observations of classroom behavior with the FSIA revealed that the teacher behavior in the indirect and direct groups were significantly different. A comparison of mean scores for each group showed that students in indirect groups scored significantly higher than students in direct groups on the post achievement test. This was true whether or not intelligence and pre-achievement were controlled. No significant differences were found between the clear and unclear treatment groups.

The 560 students from which Amidon and Flanders selected their sample of dependent-prone students were included in a larger study by Flanders (93). The parent group of students ranged from very high to very low on the dependence scale. The same design was used in both studies, but Flanders did not find significant differences in student achievement as a result of the indirect and direct treatments.

Schantz (259) examined the influence of direct and indirect methods of teaching on the recall of high and low ability fourth-grade students. Scores were obtained on the Kuhlmann-Anderson and Iowa Test of Basic Skills, and students scoring in the top and bottom fifth on both measures were assigned to either a high or low ability group. Each of these groups was divided by chance into two groups. One high and one low ability group was taught by indirect teaching, and one high and low ability group was taught by direct teaching as measured by the FSIA. A pretest was administered to determine previous knowledge, and two posttests were administered as measures of immediate and delayed recall. The data revealed that all four groups showed learning increments, but the increments on both posttests were greater for the high ability group taught by indirect methods of teaching.

Fluctuations in teacher behavior which occurred within two theoretical teaching models and the effect of teaching style on student linguistic performance were explored by Nelson (201). She reported that indirect teacher behavior generally resulted in superior written expression by students on both qualitative and quantitative measures.

Miller (185) found that the influence of highly directive teaching on student mastery of facts and achievement of higher understanding were not significantly different from those resulting from more responsive teaching. The study involved four groups of seventh and eighth grade economics students.

Training

The focus of the following nine investigations [Jackson (135), Petit (225), Torbet (288), Gunnison (115), Carline (56), Davidson (75), Millett (187), Rogers and Davis (242), and Jones (141)] was providing teachers with training in an attempt to alter their classroom behavior as well as examining the subsequent influence of the change on student outcomes. Only the investigations by Jackson (135) and Petit (225) were devoted entirely to science teacher effectiveness. The training programs used by the researchers were quite diverse, including instruction

in Bloom's taxonomy or in FSIA, providing teachers with interaction analysis feedback, microteaching or teachers' use of new curricular materials. Student outcomes included achievement and attitude test scores and/or observations of student verbal behavior.

A modified BCAC was used by Jackson (135) in an attempt to identify changes in teacher activity resulting from an earth science inservice program. The inservice program included 22 general science teachers in a study group and emphasized content and local field studies. Student achievement was measured with the Pupil Achievement Test which was developed by selecting test items from existing sources. The findings reported by Jackson revealed that teachers in the study group taught a more laboratory oriented approach to science than did teachers in a comparison group. In addition, significant positive correlations of 0.53 and 0.65 were found, respectively, between student and teacher measures of classroom activity and means of student achievement scores for each teacher in the study group.

Petit (225) investigated the effects of teaching behavior on student achievement and understanding of the process of science in high school physics classes. The study involved 16 physics teachers and 368 students. She found significant differences in the teaching behavior of PSSC and non-PSSC physics teachers using Moore's observation instrument, a modified BCAC, and an instrument derived from Bloom's taxonomy. Students taught by PSSC physics teachers performed significantly higher at all cognitive levels on an investigator-designed achievement test than did students taught by non-PSSC physics teachers. No significant differences were reported between the two groups in their understanding of the process of science as measured by the Welch Science Process Inventory.

The results of the seven investigations [Torbet (288), Gunnison (115), Carline (56), Davidson (75), Millett (187), Rogers and Davis (242), and Jones (141)] involving the effectiveness of teachers in areas other than science were similar. The training programs were successful in bringing about changes in teacher classroom behavior; however, the changes were either not significant, or they were not accompanied by significant differences in student achievement.

Miscellaneous

The following nine investigations were combined into a miscellaneous section because of the diverse nature of their research designs. In fact, all of the investigations did not specifically relate teacher behavior to measures of effectiveness. Nevertheless, they were included in the review because either systematic observation or students' perception of classroom behavior was used in an attempt to provide additional insights into effective teaching. Four of the investigations [Granger and Yager (114), Kendall (148), Hanson (120), and Cook (67)] were concerned entirely with teacher and student behavior in science classrooms, while the remaining five investigations [Furst (100), Gallagher and Aschner (104), Poe (229), Johns (138), and Gantt (107)] included a study of the classroom behavior of teachers who taught science and/or other subject areas.

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Granger and Yager (114) administered a modified version of the BCAC and a specially designed questionnaire to approximately 300 students who were completing the first semester of an introductory life science course at the college level. The responses to these instruments were used to divide the students into two groups. One group represented students who had experienced a traditional program, while a second group included students who had experienced a process-oriented high school biology program. Comparisons were made between the groups on the basis of achievement in the life science course and attitude toward biology. The results showed that the attitude of students with process oriented backgrounds were significantly more positive toward biology and the total high school biology experience than were students with traditional backgrounds in high school biology. No significant differences were found between the groups in achievement as measured by final grades in the college-level life science course.

Kendall (148) developed an observation instrument to identify student behaviors in physics classes which might foster an understanding of science and a positive attitude toward science. The instrument was used to select physics classes that exhibited high and low frequencies of the identified behaviors. The TOUS and Vitrogan's Attitude Toward Science Scale were administered to the classes, and class mean scores were compared with a one-way analysis F test. The results showed that classes who practiced the behavior, "student relates principles from one subject to another," were significantly higher in the understanding of science than classes who did not practice the behavior. Five additional behaviors were found to be associated with a significantly higher attitude toward science. These behaviors included the following: (1) student contributes to procedure in solving laboratory problems, (2) student selects mathematical operations to be performed on quantitative information, (3) student develops methods of testing his proposed conclusions, (4) student writes an essay report, and (5) student suspends final judgment until data have been analyzed.

An investigation by Hanson (120) provided descriptions of student teacher and student interactions during microlessons in high school biology classes. Observations were made of microlessons focusing on student interpretation of data and teacher response to the interpretation. Several examples were described in which students stated valid alternatives based on given data, but the teacher found the alternatives unsatisfactory. Hanson suggested, based on his observations, that some forms of teacher behavior such as guided inquiry can lead to conclusions that are different from the ones science educators would like to have students reach.

The FSIA was used by Cook (67) while comparing the effectiveness of two different methods of instruction in a general education chemistry course at the college level. Two groups of students were taught via closed-circuit television, and two groups met in discussion sessions with an instructor who made a deliberate effort to elicit student participation. The discussion groups had an average I/D ratio of 0.38 and student talk of 13 per cent. Measures of student achievement, scientific attitude and understanding of the scientific method served as the criteria of effectiveness. The mean final examination scores were found to be

significantly higher for the discussion groups, but an analysis of student gains on the TOUS, Generalized Attitude Toward Science (GATS) and Test on the Evaluation of Scientific Information (ESI) failed to reveal any significant difference between the two methods of instruction.

Furst (100) reanalyzed audiotapes and student achievement data from an earlier study and found relationships between teacher influence and student achievement. The results showed that teachers who taught groups of high achieving students tended to talk less, allow more silence and confusion and be more indirect than direct in their verbal classroom influence. Teachers who taught groups of low achieving students tended to be more direct than indirect in their classroom influence. The study involved 15 secondary school teachers and 345 students. Pre and post-knowledge tests were administered to obtain measures of student achievement, and classroom verbal behavior was coded with a cognitive category system and the FSIA.

In a preliminary report of a research project on classroom interaction, Gallagher and Aschner (104) reported a relationship between types of teacher questions and thought processes expressed by students. Classroom interaction was studied in 12 classes of gifted junior high school students with a category system based on Guilford's model of intellect. Interaction data obtained from audiotapes showed that an increase in the percentage of teacher divergent questions was accompanied by an increase in divergent production in students. The converse was also true. A decrease in the percentage of teacher divergent questions was accompanied by a decrease in divergent production in students.

Teacher behavior in classrooms with a high and low incidence of student-initiated response was investigated by Poe (229). Transcriptions of 100 elementary school teachers were drawn from the Northwest Regional Educational Laboratory audiotape library and analyzed with the FSIA. Twenty-five tapes with a high incidence and 25 with a low incidence of student-initiated response were selected. A comparison of the tapes revealed that a significant relationship existed between teacher reinforcement behavior following student response and student-initiated participation in elementary school classrooms.

Investigations by Johns (138) and Gantt (107) also reported significant relationships between teacher talk and student verbal classroom behavior. Johns found that students in English classes taught by indirect verbal patterns asked significantly more thought provoking questions than did students taught by direct verbal patterns. He further reported that student scores on the Minnesota Student Attitude Inventory (MSAI) were effective criteria for predicting the verbal influence of classroom teachers. After analyzing typescripts of junior high class sessions, Gantt reported that student responses at upper levels of thinking were directly related to teacher behaviors aimed at eliciting higher level responses and that an inverse relationship was found between the quantity of teacher talk and the quality of pupil thinking.

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Summary

Sixty-four investigations were reviewed in which systematic observation of classroom behavior was used in an attempt to find relationships between teacher behavior and various measures of effectiveness. Thirty-five of these investigations [Sharp (266), Wright and Nuthall (312), LaShier (163), Schmedemann and LaShier (261), Cook (68), Perkes (222), Steiner (278), Kochendorfer (155), Pankratz (215), Gold (112), Ladd and Andersen (160), Kleinman (154), Tisher (287), Hastings (122), Snider (268), Yager (313), Campbell (53), Utgard (292), Wolfson (309), Schirner (260), Struthers (283), Nelson (202), Lauren (165), Citron and Barnes (61), Egelston (82), Norton (208), Brogan (40), Uricheck (291), Lawlor (166), Jackson (135), Petit (225), Granger and Yager (114), Kendall (148), Hanson (120), and Cook (67)] dealt exclusively with science teacher behavior at the college, secondary and elementary school levels. Teacher behaviors served as independent variables, while teacher ratings and measures of student achievement, attitude, self-concept, interest and classroom behavior served as dependent variables or criteria of effectiveness.

The reported results of these investigations were largely inconclusive because of the diverse nature of the observation and criterion instruments, populations, and procedures used by the investigators. In those investigations where similarities existed, the reported results did not support the optimism expressed by Kleinman (153), Soar (271), Campbell and Barnes (54), and Flanders (91). The results were inconsistent and contradictory; i.e., variations in teacher classroom behavior did not have a consistent effect on the selected measures of effectiveness.

The results of the 29 investigations [Hoak (126), Talley and Solomon (285), Amidon and Giammatteo (9), Tuck (290), Spaulding (275), (276), Beiderman (22), Solomon, et al. (272), Flanders (92), (93), Morrison (195), Powell (231), Christensen (59), Amidon and Flanders (6), Schantz (259), Nelson (201), Miller (185), Torbet (288), Gunnison (115), Carline (56), Davidson (75), Millett (187), Rogers and Davis (242), Jones (141), Furst (100), Gallagher and Aschner (104), Poe (229), Johns (138) and Gantt (107)] involving subject areas other than science were similar to the results of the science education investigations, with one noticeable exception. Both of the science education investigations [Jackson (135) and Petit (225)], which included training of teachers and measuring the effects of the changes in teacher behavior on student outcomes, reported significant relationships between changes in teacher classroom behavior and student achievement. None of the similar investigations [Torbet (288), Gunnison (115), Carline (56), Davidson (75), Millett (187), Rogers and Davis (242), and Jones (141)] in subject areas other than science found significant relationships between changes in teacher behavior and student achievement.

Although the review does not clearly reveal definite relationships between teacher classroom behavior and the selected criteria of effectiveness, it does not negate the probability that such relationships exist. The problem was, and is, to identify these relationships, and then to explain why they occur. Each of the 64 investigators has made a

contribution by applying systematic observation of classroom behavior to the study of teacher effectiveness. Each has attempted to objectively describe what really takes place in the classroom and, as such, has set a precedent for future research on teacher effectiveness.

TEACHER EDUCATION

Training Research

A search of the literature revealed approximately 293 documents, representing 210 investigations, which fit into the Training Research subcategory of Teacher Education Research (Table I). Sixty-eight of these investigations were devoted exclusively to science classroom behavior. In each investigation, the dependent variable was classroom behavior as measured by systematic observation, and the independent variables were factors or methods used in an attempt to change classroom behavior.

Once the documents were identified, they were sorted into groups having similar independent variables. A list of the independent variables and the number of investigations for each variable are presented in Table II. The various classes and subclasses of independent variables listed in Table II are not mutually exclusive in all cases. For example, those investigations providing teachers with training in interaction analysis were placed in the Training in Systematic Observation of Classroom Behavior subclass of Instructional Sequences, but they could have been included in the Inservice Training subclass. In addition, a few investigators used more than one type of independent variable in their attempts to influence classroom behavior. When this occurred, the investigation was included in each of the appropriate groups.

Table II reveals that six major classes of independent variables were used in the Training Research Section. The classes were as follows: (1) Instructional Sequences, (2) Student Teaching and Cooperating Teacher Influence, (3) Teacher Perception or Expectation of Students, (4) Student Influence, (5) Situational Variables, and (6) Feedback. The classification system in Table II provides the outline for the remainder of the Training Research Section.

Instructional Sequences

From Table II it can be seen that Instructional Sequences were composed of the following subclasses: (1) Training in Systematic Observation of Classroom Behavior, (2) Inservice Training, (3) Microteaching, (4) On-Site Versus On-Campus Activities and (5) Miscellaneous Instructional Strategies. Inservice Training was further separated into Inservice Training in "New Science" Programs and Other Inservice Training Programs. The following discussion treats each subclass of Instructional Sequences in the same order as they appear in Table II.

TABLE II

CLASSIFICATION OF INDEPENDENT VARIABLES USED IN TRAINING

RESEARCH AND TOTAL NUMBER OF INVESTIGATIONS FOR EACH VARIABLE

Independent Variables	Number of Investigations		
	Science Education	Other Subject Areas	Combined Totals
I. Instructional Sequences			
A. Training in Systematic Observation of Classroom Behavior	9	62	71
B. Inservice Training			
1. Inservice Training in "New Science" Programs	29	0	29
2. Other Inservice Training Programs	3	8	11
C. Microteaching	10	15	25
D. On-Site Versus On-Campus Activities	0	4	4
E. Miscellaneous Instructional Strategies	5	9	14
II. Student Teaching and Cooperating Teacher Influence	3	14	17
III. Teacher Perception or Expectation of Students	1	7	8
IV. Student Influence	2	2	4
V. Situational Variables	7	4	11
VI. Feedback			
A. Student	0	4	4
B. Data from Systematic Observation of Classroom Behavior	2	13	15
C. Videotaped and/or Audiotaped	0	6	6
D. Supervisory Conference	2	11	13
TOTAL	73[a]	159[b]	232

[a]Four investigations were included in two or more sections because more than one type of independent variable was used in an attempt to influence classroom behavior.

[b]Fourteen investigations were included in two or more sections because more than one type of independent variable was used in an attempt to influence classroom behavior.

Training in Systematic Observation
of Classroom Behavior

Providing teachers with training in one of the systems for the systematic observation of classroom behavior was the most common method of attempting to change classroom behavior (see Table II). Eighty-seven documents, representing 71 investigations, were identified in this area, and they involved preservice and inservice teachers of most academic areas at both the elementary and secondary school levels. Nine [Boeck (30), Hall (116), Irwin (133), Jones (142), Konetski (157), Masla (174), McLeod (179), Miller (186), and Strawitz (281)] were devoted entirely to science classroom behavior. The Flanders System of Interaction Analysis (FSIA) was used in over two-thirds of the investigations as the training and/or observation instrument. The remaining investigations involved such observation instruments as the following: Classroom Observation Record (254), Instrument for the Analysis of Science Teaching (118), Instrument for Observation of Teaching Activities (279), Reciprocal Category System of Interaction Analysis (210), Sequential Analysis of Verbal Interaction (76), Instrument for Coding Teacher Verbal and Non-Verbal Behavior (41), Science Interaction System (281), and Observation Schedule and Record (23). No single one of these instruments was used in more than three of the investigations.

The One-Group Pretest-Posttest, Posttest-Only Control Group, and Pretest-Posttest Control Group Designs were used in a majority of the studies involving training in systematic observation of classroom behavior in a ratio of 1:2:2. Quasi-Experimental Designs were used in the remainder of the investigations. For the most part, the researchers either stated and used the stated design, or the design could be determined from a description of the research. However, a few of the documents revealed that more attention should be given to naming and describing research designs. For example, in some cases the researchers stated that they were using a particular experimental design, but according to the definitions presented by Gage (102), the design was actually quasi-experimental. In other cases, the exact nature of the design could not be determined from the available description of the research.

An examination of the 71 investigations revealed that providing teachers with training in systematic observation of classroom behavior was an effective means of changing classroom behavior. This was true of the science education and non-science education investigations. A summary of the reported findings is presented in Table III.

Table III shows that 54 out of 71 investigations reported significant findings in favor of the experimental group. No significant difference in classroom behavior as a result of the treatment was found in 16 investigations. Mixed results were reported in one investigation; the treatment resulted in significant changes, but some of the changes were undesirable. None reported findings in which the control group made significant changes in classroom behavior while the treatment group remained relatively unchanged.

TABLE III

SUMMARY OF FINDINGS OF CHANGES IN CLASSROOM
BEHAVIOR RESULTING FROM TRAINING IN
SYSTEMATIC OBSERVATION

Findings	Number of Investigations		
	Science Education	Other Subject Areas	Combined Totals
No significant differences	1	15	16
Mixed results	1	0	1
Significant differences favoring experimental group	7	47	54
Significant differences favoring control group	0	0	0
TOTAL	9	62	71

In those studies where changes occurred, the changes were generally
toward the positive categories of the instrument. For example, the use
of the FSIA or a modified FSIA by Bauch (20), Bond (31), Gunnison (115),
Hill (125), Furst (99), Lohman (171), Parrish (217), Bondi (32), Storlie
(280), Randall (237), Hough and Ober (130), Goldstein (113), Wolfe (308),
and several other researchers generally resulted in significantly more
indirect teacher verbal behavior. The use of question category systems
by Boeck (30), Konetski (157), and Eicher (83) resulted in a significant
increase in the use of higher order or open-ended questions. Perry (224)
and Stevens (279) reported that teachers used a larger variety of teaching
activities and increased their acceptance and use of student ideas after
receiving instruction in the Instrument for Observation of Teaching
Activities, and Davidson (76) reported that the use of the Sequential
Analysis of Verbal Interaction resulted in teachers becoming more effec-
tive facilitators of communication in the classroom.

The limitations of space prohibits a description of each of the 71
investigations in this section. Therefore, nine [Boeck (30), Hall (116),
Strawitz (281), Jones (142), Irwin (133), McLeod (179), Konetski (157),
Miller (186), and Masla (174)] were selected and are described in the
following paragraphs. These nine deal exclusively with science class-
room behavior and are fairly representative of the entire group of
investigations.

Boeck (30) investigated the effects of training preservice science
teachers to categorize and graph high level questions on teacher question-
ing behavior and rate of teacher and student talk. Twenty subjects were

randomly assigned to a control or one of two treatment groups. Each
subject taught ten, ten-minute microlessons on one of three assigned
topics to seventh and eighth grade students. Subjects in the treatment
groups were taught to identify and graph high level questions. The control
group did not receive instruction on questioning. The rates of pupil and
teacher talk in seconds per minute were analyzed from audiotapes of the
microlessons, and teacher questioning behavior was determined from type-
scripts. A question category system was developed, using taxonomies by
Bloom (26) and Sanders (258), and was used to code the teacher questions.
Analysis of the data revealed that the treatment resulted in a signifi-
cantly lower rate of teacher talk and a significantly higher rate of
pupil talk and high level teacher questions. The treatment did not con-
sistently affect the rate of low level questions asked by the teachers
during the microlessons.

In an investigation by Hall (116), 86 preservice elementary education
majors were provided with five contact hours of training in the use of the
Instrument for the Analysis of Science Teaching (IAST Base). The instru-
ment was a 14 category system of interaction analysis designed specifically
to emphasize desirable science teaching behaviors. Audiotapes were made,
before and after training, of the preservice teachers teaching science
microlessons to elementary students. The audiotapes were coded with a 32
category system, the Instrument for the Analysis of Science Teaching
(IAST v.2). The behavioral data revealed several significant changes in
teacher behavior resulting from the training sessions. There was an
increase in the acceptance of students' feelings, teacher closed questions,
student overt activity, group-student responses, and wait-time following
closed questions. There was a decrease in teacher clarification questions,
teacher lecture, teacher looking at lesson plan, teacher handling of equip-
ment, student open statements, and wait-time following clarification
questions.

Strawitz (281) reported that secondary science student teachers
trained in and supervised with the Science Interaction System differed
significantly at the end of student teaching from a control group with-
out such training. Thirteen subjects had been randomly assigned to the
control or experimental groups. Subjects in the experimental group used
more acceptance and clarification of student ideas, allowed more student
talk, exhibited a smaller proportion of factual teacher lecture, used less
factual teacher talk, placed greater emphasis on supporting and accepting
behaviors in comparison to directing and controlling behaviors, and used
less extended teacher talk in comparison to total teacher talk.

Forty-nine preservice science teachers were assigned to a control
or one of two treatment groups by Jones (142). One treatment consisted
of training in interaction analysis (IAST Base), and the second involved
training in Piaget-type interviews with children. The teachers taught
pre, post and delayed post science lessons on a one-to-one basis to
elementary students. Teaching behavior was measured with the IAST v.2.
An analysis of covariance with pretest scores as the covariate was used
in the analysis. Only one significant difference in teaching behavior
was identified. Preservice teachers receiving instruction in interaction
analysis became more flexible in their teaching behavior.

Irwin (133) randomly assigned 86 preservice science teachers to one of three treatment groups in an attempt to investigate the influence of the child and instructional task on teaching behavior. A control group was not established, and all subjects were provided with training in interaction analysis. The IAST v.2 was used to code audiotapes made of pre and post microlessons taught to elementary students. The behavioral data revealed that the changes which took place in the treatment groups were more similar than different. Training in interaction analysis was suggested as the causal agent for these similarities.

Twelve secondary student teachers were designated as an experimental group and provided with ten hours of instruction in the FSIA by McLeod (179). The classroom verbal behavior of the student teachers was encoded before and after the treatment during their student teaching experience. Once student teaching was completed, the verbal patterns of their cooperating teachers were measured. The behavioral data were gathered in an attempt to determine non-random changes in the verbal patterns of the experimental group, to search for changes that were related to the verbal patterns of the cooperating teachers, and to compare the verbal patterns of the experimental group to a control group who were not provided with FSIA training. The verbal patterns of 18 student teachers in a study by Matthews (175) served as the control data. Analysis of the behavioral data showed that both the experimental and control groups became more direct in their verbal classroom behavior over the entire student teaching experience. However, the experimental group experienced fewer non-random changes toward direct teacher influence and more non-random changes toward indirect teacher influence. The experimental group was found to be more likely to change their behavior patterns in relation to the behavior patterns of their cooperating teachers. The verbal patterns of the experimental group were more indirect than the verbal patterns of the control group at the beginning and end of the student teaching experience.

Konetski (157) measured the effects of two methods of instruction, involving the categorization of questions, on the questioning behavior of preservice science teachers. Two treatment groups categorized and discussed questions from audiotapes of science lessons. Two additional treatment groups wrote specific types of questions and received practice in classifying each other's questions into the category system. All four groups were given instruction in the value of questions in teaching science, and programmed instruction was used to introduce the question categories. A positive bias was directed toward divergent and evaluative questions. The control group was given a handout describing the category system. Each subject taught three lessons on the same topic which served as a pretest and two posttests.

Audiotapes of the lessons were analyzed, and the questions were coded into one of two categories: (1) cognitive-memory and convergent or (2) divergent and evaluative. An analysis revealed that both treatments were effective in changing the questioning behavior of preservice science teachers. Subjects in the treatment groups asked significantly more and a higher proportion of divergent and evaluative questions. Instruction in the use of divergent and evaluative questions resulted in a significant decrease in the total number of questions asked. Conferences between the

instructors and student teachers were more effective in changing question-
ing behavior when used in conjunction with the two treatments.

A combination of a Time Series and Non-Equivalent Control Group
Design was used by Miller (186) to investigate the influence of a labora-
tory centered training program on the verbal behavior of 11 physical
science teachers. The treatment included instruction in questioning, test
item construction, nature and philosophy of science, pre and post labora-
tory techniques, FSIA, and the use of Introductory Physical Science (IPS)
materials. The treatment was withheld from a control group consisting of
11 physical science teachers. The Science Classroom Interaction Instrument
(SCII) and Mann-Whitney U Test were used to collect and analyze the behav-
ioral data. Miller reported that the treatment group accepted feelings
more, gave more praise or encouragement, accepted or used more student
response, asked a larger number of science questions at higher cognitive
levels, used less criticism, and initiated more student response than the
control group.

Masla (174) investigated the effects of instruction in interaction
analysis on the verbal inquiry patterns of preservice elementary science
teachers. Scores on the Elementary Teacher's Science Inventory were used
to assign randomly by ranks 76 methods students into either a control or
an experimental group. The experimental group received instruction in a
modified version of the FSIA. Following instruction, 40 subjects were
randomly assigned to teach science lessons in local elementary schools.
Audiotapes were made of each lesson, and verbal behavior was coded with
a modified FSIA. An analysis of variance was used to determine differences
in behavior between experimental and control groups. No significant differ-
ence was found between the two groups with respect to the mean I/D ratios;
however, the proportion of open-ended questions and proportion of unpre-
dictable student responses of the experimental group were significantly
greater than those of the control group.

Inservice Training

The use of systematic observation to determine the influence of
inservice training on classroom behavior was described in 50 documents.
The review of these documents is divided into two parts - Inservice Train-
ing in "New Science" Programs and Other Inservice Training Programs. The
first part includes formal inservice training in one or more of the course
content improvement projects in science and/or the use of materials from
the projects by first year or experienced teachers. The second part
includes formal inservice training in areas other than the science course
content improvement projects.

Inservice Training in "New Science" Programs: Systematic observation
was used in 29 studies to determine the influence of inservice training
in one of the "New Science" programs on science classroom behavior. Table
IV provides a list of the programs and the number of investigations
associated with each.

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TABLE IV

TRAINING RESEARCH INVOLVING INSERVICE TRAINING IN "NEW
SCIENCE" PROGRAMS AND SYSTEMATIC OBSERVATION
OF CLASSROOM BEHAVIOR, 1960-1971

"New Science" Programs	Number of Investigations
Secondary	
BSCS	4
CHEMS	1
IPS	2
ISCS	1
PSSC	2
Elementary	
CSLS	1
ESS	2
SAPA	6
SCIS	6
Combination	4
TOTAL	29

As indicated in Table IV, 10 investigations were conducted at the secondary level, and 19 were conducted at the elementary school level. A tally of the reported results revealed that inservice training in one or more of the course content improvement projects and/or the use of the materials was a fairly effective way of influencing selected classroom behaviors. Thirteen investigations at the elementary school level showed significant differences in classroom behavior in favor of the experimental group; two reported no significant differences; and four found mixed results.

The elementary teachers generally allowed more student activity following treatment, although the increase was frequently accompanied by

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a greater number of procedural statements by the teacher. The results at the secondary school level were more inconsistent. Six investigations reported significant differences in favor of the experimental group, and four reported no significant differences in classroom behavior as a result of the treatment.

Each of the twenty-nine investigations is described in the following paragraphs. They are organized and presented in the same order as the "New Science" programs appear in Table IV.

Student perception of classroom behavior was used by Kochendorfer (155), Ost (213), and Hovsepian (131), to measure differences in class-room behavior resulting from inservice training and/or use of BSCS materials by first year and experienced biology teachers. The results of these investigations supported the position that inservice training or the use of BSCS materials resulted in teaching activities which were more in agreement with the BSCS rationale.

Kochendorfer (155) developed and applied the BCAC to three groups of biology teachers. One group of 22 teachers was experienced in the use of BSCS materials; a second group of 21 teachers was using BSCS materials for the first time; and a third group of 21 teachers consisted of experienced biology teachers who were using other curricular materials in their teach-ing. Analysis of the BCAC scores revealed significant differences among the three groups. The classroom activities of teachers with considerable experience with BSCS materials and of teachers using BSCS materials for the first time were more in agreement with the BSCS rationale than were the classroom activities of teachers using other curricular materials. Kochendorfer pointed out that the findings were limited to the teachers in his study, because the groups of teachers may not have been typical of the groups from which they were drawn.

Hovsepian (131) investigated the correlation of several factors with the role of the biology teacher in the implementation of a BSCS biology program. The degree to which the teacher's role conformed to the BSCS rationale was measured with the BCAC. He reported that there were correlations between the teacher's attitude toward the BSCS rationale, participation in BSCS Summer Institutes and NSF Inservice Institutes and the role of the teacher in the classroom. The extent of the correlations was not presented in the available research documents.

The Science Classroom Activity Checklist was used by Ost (213) to determine the general effects of an NSF Summer Institute for Biology Teachers on the teaching strategies of the participants. Pre and post measures revealed that teachers who attended the institute changed their behaviors and attitudes in a manner more consistent with the BSCS philos-ophy than these behaviors and attitudes had been before attending the institute.

An investigation by Balzer (16) did not support the findings of the other studies involving BSCS inservice training and/or the use of BSCS materials in the classroom. He used the Biology Teacher Behavior Inven-tory (BTBI) and found no significant differences in the classroom behavior of four BSCS and four non-BSCS teachers.

failure of several researchers to obtain similar results is common-place in research. A variety of factors may have been involved, although one point is particularly interesting in the inconsistency of these studies. The three researchers who obtained similar results used more or less the same observation instrument for measuring classroom behavior. The Science Classroom Activity Checklist is a modified version of the BCAC, and both depend on student perception to measure classroom behavior. The Class-room Activity Checklist and BCAC were deductively developed from a list of practices that were judged to contribute positively toward the attain-ment of BSCS objectives. The BTBI on the other hand was developed induc-tively from observations of teaching-learning situations in biology class-rooms. The point is not that one type of instrument is better than another, although Evans (85, 86) and Balzer (16, 17) have argued the merits of inductively developed observation instruments, but that different instru-ments measure different aspects of classroom behavior. Therefore, the lack of agreement using different instruments suggests the need to apply more than one observation instrument to the same classroom situations. Class-room behavior is so complex, a single instrument cannot be expected to completely describe the teaching-learning situation (87).

Teacher and student behaviors in classrooms utilizing the Chemical Education Material Study (CHEMS) materials were studied by Strietberger (282). The Shalock Observation Instrument was used to code behavior in seven CHEMS and nine traditional chemistry classrooms. No significant differences in teacher and student behaviors, interaction patterns, and the manner in which interaction was initiated and maintained were identi-fied between the two groups of chemistry classrooms.

Miller (186) provided 11 ninth-grade physical science teachers in an experimental group with an inservice program involving the use of IPS materials. Several changes in classroom behavior such as an increase in teacher praise and a decrease in teacher criticism resulted from the inservice program. These changes could not be attributed solely to instruction in the use of the IPS materials, because the inservice program also included instruction in test item construction, use of the FSIA and philosophy of science. Classroom behavior was measured with an investi-gator-designed instrument, the Science Classroom Interaction Instrument (SCII).

The FSIA and a question analysis system were used by Butler (50) to study the verbal classroom behavior of ten IPS teachers. He found that the teachers were not teaching IPS in accordance with the goals and philosophy of its designers. The overall teaching patterns were direct; teacher talk was high; student ideas were seldom accepted or used; and teacher questions were largely of the direct, cognitive memory, congruent or procedural types.

Vickery (294) developed and used a three-dimensional, science-specific category system based on the FSIA to study the influence of seventh grade Intermediate Science Curriculum Study (ISCS) materials on teacher classroom behavior. Science teachers using the seventh grade ISCS materials for the first time were reported to have exhibited significantly more individualized and laboratory-centered behaviors than teachers using commercial textbooks.

The classroom behavior of five PSSC and five non-PSSC physics teachers was shown to be similar in a study by Moore (193). Classroom behavior was measured with an observational instrument developed from sets of objectives unique to each of the PSSC and non-PSSC curricula. Moore concluded that participation in inservice training programs and the use of curriculum materials had little impact on teacher classroom behaviors.

Petit (225) applied an observational instrument developed by Moore (193) along with a modified BCAC and an instrument derived from Bloom's taxonomy and found significant differences between the classroom behavior of eight PSSC and eight non-PSSC physics teachers. The PSSC teachers devoted more time than the non-PSSC teachers to each of the following: (1) asking or answering questions, (2) hypothesizing or generalizing, (3) leading class discussions, (4) allowing student discovery of relation-- ships and (5) posing questions at higher cognitive levels than non-PSSC teachers. They devoted less time to supervised study, defining terms, and verification of known conclusions and technology of consumer products. Petit suggested that a teacher's philosophy rather than the influence of a particular curriculum may determine his objectives and teaching activities.

Matthews and Phillips (176) provided 15 first-grade teachers with training in the Child-Structured Learning in Science (CSLS) Level One Teacher Preparation Program. The training program included the following elements: a five-day CSLS workshop, printed lesson guide, student kit of materials, and associated presentations for the child. Five pre and five post observations were made of science lessons in each of the fifteen classrooms with the Science Curriculum Assessment System (SCAS) Inter- action Categories. The observational data were subjected to the Friedman Two-Way Analysis by Ranks Test, and significant changes in classroom behavior were identified. Teachers provided students with more oppor- tunities to structure their own learning, and students spent more time doing lesson-related activities and interacting with each other.

Table IV reveals that two investigations [Baker (15) and Perkes (223)] involved the influence of instruction in and the use of Elementary Science Study (ESS) materials on classroom behavior in the elementary school. Although different observation instruments were used, the reported results were similar: teachers became more indirect in their science classroom behavior.

Baker (15) randomly selected 25 ESS and 25 textbook teachers and measured their classroom behavior during science lessons with the FSIA. The ESS teachers were found to be more indirect in their verbal teaching influence and allowed a larger amount of student-initiated talk.

Perkes (223) recorded the classroom behavior of 38 first year elementary teachers as they taught their regular science lessons with the STOI. An experimental group had been required to select and teach a unit from ESS during student teaching. A control group had not taught an ESS unit, although both groups had received some ESS instruction in elementary science methods courses. The classroom behavior of the two groups, during their first year of teaching, was found to be significantly

different. The experimental group talked less, engaged in more verbal exchanges with students, asked larger number of questions requiring students to speculate and propose ways for testing conjectures, directed student activities less, and provided less help and assistance for their students than the control group.

As shown in Table IV, six investigations [Hall (117), LaShier (164), Westmeyer, et al. (299), Newport and McNeill (204), Coffey (63), and Ashley (13)] involved inservice training in the Science - A Process Approach (SAPA) and systematic observation of classroom behavior. Although the results of the investigations were not in total agreement, they generally suggested that inservice training in the SAPA program and the use of SAPA materials resulted in teachers allowing a greater number of student activities but becoming more direct in verbal classroom influence. In those cases where teachers became more direct, the increase was usually the result of teachers stating more procedural directions.

Hall (117) examined the effectiveness of two types of SAPA inservice training and follow-up supervision in changing the classroom behavior of teachers teaching the SAPA program. Twenty-four second-grade teachers were assigned to a control or to one of two experimental groups. One experimental group experienced a five-day summer workshop and met bi-weekly with a visiting science consultant. A second experimental group attended a series of inservice sessions during the regular school year and received assistance from their school system's science coordinator. The control group neither taught nor were trained to teach one of the recently developed science programs. Direct observations were made of science lessons, and the behavior was encoded with the IAST. The SAPA trained teachers were found to be more direct in their verbal classroom behavior than teachers who were not trained or teaching a recently developed science program. The two experimental groups were not found to differ significantly from each other in their classroom behavior.

The impact of a five week SAPA summer institute on the verbal class-room behavior of 35 elementary school teachers and administrators was studied by LaShier (164). The institute included activities suggested by the SAPA Guide for In-Service Instruction, opportunities for partici-pants to work on activities requiring process skills, and 10 hours of instruction in the FSIA. At the time of reporting, the data for all participants were not available. Pre and post observations of nine participants with the FSIA revealed that there was greater student involve-ment as reflected by a substantial increase in the percentage of time devoted to silence or confusion. Teacher talk and I/D ratios were not significantly changed, and student talk was reduced from 29.37 to 19.54 per cent.

Westmeyer, et al. (299) assigned 120 elementary school teachers to one of four groups in an attempt to determine the most effective of three approaches for preparing SAPA teachers. One group participated in a five week SAPA summer institute. A second group took part in a year-long inservice program involving the SAPA materials. A teacher's guide and curriculum materials were provided for a third group, and a fourth group served as the control. The evaluation included observations

with the Classroom Activity Analysis, a modified version of the FSIA. Observations showed that the I/I+D ratios of the inservice, summer institute, teachers' guide and control groups were 0.496, 0.468, 0.463 and 0.349, respectively. Since the SAPA program stressed student involvement and less teacher direction, the researchers concluded that the lower I/I+D ratio pointed to the superiority of the year-long inservice program for preparing SAPA teachers.

The SAPA program and the FSIA were used, by Newport and McNeill (204), as change agents in an attempt to modify classroom behavior in elementary science classrooms. The results of their investigation follow: (1) teachers who used textbook lesson plans were significantly more indirect in their classroom behavior than teachers who used SAPA lesson plans but were not SAPA trained; (2) the textbook lesson plans evoked a significantly greater per cent of time in extended student talk than the SAPA lesson plans; (3) teachers who used SAPA lesson plans and were SAPA trained, spent less time asking questions and lecturing, and they allowed more time devoted to student initiated talk and student investigations than teachers who used SAPA lessons but were not SAPA trained; (4) providing teachers who taught textbook lessons with interaction analysis training resulted in a decrease in giving directions; and (5) teachers who had interaction training and used textbook lesson plans were more indirect in their verbal classroom behavior than teachers who had SAPA training and used SAPA lesson plans. It should be pointed out, however, that the textbook teachers were initially more indirect than the SAPA teachers. The study involved 31 elementary school teachers who were participating in a summer science workshop.

Coffey (63) used a Pretest-Posttest Control Group Design and the FSIA and found significant changes in classroom behavior as a result of providing teachers with instruction and supervision in the use of the AAAS materials. There was less teacher lecture, more teacher directions, less student talk and an increase in silence or laboratory activity.

Changes in teaching strategy by teachers who participated in an inservice program emphasizing the SAPA approach were studied by Ashley (13). One pre and three post observations were made of each of 23 elementary teachers with the Classroom Observation Rating Form (CORF). The net change in teaching strategy between the pre and final post observations was toward more student-centered lessons, but the researcher was comparing teaching strategies in a mathematics or language arts lesson to strategies in a science lesson. When observations of the first and last science lessons were compared, the change in teacher strategy was toward a more teacher directed lesson.

As indicated in Table IV, six investigations [Wilson (305), Bruce (47), Porterfield (230), Moon (192), Blough (29), and Fischler and Anastasiow (90)] were concerned with the influence of inservice training in the Science Curriculum Improvement Study (SCIS) program on classroom behavior. The reported results of these investigations revealed that teachers who received training in the SCIS program significantly increased the number of higher level questions they asked in elementary science and reading classes, although recall questions remained the dominant type

of questions asked by the teachers. The findings were inconsistent concerning teacher verbal behavior as measured by the FSIA. The tendency was toward teachers becoming more direct because of an increased use of teacher directions.

Differences in the teaching practices of two groups of elementary science teachers were investigated by Wilson (305). One group of 15 teachers received instruction in the SCIS approach and the use of the SCIS materials. The second group of 15 teachers did not receive instruction in the SCIS approach or any other of the "new science" programs. Observations were made of the teachers while they taught science lessons, and the questioning behavior of the teachers was coded with the Teacher Question Inventory. Analysis of the observational data revealed two significant differences in the teaching practices of the two groups. The SCIS teachers encouraged a larger number of science experiences involving observation, measurement, experimentation, analysis of data, and prediction than the traditional teachers. The SCIS teachers also asked a larger number of questions which required more analytical thinking than the traditional teachers.

Bruce (47) used the Teacher Question Inventory and Minnesota Teacher Attitude Inventory (MTSI) to analyze changes in teacher questioning behavior and attitude resulting from participation in SCIS inservice training program. Thirty-three elementary teachers volunteered to attend a three-week inservice program with the understanding that they would use the SCIS materials in their classrooms the following year. Audiotapes of science lessons were made of 15 of the teachers prior to, and of all 33 teachers after, formal involvement in the inservice program. Analysis of the audiotapes revealed significant changes in teacher questioning behavior, resulting in a greater proportion of analysis type of high-level questions. The teachers made no significant changes in their attitude toward teacher-pupil relationships as a result of the SCIS inservice program.

Porterfield (230) studied types of questions asked during reading lessons by elementary teachers educated in the SCIS inquiry-discovery method of science instruction. The Teacher Question Inventory was used to code teacher questions from audiotapes recorded in each of 32 classrooms. The SCIS-educated teachers were reported to have asked a significantly greater proportion of high level questions than a similar group of teachers without instruction in any of the "new" inquiry-discovery approaches to science instruction.

A Quasi-Experimental design involving a combination of Time Series and Nonequivalent Control Group Designs was used by Moon (192) to analyze selected samples of verbal behavior in elementary classrooms during science activities. Sixteen teachers in the experimental group participated in an in-depth study of SCIS teaching methods and materials. The control group was composed of 16 elementary teachers who taught science in a more conventional manner. The behavioral data were coded from audiotapes of science lessons with the FSIA and STOI. The experimental teachers demonstrated significantly more direct teacher influence than the control group; the increase was apparently the result of increased percentages of teacher direction-giving. In addition, the

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experimental teachers displayed a greater preference for higher level questions following the SCIS workshop.

A One-Group Pretest-Posttest Design was used by Blough (29) to examine the direction and extent of change in knowledge of science concepts, ability to think critically, and indirect verbal influence in science lessons by elementary teachers who had participated in a SCIS workshop. The t-test was used to analyze Flanders interaction matrices and gain scores o.. the WGCTA, Mednick's Remote Associates Test, and STEP Test. The elementary teachers showed a slight mean gain in knowledge of science concepts and ability to think critically. They significantly increased their indirect verbal influence as measured by the FSIA.

The classroom behavior of ten elementary science teachers who were introduced to the SCIS materials in a summer workshop and who received clinical supervision while teaching summer school were studied by Fischler and Anastasiow (90). Audiotapes were made of science lessons before and after the treatment for each teacher. The recordings were analyzed with the FSIA and STOI. A comparison of mean scores revealed that the teachers allowed more continuous, uninterrupted student comment ($p < 0.05$), asked fewer questions ($p < 0.06$), and asked more indirect questions (p 0.5). At lower levels of significance, a decrease was reported in the ratio of teacher questions to lecture ($p < 0.06$) and indirect-direct ratio ($p < 0.10$). Nine of the teachers significantly decreased their use of criticism ($p < 0.02$).

Table IV reveals that four investigators [Pempek (221), Schmidt (262), Anderson and Horn (11), and Hunter (132)] concerned themselves with the influence of instruction in a combination of "New Science" programs upon classroom behavior at the elementary school level. The findings of these studies were inconsistent.

Pempek (221) provided an experimental group of 48 teachers with four introductory sessions, a two-week workshop and several follow-up consultation sessions. Fourteen teachers in the control group did not receive the special training although they were implementing the programs for the first time. Attitude and behaviors were measured with instruments developed by the researcher. No significant differences in classroom behavior were found between the two groups; however, the experimental group did show significant positive changes in attitude.

Schmidt (262) found that the instructional patterns of 14 elementary teachers were altered both in science and social studies classes as a result of a "New Science" summer institute. The teachers exhibited a significant increase in the use of rational powers (except recall), essential learning experiences and divergent questions, and they significantly decreased their use of convergent and recall questions.

A study by Anderson and Horn (11) provided a novel approach to inservice education. Elementary teachers, who participated in a program designed to aid them in the implementation of the AAAS and ESS science programs, conducted inservice programs for their peers. Twenty-eight teachers were randomly selected for pre observation and 28 were randomly selected for post observation from approximately 150 elementary school

teachers. The results showed that teachers who participated in the inservice programs taught by their peers became significantly more inductive-indirect in their teaching behavior as measured by the TSOD.

Hunter (132) randomly selected an experimental group of 11 teachers from 75 first-grade teachers who had received training in one of six "new science" programs. The programs included: Experiences in Science by Tannenbaum and Stillman, Kinney and Schmidt Science-Reading Program, Concepts in Science by Brandwein, SAPA, SCIS and New York City Board of Education curriculum. Eleven teachers who had not received the inservice training were selected as a control group. The Revised Verbal Interaction Category System-Science (Revised VICS) was used to record the science classroom verbal behavior of both groups. Analysis of the data showed that teachers in the experimental group spoke significantly less than teachers in the control group, and that students in the experimental group spoke significantly more than students in the control group. The patterns of teacher and pupil talk were similar in both groups. The teachers spent approximately 40 per cent of their talk time in asking questions. Almost 95 per cent of questions asked were of the cognitive memory type.

Other Inservice Training Programs: Eleven studies [Wiegand (302), Zoch (317), Carsetti (57), George and Nelson (108), Jackson (135), Raack (232), Caldwell (52), Cornell (69), Kidd (149), Gill (111), and Johnson (139)] were identified which involved systematic observation of classroom behavior and inservice training programs emphasizing content areas other than science course content improvement projects. Eight of the studies [Zoch (317), Carsetti (57), George and Nelson (108), Raack (232), Caldwell (52), Cornell (69), Kidd (149), and Johnson (139)] were conducted at the elementary and three [Wiegand (302), Jackson (135), and Gill (111)] at the secondary school levels. All but Cornell (69) reported significant changes in classroom behavior as a result of the inservice programs. However, the diverse content of the programs and use of nine different observational instruments served as an obstacle for making comparisons among the studies.

Three investigations [Caldwell (52), Jackson (135), and George and Nelson (108)] were devoted exclusively to science classroom behavior. In one of the investigations, Caldwell (52) found that elementary teachers significantly changed their teaching techniques as a result of participating in an inservice science methods course. An experimental group of 15 teachers made greater use of indirect activities such as laboratory experiences, group projects, student demonstrations, student library research and student speaking than a control group consisting of 15 teachers. Indirect activities had been encouraged in the inservice methods course and were measured with a self-developed observation instrument.

Jackson (135) utilized a modified version of the BCAC to evaluate the effects of an inservice program on the classroom activity of earth science teachers. The program consisted of a ten-week summer phase and fifteen meetings during the academic year and focused on earth science content and local field studies. Teachers who participated in the

program taught a more laboratory orientated approach to science than a comparison group of teachers who did not participate in the program. In addition, the inservice teachers changed the way they perceived they were teaching toward a more laboratory oriented approach.

George and Nelson (108) provided 12 elementary school teachers with a six-week summer course in science taught by an inquiry method. During the following academic year, each teacher was visited and received help in implementing inquiry techniques in the classroom. Post observations of the verbal classroom behavior were made with the FSIA. Because the more experienced teachers were observed to be direct in their verbal teaching influence, the researchers inferred that all of the teachers did not benefit from the inservice program. Unfortunately, the research design did not include a control group or pre observations of classroom behavior to further support the inference.

Audiotaped or videotaped models of teaching behavior were included in studies by Cornell (69), Wiegand (302) and Carsetti (57). Cornell's study was unique in that the inservice training did not result in significant changes in classroom behavior. Fifty-three fourth-grade teachers were randomly divided into a control and experimental group. Teachers in the experimental group were exposed to audiotaped models prior to teaching two microlessons. Questioning behavior was coded using six categories derived from Bloom's taxonomy.

Wiegand (302) developed and evaluated an Inservice Training Unit, consisting of a training manual and videotaped models of teachers portraying supportive and non-supportive behaviors in the classroom. The evaluations consisted of measuring the impact of the Inservice Training Unit on the attitude and classroom behavior of urban secondary teachers and comparing this impact with each of two other treatment groups. One group was exposed to lecture and follow-up conferences on supportive and non-supportive teacher behaviors, and a second group participated in the standard inservice program conducted by the school district. Pre and post measurements of attitude and classroom behavior were made with the Teacher Attitude Scale and Withall's Social-Emotional Climate Index. Teachers in both the Inservice Training Unit and lecture groups made significant positive changes in learner supportive attitude and behaviors. Teachers exposed to the standard inservice training program made no significant changes in attitude or behaviors.

The effects of providing elementary teachers with one or two presentations of the same inservice program on Teacher Classroom Behaviors were studied by Carsetti (57). The inservice program included a technique of eliciting multiple responses from children and was presented live and on videotape. An instrument modeled after the behavioral objectives of the inservice program was used to analyze three, ten-minute samples of classroom behavior for each of 30 teachers. The researcher reported that exposure to a videotaped presentation of the inservice program was effective in changing teacher classroom behavior. Exposure to the live and videotaped presentations was no more effective in changing behavior than exposure to only videotaped presentations. Regression of teacher behavior was not found to occur between the fourth and eighth week of the study for either treatment group.

The inservice training programs in the remaining studies [Johnson (139), Kidd (149), Raack (232), and Gill (111)] were not similar in their content, but each was successful in altering selected aspects of classroom behavior. In one of the studies, Johnson (139) provided 10 elementary school teachers with inservice training in group process intervention. The FSIA revealed a reduction in teacher verbalization and an increase in student expressions of diverse or original ideas. The teachers were shown to have modeled their verbal classroom behavior after the group trainer.

Kidd (149) reported that 24 elementary school educators who attended a three-week summer workshop on behavior modification significantly increased their positive and total reinforcement rates while teaching. Educators who viewed videotapes of their own teaching increased their reinforcement rates to a greater degree than those who only viewed the performance of others.

Raack (232) provided 16 elementary teachers with an inservice program designed to emphasize the attainment of inquiry goals, self-initiating purposeful behavior and self-evaluation by pupils. The teachers became more indirect in their verbal classroom behavior, as measured by the FSIA, and changed their conception of the teacher's role toward a role more congruent with an indirect approach to teaching.

The effects of inservice training in group interaction skills on classroom patterns of 14 secondary school teachers were studied by Gill (111). The treatment included training in the use of a structured small group discussion method and activities designed to improve group interaction skills. Audiotapes of classroom sessions were analyzed for the following: (1) positive and negative teacher reactions to student behavior, (2) level of teacher questions, (3) teacher and pupil talk, and (4) student initiated response. The analysis revealed significant changes in classroom behavior as a result of the treatment. Teachers in an experimental group made more positive reactions to student behaviors, asked a greater number of high level questions, talked less and allowed more student talk than teachers in a control group.

Microteaching

Thirty-one documents were identified which included the use of systematic observation to measure the impact of microteaching on classroom behavior. The documents represented 25 studies [Brown (45), Montague (191), Staley (277), Waldrop (296), Wood, et al. (310), Morse (196), Kissock (151), Davis and Smoot (78), Rogers and Davis (242), Borg (34), Friebel, et. al. (96), Blosser (27), Brashear (36), Limbacher (168), Leonard (167), Wagner (295), Sparks (274), Young, et al. (314), Bartholomew (19), Widell, et al. (300), Harris, et al. (121), Borg, et al. (33), Codwell (62), Raymond (238), and Schutte (263)] and involved educational psychology and methods students, interns, student teachers and inservice teachers at both the elementary and secondary school levels. Most academic areas were represented with 10 of the studies [Montague (191), Staley (277), Waldrop (296), Raymond (238), Blosser (27), Sparks (274), Bartholomew (19), Widell, et al. (300), Harris, et al. (121), and Schutte (263)] being devoted specifically to changes in science classroom behavior. A variety

of observational instruments were used to measure selected aspects of behavior. In most cases, the primary focus of the instruments was on teacher verbal classroom behavior. The reported results of all 25 studies are presented in Table V.

TABLE V

SUMMARY OF FINDINGS OF CHANGES IN CLASSROOM
BEHAVIOR RESULTING FROM MICROTEACHING

Findings	Number of Investigations		
	Science Education	Other Subject Areas	Combined Totals
No significant differences	3	1	4
Mixed results	0	0	0
Significant differences favoring experimental group	7	13	20
Significant differences favoring control group	0	1	1
TOTAL	10	15	25

Table V shows that microteaching, either by itself or in combination with other instructional sequences, was reported to have been effective in changing selected aspects of classroom behavior in 20 out of 25 studies. Selected aspects of behavior referred to specific teaching skills which were generally predetermined, operationally defined and practiced in a microteaching format. Four studies reported no significant differences resulting from the treatment. This figure was misleading, however, because two of the studies were comparing changes in behavior resulting from vari- ations within the microteaching environment. Only one researcher reported significant differences in favor of the control group.

Microteaching was used in the research documents to describe a variety of situations. On the one hand, a few researchers applied the term in the manner suggested by the originators of microteaching at Stanford Univer- sity. That is, microteaching involved the teaching of a real lesson, lasting from four to twenty minutes and including three to ten students. The teacher attempted to implement pre-selected teaching skills while teaching, and following the lesson, he received immediate feedback on his effectiveness. The suggested microteaching pattern followed a teach- critique-reteach format.

On the other hand, a majority of the researchers modified the original description of microteaching. They substituted peers for students, failed to identify pre-selected behaviors and/or omitted feedback and reteach sessions. The point in common among the studies was that microteaching involved teaching a short lesson to a small number of persons.

Three investigations [Brown (45), Montague (191), and Staley (277)] were particularly interesting because they were specifically directed toward a study of the effects of modifying the microteaching environment on teaching behavior. The reported results of these studies indicated that substituting peers for students and the use of a teach-critique format instead of a teach-critique-reteach format did not reduce the effectiveness of microteaching in changing classroom behavior.

Brown (45) compared the impact of microteaching and Skills of Teaching (SKIT) Presentations on selected teaching skills of business and distributive education interns. He also examined the variable of audience composition within the microteaching treatment. Pre and post observations by inservice business teachers revealed that microteaching was more effective than SKIT Presentations in changing selected teaching skills. The extent of skill gain was not reduced when methods class peers or beginning education students were substituted for high school students in the microteaching audience.

In a study by Montague (191), nine student teachers taught the same twenty-minute science lesson to peers and to high school students. The lessons were videotaped, and the FSIA was used to measure verbal classroom behavior. With the exception of the number and length of questions, the student teachers exhibited similar verbal behavior in both situations.

Montague replicated the study the following quarter, and the differences found in the first trial were not evident in the replication. He concluded that teaching science lessons to peers was a reasonable substitute for teaching science lessons to secondary school students.

The effectiveness of several microteaching paradigms in changing preservice science teacher behavior and attitude was examined by Staley (277). The paradigms included variations in the number of microlessons and composition of the microteaching audience. Analysis of data obtained by administering the Sematic Differential Attitude Instrument, Microteaching Rating Scale and Audio-Tape Analysis Instrument failed to reveal significant differences in behavior and attitude resulting from the following situations: (1) presenting one or two microlessons to peers, (2) including four, eight, or twelve to sixteen peers in the microteaching audience, and (3) substituting peers for elementary students in the microteaching audience. The findings suggested that a variety of microteaching paradigms could be effectively used to change preservice teacher behavior and attitude. The population of the study involved 60 subjects drawn at random from a group of 240 preservice elementary school teachers.

Waldrop (296) investigated several factors in a microteaching environment on the coping behavior and verbal response of elementary students. Spaulding's Coping Schedule for Educational Settings and a modified FSIA

were used to measure changes in student behavior. Student coping behavior was found to be significantly different in the presence of exposed video-tape equipment and technicians. Their verbal responses were not significantly changed by such factors in the microteaching environment.

Two organizational patterns of microsimulation were investigated by Wood, et al. (310). Microsimulation involved student teachers teaching short lessons to peers who role played predetermined roles corresponding to a hypothetical class. Student teachers who were trained in the use of the Reciprocal Category System of Interaction Analysis and those not so trained experienced microsimulation concurrently or sequentially to student teaching. Analysis of behavioral data gathered during the student teaching experience revealed that concurrent microsimulation, combined with inter-action training, was the most effective pattern for changing verbal teaching behavior.

The influence of instructional sequences which involved microteaching on teacher questioning behavior were investigated by Morse (196), Kissock (151), Davis and Smoot (78), Rogers and Davis (242), Borg (34), Friebel et al. (96) and Blosser (27). All seven of the studies reported significant differences in teacher behavior resulting from the instructional sequences.

Morse (196) sought to determine the relative effectiveness of laboratory and non-laboratory instructional techniques in changing the questioning behaviors of preservice teachers. The laboratory instructional techniques included a simulated teaching experience followed by evaluation and feedback. Forty-three teachers in the simulated teaching group asked significantly more cognitive questions and reacted significantly more positively to student responses during a final simulated teaching experience than did 43 teachers in the non-laboratory group. Questioning behaviors were recorded with an investigator-designed observational instrument.

The effectiveness of microteaching in developing higher order question asking among preservice secondary teachers was studied by Kissock (151). Sixty-nine subjects participated in eight hours of instruction involving videotape and symbolic models on the use of higher order questions. In addition, one half of the subjects taught four, five-minute microlessons. Analysis of the questioning behavior on pre and post microlessons revealed findings similar to those found by Davis and Smoot (78). Teachers in the microteaching group asked significantly more higher order questions than teachers in the non-microteaching group.

Rogers and Davis (242) reported that 10 social studies student teachers who participated in an instructional program involving microteaching asked a significantly larger number of higher cognitive questions than did 10 student teachers in a control group. It should be pointed out, however, that the mean number of questions asked in each higher level was less than two. Student teachers in the control group did not ask any higher level cognitive questions.

Borg (34) examined the influence of an instructional microteaching package in changing specific teacher behaviors. Pre and post observations

were made in regular classroom situations for each of 48 participating teachers. The teachers significantly increased their use of higher cognitive questions and reduced by one-half their precourse level of teacher talk.

In an exploratory study, Friebel, et al. (96) found significant differences in classroom behavior as a result of providing elementary school student teachers with a self-instructional minicourse on questioning techniques. One group of teachers experienced the entire course, including microteaching, videotaped feedback, and filmed instructional and model lessons. Microteaching and videotaped feedback were withheld from a second group. Teachers who completed the entire course showed a decrease in the percentage of teacher talk, percentage of higher cognitive questions, number of times teacher answered his own question, and number of times teacher repeated student answers. The group of teachers that completed the course did not consistently make more or greater changes in behavior than the other group. Neither group of teachers significantly increased the pause time between a teacher stating his question and calling for a student response.

Blosser (27) employed a modification of the Solomon Four-Group Design and found that membership in the microteaching group correlated significantly in a positive direction with pause time following teacher questions and in a negative direction with the percentage of teacher talk. The treatment did not result in significant differences in the percentage of open questions or the total number of questions asked during the period analyzed.

Two of the researchers extended their investigations to include a study of retention or transfer of the questioning skills learned in microteaching. Kissock (151) found that four weeks after the post observation there were no significant differences between the microteaching and non-microteaching groups. In fact, the microteaching group declined significantly in their use of combined higher order questions. Blosser (27) reported that the acquired questioning skills did not transfer to the student teaching situation.

Although microteaching was found to be effective in changing teacher questioning behavior, it did not appear to be particularly effective in causing teachers to become more student-centered or indirect in their verbal teaching behavior. In a study by Schutte (263) microteaching resulted in science student teachers becoming more indirect as measured by the FSIA. In a similar study, Limbacher (168) reported that the control group exhibited higher indirect-direct ratios. Investigations by Leonard (167), Wagner (295), Sparks (274) and Young, et al. (314) also dealt specifically with indirect or student-centered teaching behavior. All four investigations failed to reject the hypothesis in favor of the experimental group; the teachers did not become more indirect or student-centered as a result of the microteaching experience. Borg (34), Blosser (27), Davis and Smoot (78) and Friebel, et al. (96) reported a reduction in teacher talk and/or an increase in student initiated responses, but the specific hypothesis relating to student-centered or indirect verbal teacher behavior was not tested.

Three studies [Davis and Smoot (78), Brashear (36) and Limbacher (168)] were concerned with the influence of training laboratories on the teaching behavior of preservice teachers. Microteaching was a major component in each of the laboratory experiences. The findings of these three studies suggested that teaching behaviors acquired through microteaching in teaching laboratories had very little, if any, carry-over into actual classroom teaching situations.

Davis and Smoot (78) investigated the effects of the Teaching Laboratory at the University of Texas, Austin, on the teaching behavior of preservice teachers. Eighty-five secondary teacher candidates in the treatment group taught two short lessons on a topic of their choice, using the teach-critique-reteach format. The control group consisted of 55 teacher candidates. Microteaching situations in which the subjects taught ten-minute lessons to their peers were used as pre and post observations. The Laboratory Observation Schedule and Record (LOScAR) served as the criterion measure. Analysis revealed that subjects receiving the laboratory experience significantly expanded their repertoire of teaching behaviors. They asked more divergent questions, asked fewer convergent questions, informed less, clarified more, stated fewer procedural-nonsubstantive units, provided greater student support and allowed more student initiated responses.

A follow-up study of the effects of the Teaching Laboratory experience was conducted by Brashear (36). The research did not indicate whether or not the subjects were the same ones in the Davis and Smoot study, although both studies involved the same Teaching Laboratory and the use of similar observation instruments. Brashear found only one significant difference in classroom behavior. Student teachers with prior laboratory experience made fewer directing-rejecting statements than student teachers without the laboratory experience.

Limbacher (168) investigated the effects of training in the University of Illinois Teaching Techniques Laboratory on the subsequent student teaching behavior of 25 student teachers in social studies classrooms. He found the experimental group to be more direct in their classroom behavior, as measured by FSIA, than a control group of student teachers who did not participate in the laboratory experience.

Microteaching combined with instructional models were shown by Bartholomew (19) to produce changes in the investigative teaching behavior of experienced science teachers. The teachers changed their behavior in the direction of the models they studied. Observations were made of each of the 27 teachers in pre and post-laboratory discussion sessions with a modified version of the FSIA.

Secondary preservice science teachers were exposed to models of laboratory teaching in a study by Widell, et al. (300). While viewing the laboratory situations, the preservice teachers were provided with feedback which consisted of an analysis of the models with the Small Group Interaction System. The Verbal Interaction Category System (VICS) was utilized to code the teaching behavior of the preservice teachers as they taught microlessons before and after presentation of the models and feedback. Observations with the VICS revealed that the preservice teachers were able

not only to duplicate but to improve significantly upon the models.

An investigation by Raymond (238) was the only study identified which specifically examined the influence of microteaching on the nonverbal teaching behavior of science student teachers in a methods course. The BTBI and % All were used to collect the behavioral data during the student teaching experience. Analysis showed that the ten student teachers in the treatment group devoted a significantly larger percentage of time to non-verbal behaviors (p = .10), and their nonverbal behaviors were significantly more positive than the nonverbal behaviors of the ten student teachers in the control group (p = .10).

The remaining studies by Harris, et al. (121), Borg, et al. (33), and Codwell (62) found that microteaching was an effective change agent. The changes in teaching behavior generally coincided with the teaching skills that were practiced in the microteaching format.

On-Site Versus On-Campus Activities

Four investigators [Jacobsen (136), Kelly (147), Holcomb (127), and Kallenbach (145)] compared the effects of on-site and on-campus activities in changing the classroom behavior of student teachers and interns at the elementary and secondary school levels. None of the investigations was devoted exclusively to science teacher behavior. The results of these investigations, contrary to the opinion of many teacher educators, supported the position that selected on-campus activities involving microteaching, viewing kinescopes of various teaching strategies, using audiovisual materials and/or learning about group dynamics and set induction theory were just as, or more, effective in altering classroom behavior as obser-vation and participation in elementary or secondary schools.

Miscellaneous Instructional Strategies

Miscellaneous instructional strategies were operationally defined to include the use of instructional sequences other than training in system-atic observation of classroom behavior, inservice training, microteaching and on-site versus on-campus activities in attempts to modify classroom behavior. Seventeen research documents were identified which fit this definition. The documents described 14 investigations [Wieder (301), Hill and Medley (124), Sagness (255), Brown (46), Brewington (37), Cignetti (60), Williams (303), Hauserman (123), Rusch (252), Jones (141), Millett (187), Eder (81), McKnight (178), and Woods (311)] and involved student teachers, teacher trainees or interns at both the elementary and secondary school levels. Changes in science classroom behavior was the primary focus in five of the investigations [Sagness (255), Brown (46), Brewington (37), Cignetti (60), and Rusch (252)]. The most unique feature of these inves-tigations was the diversity of treatments used by the researchers. They included participation in internship or experimental teacher education programs, instruction in cognitive behavior or divergent thinking, orientation to the out-of-doors, group counseling and responsiveness training. A summary of the findings are presented in Table VI.

TABLE VI

SUMMARY OF FINDINGS OF CHANGES IN CLASSROOM
BEHAVIOR RESULTING FROM MISCELLANEOUS
INSTRUCTIONAL STRATEGIES

Findings	Number of Investigations		
	Science Education	Other Subject Areas	Combined Totals
No significant differences	3	1	4
Mixed results	0	1	1
Significant differences favoring experimental group	4	2	6
Significant differences favoring control group	2	1	3
TOTAL	9	5	14

Table VI indicates that the miscellaneous instructional strategies
were not particularly effective in modifying classroom behavior. This
was true for the investigations devoted to science education as well as
to those investigations involving other subject areas. Further comparisons
among the findings wei : limited because the instructional strategies and
observational instruments used by the researchers were so diverse.

Selected outcomes of two preservice teacher education programs at
The Ohio State University were assessed by Sagness (255) in 1969-70 and
Brown (46) in 1970-71. One program (project) emphasized participation in
urban and suburban secondary schools prior to student teaching. The second
program (non-project) consisted of methods and university based courses
with few participatory experiences in public schools prior to student
teaching. In both studies comparisons were made of the instructional
activities used by project and non-project students during student teach-
ing. Sagness administered the Science Classroom Activities Checklist:
Student Perceptions (SCACL:SP) to 64 project and 34 non-project student
teachers and found that project student teachers used fewer types of
activities thought to be consistent with contemporary objectives of science
education than did non-project student teachers. Brown also measured
instructional activities by administering the SCACL:SP to 46 project and
46 non-project student teachers. He reported that the non-project student
teachers used fewer activities thought to implement contemporary objec-
tives of science education, and concluded that adjustments in university
instruction and student teacher placement were apparently sufficient to
reverse the 1969-70 results.

The classroom activities of selected preservice science teachers who participated in the investigation by Sagness (255) were further investigated during their first year of teaching by Brewington (37) and Cignetti (60). The population of Brewington's study consisted of 26 secondary school science teachers who graduated from The Ohio State University during the 1969-70 school year. He found that 10 project teachers used significantly more inquiry teaching activities than 16 non-project teachers and that the availability of equipment strongly influenced inquiry oriented teaching activities.

Cignetti compared the teaching activities of 18 project and non-project secondary school science teachers who graduated during the 1960-69 school year from The Ohio State University with the teaching activities of 25 secondary school science teachers who graduated from schools other than The Ohio State University. He reported the following results: (1) the teaching activities of The Ohio State University graduates did not change over the school year; (2) the non-Ohio State University graduates significantly decreased in their use of inquiry activities over the school year; and (3) at the completion of the school year, the project and non-project teachers were not significantly different in the type of activities they used for science instruction. Both Brewington and Cignetti measured teacher classroom activities by means of SCACL:SP.

In a study by Williams (303), 17 secondary student teachers were provided with cognitive instruction while 16 student teachers in a control group received no such treatment. The classroom behavior of both groups was coded with the Florida Taxonomy of Cognitive Behavior. The observations revealed that the treatment resulted in a significant increase in the use of the five higher levels of cognitive behavior by student teachers and their students.

Hauserman (123) reported that a warmer classroom climate was established in elementary school classrooms when the student teachers had experienced an orientation to the out-of-doors. Treatment included a unit on outdoor education, evening discussion groups, school campsite visitations and review of the Outdoor Education Committee Report. Classroom climate was measured with the OScAR.

Rusch (252) studied the classroom behavior of 54 prospective science teachers who had received instruction in a modified version of the Revised VICS and the use of praise, acceptance and rejection behavior in the classroom. Behavioral data were collected from audiotapes of science lessons which each subject presented to his peers, before and after instruction, and to science students in student teaching the following semester. The data were coded into the following categories: (1) minimal reinforcement, (2) praise, (3) acceptance, (4) rejection, and (5) all reinforcement-acceptance pairs. Analysis of these data resulted in mixed and confusing results. The subjects significantly increased their use of acceptance behaviors during student teaching. A significant decrease was reported in the use of praise and reinforcement-acceptance pairs. The decrease in the use of praise persisted into student teaching, but the use of reinforcement-acceptance pairs significantly increased during student teaching. Rejection behavior increased during student teaching, and it

increased as a function of the time between the methods course and student teaching. No significant differences were found in the use of minimal reinforcement, rejection and all rating behavior (sum of categories 1, 2, and 4).

The VICS was used by Jones (141) to investigate the effects of instruction in a strategy of divergent thinking on the classroom behavior of elementary student teachers and the students they taught. The interaction scores showed that the student teachers were more indirect and used less teacher talk than average before the treatment. Following the treatment, they still talked less than average but grew more direct in talk, control and motivation.

Millett (187) and Wieder (301) studied the effects of various teacher training procedures on the classroom behavior in social studies classrooms. Millett found that unstructured discussion resulted in significantly less of the desired behaviors than did the other three treatments. Oral instruction plus videotaped demonstrations produced twice as many teacher translation tactics and pupil oral translation as did any of the other three treatments. No significant differences were found between oral instruction and videotaped demonstrations. Wieder reported that 15 interns who postponed their professional training until they had received their Bachelor's degree were significantly more direct in their verbal classroom behavior than were 15 student teachers who e..perienced their professional training prior to receiving degrees.

The Observation Schedule and Record (OScAR) and FSIA were used by Hill and Medley (124) to investigate changes in the teaching behavior of 70 secondary school interns. The interns received six weeks of graduate training in the summer, participated throughout the year in seminar classes, and received close university supervision. Observations made in February and May showed significant differences in classroom behavior. The interns asked a larger number of divergent questions, asked fewer convergent questions and became more neutral in their responses to students.

The effects of group counseling, responsiveness training, or instruction in programmed learning and systems approach on the classroom behavior of student teachers and teacher trainees were investigated by Eder (81), McKnight (178) and Woods (311). None of these treatments resulted in significant changes in teacher classroom behavior.

Student Teaching and Cooperating Teacher Influence

The influence of student teaching and/or the teaching behavior of cooperating teachers on the classroom behavior of student teachers was identified in twenty-one research documents. Seventeen investigations [Ragsdale (234), Moskowitz (198), Bowers (35), Farrow (89), Nickel (207), Flint (94), Matthews (175), Seperson (265), Ishler (134), McLeod (179), Mitchell (188), Palmer (214), Burton (49), Brown (44), Nichols (206), Neuhard (203), and Van Den Berg (293)] were described. They included most academic areas at both the elementary and secondary school levels. Three investigations [Nickel (207), Matthews (175), and McLeod (17^)]

were devoted to science classroom behavior. In a majority of the investigations, classroom behavior was measured with instruments whose emphasis was entirely on verbal classroom behavior.

Although student teaching is generally accepted as the crucial component of teacher preparation, the reported results of its influence on student teacher classroom behavior were found to be inconclusive. Student teachers often changed their teaching behaviors, but the direction of the change was not predictable.

The findings related to the influence of cooperating teacher teaching style on student teacher classroom behavior were inconsistent and contradictory. Such findings do not negate the importance of student teaching; they suggest that additional research is needed before a clear understanding of its impact on student teacher classroom behavior can be realized. The additional research should include more stringent controls and the use of observation instruments which measure a wider spectrum of classroom behavior. Attention should also be given to the differential effect of student teaching on individuals rather than on groups of student teachers.

An investigation by Ragsdale (234) was interesting because two classroom observation instruments were used to measure changes in the classroom behavior of 49 elementary student teachers. Observations made with the Teacher Characteristics Classroom Record revealed a significant positive change in student teacher behavior resulting from the student teaching experience. Data obtained through the use of the FSIA did not reveal significant changes in student teacher verbal classroom behavior. These findings emphasize the danger of studying only limited aspects of teacher classroom behavior. The treatment may result in changes, but the selected observation instrument may not be sensitive to those changes.

Moskowitz (198) assigned 44 secondary school student teachers and their cooperating teachers to one of four possible combinations of training or no training in interaction analysis groups. Observations with the FSIA revealed a consistent tendency for student teachers to acquire verbal teaching patterns similar to those of their cooperating teachers. The specific findings were as follows: (1) student teachers who were trained in interaction analysis developed teaching patterns similar to their cooperating teachers who were also trained in interaction analysis; (2) student teachers and their cooperating teachers who were trained were significantly more indirect in their teaching patterns than student teachers and cooperating teachers who were not trained in interaction analysis; and (3) the teaching patterns of trained student teachers were significantly more indirect than the teaching patterns of their untrained cooperating teachers.

Similar designs were used by Bowers (35), Farrow (89), Nickel (207), Flint (94), Matthews (175) and Seperson (265) to determine the influence of student teaching and cooperating teacher behavior on the classroom verbal behavior of elementary and secondary school student teachers. Pre-observations were made of cooperating and student teacher classroom behavior either prior to or immediately after the beginning of the student teaching experience. From one to three post observations were made of

each student teachers' classroom behavior, and these were compared statistically with the pre-observations. The findings from these studies were largely inconsistent, although two patterns seemed to emerge. Student teacher verbal classroom behavior did change as a result of the student teaching experience, but there was considerable variability in the direction of change. When student teachers changed their behavior and became more like the classroom behavior of the cooperating teacher, the change occurred early in the student teaching experience. The FSIA or a modified FSIA, Conceptual Systems Manual and OScAR were used by the researchers as observational instruments.

An investigation by Ishler (134) was concerned primarily with feedback and change in classroom behavior, but the results provided evidence of cooperating teacher and student teaching influence on student teacher classroom behavior. Experimental and control group of student teachers became significantly more learner-centered during their student teaching experience. Feedback from Withall's Social-Emotional Climate Index was provided by the college supervisor for the experimental group but not the control group. Additional data showed that the verbal classroom behavior of both groups of student teachers were significantly different from the classroom behavior of their respective cooperating teachers. Thirty-four elementary education majors participated in the investigation.

The Stewart Process and Movement Codes was used by Burton (49) to observe the classroom behaviors of 35 cooperating and 35 student teachers at the elementary school level. The observations were used to identify eight teaching styles, i.e., scores above and below the median on each of four categories of behavior. The student teache re placed with cooperating teachers in such a manner that all possible combination of teaching styles were together. Later observations were made, and analysis revealed that student teachers placed with cooperating teachers who were above the median on one of the categories, tended to change their behavior in that direction. Those placed with cooperating teachers who were below the median on a category tended to move away from that teaching style.

A majority of the researchers found that student and cooperating teacher behavior was not similar at the beginning of the student teaching experience. Brown (44) provided further evidence by relating the initial teaching style of 28 student teachers to several factors, including cooperating teacher teaching style. The teaching styles of the two groups were reported as being distinctly different.

McLeod (179) found that 12 science student teachers became more indirect in their verbal classroom behavior over the entire student teaching experience. Student teachers in McLeod's study who were provided with training in the FSIA were shown to be more likely to change their verbal behavior patterns in relation to the verbal behavioral patterns of their cooperating teachers than a similar group of 18 student teachers who were not trained in the use of FSIA.

Palmer (214) reported that the classroom behavior patterns of 23 post-baccalaureate student teachers were not significantly related to the behavior patterns of their cooperating teachers. The two groups had

essentially the same measures of personality, but the student teachers were more positive in their attitude toward teaching as a profession. Observations were made with the OScAR.

The classroom behavior of 26 student teachers placed on teaching teams and 26 student teachers placed with individual cooperating teachers was investigated by Nichols (206). He did not find significant differences in the verbal classroom behavior of the two groups as measured by FSIA. A post administration of a modified Aikman inventory of satisfaction with student teaching revealed that the team student teachers were significantly more negative toward student teaching than those placed with individual cooperating teachers.

Neuhard (203) found that student teachers who worked with cooperating teachers trained in the use of the Social-Emotional Climate exhibited a significantly larger proportion of learner-supportive and acceptance statements and a significantly smaller proportion of directing and reproving statements than did student teachers who worked with cooperating teachers not trained in the use of the observational instrument. The trained cooperating teachers used a significantly larger proportion of learner-supportive and acceptance statements and a significantly smaller proportion of directing and reproving statements than did the untrained cooperating teachers. The investigation included 22 English, mathematics, social studies and science cooperating teachers and their student teachers.

One question immediately came to mind in reviewing research on the influence of cooperating teacher classroom behavior on student teacher classroom behavior. What influence do student teachers have on the classroom behavior of cooperating teachers? Only one study was identified which investigated this question. Van Den Berg (293) used the FSIA to study cooperating teacher behavior before and after they supervised a student teacher. She reported that 56.25 per cent of the 32 cooperating teachers who participated in the study significantly changed their overall verbal behavior patterns. Two-thirds of these teachers became more indirect in their verbal classroom influence.

Teacher Perception or Expectation of Students

Eight investigations [Jose (144), Brophy and Good (42), Willis (304), Kranz (158), Rogers (241), Martinello (173), Pfeiffer (227), and Beez (21)] were identified which included an examination of the effects of teacher perception or expectation of students on classroom behavior. Only one investigation [Rogers (241)] was devoted exclusively to science classroor behavior. Six [Brophy and Good (42), Willis (304), Kranz (158), Rogers (241), Martinello (173), and Beez (21)] out of the eight investigations reported that classroom behavior did change, depending on a teacher's perception or expectation of the students with whom he or she was interacting. These findings generally supported the position held by Rosenthal and Jacobson (249) that teacher expectations of students served as self-fulfilling prophecies.

The relationship between science teachers' perception of pupils and classroom verbal behavior was studied by Rogers (241). Teacher perception was measured by administering the Perception of Pupils Adjective Checklist. The five highest and lowest scoring teachers from each of two parent populations of inner-city and outer-city, fifth grade teachers were selected. The FSIA was used to study the verbal classroom behavior of the various groups. The data revealed that teachers who had positive perceptions of pupils were generally indirect and teachers who had negative perceptions of pupils were generally direct in their verbal classroom behavior. In addition, more pupil initiated talk was found to exist in outer-city than inner-city classrooms.

Jose (144) partially replicated the Rosenthal and Jacobson study. The study involved 18 first and second-grade teachers and 144 students. An experimental group of elementary students was identified to teachers as having scored in the upper twenty per cent on a test designed to predict intellectual growth. A control group of students was not identified. The Interaction Analysis Scale was developed and used to code classroom behavior. No significant changes were found in teacher behavior by the researcher. She reported, however, that teacher expectancy had not actually been modified in a majority of the cases.

Brophy and Good (42) used dyadic interaction system to study the process by which teachers communicate performance expectations to individual students. The Brophy-Good Interaction Coding System concerned itself with dyadic contacts between a teacher and an individual student and ignored the interaction of the class as a group. After analyzing the teacher-student interactions in four first-grade classrooms, the investigators reported that teachers did discriminate in their behaviors toward children. Teachers who held high expectations for students demanded better performance from these students and were more likely to praise the performance when it occurred. In contrast, the teachers who held low expectations for students were more likely to accept poorer performance from these students and were less likely to praise good performance even though it occurred less frequently.

Willis (304) developed an observational instrument to study the behavioral interactions in five groups, each containing one teacher and two students. The children were perceived by the teachers as least or most efficient learners. The behavioral data indicated that teachers ignored the behavior of students perceived as least efficient more frequently than they did the behavior of students perceived as most efficient learners.

Kranz (158) investigated the relationship between teacher perception of pupils and teacher behavior towards those pupils. A modification of the Observational System of Interaction Analysis was used to measure teacher-pupil interaction. Students in 11 classrooms were ranked by their teachers on academic potential and achievement level, and each class was divided into three groups designated as high, average and low on the two variables. Analysis of the observational data revealed that students ranked high generally received more substantive, positive appraisal and total teacher behaviors than those students ranked as average and low. Students ranked average received more substantive, positive appraisal and

total teacher behavior than those ranked as low. Students ranked as low were the targets of more managerial teacher behaviors than students in the other two groups.

Martinello (173) examined the instructional role enactment by teachers with students perceived as high or low achievers. Forty high and 40 low achievers were identified, from four first and four fourth grade class-rooms, by their respective teachers. An instrument designed by the teachers was used to gather the behavioral data for every student in all eight classrooms. Overall, the data revealed that individual teachers exhibited variability in their classroom behavior, but a few similar teacher behavior patterns were identified within and among grade levels. For example, high achievers were more often asked for ideas and valuations relative to sub-stantive topics than low achievers, and lower achieving boys in the fourth grade received larger proportions of prompting functions. The similarities in teacher behavior were attributed to teacher conformance to institutional norms within limiting conventional situations of instruction.

Beez (21) found that tutors who had low expectations for their students engaged in more non-task oriented behaviors and explained the meanings of words more often than did tutors who had high expectations for their students. Further findings showed that students who were expected to do well covered more words and learned significantly more than students who were expected to do poorly. Sixty subjects from a Headstart program had been randomly assigned to a high or low expectancy condition, and expectancies were com-municated to the 60 education students serving as tutors, through falsified psychological evaluations.

Student Influence

Despite the large number of studies involving student-teacher inter-action, few researchers have examined the extent to which students influence classroom behavior. Four studies [Irwin (133), Wallace (297), Oppenlander (212), and Klein (152)] were identified, and only three of these [Irwin (133), Oppenlander (212), and Klein (152)] dealt specifically with the problem. The studies were described in six documents and included elemen-tary and secondary school and college levels. The findings of all four studies supported the position that students were major factors in deter-mining classroom behavior patterns, as measured by systematic observation.

The influence of students on science classroom behavior was investi-gated by Irwin (133) and Wallace (297). Irwi examined the influence of the child and instructional task on the teaching behavior patterns of preservice science teachers at the elementary school level. Eighty-eight subjects were assigned to one of the following treatments: (1) taught the same lesson to different pairs of children, (2) taught different lessons to same pair of children, and (3) taught different science lessons to different pairs of children. The teaching behavior of the subjects was coded from audiotapes of the first and second science lessons. The data revealed that the preservice teachers were more similar than different on the pre and post teaching sessions. All the preservice teachers had been provided with instruction in interaction analysis, and the researcher

suggested this as causing the similarities in behavior. The few changes that did occur were attributed more to the influence of the child than the instructional task.

Situational Variables

Eleven investigations [Friedli (97), Costantino (71), Payne (219), Snyder (270), Irwin (133), Kondo (156), Youngs, et al. (315), Rains (236), Altman (4), Rogers (241), and Wiegand (302)] were concerned with the influence of various situational variables on classroom behavior at the elementary and/or secondary school levels. Seven investigations [Snyder (270), Irwin (133), Kondo (156), Youngs, et al. (315), Rains (236), Altman (4), and Rogers (241)] were devoted to a study of situational variables in science classrooms. Situational variables were defined as particular locations or conditions in which a lesson was conducted. They included school or classroom organization, location and type of school and the nature of the instructional task. Six [Wiegard (302), Payne (219), Rains (236), Altman (4), Youngs, et al. (315), and Rogers (241)] of the eleven investigations reported changes in the classroom behavior resulting at least in part from the influence of a particular situational variable.

Variations of the organizational patterns within or among schools and the resulting changes in classroom behavior were investigated by two researchers. Friedli (97) recorded the verbal classroom behavior patterns in team taught and self-contained elementary classrooms with the FSIA. Costantino (71) used the Cornell, Lindvall and Saupe Classroom Observation Schedule to measure differences in the teacher-student interactions in junior high school and middle school classrooms. The researchers found that team teaching and the establishment of middle schools did not result in significant changes in verbal classroom behavior patterns.

Payne (219) analyzed the classroom verbal interaction patterns in Amish and Non-Amish schools. He reported that, as sampling moves from Amish to Non-Amish classrooms, the teachers become more indirect in their classroom behav   as measured by the Flanders revised i/d ratio.

Two investigations were concerned in part with the effects of different lessons or units of study on teacher-pupil behavior in science classrooms. Snyder (270) found variability in the question-asking behavior of five junior high school teachers and their students, and he suggested that the variability may have resulted from changes in the science subject matter. Irwin (133) reported a significant decrease in the ratio of open to closed questions for preservice elementary school science teachers who taught different lessons to different pairs of students. Neither investigator, however, was able to identify conclusively a cause and effect relationship between change in behavior and the content of the lessons.

Kondo (156) investigated the questioning behavior of four elementary science teachers who taught two invention and discovery lessons from a SCIS unit on Material Objects. He found a fairly consistent pattern in the questioning behavior of the teachers across all four lessons and suggested that the way a lesson is approached, for example teacher demonstration or student experiment, has a greater influence on teacher questioning behavior than the type of lesson.

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The efficacy of inquiry materials in teaching gifted seventh-grade students was studied by Youngs, et al. (315). Six students in an experimental group participated in an inquiry science class twice a week for forty minutes over a six month interval. A control group of six gifted students worked on science activities in another classroom. Analysis of teacher interactions and student questions from transcripts revealed significant changes in classroom behavior. A secondary science teacher who used inquiry development materials with gifted students was more likely to clarify student questions and respond to students seeking data while he provided data to gifted students in a conventional science class.

Rains (236) studied the differences in teacher-student and student-student verbal interactions between elementa school science classes taught by the Inquiry Centered Learning and traditional methods. Observations involving 18 fourth and fifth grade classrooms revealed that the amount of teacher-student interaction in science classes taught by the traditional method was significantly greater than in science classes taught by the Inquiry Centered method. The student-student interactions were similar under both methods of teaching.

Three investigators [Altman (4), Rogers (241), and Wiegand (302)] found that the location of a school was associated with differences in classroom behavior. In one study, Altman (4) used a self-developed science observation system to record teacher and student behavior during SCIS lessons in 13 inner-city and 15 suburban elementary school classrooms. Analysis revealed the following findings: (1) elementary science students in inner-city classrooms engaged in more self-initiated talk than science students in suburban or advantaged classrooms; and (2) elementary science teachers in advantaged classrooms used more verbal cognitive and less verbal procedural interactions than teachers in inner-city classrooms.

The results of the two remaining studies further substantiated Altman's findings. Rogers (241) analyzed the verbal interaction during science instruction in inner-city and ten outer-city elementary schools. He reported that students in ten outer-city science classrooms initiated more talk and talked for longer periods of time than students in inner-city science classrooms. Wiegand (302) showed that secondary school teachers who taught in middle class neighborhoods used a high frequency of supportive behaviors while teachers who taught in lower class neighborhoods used a high frequency of non-supportive behaviors as measured by Withall's Social-Emotional Climate Index.

Feedback

The method used in 38 investigations in an attempt to alter classroom behavior was feedback following teaching. Four of these investigations [Yulo (316), Johnson (140), James (137), and Moriber (194)] were devoted exclusively to science classroom behavior. Table II shows that feedback as an independent variable was separated into four subclasses, i.e., Student, Data From Systematic Observation of Classroom Behavior, Videotaped and/or Audiotaped, and Supervisory Conference. Each of these subclasses is treated separately in the following review. The results revealed that, individually, the subclasses of feedback were ineffective

or inconsistent change agents, but that supervisory conference and video-taped feedback, in combination, brought about changes in selected aspects of classroom behavior.

Student Feedback

The effects of student feedback on the classroom behavior of secondary teachers, student teachers or interns were examined by four investigators [Holleran (128), Reed (239), Littlefield (170), and Ryan (253)]. All four of the documents were doctoral dissertations, and none were concerned exclusively with the teaching of science. The findings reported in the investigations were unanimous: student feedback, written, spoken or used in conferences, failed to result in identified changes in teacher class-room behavior.

The reported findings of all four investigations suggested using student feedback to change classroom behavior may not succeed. Analysis of the documents revealed two situations which suggest the need for addi-tional research before student feedback can be totally disregarded as a change agent. First, only selected aspects of teacher classroom behavior were considered by the researchers. Changes may have occurred, but the instruments may not have been sensitive to them. Secondly, the necessity for change may not have been perceived by the subjects in at least two of the studies. The student teachers or interns in both studies received high ratings on their classroom behavior from the students throughout the treatment. One researcher provided student teachers with only one feedback session, and in the same study, student teachers rated themselves high on the behaviors under consideration at the beginning and end of the treatment. As a result, the impetus for change in both studies may have been minimal or non-existant.

Data From Systematic Observation of Classroom Behavior

Fifteen investigations [Yulo (316), Johnson (140), Mittelstadt (189), Manson (172), McCall (177), Hill (125), Bondi (32), Ishler (134), Traill (289), Reed (239), Short (267), Furr (98), Kinerk (150), Nichols (205), and Davidson (75)] were identified which included the use of feedback in the form of data from the systematic observation of classroom behavior in an attempt to modify classroom behavior. In nine of the investigations [Reed (239), Short (267), Yulo (316), Furr (98), Mittelstadt (189), Manson (172), Nichols (205), Hill (125), and Kinerk (150)], the feedback was not found to be an effective change agent. The remaining six investigations [Traill (289), McCall (177), Bondi (32), Johnson (140), Ishler (134), and Davidson (75)] reported significant changes in classroom behavior resulting from the treatment. The investigations included teachers, student teachers, interns and preservice methods students at both the elementary and secon-dary school levels. Behavioral data were gathered using the FSIA, modified FSIA, Question Classification Instrument, Withall's Social-Emotional Climate Index or an investigator-designed interaction analysis system.

The research by Yulo (316) was one of two investigations in this section concerned solely with science classroom behavior. He explored the use of the FSIA as a supervisory device and the effects of feedback

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from the instrument in changing the classroom verbal behavior of science interns. Fourteen interns were divided into control and experimental groups, and the behavioral data were gathered on six occasions during the semester for each intern. Both groups received the usual supervision by cooperating teachers. The experimental group was given written and verbal interaction feedback. Twenty-three items measured by the FSIA were analyzed. The researcher reported that the experimental group did not make a greater number of significant changes than did the control group in their classroom verbal behavior. The FSIA was suggested as a useful supervisory device only as part of a more comprehensive supervisory program.

In the second investigation devoted to science education, Johnson (140), provided five elementary school teachers with feedback on their classroom questioning behavior by means of the Questioning Dissector Grid. Questioning profiles were drawn for each teacher from videotaped science lessons and discussed in post teaching conferences. As the study progressed the questioning profiles showed that the teachers tended to increase their use of observational, information processing and evaluative questions and to decrease their use of memory-recall questions.

A consideration of the reported results of all 15 investigations included in this section revealed that written and/or verbal feedback from systematic observation of teaching behavior was not an effective way to modify classroom behavior. This was true for the science and non-science investigations, for the secondary and elementary school levels, and for preservice and inservice teachers at each level. It was tempting to draw this as a conclusion especially if the investigations in which the subjects were taught to code and interpret the interaction systems were omitted. However, after re-examining the research designs more closely, a decision was reached that the research involving the use of interaction analysis feedback to alter classroom behavior was inconclusive. This decision was based on the fact that most of the researchers failed to control or did not describe the methods used to control such variables as bias toward particular types of behavior, individual teacher's perception of need for change, exact nature of feedback and no-feedback sessions, teacher's self-perception of his own classroom behavior and the influence of cooperating teacher, college supervisor and student teaching experience on both the experimental and control groups.

Videotaped and/or
Audiotaped Feedback

An attempt to modify teacher classroom behavior through the use of videotaped and/or audiotaped feedback was identified as one of the major purposes in six investigations [Kautz (146), Kinerk (150), Morse, et al. (197), Ragan (233), Roush (250), and Wolfe (308)]. None of the investigations was devoted entirely to science classroom behavior. All six reported that significant changes in classroom behavior did not occur as a result of the feedback.

Supervisory Conference Feedback

Sixteen documents, representing 13 investigations [Acheson (1), Brown (43), Canfield (55), Douglass (79), James (137), Lippe (169), Medley (181), Metzger (184), Moriber (194), Rousseau (251), Ryan (253), Samph (256), and Sams (257)] were identified which involved supervisory conference feedback and the resulting changes in teaching behavior. Supervisory conference feedback referred to the verbal interaction that took place between supervisors and student teachers or instructors following an observation of teaching by the supervisor. Nine of the investigations [Canfield (55), Medley (181), Moriber (194), Ryan (253), Acheson (1), Brown (43), James (137), Lippe (169), and Metzger (184)] were concerned specifically with the influence of supervisory conference feedback, by itself and/or in combination with videotaped, audiotaped, written, or filmed feedback, on teacher classroom behavior. The remaining investigations included studies of verbal interaction during supervisory conferences, effects of conference training and impact of direct supervisor observation on verbal classroom behavior.

The results of the nine investigations involving supervisory conference feedback were interesting, especially when they were related to the findings in the Videotaped and/or Audiotaped Feedback Section. The reported results of both sections supported the position that supervisory conference feedback and videotaped feedback by themselves were ineffective change agents. In combination, however, they appeared to be an excellent means of altering specific aspects of teacher classroom behavior. Three investigations [Medley (181), Canfield (55), and Ryan (253)] out of five investigations which did not include the use of videotaped feedback in the supervisory conference reported no significant differences in teacher classroom behavior resulting from supervisory conference feedback. The two investigations [Lippe (169) and Brown (43)] that did find significant differences favoring the experimental group included systematic observation training for the subjects, or the observations were brief and made under simulated teaching-learning situations. Five investigations [Kautz (146), Kinerk (150), Ragan (233), Roush (250), and Wolfe (308)] in the Videotaped and/ r Audiotaped Feedback Section reported that videotaped feedback did not alter teacher classroom behavior. But, three investigations [Acheson (1), Lippe (169), and James (137)] that combined supervisory conference and videotaped feedback reported significant changes; the teachers allowed a greater proportion of student talk and/or became more inductive-indirect in their classroom behavior.

Only two of the investigations [Moriber (194) and James (137)] focused primarily on changes in science teacher behavior. In one of the investigations, Moriber (194) reported that college science instructors consistently asked low level questions during structured prelaboratory lessons and that supervisory conferences did not result in significant changes in the level of questions asked by the instructors. Each instructor was observed for approximately one hour per week over a five-week period, and each lesson was audiotaped. A one-hour supervisory conference was held with the instructor following each observation. During the conferences, audiotaped recordings were studied; the art of questioning was discussed; instructors were advised to ask more high level and fewer

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low level questions; and instructors agreed to implement the suggestions.
Instructor questioning behavior was coded from audiotaped recordings with
the Sanders taxonomy of questions.

The effects of three approaches to university supervison on the
attitude and inductive-indirect teaching strategy of science student teachers
were investigated by James (137). Twenty student teachers were randomly
assigned to the following treatments: (1) traditional university super-
vision, (2) traditional university supervision plus observation and dis-
cussion of films of experienced teachers, and (3) traditional university
supervision plus viewing videotaped recordings of their own behavior.
The Science Related Sematic Differential was administered as a pretest-
posttest measure of attitude. The Teaching Strategies Observation Dif-
ferential (TSOD) was used to measure teaching strategy from videotaped
recordings of classroom behavior. Student teachers who received supervision
plus self-evaluation via videotaped recordings developed significantly more
(p = .10) inductive-indirect teaching behaviors. Changes in student teacher
attitude were not significant at the five per cent level.

Summary

Two hundred thirty-two investigations were identified whose dependent
variable was classroom behavior, as measured by systematic observation, and
whose independent variables were factors or methods used in attempting to
alter classroom behavior. Science classroom behavior was the primary focus
in 68 of these investigations [Boeck (30), Hall (116), Irwin (133), Jones
(142), Konetski (157), Masla (174), McLeod (179), Miller (186), Strawitz
(281), Anderson and Horn (11), Ashley (13), Baker (15), Blough (29),
Bruce (47), Coffey (63), Fischler and Anastasiow (90), Hall (117), Hunter
(132), LaShier (164), Matthews and Phillips (176), Moon (192), Newport and
McNeill (204), Pempek (221), Perkes (223), Porterfield (230), Schmidt
(262), Westmeyer, et al. (299), Wilson (305), Balzer (16), Butler (50),
Hovsepian (131), Kochendorfer (155), Moore (193), Ost (213), Petit (225),
Strietberger (282), Vickery (294), Caldwell (52), George and Nelson (108),
Jackson (135), Bartholomew (19), Blosser (27), Harris, et al. (121),
Montague (191), Raymond (238), Schutte (263), Sparks (274), Staley (277),
Waldrop (296), Widell, et al. (300), Brewington (37), Brown (46), Cignetti
(60), Rusch (252), Sagness (255), Matthews (175), Nickel (207), Johnson
(140), Yulo (316), James (137), Moriber (194), Altman (4), Kondo (156),
Rains (236), Snyder (270), Youngs, et al. (315), Rogers (241), and
Wallace (297)]. The conclusions that were drawn from a review of the
investigations were as follows: (1) training in systematic observation
of classroom behavior, inservice training and microteaching were effec-
tive methods of altering selected aspects of teacher behavior; (2) the
effectiveness of microteaching for changing teacher behavior was not
reduced by substituting peers for students or by altering the microteaching
format; (3) changes brought about through microteaching were not retained
and carried over into actual classroom situations; (4) on-campus activities
were just as, or more, effective than off-campus activities for changing
teacher behavior; (5) student feedback, data from systematic observation
of classroom behavior, videotaped and/or audiotaped feedback, supervisory
conference feedback and miscellaneous instructional strategies, such as
experimental teacher training programs, group counseling, responsiveness

training, or instruction in programmed learning, were not effective change agents; (6) changes in teaching behavior often accompanied student teaching but the direction of change was not predictable; (7) teacher expectations of students served as self-fulfilling prophecies; (8) students were major factors in determining classroom behavior; (9) team teaching and the establishment of middle schools did not result in significant changes in verbal patterns of classroom behavior; and (10) the location of a school was associated with specific types of teacher behavior; i.e., teachers who taught in inner-city classrooms used less supportive behaviors than teachers who taught in middle-class or outer-city classrooms.

The conclusions drawn from the science investigations and those investigations involving other subject areas were in general agreement for the particular independent variables. However, there was a lack of, or no, investigations in science whose independent variables were on-campus versus off-campus activities, teacher expectation of students, student feedback, videotaped and/or audiotaped feedback, and supervisory conference plus videotaped feedback.

Relationships

An attempt was made in 63 investigations to identify relationships between a variety of independent variables and observations of classroom behavior. The investigations were described in 81 documents and involved teachers and students at the college, secondary and elementary school levels. Twenty-six were specifically concerned with science classroom behavior. Each of the investigations belonged to the Relationships subcategory of Teacher Education Research (see Table I). The independent variables included teacher age, sex, race and measures of personality, attitude and perception. Classroom behavior or the dependent variable was limited in a majority of the cases to teacher verbal classroom behavior. A few investigators subjected their data to analysis of variance, multiple regression, chi square or t-tests, but correlation was the predominant statistical technique for determining relationships between the variables. The overall results of these analyses revealed that none of the identified variables was a consistent predictor of teacher classroom behavior as measured by systematic observation.

The following review and discussion of the 63 investigations are organized into four parts; each corresponding to the general type of independent variable used by the investigator. The variables include teacher background and experience, attitude, personality, and perception of self or what constitutes preferred teaching.

Background and Experience

Twenty-eight investigations [Ager (3), Azbell (14), Conrad (66), Perkes (222), Blosser (28), Ashley (13), Giese (110), Spangenberg (273), Bruce (47), Brewington (37), Cignetti (60), Sagness (255), Brickner (38), Amershek (5), Ost (213), Cosper (70), Windham (306), Kleinman (154), Butts and Raun (51), Regan (240), Jones (141), Sharp (266), Rogers (241), George and Nelson (108), Eccles (80), Bane (18), Summers (284), and

Dahlberg (74)] were identified in which attempts were made to relate a
variety of teacher background and experiential variables to selected
aspects of classroom behavior. Sixteen of these investigations [Perkes
(222), Blosser (28), Ashley (13), Giese (110), Spangenberg (273), Bruce
(47), Brewington (37), Cignetti (60), Sagness (255), Ost (213), Kleinman
(154), Butts and Raun (51), Sharp (266), Rogers (241), George and Nelson
(108), and Eccles (80)] were exclusively science education research. The
variables included such items as academic rank, age, science and science
methods credit hours, grade point averages, scores on Graduate Record
Examination, grades in student teaching, knowledge of subject matter, grade
level taught, level of professional preparation, scores on National Teacher
Examination, race, extent of planning, sex, recency of enrollment in last
college science or science methods course, population in community, size
of class, size of secondary school attended by teacher, socioeconomic
background of teacher, subject area taught and years of teaching experi-
ence. Although the investigations involved a wide assortment of observa-
tional systems, the most frequently used technique for measuring class-
room behavior was the FSIA.

The reported results of the 28 investigations revealed that all but
five of the independent variables were either inconsistently or not signifi-
cantly related to the selected measures of classroom behavior. Recency of
enrollment in last college science course, science methods credit hours,
population of community, education grade point average and scores on the
Graduate Record Examination were found by Ager (3), Azbell (14), Conrad
(66) or Perkes (222) to be significantly correlated to some aspect of
classroom behavior. The consistency of these relationships, however, could
not be determined because each variable was not included in more than one
study. The significant correlations did provide hypotheses for future
research, but it could not be concluded that the relationships were causal
without further evidence.

In the following paragraphs, a more detailed description is presented
for 16 [Dahlberg (74), Cosper (70), Windham (306), Kleinman (154), Conrad
(66), Butts and Raun (51), Regan (240), Jones (141), Perkes (222), Sharp
(266), Rogers (241), George and Nelson (108), Eccles (80), Bane (18),
Azbell (14), and Summers (284)] of the 28 investigations dealing with
relationships between selected aspects of classroom behavior and teacher
background and experiential variables. Seven of these investigations
[Kleinman (154), Butts and Raun (51), Perkes (222), Sharp (266), Rogers
(241), George and Nelson (108), and Eccles (80)] are in the area of science
education. The remaining 12 investigations [Blosser (28), Ashley (13),
Giese (110), Spangenberg (273), Bruce (47), Brewington (37), Cignetti (60),
Sagness (255), Brickner (38), Amershek (5), Ager (3), and Ost (213)] are
included with those studies involving relationships between classroom
behavior and teacher personality and attitude.

Dahlberg (74) found that the cognitive level of teacher questioning
behavior was not significantly related to years of teaching experience,
subject area taught, level of professional preparation or grade level
taught. The population was drawn from elementary school teachers who had
participated in research projects sponsored by Northwest Regional Educa-
tional Laboratory. Teacher questioning behaviors were coded from type-
scripts using Bloom's taxonomy.

The French and Galloway IDER system of behavior analysis was used by Cosper (70) to investigate sex-differences in teacher-student classroom interactions. He reported that female teachers initiated significantly more talk with male than female students, discriminated significantly in favor of male students and exhibited significantly more restricting behavior toward female than male students. The study involved four female elementary school teachers and 105 gifted students.

Windham (306) reported that the classroom behavior of 45 college teachers was not significantly related to academic rank, years of college teaching experience, sex, age, years of public school teaching experience, level or size of college classes. Each teacher was observed for one thirty-minute period, and classroom behavior was coded with the FSIA.

In a study involving 23 junior high school science teachers, Kleinman (154) found that there was little or no correlation between the number of critical thinking questions asked by teachers and their educational or experiential backgrounds. An investigator-constructed question category system and questionnaire were used to assess teacher background and classroom questioning behavior.

An investigation by Conrad (66) revealed that secondary school teachers who planned extensively tended to use less talk in the classroom, but that the quality and quantity of planning was not significantly correlated to teacher flexibility, spontaniety of student response or teacher domination in the classroom. He further reported that experienced teachers did more planning than less experienced teachers. Questionnaires, interviews and observations were employed to assess the quality and quantity of planning, and classroom behavior was measured with the FSIA.

Butts and Raun (51) reported that teachers' classroom practices as measured by observations with the CORF were not significantly related to credit hours of science, years of teaching experience and grade level taught. A significant correlation of 0.496 was reported between teacher classroom practice and knowledge of science. Nineteen elementary school teachers who took part in an inservice project and who used SAPA materials in their classrooms participated in the study.

Selected child development principles were used by Regan (240) to develop instruments for measuring teacher beliefs concerning child development principles and for observing related classroom behaviors. Comparisons of the beliefs and behavior of 27 second-grade teachers revealed similar patterns of classroom behavior regardless of differences in belief or commitment. In addition, common factors were not identified in the preparation or experience of teachers who held similar beliefs.

Jones (141) did not find significant relationships between student teacher grade point averages and teaching performance, personality or verbal interaction scores. This finding was part of a larger investigation in which Jones examined the influence of teaching elementary school student teachers a strategy in divergent thinking on classroom behavior, student creativity and achievement. Classroom behavior was observed and assessed with the Amidon-Hunter Interaction Analysis system and an investigator-designed performance checklist.

Perkes (222) correlated measures of teacher classroom behavior with several teacher background variables. The classroom behavior and background variables were obtained from school records and observations of teaching with the STOI. The results of the analysis showed that the total science credits, years in teaching and age did not significantly correlate with teaching behavior. Recency of enrollment in last college science course correlated significantly in a positive direction with teacher talk (0.61), teacher conducted demonstrations (0.52), and questions requiring recall of facts (0.49). Significant negative correlations were found between recency of enrollment in last college science course and teacher-student discussions (-0.59), questions of a hypothetical nature (-0.52), student laboratory participation (0.60), use of equipment (0.56) and lessons stressing principles and clarifying applications (-0.47). Grade point average in science courses significantly correlated in a positive direction with teacher-student discussions (0.39), questions of a hypothetical nature (0.45), student laboratory participation (0.43), use of equipment (0.40) and lessons stressing principles and clarifying applications (0.37) and in a negative direction with teacher talk (-0.46), teacher conducted demonstrations (-0.52), and questions requiring recall of facts (-0.41). Credits in methods of science teaching significantly correlated in a positive direction with teacher-student discussions (0.53), questions of a hypothetical nature (0.45), student laboratory participation (0.52), use of equipment (0.43) and lessons stressing principles and clarifying applications (0.42). Significant negative correlations were reported between credits in methods of science teaching and teacher talk (-0.42), teacher conducted demonstrations (-0.52) and questions requiring recall of facts (-0.42). Perkes concluded from these results that student-centered teachers behaviors were associated with science teachers who had recently enrolled in a college science course, had more credits in science methods courses and had achieved a higher grade point average in college science courses.

One portion of a teacher effectiveness study by Sharp (266) was concerned with relationships between various aspects of biology teacher preparation and classroom verbal behavior as measured by FSIA. Teacher preparation included knowledge of biology, years of teaching experience, scores on the Common Examinations of National Teacher Examination and number of semester hours in biology, chemistry, mathematics and physics. The data analysis revealed that the amount of teacher talk was significantly correlated in a positive direction with the number of semester hours in mathematics. No other significant correlations were reported between teacher preparation and verbal classroom behavior.

Rogers (241) found that teachers who had positive perceptions of their students generally exhibited more indirect classroom influence as measured by FSIA than teachers who had negative perceptions of their students. Additional findings included: (1) age and having completed a recent science methods course were not significantly related to classroom verbal behavior; (2) teachers who liked to teach science made greater use of restrictive behavior; and (3) teachers from lower socioeconomic backgrounds tended to use authority more than teachers from higher socioeconomic backgrounds. The study involved 38 inner-city and 38 outer-city fifth-grade teachers. The Perception of Pupils Objective Checklist was used to assess teachers' perceptions of students.

George and Nelson (108) correlated years of teaching experience with the I/d and I/D ratios of 12 elementary school teachers who were participating in an inquiry workshop. A significant correlation of 0.65 was found between i/d ratio and years of experience. The I/D ratio correlated in a positive direction with years of experience, but the correlation was not significant. Similar results were reported for correlations between years of urban teaching experience and the interaction ratios. The FSIA served as the instrument for observing teacher classroom behavior.

In a study by Eccles (80), an attempt was made to identify relationships between knowledge of subject matter and the teaching behavior of sixth-grade science teachers. The Iowa Test of Educational Development, Test 2 was administered to 30 teachers. Five teachers who scored high and five who scored low were selected for observation. Eight ten-minute audiotapes were made in each classroom and analyzed for the following behaviors: (1) omitting science lessons, (2) errors, (3) use of technical terms, (4) use of various teaching aids, (5) use of reference books, (6) total teacher talk, (7) copying notes, (8) use of demonstrations, (9) number of student comments, and (10) classroom influence as measured with FSIA. A comparison of the behavioral data failed to reveal significant differences between the high and low scoring teachers.

Bane (18) explored relationships among three measures of teaching behavior and selected teacher characteristics. The Teacher Practices Observation Record, Florida Taxonomy of Cognitive Behavior and Reciprocal Category System (FTCB) were used to measure a thirty-minute sample of behavior for each of a 50 per cent sample of all public school teachers in Nassau County, Florida. Teacher characteristics included philosophical and educational beliefs, open and closed mindedness, age, sex, race, grade level and teaching experience. Beliefs, open mindedness and closed mindedness were assessed by administering the Teacher Practices Inventory, Personal Beliefs Inventory and Rokeach Dogmatism Scale to each teacher.

After subjecting the data to correlation, analysis of variance or multiple regression analysis, Bane reported the following results: (1) teaching behavior was not significantly related to race, age, teaching experience, grade level, educational beliefs or open and closed mindedness; (2) men teachers exhibited greater amounts of warming, accepting and amplifying behaviors, while women teachers exhibited more directing, correcting and scolding behaviors; (3) teachers whose educational beliefs were more in agreement with Dewey exhibited more experimental practices and complex cognitive behaviors than teachers whose educational beliefs were not in agreement with Dewey; (4) teacher cognitive and affective behaviors were significantly correlated in a positive direction; and (5) social studies teachers were significantly more positive in affective tone and less experimental than teachers of other subject areas.

Azbell (14) reported that a more interpersonal approach during classroom instruction was related to grade level, number in class, population of community and size of secondary school attended by the student teachers but not to student teachers' TSRT scores, social background, grade point average, age or grades in student teaching. Interpersonal acts were measured with a modified FSIA and included the use of personal names, silence, personal pronouns and teacher and student talk. Fifty-four student teachers from Western Illinois University participated in the study.

An attempt was made by Summers (284) to relate observations of verbal classroom behavior with school organizational climate and selected teacher variables. The conclusion was reached that older, more experienced men teachers with advanced degrees may have better discipline, be more indirect in motivation and control, spend more time advancing student ideas and be more deliberate in communication than younger, less experienced women teachers who are seeking advanced degrees. Organizational climate, as measured by the Organizational Climate Description Questionnaire (OCDQ), was directly related to teacher discipline behavior but generally unrelated to the quality of teacher behavior. The study included 52 elementary school teachers, and classroom verbal behavior was coded with FSIA.

Attitudinal Variables

Attitude scores served as independent variables while selected measures of classroom behavior served as dependent variables in 23 investigations [Amershek (5), James (137), Raiche (235), Bridgman (39), Storlie (280), Davies (77), Ragsdale (234), Giebink (109), Palmer (214), Ashley (13), Ager (3), Fowler (95), Bruce (47), Olson (211), Kochendorfer (155), Hovsepian (131), Ost (213), Jones and Blankenship (143), Sagness (255), Brewington (37), Cignetti (60), Brown (46), and Spangenberg (273)]. Twelve of these investigations [James (137), Ashley (13), Bruce (47), Kochendorfer (155), Hovsepian (131), Ost (213), Jones and Blankenship (143), Sagness (Brewington (37), Cignetti (60), Brown (46), and Spangenberg (273)] dealt with science teacher behavior. The reported results of 14 investigations [Amershek (5), James (137), Raiche (235), Bridgman (39), Storlie (280), Davies (77), Ragsdale (234), Giebink (109), Palmer (214), Ashley (13), Ager (3), Fowler (95), Bruce (47), and Olson (211)] almost unanimously supported the position that teacher scores on the Minnesota Teacher Attitude Inventory (MTAI), Sematic Differential and Runner Studies in Attitude Patterns were not significantly related to classroom behavior as measured by the FSIA, Teacher Question Inventory, OScAR, CORF, TSOD and Classroom Observation Record. Although there were some inconsistencies in the findings, eight of the science investigations [Kochendorfer (155), Hovsepian (131), Ost (213), Jones and Blankenship (143), Sagness (255), Brown (46), Brewington (37), and Cignetti (60)] suggested that teacher or student teacher scores on the Blankenship Attitude Inventory, Pupil Control Ideology Form and Cultural Attitude Inventory were significantly related to student perception of classroom behavior and/or activity. One science investigation [Spangenberg (273)] reported significant correlations between student attitude and measures of student laboratory behavior on an investigator-designed category system. Whether or not these correlations reflected causal rather than statistical relationships remains to be tested.

Amershek (5) developed the Classroom Verbal Behavior Record and used the instrument to record the cognitive psychomotor and affective verbalization of 23 women student teachers at the elementary school level. These observations were related to various teacher characteristics including MTAI scores, student teaching grades and knowledge of educational psychology. The findings were as follows: (1) knowledge of educational psychology was not significantly related to cognitive or affective verbalization, but increased use of skill verbalization was significantly rated to student teacher rank as high and low on educational psychology; (2) teachers who

ranked high on educational psychology and the MTAI exhibited a greater use of cognitive and less use of skill verbalizations than teachers who ranked low on both of these measures; (3) student verbal classroom behavior did not significantly relate to student teachers' MTAI scores; and (4) verbal behavior of students and student teachers did not significantly relate to grades in student teaching.

James (137) correlated the inductive-indirect teaching strategies of 23 secondary school student teachers as measured by the TSOD with teacher scores on the Science Related Sematic Differential. She reported that although the correlations between performance and attitude showed general compatibility, they were not generally significant. The results of an investigation by Bridgman (39) revealed significant relationships between classroom behavior and teacher attitude and personality. Teachers who exhibited behaviors toward the positive end of the eighteen bipolar dimensions of the Classroom Observation Record had more positive attitudes, were more creative, were less authoritarian and had lower economic and theoretical values than teachers who exhibited behaviors toward the negative dimensions of the instrument. An additional finding was that the most authoritarian teachers were female, Negro experienced teachers who graduated from state teacher's colleges and who taught at the secondary school level. The MTAI, Welch Figure Preference Test, California F-Scale, Study of Values and a questionnaire served as instruments for measuring attitude, professional status, values, creativity, and personality.

Storlie (280) examined relationships between teacher characteristics and changes in verbal classroom influence following instruction in interaction analysis. Fifty-one secondary school teachers were provided with an inservice program in interaction analysis. Half of the teachers were taught in an indirect, and half were taught in a direct manner. Observations with the FSIA revealed that 37 of the teachers significantly increased in their use of indirect classroom influence, but the changes were not found to be significantly related to teacher characteristics as measured by Sixteen Personality Factor Questionnaire, Runner Studies in Attitude Patterns and MTAI.

An investigation by Davies (77) revealed that only one factor discriminated between 51 secondary school teachers on their use of indirect classroom influence. Teachers who were enthusiastic, talkative and cheerful tended to encourage greater student participation in classroom activities. The teachers had been ranked according to their indirect verbal influence as measured by the Minnesota method of interaction analysis. Personality and attitudinal instruments included the MTAI and Sixteen Personality Factor Questionnaire.

Ragsdale (234) explored relationships between changes in student teacher attitude and teacher-student relations and changes in student teacher classroom behavior. The MTAI, California F-Scale and Teacher Characteristics Schedule were administered to 49 elementary school student teachers at the beginning and end of their student teaching experience. Classroom behavior was coded by means of the FSIA and Classroom Observation Record. Changes in attitude and behavior were determined by t-tests of significance for the difference in means of matched groups. The analysis

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revealed that student teacher attitude toward students and teaching remained constant but that student teachers became significantly more positive in their classroom behavior as measured by Classroom Observation Record. No changes in behavior were observed with the FSIA. Ragsdale concluded that changes in student teacher classroom behavior could occur without a corresponding change in attitude.

Significant relationships between MTAI scores and measures of teacher verbal classroom behavior were not found in a study by Giebink (109). The classroom behavior of 27 female elementary school teachers was recorded using the FSIA. Correlations were computed between attitudes scores and student talk, indirect and direct teacher talk, silence or confusion, continued use of teacher acceptance and praise and continued use of teacher directions and criticism.

Palmer (214) studied the classroom behavior patterns of 23 post-baccalaureate student teachers and attempted to determine if these patterns were dependent upon selected personality and attitudinal factors and upon the classroom behavior of their cooperating teachers. He did not find significant correlations between student and cooperating teacher behavior and concluded that the personality and attitudinal measures showed little power for predicting classroom behavior. The Bower Teacher Opinion Inventory (BTOI), MTAI, Minnesota Multiphasic Personality Inventory (MMPI) and OScAR served as the attitudinal, personality and observational instruments.

Relationships between changes in behavior resulting from a SAPA inservice program and teacher attitude, years of experience and grade level taught were investigated by Ashley (13). Observations of 23 elementary school teachers with the CORF revealed that the teachers became more student-centered between the first and fourth observation. Primary teachers changed their teaching behavior to a greater extent than did intermediate teachers. The number of significant correlations between changes in behavior and attitude were less than would be expected by chance alone. No significant correlations were found between changes in teaching behavior and years of experience. Teacher attitude was measured with the Semantic Differential.

Ager (3) concluded that the scores of 30 female elementary education student teachers on the Rokeach Dogmatism Scale did not significantly relate to measures of their classroom verbal behavior with the FSIA. He did, however, report significant relationships between various categories and indices of verbal behavior and the following independent variables: (1) MTAI, (2) Junior Index of Motivation Scale, (3) Ohio State Preference Scale, (4) total grade point average, (5) American College Test scores, (6) education grade point average, (7) Graduate Record Examination (Humanities) and (8) Advanced Graduate Record Examination (Education). Correlations were computed between the independent and dependent variables, and the predictability of each independent variable was determined through multiple regression analysis.

An investigation by Fowler (95) revealed that personality and attitude of 53 elementary school teachers were significantly related to teacher and student classroom behavior. Criterion measures consisted of the OScAR,

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Russell Sage Social Relations Test, Interaction Analysis, Hostility-Affection Scorecard and principals' rating on emotional climate. Teacher scores on the MTAI, MMPI and Survey of Educational Leadership Practices served as predictor variables.

The Teacher Question Inventory was used by Bruce (47) in an attempt to find relationships between selected teacher characteristics and class-room questioning behavior. He reported the following results: (1) years of experience were significantly correlated in a negative direction (-0.41) with change in proportion of high level questioning behavior; (2) a signifi-cant correlation of -0.33 was found between age and high level questioning behavior; (3) age was significantly correlated in a positive direction (0.31) with recall of fact questions; and (4) no significant correlations were found between questioning behavior, MTAI scores or number of science credit hours. The population of the study consisted of 33 elementary school science teachers.

Olson (211) sought relationships between teaching behavior and student ratings, after hearing teachers speak, on the Sematic Differential. The FSIA served as the instrument for measuring the classroom behavior of 15 student teachers. Based on the evidence presented, Olson concluded that student ratings were significantly related to direct teacher influence but not to classroom interaction in general.

As part of a larger investigation, Kochendorfer (155) correlated the scores of 64 secondary school biology teachers on the Blankenship Attitude Inventory with student perception of classroom activity on the BCAC. A significant correlation of 0.73 was obtained between the teacher variables. Kochendorfer pointed out, however, that although the correlation was significant, some teachers' scores on the inventory indicated a high degree of agreement with the BSCS rationale, but their classroom activity did not reflect this rationale. In several cases the activity was in agreement but the rationale was not. He concluded that some individuals did not have the ability or were unwilling to conform their classroom activity to their professional rationale or that some incongruity existed between their professional rationale and whatever actually guided their classroom practices.

Hovsepian (131) correlated the teacher classroom activities of 70 secondary school biology teachers with a variety of teacher characteristics, including their attitude toward the BSCS rationale. After finding correla-tions between classroom activity and teacher attitude and participation in BSCS and NSF inservice programs, he concluded that curriculum change could be expected when teachers' attitude toward the subject matter and way they related to students were changed. The Blankenship Attitude Inventory and BCAC served as classroom activity and attitudinal measures.

An investigation by Ost (213) revealed that teachers who attended an NSF Summer Institute for Biology Teachers increased the number of activ-ities they used in their teaching and changed their attitude to one more in agreement with the BSCS rationale. Teachers with less than three years of experience teaching biology generally exhibited the greatest gains on all criterion instruments. Teachers who were rigid in their belief systems and scored high on the Dogmatism Scale showed the least gains. Attitude,

rigidity and classroom activity were measured with the Blankenship Attitude Inventory, Rigidity-Flexibility Scale and Science Classroom Activity Checklist. Data were analyzed by means of correlation, t and f-ratios and stepwise regression analysis.

Jones and Blankenship (143) reported that biology teachers exhibited classroom practices recommended by BSCS to a greater extent when they had a more humanistic pupil control ideology and when they were in a position to play a major-role in classroom interaction. The Pupil Control Ideology Form (PCI) was administered to 68 secondary school biology teachers, and 2,040 students responded to the BCAC. Pearson product-moment correlations were computed between teacher scores on PCI and mean scores for each class on each of seven BCAC variables. A significant correlation of -0.33 was found between pupil control ideology and the combined BCAC variables. A high score on the PCI represented a more custodial orientation, and a low score represented a more humanistic orientation toward pupil control.

An investigation by Sagness (255) revealed a number of significant relationships between student teacher classroom activity and selected student teacher, cooperating teacher, classroom student, school and curriculum variables. The following variables were among those which showed significant positive relationships with activities used by student teachers during student teaching: (1) student teachers' attitude toward their cooperating teacher, teaching science, science textbook and laboratory facilities; (2) publication date of science textbooks; (3) classroom students' attitude toward science and the science course; and (4) the amount of laboratory work used during student teaching. Significant negative relationships were reported between student teacher classroom activity and the number of students in the class, environmental setting of the school and student teachers' posttest scores on Cultural Attitude Inventory (CAI). The actual correlations between scores on CAI and student activity were positive, but the scale for the CAI was one being high or positive and five being low or negative. The population of the study included 98 secondary school preservice teachers in science education. Student teacher classroom activity was measured by means of classroom students' responses on the SCACL:SP.

Brewington (37) reported that teacher classroom activity as measured by SCACL:SP correlated significantly in a positive direction with teacher scores on the attitude subscale of CAI and sex of teacher and in a negative direction with teachers' view of the importance of salary, students' average number of years of science, teachers' attitude toward the importance of facilities, age of class, students' attitude toward the course, and teachers' composite scores on CAI. The teachers' attitudes regarding the use of innovative strategies and scores on the SCACL:SP were significantly and positively related. The actual correlation coefficients were not presented. The population of the study consisted of 26 first year secondary science teachers who graduated from The Ohio State University during the 1969-70 school year and who had participated in the investigation by Sagness (255).

The results of a similar investigation by Cignetti (60) agreed with three of the findings reported by Brewington. Significant correlations of -0.61, -0.43 and 0.46 were found, respectively, between the SCACL:SP

scores of 13 first year secondary school science teachers who graduated
from The Ohio State University and the teachers' view of the importance of
salary, students' average number of years of science and teachers' attitude
regarding the use of innovative strategies. Significant relationships were
not found between SCACL:SP scores and teacher scores on the attitude sub-
scale of CAI, teachers' composite scores on CAI, sex of teacher, age of
class, students' attitude toward the course, and teachers' attitude toward
the importance of facilities. The population of the study included 25
secondary school science teachers who did not graduate from The Ohio State
University. Correlations between their SCACL:SP scores and the afore-
mentioned variables were not presented in the research document.

Brewington (37) and Cignetti (60) related grade level taught, number
of students in class, and age of teacher to scores on the SCACL:SP. Neither
researcher reported significant relationships between these variables and
teacher classroom activity.

The SCACL:SP was used by Brown (46) to investigate relationships between
selected student teacher variables and student perception of student teacher
classroom activity during science lessons. Student teacher variables in-
cluded scores on the CAI and ratings by cooperating teachers and university
supervisors on Checklist for Assessment of Science Teachers (CAST). Signifi-
cant correlations of 0.325 and 0.328, were found between teaching activ-
ities of project student teachers and posttest scores on the knowledge
subscale of CAI and ratings by university supervisors on subscale B (class-
room activities section) of CAST. Significant correlations of 0.412, 0.375
and 0.422 were reported between classroom activities of non-project student
teachers and ratings by cooperating teachers on subscale B and ratings by
university supervisors on subscales A and C (student-teacher relations and
personal adjustment) on CAST. Forty-six project and 46 non-project second-
ary school student teachers participated in the study.

Spangenberg (273) concluded that college students who held positive
attitudes toward a general biology course asked more questions of their
laboratory partners and engaged in the least amount of student laboratory
talk. His conclusion was based on significant correlations (p .10) of
0.279 and 0.355, respectively, between student attitude and asking questions
and silence. He also reported a significant correlation (p .10) of 0.50
between lesson centered discussion and academic achievement in the labora-
tory. The scores of 28 zoology students on an investigator-designed in-
strument, the Student Attitude Inventory, were correlated with laboratory
behavior which was coded from audiotaped recordings. Laboratory verbal
behavior was categorized as lesson-centered discussion, irrelevant dis-
cussion, questioning, teacher talk and silence.

Personality Variables

The attempt to relate systematic observations of classroom behavior
and selected measures of teacher personality was identified in 30 investi-
gations [Brickner (38), Burge (48), Evans (85), Giese (110), Taylor (286),
Laney (161), Blosser (28), Castelli (58), Ryan (253), Pavlovich (218),
Hanny (119), Ober (209), Piele (228), Bird (25), Lantz (162), Petrusich
(226), Mulligan (199), Crispin (72), Davies (77), Ager (3), Raiche (235),

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Storlie (280), Ost (213), Palmer (214), Fowler (95), Azbell (14), Jones (141), Bane (18), Bridgman (39), and Ragsdale (234)]. Five of these investigations [Giese (110), Evans (85), Blosser (28), Bird (25), and Ost (213)] were devoted entirely to science classroom behavior. Although the instruments used in the investigations were extremely diverse, enough similarity existed so that the investigations could be roughly sorted into three groups. The first group consisted of 11 investigations [Brickner (38), Burge (48), Evans (85), Giese (110), Taylor (286), Laney (161), Blosser (28), Castelli (58), Ryan (253), Pavlovich (218), and Jones (141)]. In these investigations, measures of teacher personality on the Gough-Sanford Rigidity Scale, Myers-Briggs Type Indicator (MBTI), Guilford-Zimmerman Temperament Survey (GZTS), Edwards Personal Preference Schedule (EPPS), Michigan Student Index and Alcorn-Erb Interpersonal Orientation Scale were related to classroom behavior by one or more investigators, and the results were always insignificant. The observation instruments included the Biology Teacher Behavior Inventory (BTBI), OScAR, Question Category System, FSIA, Verbal Interaction Category System (VICS) and/or the Science Teacher Behavior Inventory.

The second group consisted of 18 investigations [Ober (209), Piele (228), Taylor (286), Brickner (38), Bird (25), Ager (3), Raiche (235), Davies (77), Storlie (280), Bridgman (39), Ragsdale (234), Lantz (162), Palmer (214), Fowler (95), Ost (213), Hanny (119), Azbell (14), and Bane (18)]. The results of these investigations were inconsistent concerning relationships between classroom behavior and teacher scores on the Rokeach Dogmatism Scale, MMPI, Teacher Practices Inventory, California F-Scale, Interpersonal Check List, Teaching Situation Reaction Test (TSRT), and Sixteen Personality Factor Questionnaire. Classroom behavior was measured with such instruments as the FSIA, OScAR, Classroom Observation Record, Science Curriculum Assessment System (SCAS), BCAC, Florida Taxonomy of Cognitive Behavior (FTCB), Reciprocal Category System and Teacher Practices Observation Record.

Each investigation in the third group [Petrusich (226), Mulligan (199), and Crispin (72)] used personality measures that were not included in any other investigation. All reported significant relationships between classroom behavior and teacher personality. Petrusich (226) found significant correlations between observations with the OScAR and teacher anxiety as measured by the IPAT Anxiety Scale Questionnaire and IPAT 8-Parallel-Form Anxiety Battery. Significant correlations between classroom interaction and teacher scores on the Teacher Characteristics Schedule were reported by Mulligan (199). After studying teacher discipline behavior under a variety of controlled conditions, Crispin (72) reported that teacher classroom behavior appeared to be a function of teacher personality.

The overall results of the 30 investigations involving measures of teacher personality and classroom behavior did not support the position that teacher personality was a valid and reliable predictor of classroom behavior. Teacher and student classroom behavior may be dependent on teacher personality, but the relationship remains to be substantiated.

The five investigations [Giese (110), Evans (85), Blosser (28), Bird (25), and Ost (213)] devoted to science education research were representative of the 30 investigations identified in this section. Four of the science investigations [Giese (110), Evans (85), Blosser (28), and Bird (25)] are presented in greater detail in the following paragraphs. The fifth science investigation [Ost (213)] was described in the previous section.

Giese (110) attempted to relate selected characteristics of 28 classroom teachers with observations of their classroom behavior. He found that teacher scores on the GZTS were generally not predictors of behaviors espoused in the ISCS model for science teaching. Knowledge of the processes of science and ISCS content were found to be predictors of ISCS teaching behavior. An instrument developed by the investigator, the Science Teacher Behavior Inventory, was employed as the observation instrument.

One portion of an investigation by Evans (85) was concerned with correlations between teacher scores on the Guilford-Zimmerman Temperament Survey (GZTS) and classroom behavior. The number of significant correlations found was not more than would be expected by chance alone. The classroom behavior of eight secondary school biology teachers was coded using an instrument developed by Evans (85) and Balzer (16), the Biology Teacher Behavior Inventory.

Blosser (28), as part of a larger investigation, examined relationships between the questioning ability of 42 preservice secondary school science teachers and measures of their personality, intelligence, sex and educational set. Teacher questioning ability included types of teacher questions, mean pause time and percentage of teacher talk. Observations were made during student teaching, and teacher questioning ability was coded with the Question Category System. The Otis Quick-Scoring Mental Ability Test, Myers-Briggs Type Indicator and Educational Set Scale were administered to each of the participants. Correlational analysis and analysis of variance did not reveal any significant relationships between teacher questioning ability and the independent variables.

Scores on the Rokeach Dogmatism Scale were used by Bird (25) to select a group of openminded and a group of closeminded teachers from a sample of 43 elementary school teachers who were enrolled in a AAAS inservice workshop. Comparisons between the two groups' classroom behavior were made by applying the Science Curriculum Assessment System (SCAS) observational technique. The results showed that openminded teachers exhibited behaviors more in agreement with those associated with providing students the opportunity to learn through inquiry. The openminded teachers interacted more frequently with small groups while the closeminded teachers interacted more frequently with large groups of students. The openminded teachers spent less time than did the closeminded teachers giving directions, suggesting alternatives, giving information and asking rhetorical questions.

Teacher Perception of Self
and Preferred Teaching

In each of the following six investigations [Myers (200), Seidman (264), Peek (220), Crockett (73), Molchen (190), and Collea (65)], an attempt was made to relate measures of teacher perception and classroom behavior. Science classroom behavior was the focus in three of the investigations [Crockett (73), Molchen (190), and Collea (65)]. The independent variables included teacher perception of self and perception of what constitutes preferred teaching as measured by the Index of Adjustment, Science Survey Instrument, Verbal Behavior Q Sort, Tennessee Self Concept Scale and a self-analysis questionnaire. Classroom behavior or the dependent variable was assessed in five of the studies with the FSIA. The results of these investigations revealed that the stated measures of teacher perception were not effective predictors of teacher verbal classroom behavior.

Myers (200) administered the Index of Adjustment and Values to 60 student teachers and selected 15 highest and 15 lowest scoring student teachers on the self-acceptance section of the Index. After comparing the verbal classroom behavior of the two groups, Myers reported that the higher or positive self-accepting student teachers used criticism and justification of teachers' role, fostered the use of extended student responses and expanded student ideas to a greater extent than did the lower or negative self-accepting student teachers. The Flanders i/d ratios revealed that the negative self-accepting student teachers were more indirect in their classroom influence than the positive sample. Differences in the indirect influence were attributed to the greater use of direct and control statements by the positive self-accepting student teachers.

The results of an investigation by Seidman (264) did not agree with the findings reported by Myers. Seidman reported that student teachers who had high self-concepts talked less and used more indirect teaching behavior than students who had low self-concepts. The self-concepts of 50 elementary school student teachers were measured with the Tennessee Self-Concept Scale, and classroom behavior was coded from audiotaped recordings with the Flow Chart, an instrument developed at Hofstra University.

Peek (220) reported that a teacher's perception of his or her own classroom behavior and actual measurements of the teacher's verbal classroom behavior were not in agreement except for the area of praising and encouraging students. Perceived behavior was measured by administering a self-analysis questionnaire to 52 elementary and secondary school teachers. Classroom behavior was coded using the FSIA.

An investigation by Crockett (73) revealed that teacher and student teacher perceptions of what constitutes preferred teaching behavior in selected science teaching situations were not significantly related to a measure of their verbal classroom influence. Correlations were computed between the scores of 17 upper elementary school teachers and 18 student teachers on the Science Survey Instrument and their I/D ratios as derived from observations with the FSIA.

The Verbal Behavior Q Sort was developed and used by Molchen (190) to measure changes in the intentions, role perceptions and self-perceptions of 25 science interns and apprentices in the Harvard MAT Program. Changes in classroom behavior were assessed with the FSIA. After analyzing the two sets of variables, Molchen reported that the perceptions and intentions between science interns and apprentices were significantly different and that changes in perceptions and intentions of science student teachers were accompanied by corresponding changes in their verbal classroom behavior.

One portion of an investigation by Collea (65) was concerned with relationships between changes in intentions role perceptions and self-perceptions of 25 first year science teachers and changes in their verbal classroom behavior. Changes were determined by observing classroom behavior with the FSIA and by administering the Verbal Behavior Q Sort during the *first and last month of the school year.* Correlational analysis revealed that only changes in Category 10, Silence or Confusion, were significantly related (r = 0.55) to changes in intentions, role perceptions and self-perceptions.

Summary

Sixty-three investigations were identified in which attempts were made to find relationships between classroom behavior, the dependent variable, and various independent variables such as teacher background and experience, attitude, personality, perception of self and perception of what constitutes preferred teaching. Twenty-six of these investigations [Blosser (28), Perkes (222), Kochendorfer (155), Molchen (190), Rogers (241), Ashley (13), Giese (110), Spangenberg (273), Bruce (47), Brewington (37), Cignetti (60), Sagness (255), Ost (213), Kleinman (154), Sharp (266), Bird (25), Brown (46), Butts and Raun (51), Collea (65), Crockett (73), Eccles (80), Evans (85), George and Nelson (108), Hovsepian (131), Jones and Blankenship (143), and James (137)] focused on science classroom behavior. The overall results of the science investigations and the investigations involving other subject areas strongly supported the position that the identified independent variables were not reliable predictors of classroom behavior as measured by systematic observation.

Eight science investigations [Kochendorfer (155), Hovsepian (131), Ost (231), Jones and Blankenship (143), Sagness (255), Brown (46), Brewington (37), and Cignetti (60)] used student perception of classroom behavior and/or activity as the dependent variable. The overall results of these investigations suggested that student perception of classroom behavior and/or activity was significantly related to teacher or student teacher attitude as measured by the Blankenship Attitude Inventory, Pupil Control Ideology Form and Cultural Attitude Inventory.

Discussion

The use of systematic observation or student perception of classroom behavior in research on teaching was identified in 305 investigations. The investigations were described in approximately 376 documents and included most academic areas as well as the college, secondary and elementary school levels. One hundred eleven were devoted exclusively to research on

science teaching. The investigations were categorized and reviewed in three sections depending on the nature of the independent and dependent variables (see Table I). The sections included Teacher Effectiveness, Training Research and Relationships. The following were among the conclusions that were reached as a result of the review of both the science investigations and the investigations involving science and/or other subject areas.

1. Variations in teacher classroom behavior did not have a consistent effect on effectiveness criteria such as teacher ratings and measures of student achievement, attitude, creativity, interest, self-concept and classroom behavior.

2. Providing teachers with training in one of the systems for systematic observation of classroom behavior generally resulted in changes in classroom behavior, and the direction of the change was toward the positive categories of the system used in the training program.

3. The influence of inservice training in one of the "New Science" programs or the use of the material from one of these programs on classroom behavior was inconsistent at the secondary school level.

4. Inservice programs involving one or more of the "New Science" programs or the use of the program materials at the elementary school level generally resulted in an increase in student activity accompanied by an increase in teacher procedural statements.

5. Inservice training programs, other than those involving one of the "New Science" programs, were reported as being effective change agents, but the diverse content of the programs and the use of different observational instruments severely limited the comparisons that could be made among the investigations.

6. Microteaching by itself or in combination with filmed illustrations, videotaped models, role playing and self-evaluation was found to be effective in changing teacher classroom behaviors which were predetermined, operationally defined and practiced in a microteaching format.

7. Classroom behaviors acquired during microteaching or micro-simulated teaching sessions were generally not found to transfer into actual classroom situations.

8. Selected on-campus activities such as microteaching, viewing kinescopes of various teaching strategies, using audiovisual materials and/or learning about group dynamics and set induction theory were shown to be just as, or more, effective in changing teacher verbal classroom behavior as on-site observations, participations and seminar activities.

9. Miscellaneous instructional strategies such as internships, experimental preservice training programs, group counseling, and responsiveness training were not particularly effective in modifying selected aspects of classroom behavior.

10. Student teacher verbal classroom behavior often changed as a result of the student teaching experience, but the direction of change was not predictable.

11. The results of research involving the influence of the cooperating teacher on student teacher verbal classroom behavior were inconsistent and contradictory.

12. The classroom behavior of a teacher was shown to change depending on the teacher's perception or expectation of the student with whom he or she was interacting; the changes reflected that the teacher's perception of students served as self-fulfilling prophecies.

13. Students were found to be major factors in determining classroom behavior patterns.

14. Varying the organizational patterns within or among schools through the establishment of a middle school or changing from a self-contained classroom to a team teaching situation was not accompanied by significant changes in teacher verbal classroom behavior.

15. Teachers in advantaged or outer-city classrooms tended to use more cognitive and less procedural interactions, allow more student-initiated talk and be more supportive than teachers in disadvantaged or inner-city classrooms.

16. Student feedback, written, spoken or used in supervisory conferences, was not an effective means of changing teacher classroom behavior.

17. The results of research involving the use of verbal and/or written feedback from the systematic observation of teaching situations in attempts to influence classroom behavior were inconclusive.

18. Videotaped and audiotaped feedback, individually or in combination, were not effective in changing teacher verbal classroom behavior.

19. Supervisory conference feedback by itself was not an effective means of altering teacher classroom behavior.

20. Supervisory conferences plus videotaped feedback were found to be effective change agents for selected aspects of classroom behavior; teachers allowed a greater proportion of student talk and/or became more inductive-indirect in their classroom behavior as a result of the feedback sessions.

21. Independent variables such as teacher experience, background, attitude, personality, and perception of self or perception of what constitutes preferred teaching behavior were not consistent predictors of classroom behavior as measured by systematic observation.

This list of conclusions was drawn jointly from the science investigations and the investigations involving science and/or other subject areas. There was general agreement between the science and non-science investigations regarding the conclusions except in four instances.

First, only two science investigations [Jackson (135) and Petit (225)] included the training of teachers and measuring the effects of the changes in teacher behavior on student outcomes. Both investigators reported significant relationships between the changes and student achievement. None of the similar non-science investigations [Torbet (288), Gunnison (115), Carline (56), Davidson (75), Millett (187), Rogers and Davis (242), and Jones (141)] found significant relationships between changes in teacher behavior and student achievement.

Secondly, in the Training Research Section there was a lack of, or no, science investigations whose independent variables were on-campus versus on-site activities, teacher expectations of students, team teaching, establishment of a middle school, student feedback, videotaped feedback, audiotaped feedback, and supervisory conference plus videotaped feedback. Therefore, the conclusions regarding these variables were limited to the non-science investigations.

Thirdly, the overall results of eight science investigations [Kochen-dorfer (155), Hovsepian (131), Ost (231), Jones and Blankenship (143), Sagness (255), Brown (46), Brewington (37), and Cignetti (60)] suggested that significant relationships did exist between student perception of classroom behavior and selected measures of teacher or student teacher attitude. Similar investigations were not conducted in the non-science areas.

In reviewing both the science and non-science investigations, a number of limitations and practices were identified which questioned the general-izability of some of the studies and/or the validity of their reported results. These practices are pointed out in the following paragraphs. The intent is not to criticize but to provide a list of questionable prac-tices that should be avoided in future research on teaching involving the systematic observation of classroom behavior.

Four examples of questionable practices were especially noticeable in the Training Research Section, although these practices were not confined solely to that section. First, classroom behaviors were often compared without the subject matter or teaching procedures being described or con-trolled. Such a practice, coupled with extremely small numbers of obser-vations and lengths of observation periods, cannot be assumed to result in a comparison of representative samples of classroom behavior. Regard-less of the treatment, it should not be surprising to find significant differences in classroom behavior when comparing liberal arts and science lessons, teacher demonstrations and laboratory activities and/or inadequate samples of classroom behavior. Second, questions were frequently classi-fied into cognitive category systems without controlling the lesson materials. Bloom (26) and Gall (103) have pointed out that questions may be classified as being at high cognitive levels when in reality they are recall questions. The answers may have been in the textbook, or they may have been provided by the teacher at an earlier date. Third, the FSIA was used to measure something it was not designed to measure, i.e., the behavior in activity-oriented science classrooms. Fourth, multiple treat-ments were frequently applied to the experimental group. When significant

changes in classroom behavior occurred, any one variable or combination thereof may have caused the change. As a result, the generalizability of the findings was jeopardized.

Another practice that severely limited the generalizability of the findings was measuring changes in tea hing behavior only under simulated conditions. Finding changes in behavior under simulated conditions is no assurance that they will transfer to the classroom. In fact, the existing research strongly supports the position that teaching skills learned during microteaching and microsimulated teaching sessions are not retained and transferred into actual classroom situations.

In several of the investigations involving training in one of the observational systems, the researcher failed to mention whether or not the training involved bias toward specific behaviors. Unless this variable is described and controlled, replication and comparison with other investigations becomes difficult if not impossible.

Additional examples of the more common questionable practices identified in the research documents follow: (1) limiting sample size to one or two teachers; (2) failing to control or adjust for initial teacher and student ability, knowledge or motivation; (3) neglecting to provide a rationale for the selection and use of specific observational instruments and techniques; (4) comparing supposedly contrasting teaching styles without providing interaction or observational data; (5) subjecting students to inappropriate curriculum materials; (6) disregarding whether or not a discrepancy was evoked between a teacher's perceived and actual classroom behavior; (7) restricting teacher behavior to verbal behavior while ignoring teachers' gestures, use of silence, tone and inflection of voice, facial expressions and spacial relationships with students; (8) failing to properly identify and describe the observational and criterion instruments; (9) disregarding variables such as curriculum materials and classroom facilities; (10) selecting teacher ratings as the criterion of effectiveness; (11) failing to describe the nature of feedback and no-feedback sessions; and (12) incorrectly using students instead of classes as the units of statistical analysis.

Several recommendations for future research and practice were identified as a result of analyzing the investigations. The following discussion focuses on 19 of these recommendations. Some of the recommendations refer specifically to the previous list of questionable practices while others add to that list. The order in which they are presented suggests no hierarchial arrangement. If the recommendations are implemented, future research on teaching involving the systematic observation of classroom behavior may be improved.

Recommendations

The first recommendation is related to the relevance of criterion measures. Researchers should have some assurance that teachers, who participate in teacher effectiveness research, know what the criterion instruments purport to measure and agree upon these measurements as legitimate objectives of their teaching. Unless the objectives are understood

and agreed upon by teachers, it does not seem reasonable to use measures of these objectives as the basis for comparing their teaching styles.

The second recommendation concerns the restrictive nature of observational systems which are limited to verbal classroom behavior. Researchers should not consider the results of applying these systems to classroom and laboratory situations as a complete description of teacher-student interaction. These systems should be expanded to include nonverbal behaviors, i.e., facial expressions, gestures, use of silence, tone and inflection of voice, gestures and spacial relationships, if they are to provide adequate descriptions of classroom interaction.

Galloway (106), Parakh (216), Evans (86) and Balzer (16) have shown that a considerable portion of teacher classroom behavior was nonverbal. Mehrabian, et al. (182), (183) have pointed out the importance of facial expressions and tone of voice in communicating attitudes and interpreting messages. Rosenshine (243) suggested in a review on enthusiastic teaching that selected nonverbal behaviors were related to student achievement. In spite of these findings, most of the investigations utilizing systematic observation of classroom behavior have ignored nonverbal classroom behavior. Thus, the third recommendation is for researchers to direct their attention toward this facet of classroom behavior, including an examination of relationships between teacher nonverbal behavior and student learning and attitude.

The fourth recommendation is that researchers apply more than one category system to the same teaching-learning situations. This could be accomplished by means of cooperative research efforts and the use of videotape recordings. Classroom behavior is so complex that a satisfactory description may never be obtained from the use of any one system. In addition, very little is known about the relationship among the various systems for systematically observing classroom behavior.

The next three recommendations are related to the fact that a majority of research on teaching has been accomplished by doctoral candidates. If research should continue to be relinquished to doctoral candidates, then, cooperative programs should be established within and among institutions granting doctoral degrees, and replication of previous investigations should be accepted as doctoral theses. A further recommendation is for institutions to concentrate their research efforts on one or two major areas instead of dabbling in many areas. Implementing these recommendations would provide the opportunity for the following situations to become a reality: (1) the initiation of coordinated longitudinal studies of teacher effectiveness, (2) a reduction in the present level of duplicated effort, (3) the establishment of videotaped libraries of teaching-learning situations, (4) a reduction in the number of investigator-designed instruments that are used only once, (5) an increase in the number of research advisers who have depth in the area being researched, (6) the establishment of centralized computer storage and retrieval systems for classroom behavior and effectiveness data and (7) the opportunity to analyze data from duplicated investigations.

The investigations involving classroom questioning behavior and an earlier review by Gall (103) revealed that three areas have been given little or no attention. They include the following: (1) sequential nature

of teacher questions; (2) question types such as those that stimulate curosity, guide students through a particular learning sequence, create a discussion atmosphere or cue students in an attempt to improve a weak response; and (3) the correctness and quality of student responses to teacher questions. The eighth recommendation is that researchers examine these three aspects of classroom behavior and their relationships to student learning.

The ninth recommendation is for additional research to be directed toward a determination of the minimum number and length of observations necessary for obtaining a representative sample of a teacher's classroom behavior. Investigations by Wells (298), Kranz (159), Armstrong, et al. (12) and Gallaher (105) examined this problem with respect to the use of the FSIA, but the results were inconsistent. Rosenshine (247) reported that one or two observations appeared sufficient for obtaining a representative sample of a teacher's affective classroom behavior, but a considerably larger number of observations would be required for obtaining a representative sample of a teacher's cognitive classroom behavior. Until guidelines are empirically established through additional research, investigators will continue to arbitrarily use as little as one or two five-minute observations and report the data as being representative of a teacher's classroom behavior.

Several of the investigations in this review were judged to be of questionable value, because the reports were inadequate and/or incomplete. When descriptions are vague and data are omitted, studies cannot be properly interpreted. Replication also becomes difficult. Therefore, the tenth recommendation is that researchers report their investigations in a more accurate and complete manner.

Discrepancies sometimes exist between reviews of identical research, e.g., Campbell and Barnes (54) and Rosenshine (244). The exact reasons for these discrepancies are not readily discernible but they may be related to the large amount of time and energy involved in securing and analyzing original research documents. Some reviewers rely on abstracts and short articles, because original research documents are difficult to obtain. Critical details are commonly omitted from abstracts and short articles, and their omission could result in misinterpretations of research. The eleventh recommendation is a possible way to alleviate some of the discrepancies which result from using abstracts and short articles for reviewing research. That is, comprehensive reviews of original research documents should be acceptable as doctoral dissertations. Both Gage (101) and Rosenshine (244) have indicated the need for such reviews. In-depth studies of original research documents, using a variety of approaches, could result in major contributions to educational research and practice.

The twelfth recommendation is related to research that is designed to contrast different teaching styles such as indirect versus direct or teacher-centered versus student-centered. Researchers should be certain that teachers exhibit these contrasting styles before they are included in the investigation. The analysis of these behaviors should be made in each type of teaching activity, and the observation data for each teacher should accompany the description of the teaching style. These procedures

would reduce problems associated with role playing or by ranking and selecting upper and lower ranks of teachers from a limited sample. Research by Carline (56), Gunnison (115), Snider (268), Lauren (165), Campbell (53) are examples where contrasting teaching styles were not assured through training, role playing or by ranking and selecting upper and lower ranks of a limited number of teachers.

The thirteenth recommendation is that researchers report the method they used for calculating various interaction indices even though they believe that the calculations are generally understood. The reason for this recommendation is illustrated by Flanders' I/D ratio. An early publication by Amidon and Flanders (6), described the I/D ratio as the ratio of indirect (Categories 1+2+3+4) to direct teacher talk (Categories 5+6+7). In a later publication by Amidon and Flanders (7) the I/D ratio was defined as the ratio of indirect (Categories 1+2+3+4) to direct teacher talk (Categories 1+2+3+4+5+6+7). The ratios are obviously not the same. The later calculation is usually described as the I/I+D ratio, but when a researcher reports an I/D ratio without the accompanying computations, the reader cannot be certain whether it is really an I/D or I/I+D ratio. In this review, a differentiation was made between the two ratios when it could be determined from the research document. No doubt some of the reported I/D were actually I/I+D ratios as a result of the researcher failing to include the calculations or, perhaps, as a result of some editor attempting to save space.

A two-variable research paradigm was used by a majority of the researchers who investigated teacher effectiveness. Efforts were made to identify relationships between classroom behavior and student outcomes. Classroom behavior was the independent variable and student outcomes were the dependent variables. Other variables, such as class size, time of day, amount of individual consultation, distraction by jobs, extracurricular activities, time spent in study, aptitude, motivation and personality, were ignored or theoretically controlled by means of sampling techniques and/or statistical treatments. The results of using a two-variable paradigm to research teacher effectiveness have largely been fruitless and suggest the fourteenth recommendation. Researchers should create new paradigms for research on teacher effectiveness which include classroom behavior, teacher, environmental, pupil and criterion variables.

The fifteenth recommendation is aimed specifically at a consideration of individual differences. Researchers should investigate the effects of teacher-student interaction on differentiated rather than on heterogeneous groups of students; i.e., interaction of treatment and learner variables should be examined. This recommendation is based on the assumption that there is not one best way to teaching anything to all students. For example, treatment A may be more effective than B for certain students, and treatment B may be more effective than A for other individual students. If the assumption is true, it would be more productive to investigate the relationships in the example rather than trying to determine the effects of treatment A versus B on a heterogeneous group of students. Snow and Gavriel (269) have suggested that one of the reasons we know so little about teacher effectiveness is that most of the accumulated evidence applied to some generalized "average student" and, thus, to no one.

The previous recommendation also applies to training research. Researchers should examine the effects of specific treatments on differentiated rather than on heterogeneous groups of teachers. The investigations in the Training Research Section revealed numerous examples where a particular treatment was accompanied by one or more teachers changing their classroom behavior while the same treatment had no apparent effect on the classroom behavior of other teachers within the same study.

The four concluding recommendations were suggested by Rosenshine (245), (248) and Rosenshine and Furst (246) in a review on teacher performance criteria or by means of a personal communication. Three of the recommendations follow: (1) researchers should subject their behavioral and effectiveness data to more than one type of statistical analysis and should not limit themselves to any given level of statistical significance, especially if their purpose is to identify promising variables for future experimental investigations; (2) funding should be made available for research on teaching commensurate with the amount made available for implementing model teacher education programs; and (3) teachers should be trained to exhibit behaviors which are considered to be important but are seldom observed in typical teaching-learning situations, and once the behaviors are exhibited, their relationship to student gains should be investigated.

The final recommendation is related to decreases in student attitude scores. Investigations involving student attitude often report that the scores were significantly higher for the treatment than for the control group, but in actuality, both groups showed losses. In other words, student attitude scores in the treatment decreased significantly less than they did in the control group. Such results point out the need for more research on student attitude and the relationships between teacher behavior and student attitude scores. Rosenshine suggested that it would be interesting for future investigations to include pre and post measures of student attitude of students who have not received instruction in the subject area being considered.

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A REVIEW OF RESEARCH RELATED TO TEACHER BEHAVIOR

IN CLASSROOMS OTHER THAN SCIENCE

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INTRODUCTION

The third section of this monograph deals with teacher behavior studies
in fields other than science education. The literature search for this
section was confined primarily to documents reported in Research in Education,
Current Index to Journals in Education, the monthly volumes of Dissertation
Abstracts, for the period of June, 1970-June, 1972, and reports of teacher
behavior studies presented at national meetings such as those of the American
Educational Research Association. Research in Education and Current Index
to Journals in Education are monthly publications in which documents processed
by the various Educational Resources Information Centers are announced.

The literature search was confined to a ten year period, 1960-1970, for
ERIC materials. The original intent of the search was to review Dissertation
Abstracts for this same time period. However, a review of two years of
Dissertation Abstracts, (June 1970-June 1972)* resulted in the identification
of over 200 studies concerned with teacher behavior. The assumption was
made that these studies are representative of doctoral dissertations focusing
on teacher behavior. No attempt was made to survey the ten year period for
all doctoral studies on teacher behavior reported in Dissertation Abstracts.
However, "landmark studies" such as those of Flanders, Bellack and others
were included in the literature survey although some of these investigations
were completed prior to 1960.

Types of Studies

Over 500 studies were reviewed for this section of the monograph. These
studies have been divided into nine areas: (1) selected landmark studies,
(2) descriptive reports of classroom interaction, (3) behavior change studies,
(4) studies of teacher behavior as revealed in or influenced by personality

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*This period was chosen because there is a time lag from the completion of
a dissertation until its announcement via inclusion in Dissertation Abstracts.
Similarly, papers presented at professional meetings may bear a 1971 or 1972
date but the inference was made that the work was completed some time prior
to the meeting rather than immediately preceding it.

characteristics or by attitudes, (5) studies of teacher behavior as perceived by students or reflected in student behavior (including achievement), (6) reports of instrument development, (7) papers in which problems related to coding and/or analysis of behavior are described, (8) reports of courses developed for the modification of teacher behavior and position papers relative to teacher behavior research, and (9) literature reviews. Table I contains the number of documents in each of these areas.

TABLE I

DOCUMENTS REVIEWED

DOCUMENT TYPE	NUMBER
Landmark Studies	9
Descriptive Reports	98
Behavior Change	167
Personality, Attitudes	82
Teacher Behavior/Student Behavior	9
Instrument Development	82
Coding, Analysis Problems	27
Papers, Reviews	46
Total Reviewed	520

A discussion of each of the studies in each of the areas listed above would be an unrealistic objective. Instead, studies considered representative of those in a particular area or those in which a different approach to the problem of analyzing teacher behavior had been attempted will be discussed. The remainder of the studies will be included in the bibliography at the end of this section of the monograph.

Figure 1

LANDMARK STUDIES IN THE OBSERVATION AND

INVESTIGATION OF TEACHER BEHAVIOR

INVESTIGATOR	FOCUS OF INVESTIGATION
Barr (1920's, 1940-60's)	To identify criteria for teacher effectiveness
Anderson, H. H. et al. (1945-46)	To study classroom climate via teacher-pupil contacts
Withall (1940-50's)	To assess the socio-emotional climate in a learning situation
Morsh & Wilder (1954)	To identify and review studies, completed from 1900-1952, concerned with teaching effectiveness
Flanders (1950's -)	To obtain a greater understanding of the teacher's role in the classroom, the control the teacher provides while teaching, and patterns of influence teachers use in classroom management
Hughes (1959)	To study the feasibility of and to formulate a method for rating teachers (so that effective teachers could be rewarded through merit pay)
Ryans (1960)	To gather information on significant teacher characteristics and to develop objective measures for use in evaluation and prediction of teacher behavior
Bellack (1960's)	To describe patterned processes of verbal interaction that characterize classrooms in operation; to study linguistic variables of classroom discourse in relation to subsequent pupil learning
Smith & Meux (1962)	To attempt to divide verbal teaching behavior into pedagogically significant units; to analyze these units in logically meaningful ways

Landmark studies are defined as consisting of those investigations in which attempts have been made to develop systematic research in areas not previously studied and/or which have served as models for subsequent research. Just as a landmark is some prominent feature of the terrain of which it is a part, certain studies or groups of studies stand out in the area of teacher behavior research.

Barr, A. S. The quest for the identification of criteria for teacher effectiveness has resulted in numerous studies. Some of these deserve the landmark classification. One of the pioneers in the area of teacher effectiveness was A. S. Barr (20) who, with the help of numerous graduate students, produced a series of reports on the measurement and prediction of teacher effectiveness. Beginning in 1920, when he was assistant director in charge of supervision in the Detroit Public Schools, Barr attempted to make observation of teachers and teaching more objective than subjective. After a series of investigations over a six year period, Barr concluded that (1) simultaneous observation of a teacher did not result in the same assessment of the teaching observed, (2) specific teacher behaviors alone did not distinguish between good and poor teachers, and (3) observation could be made more objective if teacher and pupil behaviors as well as operational definitions of personal and professional prerequisites were used (20:ii).

Barr continued his studies of teacher effectiveness from 1940-1960 and, as a college professor, enlisted the help of graduate students in his work. A volume published in 1960 (20) contains summaries of 75 doctoral dissertations focused on teacher effectiveness. Barr's discussion, in Chapter 12, of teacher effectiveness and its correlates not only provides a summary of the major findings of the investigations but also presents an overview of the problems associated with assessing teacher effectiveness which still has validity for today's researchers.

Barr emphasized the criterion of teacher effectiveness needs to be clarified. In order to accomplish this, other problems (which Barr termed "sub-issues") need to be solved: an acceptable theory of the nature and structure of teaching ability has to be formulated and tested, using data-gathering devices. Additional problems stem from the facts that some investigators use a carefully controlled model in their studies of teacher effectiveness while others use uncontrolled natural events models, with little or no attempt to integrate the two models. Differences arise because various criteria and approaches to the evaluation of teacher effectiveness are used, as well as different vocabularies. Many of the studies are undertaken by doctoral candidates and never go beyond exploratory stages. Once the doctoral degree is obtained, the research is not continued.

No group efforts comparable to the studies of Barr and his students were identified in the 1960-1970 period, although Rosenshine has reported on studies in which teacher behavior was investigated in relation to student achievement. His book (304), containing a summary of the results of more than 50 studies, will be described in the portion of this Section which is devoted to literature reviews.

Hughes, M. Work reflecting the influence of Barr was begun in 1955 in a Utah school district which was cooperating with the Utah State Committee on Merit Rating of Teachers (25:25). The study was funded to determine the feasibility of and the formation of a method of rating teachers.

The researchers decided their first task was to describe teaching objectively as it was carried out in the classroom. A pilot study involving six individuals judged as good teachers preceded the major investigation. Participants in the major investigation were 35 teachers in one school. Twenty-five of these teachers had been judged as good and the remaining ten as representative. Data from pilot and major studies were combined for the final analysis.

Basic data, called specimen records, were obtained through stenographic recordings by two observers in the classroom. The observers compared their recordings and retained only that information about which both could agree. Records for the 35 teachers in the major study were collected for three 30 minute periods for each teacher. These records were analyzed using an instrument entitled "The University of Utah Revision of the Provo Code for the Analysis of Teaching."

The development of this instrument was also influenced by the work of Barr who had written that teacher effectiveness might be essentially a relationship between individuals concerned with the teaching-learning process. If this were true, Hughes reasoned that the content of instruction was always mediated through the teacher and that the focus of investigation should be on the interaction of teacher and pupil.

Hughes and her colleagues viewed the classroom as an involuntary group with goals roughly determined by the objectives of education (25:27). They defined teaching as interaction of the mutual or reciprocal action type. Although, in their frame of reference, teaching cannot be separated from the learner, the teaching relationship is a superior-subordinate one. Thus, the concept of teacher power influenced the development of the Provo Code.

A second influence was the concept of teacher responsiveness. Although the learner is assumed to be an active participant rather than a passive one, student influence can be known only through the teacher's response to what the student says and does (25:29).

Using these concepts of teacher power and teacher responsiveness, the specimen records were analyzed and the instrument developed. The unit of teacher behavior used was the function performed for the student or group of students toward whom the teacher was directing his influence. Thirty-one teaching functions were identified. These were grouped into seven categories: controlling, imposition, facilitating, content development, response, positive affectivity, and negative affectivity (137:9).

Hughes found that the teachers' most pervasive and frequent function was in the category of control. In over two-thirds of the 129 specimen records, more than 40 per cent of all teaching acts fell into the control category. Teachers also used the function of negative affectivity to

control their classes. Teachers rarely expanded student ideas or acted as resource persons for students. Few functions of personal response were coded, although teachers were generally more positive than negative with children (137:9). Few teachers evaluated with discrimination. Evaluation seldom went beyond "good" or "O.K.," which are more approval or reinforcement than evaluation. Children were not, therefore, helped to develop finer discrimination or standards of work (25:33,35).

Although the Code categories would assume a wide range of behaviors open to teachers, Hughes found that teachers actually used a narrow range of behavior which might be used to infer a classroom program that is also narrow and repetitive. The greatest range of behavior was found during the work or activity period and the narrowest range, during reading and arithmetic periods. Differences among teachers were contributed by relatively few individuals.

Few attempts were made to elaborate on the content under discussion. Student questions and personal experiences were most frequently rebuffed or ignored. Teachers made little attempt to build generalizations, to ask for comparisons, to look at alternatives, or to look at consequences. They seldom demonstrated or stimulated the use of the processes of analysis and synthesis (25:34-35).

If one remembers the fact that the data secured in Hughes's study came from observations in the classrooms of 31 (of 41) teachers judged to be good teachers, the identification of effective teaching would seem to be an area in need of further research. An additional, related but possibly more complicated problem is that of designing pre-service and in-service programs so that teachers judged as "good" merit descriptions that are more favorable than those contained in Hughes's study.

Morsh and Wilder. Six years prior to the ten year period emphasized in this monograph, Joseph E. Morsh and Eleanor W. Wilder produced a research bulletin for the Air Force Personnel and Training Research Center in San Antonio, Texas, in which they reviewed studies completed during the years 1900-1952 and concerned with teaching effectiveness (246). A working bibliography of over 900 references had been assembled as a part of a project for "The Identification of the Characteristics and Teaching Procedures of Successful Technical School Instructor." Morsh and Wilder abstracted 360 of the 900 references for inclusion in their review. They grouped the studies into those concerned with instructor effectiveness according to ratings (by administrators, by peers, by students, by self) and those concerned with predictors of effectiveness.

Twenty predictors of effectiveness were identified: intelligence, education, scholarship (grades), age and experience, knowledge of subject matter, professional information, extracurricular activities, general culture, socioeconomic status, sex, marital status, teaching aptitude, teaching attitude, interest in teaching, voice and speech characteristics, use of the photograph, statistical analyses of instructor abilities, opinion studies of instructor personality characteristics, causes of teacher failure, and personality tests (246:2-7).

Morsh and Wilder reported the following findings about rating studies. Methods for identifying significant items to be used in setting up instructor rating devices needed improvement. No general agreement existed concerning the essential characteristics of a competent teacher. Nor was there consistency concerning the traits a supervisor should observe and evaluate.

Administrative ratings did not produce very high correlations with measures of student gain. Ratings made by the same person appeared contaminated by a halo effect and, in many such instances, a single rating of overall effectiveness was as useful as an evaluation based on a composite of a number of ratings of separate traits. Peer ratings were found to be little used in the studies included in the survey. However, the use of student ratings of instructor effectiveness appeared to be increasing. Again, the halo effect was found when students rated instructors on several traits. Factors such as class size, student sex, age, maturity, and intelligence had little bearing on student ratings. Self-ratings showed negligible relationship with administrative ratings, student ratings, or measures of student gains.

Morsh and Wilder felt that systematic observation techniques to determine differences in performance of effective and ineffective instructors had been largely neglected in research. No single, specific, observable teacher act was identified for which the frequency was invariably significantly correlated with student achievement. A factor analysis of several instructor and student behaviors resulted in the identification of three factors: (a) understanding, friendliness, and responsiveness of the instructor; (b) systematic and responsible instructor behavior; and (c) the instructor's stimulating and original behavior (246:4).

The two reviewers concluded that residual student gain (the difference between actual gain and predicted gain) was becoming the most widely used of several methods for measuring student change and judged this criterion to be one of the best thus far. There was extreme variability in the relationship of the student-gains criterion with other criteria used to indicate instructor ability, however.

Mixed results were found when predictors of teacher effectiveness were considered. The situation investigated appeared to determine whether or not intelligence was an important variable in the success of the instructor. Intelligence appeared to be of little value as a single predictor. The education of a teacher, in terms of courses or credit hours, was unimportant in discriminating between good and poor teachers.

Morsh and Wilder reported that no investigator had shown that the attainment of a particular standing in high school or college or the mastery of any single course or group of courses was essential to teaching competence, although the grades a student earned in student teaching could be predicted, to some extent, by the grades obtained in college. However, positive correlation coefficients probably reflected primarily the relationship of general intelligence to both academic and teaching success.

When surveying studies concerned with effectiveness relative to age and experience, Morsh and Wilder found that a teacher's rated effectiveness increased at first rather rapidly as he gained experience and then more slowly

up to five years. Then a leveling process set in, with little change in rated performance for the next 15 to 20 years, usually followed by a decline.

Knowledge of subject matter as related to competence appeared to be, like intelligence, a function of the particular teaching situation studied. Knowledge of professional information appeared to have a slight positive relationship to supervisor's ratings and a negative relationship when such scores were correlated with pupil gain.

In the studies reviewed, there was a low positive relationship between an individual's participation as a student in extracurricular activities and later instructor effectiveness. The relation of scores on the Cooperative General Culture Test and effectiveness differed little from those reported for other subject matter tests. Studies of socio-economic status (measured by devices such as the Sims Socio-Economic Scales) and effectiveness showed little relationship.

Studies of the relative effectiveness of women and men teachers or of married and unmarried teachers revealed no particular differences in effectiveness. Great disparity was found in the results obtained from measures designed to predict teacher ability. Data reviewed either failed to establish the existence of any specific aptitude for teaching with any degree of certainty or indicated that tests used were inappropriate. Studies in which the Yeager Scale was used to measure attitude toward teachers and teaching revealed a small but positive relationship to teacher success measured in terms of pupil gains. When interest in teaching was considered as a predictor of teaching effectiveness, the correlations resulting from the use of several standard interest tests either clustered around zero or were so inconsistent as to render such tests of rather doubtful value as predictors.

The quality of the teacher's voice did not appear to be considered of much importance by administrators, teachers or students. There were some studies in which photographs were used as a predictor of instructor effectiveness but these did not demonstrate that photographs have any predictive value. Factor analysis studies have resulted in the identification of instructor factors such as empathy, mental ability, social adjustment, and others, but these studies were marred by inadequacies of criteria, testing instruments, or the number of cases involved in the samples, according to Morsh and Wilder.

The reviewers categorized opinion studies of instructor personality characteristics as sterile in terms of usability for evaluation or selective purposes. The inability to maintain proper discipline or a lack of cooperation were found to be the chief causes of teacher failure. Results of personality tests showed wide variation when correlated with other measures of effectiveness. Carefully controlled, well-designed studies involving adequate numbers of instructors appeared to be needed if the problem of determining personality patterns of effective teachers was to be solved.

Morsh and Wilder found that the problems of determining criteria for instructor effectiveness were treated with widely varying degrees of research sophistication. They suggested that the major problems of research on criteria might be conceptual or definitional problems rather than methodological problems. Objectives of training programs needed to be defined,

students' achievements of these objectives insofar as they can be measured needed to be ascertained, and the effects of instructors on those achievements isolated (246:122). More objective observation measures were needed. The major problem of ratings was, perhaps, not the justification of their use but the improvement of their accuracy.

Changes in students appeared to constitute the most important component of any criteria of instructor effectiveness (246:119). However, if results are to receive an accurate interpretation, such variables as student aptitude, ability and motivation, the effects of distractions, diverse classroom conditions, cultural differences in different localities, and others must be controlled.

Morsh and Wilder urged that research on predictors of teacher effectiveness involve hypotheses and conceptual frameworks based on the best available psychological and educational theories, and that further research with large numbers of subjects be continued, using carefully controlled, well-designed experiments.

Ryans, David G. In October, 1948, preliminary work was begun for a large scale study which was a research project sponsored by the American Council on Education and supported by money from The Grant Foundation. The major portion of this research project was a six year study dealing with the personal and social characteristics of teachers and involving more than 6,000 teachers in 1,700 schools in 450 school systems. This major study was termed the Teacher Characteristics Study and was directed by David G. Ryans. Over 100 separate research studies were completed during the project. Although many of the sub-studies were reported in various professional journals, data from all facets were assembled and presented in a book entitled Characteristics of Teachers, first published in 1960.

The major emphasis of the Teacher Characteristics Study was to gather information on significant teacher characteristics and to develop objective measures that might be used in the evaluation and prediction of teacher behavior (311:9). This emphasis was focused on three major objectives: (1) to identify and analyze some of the patterns of classroom behavior, attitudes, viewpoints, and intellectual and emotional qualities which may characterize teachers; (2) to develop paper-and-pencil instruments suitable for the estimation of certain patterns of classroom behavior and personal qualities of teachers; and (3) to compare characteristics of various groups of teachers (311:9-10).

Operating on two basic assumptions (teacher behavior is a function of situational factors and characteristics of individual teachers; teacher behavior is observable), Ryans and his staff worked with teachers who voluntarily cooperated in composing the population of the study. In order for a teacher to be a part of the Study's sample, both the teacher and school administrator had to agree to cooperate.

Participation extended from 1948 through 1954, with different teachers being used in the three different phases of the Study (the basic analysis sample, survey sample, special studies sample). Three factors were considered when the sampling was done: the size of the community or school system,

geographic section of the United States, and the salary level of the school system (311:62). Public, private, and parochial schools were involved. The investigators looked at the content areas of English, social studies, mathematics, and science, with foreign language and business education added in later portions of the study. Initially, research in elementary schools was concentrated on grades three and four. In later portions of the study grades one and two as well as grades five and six were included.

Trained observers were used to systematically observe and immediately assess ongoing teacher behavior in the classroom. This observation always had as its goal either verbal or quantitative behavior descriptions (311:73). Because of various problems involved in this direct observation, classroom observations were restricted, to a large extent, to the larger city school systems.

To obtain data via classroom observations of teachers and pupils in natural, nonlaboratory situations, an instrument known as the Classroom Observation Record (COR) was developed. Working from lists of significant teacher behaviors, the investigators developed an assessment blank containing four dimensions of pupil behavior and eighteen of teacher behavior (311:86). Adjectives representing opposite poles of a particular dimension were separated by seven intervals. These adjectives, used to describe teacher and pupil behaviors, were defined in an extensive glossary which is a part of the Classroom Observation Record.

This instrument (COR) or the teacher behavior patterns (X_o, Y_o, Z_o) or their modifications have been used in many subsequent studies of teacher behavior. In the research directed by Ryans, the COR was used to gather data concerning the behavior of the teachers involved in the study. Two observations, made at different times by different observers, became the complete record for a teacher, provided that these assessments did not show substantial discrepancy. If they did differ significantly a third observation and assessment, made by a third independent observer, was made. From the data compiled via direct observations, data from other assessments, and information compiled through reviewing the literature on the organization of human personality and on traits hypothesized as desirable for teachers, three major clusters of observable teacher behaviors were identified. These clusters served as criteria for use in determining correlates of teacher behavior during the study. These clusters were identified as TCS Patterns X_o, Y_o, and Z_o.

TCS Pattern X_o was characterized by understanding, friendly teacher behavior as compared to aloof, egocentric, or restricted behavior. TCS Pattern Y_o was responsible, businesslike, systematic vs. evading, unplanned, slipshod teacher behavior. TCS Pattern Z_o was stimulating, imaginative, surgent or enthusiastic vs. dull, routine teacher behavior (311:77).

In addition to the assessment of overt classroom performance, other aspects of teacher behavior were studied. Teachers' attitudes, educational viewpoints, verbal intelligence, and emotional adjustment were analyzed. Twelve trends relating to these areas of research are highlighted by Ryans in the summarizing chapter of Characteristics of Teachers (311:385-386).

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1. The attitudes of elementary teachers toward pupils, toward administrators, and also toward fellow teachers and non-administrative personnel in the schools were markedly more favorable than were similar attitudes of secondary teachers.

2. The attitudes of teachers who were judged by their principals to be superior in teaching performance were significantly and distinctly more favorable toward pupils, and also toward administrators, than the attitudes of teachers who were judged by their principals to be unsatisfactory or poor.

3. Neither amount of teaching experience nor age appeared to be very highly associated with teacher attitudes, although there was a slight tendency for the attitudes of secondary teachers of greater experience to be slightly more favorable toward administrators and somewhat less favorable toward pupils than other experience groups.

4. More favorable attitudes toward pupils were expressed by women teachers in the secondary school, but among elementary teachers there was a tendency for men to possess more favorable pupil attitudes than did women.

5. Teachers whose observed classroom behavior was judged to be more characteristically warm and understanding (TCS Pattern X_o) and more stimulating (TCS Pattern Z_o) possessed more favorable attitudes toward pupils and also more favorable attitudes toward administrators.

6. Actual pupil behavior in the classroom (based upon observers' assessments) did not appear to be related to the attitudes held by teachers.

7. The educational viewpoints expressed by secondary teachers were of a more traditional or learning-centered nature, while those of elementary teachers leaned more in the direction of permissiveness; within the secondary school, science and mathematics teachers appeared more traditional in their viewpoints and English and social studies teachers more permissive in theirs.

8. Teachers judged to be more warm and understanding in their classroom behavior, and to a somewhat lesser extent, those judged to be more stimulating, expressed more permissive educational viewpoints. Teachers judged to be more business-like and systematic showed a slight tendency toward more traditional viewpoints.

9. The verbal understanding scores obtained by secondary teachers were significantly higher than those of elementary teachers, English and foreign language teachers excelling other subject-matter groups within the secondary school.

10. Men teachers at both the elementary and secondary levels appeared to be markedly more emotionally stable than women teachers.

11. There was a tendency for elementary teachers who were judged to be warm and understanding in classroom behavior, and also those judged to be stimulating in their classes, to manifest superior emotional adjustment.

12. There seemed to be no observable relationship between scores on the validity-of-response scale and the classification of teachers by amount of teaching experience, age, sex, grade or subject taught, or observed classroom behavior.

The Teacher Characteristics Schedule, an omnibus self-report type of inventory, was developed from the various materials used in the Teacher Characteristics Study. The Schedule consists of 300 multiple-choice and checklist items relating to personal preferences, self-judgments, frequently engaged-in activities, biographical data, etc.

The identification of the three major clusters of observable teacher behavior (TCS Patterns X_o, Y_o, Z_o) and the development of the Classroom Observation Record and Teacher Characteristics Schedule fulfilled the accomplishment of two of the three major objectives of the Teacher Characteristics Study. The third objective, that of comparing characteristics of various groups of teachers was also accomplished.

Ryans summarized the comparisons in light of the several personal-social traits measured by the Teacher Characteristics Schedule, using a taxonomic approach and looking at a cross-section of American teachers during the first half of the 1950-1960 decade. The inferences which Ryans drew were based on the mean scores of the groups of variously classified teachers in relation to (1) age, (2) extent of teaching experiences, (3) sex, (4) marital status, (5) professed avocational activities, (6) religious activities, (7) type of undergraduate college attended, (8) academic success, (9) influences affecting choice of teaching, (10) activities during child-hood and adolescence, (11) size of school, (12) size of community, (13) socio-economic status of community in which school was located, and (14) geographic area in which teaching was performed.

Ryans and his staff found significant differences between teachers of different age groups with respect to a number of teacher character-istics. (Forty-five of 60 F tests resulted in differences between means which were significant at or beyond the .05 level.) An important impli-cation appears to be that age must be taken into account as a relevant independent variable whenever teacher characteristics are concerned. However, the approach used in the Teacher Characteristics Study was a cross-sectional one rather than longitudinal and therefore did not supply information to answer the question of whether age differences are dependent primarily on changes in the teacher's characteristics as he or she grows older and gains experience or on cultural influences, especially those of their preservice education programs, which have some common effect upon a given generation of teachers (311:390).

Trends relating to extent of teaching experience did not differ substantially from those identified when teachers were classified according to age.

Male and female elementary school teachers appeared to differ on only four of the personal-social characteristics studied. Although differences between the sexes were often insignificant in the elementary school, they were more obvious when male and female secondary school teachers were compared. Women teachers generally attained significantly higher scores on scales measuring understanding and friendly classroom behavior, stimulating and imaginative classroom behavior, favorable attitudes toward pupils, favorable attitudes toward classroom practice, "permissive" educational viewpoints, and verbal understanding. Men teachers scored significantly higher with respect to emotional stability (311:391).

When secondary teachers were considered by sex and by subject matter area, the differences between the sexes among English-social studies teachers were much like those found among elementary teachers. Two significant trends were noted: women scored higher relative to responsible, systematic classroom control, men scored higher with regard to emotional adjustment. The differences among math-science teachers were similar, with a few exceptions, to those found for the general sample of secondary teachers.

Only a few significant differences were found when marital status was studied for elementary and secondary teachers combined into one large sample. When only elementary teachers were considered, significant differences favored the married group with respect to understanding, friendly classroom behavior; responsible, businesslike classroom behavior; favorable attitude toward pupils; and child-centered educational viewpoints. Among the secondary teacher sample, significant differences in favor of the single teacher group were identified for responsible, businesslike behavior; favorable attitude toward democratic classroom practices; permissive educational viewpoints; and verbal understanding. The married secondary school teacher group achieved superior scores on emotional stability (311:392).

When content field was considered for the secondary school teacher sample, other significant differences were found. Math-science single teachers scored higher than married teachers relative to responsible, businesslike classroom behavior; stimulating classroom behavior; favorable attitude toward democratic classroom practices; and verbal understanding. Again, married teachers scored higher on the emotional stability measure. Among the English-social studies group, married teachers were found to be significantly superior relative to understanding, friendly classroom behavior; favorable attitude toward pupils; and emotional stability. Unmarried English-social studies teachers were superior for responsible, businesslike classroom behavior and for verbal understanding.

When professed avocational activities were considered, teachers who reported that they were actively engaged in outside-teaching interests appeared generally to score relatively high on the characteristics measured. Differences in mean characteristics scores between teachers professing various kinds of religious participation were small, however.

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When characteristics relative to academic preparation and success were considered, no significant differences were found among the secondary school teacher group relative to the kind of college in which undergraduate education was obtained. For elementary teachers, those who had attended large universities scored higher on scales measuring stimulating classroom behavior and child-centered educational viewpoints. For the aspect of academic success, most of the scales yielded F ratios significant at the .05 level. Generally, teachers who reported that they were outstanding students scored higher than those who reported themselves as having been good, average, or poor students.

Teachers who said they entered the profession because of its intellectual nature, because they liked school, or because of the social or public service character of teaching generally scored higher on most of the characteristics than did those who entered the profession due to the advice of relatives or because they considered a teaching career as providing them with a desirable position in their community and favorable prospects for advancement (311:394).

The sample was also analyzed by dividing the teachers into those who had participated in such childhood and adolescent activities as "playing school" and those who had not participated in such activities. Significant t ratios (.05 level) were obtained between the two groups relative to seven behaviors: understanding, friendly classroom behavior; responsible, business-like classroom behavior; stimulating, imaginative classroom behavior; favorable attitude toward pupils; favorable attitudes toward democratic classroom practices; favorable attitudes toward administrative and other school personnel; and permissive (as compared to traditional) educational viewpoints.

The relationships of teacher characteristics to size of school and to size of community were also studied. Teachers in larger schools scored higher (.05 level) for five characteristics: understanding, friendly classroom behavior; stimulating imaginative classroom behavior; favorable attitudes toward administrators and other school personnel; verbal understanding; emotional stability. The trend with regard to the means of teachers classified according to size of community generally followed that for size of school. In addition, teachers from the largest cities (1,000,000 and over) scored relatively low on most characteristics. Their scores were about as low as those of teachers from very small communities. The one exception was the characteristic of verbal understanding (311:396).

Socio-economic community status and geographic area were also considered as variables. In general, the lowest scores relative to understanding, friendly classroom behavior; favorable attitudes toward democratic classroom practices; verbal understanding; and emotional stability as well as the most traditional, learning-centered viewpoints were held by teachers working in communities of average socio-economic level. Ryans found an apparently parabolic relationship between socio-economic level and several teacher characteristics in that higher scores and more permissive educational viewpoints were held by teachers in groups representing both low socio-economic and high socio-economic levels. Teachers in schools in the Middle Atlantic and West Coast states were more child-centered and permissive in their educational viewpoints than were other sectional groups (311:396).

An additional, smaller, study was completed to identify and compare teachers rated as superior and poor. Both elementary and secondary teachers were considered in this analysis. When the two levels were combined, the superior teachers were found to be (1) extremely generous in their appraisals of the behavior and motives of others; (2) strongly interested in reading and literary affairs; (3) interested in music, painting, the arts in general; (4) active in social groups; (5) able to enjoy pupil relationships; (6) involved in nondirective classroom procedures; (7) superior in verbal intelligence; (8) superior with respect to emotional adjustment (311:397-398).

Teachers in the low (poor) group were (1) restrictive and critical in appraisals of others; (2) more likely to prefer activities not involving close personal contacts; (3) less favorable in their opinions of pupils; (4) lower in verbal intelligence; (5) not as well adjusted emotionally; (6) representative of older age groups (311:398).

Ryans, in summarizing the Teacher Characteristics Study, reemphasized that generalizations are appropriate only when the population under consideration is similar to that of the Study, that the participants in the Study were volunteers, that the "conclusions" drawn were really probability estimates rather than statements of invariable relationships, and that the findings were noted in terms of averages for groups of teachers (311:398). These findings, however limited they may be by sampling and instrumentation, have provided a basis for subsequent investigations in the area of teacher behavior. Many investigators have modified the Classroom Observation Record for their own studies and/or have used some of the teacher behavior patterns described by Ryans and his staff.

Anderson, H. H., et al. In the second half of the 1950's, research was conducted that would influence many investigators. Aimed at obtaining a greater understanding of the teacher's role in the classroom, Ned A. Flanders and some colleagues began a series of investigations. Flanders was influenced by the earlier systematic studies of spontaneous pupil and teacher behavior completed by H. H. Anderson and others as well as by the work of Withall on classroom climate. Therefore, the investigations of Anderson and Withall will be discussed in order to provide perspective for that of Flanders.

Anderson and his colleagues, in 1945-1946, used procedures originally devised in nursery schools to study classroom situations in kindergartens and the elementary grades (10, 11, 12). They studied the teacher's techniques of responding to children and identified, and defined, two types of teacher behavior: dominative and integrative.

Anderson and Brewer, in the first of a series of three volumes (10), defined dominative behavior as that characterized by rigidity or inflexibility of purpose, by an inability or an unwillingness to admit the contribution of another's experience, desires, purposes, or judgment in the determining of goals which concern others. In domination the teacher attempts to make the pupils behave according to the teacher's own standards or purposes.

They defined integrative behavior as that in which the teacher makes allowances in his behavior for differences in pupils, in which requests are made meaningful so that pupils voluntarily cooperate, in which the teacher changes his mind when confronted with new evidence which has grown out of the experience of another. They considered integrative behavior to be consistent with the scientific point of view as well as with concepts of growth and learning (10:9).

Using a five-minute observation schedule which they had developed, Anderson and Brewer worked with 32 kindergarten children, the head teacher, and an assistant teacher. The children were enrolled in two sessions of kindergarten. All 32 children were observed for a period of one hour each, and 16 of these children were observed for an additional hour. The observation schedule contained seven child behavior categories. Symbols were used to record behavior in terms of frequency on the child-behavior time-line, noting teacher contacts and social group contacts as they occurred.

In their previous work, Anderson and Brewer had found that children and teachers exhibited dominative and socially integrative behavior. Dominative behavior was more reliably recorded because it represented much more specifically motivated behavior. Now Anderson and Brewer wanted to learn if the behavior of the teacher could be demonstrated to be related to that of the child. They found that the kindergarten teachers they observed had higher mean frequencies of dominative than integrative contacts. They also found that, among the contacts initiated by the teacher, two out of three were dominative while, among teacher contacts which resulted from a child's initiative, six out of seven were integrative. They also found that teachers met aggression with aggression, perpetuating the vicious circle rather than breaking it (10:109-156).

Anderson and his colleagues continued their reporting in volumes II and III of monographs published by the American Psychological Association (11, 12). In volume II, they presented revised categories of teacher contacts as well as correlations which provided evidence that the behavior of teachers was related to the behavior of children. They also showed that the category systems they developed for teacher contacts and for pupil behavior could be used throughout elementary school, including classrooms in which teaching was departmentalized.

Volume III contains the report of Reed's investigation in which she conducted a follow-up study of two second grade teachers, in the same building, who showed a range of large and highly consistent differences in their management of children. Reed studied these teachers a second year, with new groups of children, and also studied the children who were now in third grade. She found that the more dominating teacher was again more dominating, with a new group of children, and that the highly integrative teacher was again highly integrative. She also found that the undesirable behaviors exhibited in second grade did not persist when the children were in the third grade, with new teachers.

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Volume III also contains the report of an additional study concerned with the nature and degree of changes in classroom personalities that occurred as teachers and children worked together over a five month period. Two third-grade teachers with large differences in personality patterns were involved in this study, along with their pupils.

To summarize the information contained in these volumes, Anderson et al. presented evidence that, in a given school, the main direction of influence is from teacher to pupils. Integrative teacher behavior promotes integrative pupil behavior. Dominative teacher behavior primarily provokes conflicts and misunderstandings and also stifles spontaneity and social development in children. Working with a different group of pupils did not appear to significantly alter a teacher's pattern of behavior although working with a different teacher did result in changes in pupil behavior.

Withall. The emphasis in Anderson's work had been on the effects of verbal interaction. Anderson and his colleagues developed an I-D Index which was the ratio of the total number of integrative contacts (I) of a teacher to this total of dominative ones (D). Withall renamed this aspect of teacher influence, calling it the socio-emotional climate of the classroom.

Withall was interested in developing an instrument for use in assessing the social-emotional climate in a learning situation. This assessment was accomplished by means of a categorization of teacher statements and a description of the resultant pattern of statement (379:93). Working with an eighth grade art class in the Laboratory School of the University of Chicago, Withall made daily tape recordings of the verbal interaction. Excerpts from these class sessions were made into typescripts. Withall then proceeded to describe each teacher response in terms of grammatical structure and verbal content, emotional content, and inferred purpose of the teacher.

Using 117 teacher responses, taken in the context of pupils' remarks, Withall identified 25 kinds of teacher statements. He found that these statements did not fall into mutually exclusive categories but after additional analysis and relistening to tapes, Withall developed a seven category instrument for classifying teacher statements.

These seven categories were considered by Withall to comprise a continuum from teacher-centeredness to learner-centeredness. The seven categories are:

1. Learner-supportive statements or questions: the dominant intent of which is to praise, encourage or bolster the learner.

2. Acceptant or clarifying statements or questions: such
    responses are designed to help the learner to gain
    insight into a problem.

3. Problem-structuring statements or questions: these
    offer facts or ideas or opinions to the learner, in a
    non-threatening and objective matter, about phenomena
    or procedures. No element of advising is involved.

4. Neutral statements evincing no supportive intent:
    statements relative to classroom management fall into
    this category as do those in which a teacher merely
    repeats what a student has said or engages in polite
    conversation.

5. Directive statements or questions: these are used to
    advise the learner about a course of action or future
    behavior and restrict his choice of action or provide
    no choice.

6. Reproving, disapproving or disparaging statements or
    questions: these appear to have one, or a combination,
    of three intents. One is to represent to the learner
    societal values as the teacher sees them. A second is
    to admonish the learner for unacceptable behavior and
    to deter him from repetition. The third is to impress
    on the learner the fact that he has not met the teacher's
    criteria for successful achievement.

7. Teacher-supportive statements or questions: such state-
    ments are used to defend, to assert, or to justify the
    teacher (379:96-98).

Withall assumed that his Climate Index measured a basic factor-complex
influencing perceptions, feelings and behaviors and behaviors of the class group. He
compared his L.C.-T.C. ratio with the I.D. ratio of Anderson in an analysis
of typescripts of three randomly selected class sessions. The first two
sessions were indicated by both ratios to be more learner-centered than
teacher-centered. The third session was oppositely indicated. The Climate
Index which is oriented to group work was not so strongly influenced by
teacher contacts with individuals as was Anderson's I.D. ratio. Another,
and more precise, check was provided by an experiment in which the climate
during a class session was varied experimentally. Students had been trained
to push one button whenever they felt "positively" and another button when
they felt "negatively." At the same time a team of observers rated each
teacher statement, using Withall's Climate Index. Statements from type-
scripts of the lessons were also analyzed. Tetrachoric correlations
between climate and each of the three measures were .39, .94, and .68
respectively (379:99). Withall considered a minimum of 50 teacher state-
ments necessary in order to determine classroom climate but that, while
not necessary, 200 teacher statements are more desirable and can be collected
during a single class period in most classrooms.

Flanders. The investigations of Flanders might be considered as second-generation relative to the work of H. H. Anderson, with influences from Anderson to Withall being transmitted to Flanders and his colleagues. Flanders was interested in obtaining a greater understanding of the teacher's role in the classroom, the control the teacher provides while teaching, and the patterns of influence the teacher uses in classroom management.

The theoretical model which Flanders used to understand the interaction analysis data collected was based on a set of social skills used by teachers to control and manage class activities and on the psychology of superior-subordinate relationships adapted to fit classroom conditions (101:2). Flanders studied patterns of teacher influence rather than classroom climate per se. He identified different kinds of verbal statements which teachers used and developed a system of interaction analysis composed of ten categories. Seven categories describe teacher talk, two categorize pupil talk, and the tenth category is used to designate silence or confusion in the classroom.

Flanders considered that a teacher's verbal statements represented some part of a continuum of influence. At one end of the continuum was direct influence which restricts the freedom of action of the student, making him momentarily more dependent on the teacher. At the other end was indirect influence which encourages a student's self-initiation and expands his freedom of action. Flanders held that no teacher employed a pure pattern of influence: direct or indirect, but that all teachers establish some kind of balance based on a combination of direct and indirect influence.

Teacher influence patterns relate to classroom climate. Verbal state-ments classified as "direct influence" focus attention on a problem, inter-ject teacher authority, or both, thus restricting freedom of action. Such statements may involve lecturing, giving directions, criticizing, or justify-ing the teacher's use of authority. Statements categorized as relating to "indirect influence" encourage students to participate verbally and to show initiative, thus expanding freedom of action. When a teacher asks questions, accepts or clarifies the ideas or feelings of a student, or speaks praise or encouragement, he is exhibiting some type of indirect influence.

Flanders was interested in determining the effect of direct and indirect teacher influence on student learning. He hypothesized that (1) indirect teacher influence increases learning when a student's perception of the goal is confused and ambiguous, (2) direct teacher influence increases learning when a student's perception of the goal is clear and acceptable, and (3) direct teacher influence decreases learning when a student's perception of the goal is ambiguous. For his purposes, "learning" was defined to refer to the development of skills and understandings that could be measured by pre- and post-tests of achievement.

Prior to the project concerned with testing the three hypotheses described in the preceding paragraph, Flanders had studied teacher influence and student attitudes in Minnesota and in New Zealand. The Minnesota study was carried out during 1955-1956 and the New Zealand study in 1957. These earlier studies served to develop and refine the procedures of interaction analysis and the design of attitude tests for use in the classroom. During the New Zealand study, the method of tabulating tallies for matrices was developed.

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In the study completed in 1960, Flanders again worked in Minnesota. The 1960 project involved social studies and mathematics teachers selected at random from a population of 13 junior high schools. The content areas were selected because problems in mathematics usually require specific logical steps and have one, and only one, correct answer but, in social studies, problems are considered that involve less rigid logical steps and that have answers that are frequently matters of opinion (101:68).

The teacher-class population selected for study was drawn from a larger sample that had agreed to participate. Eight classes in each subject were selected from the high and low ends of the score distributions of the Minnesota Student Attitude Inventory. Teachers were asked to teach a two-week unit in their content area, using instructional materials supplied by Flanders and his staff. Teacher influence was controlled by measuring the spontaneous interaction patterns of the teachers. Data were tabulated separately for different class formations and purposes. Achievement of students was an outcome variable measured by pre- and post-tests. Trained observers were assigned to spend the first two days and the last few days of every unit in the classrooms of participants. Additional visits were made so that there was a total of six hours of observation in mathematics and ten to twelve hours in social studies for each teacher (101:67-69).

There were significant differences in initial ability between the classes involved in the study. The I.Q. means of the mathematics classes were quite variable. The indirect classes in social studies had a combined mean that was significantly higher than the direct classes. These conditions required a covariance analysis to adjust final scores to compensate for initial differences, and this analysis was carried out. Significant F-ratios were found, providing evidence for rejection of the hypothesis that there were no differences of variation between classes. Adjusted final achievement scores were used, in subsequent analyses, as a basic measure of achievement.

Flanders and his staff found that students in classes identified as indirect achieved more than students in the direct classes in both social studies and mathematics. They also found that, as the influence pattern of the teachers approached a more consistent direct or indirect pattern, the differences in student achievement (in the predicted directions) became larger.

Teachers' use of time and teacher influence were analyzed for the two week unit of study. Flanders found that both direct and indirect teachers varied their use of planning and evaluation similarly. However, planning in indirect classrooms was more indirect and involved those classroom activities classified as expanding student initiative much more frequently than in direct classrooms. Evaluation increased over time, indicating that in both direct and indirect classrooms direct influence increased. Flanders inferred that, in indirect classrooms, there was greater variation of teacher influence. Teachers were initially indirect, shifting to more direct influence as progress toward learning goals occurred. This same variation was not present in the direct classrooms (101:118).

When the data collected were analyzed and the results summarized in terms of the three hypotheses tested, Flanders concluded that significant differences in achievement supported the generalization that the teaching methods he termed "indirect" produced more achievement. The students whose teachers used an above-average proportion of direct influence consistently showed less achievement (101:120). Using these data, Flanders also concluded that he could modify hypothesis one to read "direct influence decreases learning except when goals have initially been clarified and made acceptable by the use of indirect influence" (101:120).

Hypothesis two stated that direct teacher influence increases learning when a student's perception of the goal is clear and acceptable. In the sample studied, the indirect teachers decreased their use of activities that expanded student initiative as learning progressed and increased their use of activities that restricted student initiative, at the same time making adjustments in their own patterns of teacher influence.

Flanders found, relative to hypothesis three, that the verbal influence of the indirect teachers was much more indirect during the initial stages of the unit both compared with their own two week average and with the averages of the direct teachers (101:120).

Flanders had assumed that different types of students would react differently to direct and indirect teacher influence. No differences were found in achievement when dependent prone students were compared with the more independent prone. In addition, students classified by I.Q. scores into top quartile, middle 50 per cent, and bottom quartile did not respond differently to teachers classified as direct and indirect, although one exception was found, in social studies, indicating that high I.Q. students were more sensitive to differences in direct and indirect influence. This finding was not supported in larger samples, however (101:120).

Perhaps the most important finding of Flanders' 1960 study was that students who achieved the most and had significantly higher scores on the revised classroom attitude instrument were in classes exposed to flexible patterns of teacher influence (periods of predominantly direct influence were included along with periods of predominantly indirect influence) (101:121).

Three assumptions were basic to Flanders' approach to studying teacher behavior: (1) acts of influence are expressed primarily through verbal statements, (2) how much teachers talk and what they say determines to a large extent the reactions of students (the teacher is an influential authority figure), (3) teachers can control their verbal participation in the classroom (101:123). These assumptions as well as the 10 category system developed by Flanders have provided a general focus as well as instrumentation for many of the teacher behavior investigations identified in this monograph. For example, even in the limited time period considered in this monograph and based on a search of the literature that was intended to be representative rather than exhaustive, 119 studies involved Flanders' system of interaction analysis (79 studies) or some modification of IA (40 studies).

Bellack. Another landmark study was completed in the first half of the 1960 decade. In this three year study (26) Bellack and his colleagues investigated verbal behavior in the classroom. Teachers and students in seven high schools in the New York area were observed and data recorded as the classes studied a unit on international trade. The major task of Bellack's research was to describe patterned processes of verbal interaction that characterize classrooms in operation and a secondary emphasis was the study of linguistic variables of classroom discourse in relation to subsequent pupil learning. Bellack and his colleagues felt that only as teachers have available for their use knowledge regarding the teaching process which has been gained through research would they be able to exercise control over the teaching process (26:v).

Influenced by Wittgenstein's work on language games, Bellack et al. hypothesized that the role played by the teacher could be adequately described only in relation to the role played by the students and that these roles are influenced by what is spoken about, how much is spoken, when, under what conditions, and with what effect. They were concerned with identifying the pedagogical significance and the content of classroom communications.

Four different pedagogical moves were identified for the system used to categorize classroom discourse: structuring, soliciting, responding, and reacting moves. A structuring move is considered to be one which sets the context for subsequent verbal behavior. It launches some discourse or halts it or excludes interaction. A soliciting move is used to elicit a verbal response, to get attention, or to elicit a physical response. Soliciting moves include questions, commat. ., requests. A responding move occurs only in relation to a soliciting . The fourth move, reacting, serves to modify and/or to rate a prior move but is not directly elicited by a prior move. These moves occur in patterns called "teaching cycles," with each cycle beginning with a structuring move or with a solicitation not preceded with a structuring move (26:4-5, 19).

In addition to the pedagogical moves, Bellack et al. assumed that four functionally different types of meaning are communicated by teachers and students in the classroom. Substantive meanings refer to subject matter, to specific concepts. Substantive-logical meanings deal with the cognitive processes involved in dealing with subject matter. Instructional meanings center around assignments, materials, and classroom procedures. Instructional-logical meanings refer to the didactic verbal processes (positive and negative ratings, explaining procedures, giving directions, etc.) (26:5-6).

Bellack's Content Analysis System is a rather complex one requiring that classroom interaction be tape-recorded for later analysis. Eight potential category types are available for every statement and include the type of speaker, type of pedagogical move, the kind of content, the logical meaning of the content as well as the amount of talk and managerial functions which occur. By defining structuring and soliciting moves as initiatory, and responding and reacting moves as reflexive, Bellack developed 21 possible types of teaching cycles. The first 12 of these are structure-initiated; the next 9, soliciting-initiated. Each of the 21 cycles represents a different pattern of pedagogical moves (26:19).

Bellack's sample consisted of 15 (of a possible 19) classes of 10th and 12th grade students in metropolitan and suburban New York City whose teachers had agreed to participate in the study. The unit of instruction consisted of the first four chapters of a pamphlet on international trade. Four successive class sessions were observed, the discussion tape recorded, and typescripts were made for analysis.

Pre- and post-tests were constructed on the material of the unit. In addition, the students were asked to respond to a seven point attitude scale concerning studying economics, given as a pre- and post-test, and to Thorndike's 40-item vocabulary test designed to measure verbal intelligence.

Bellack and his colleagues found that the 15 teachers did more talking than did the 345 pupils involved in the study. Seven of the teachers spoke 70-75 per cent of the total lines for all sessions and also made the majority of pedagogical moves (26:41-43). The investigators found that teacher and pupil play different but complimentary roles in the classroom game. The teacher dominates in structuring, soliciting, and reacting moves, making approximately 80 per cent of each type, but is responsible for only 12 per cent of the responding moves (26:47). The pupil has a very limited role to play in classroom discussions. He reacts infrequently and solicits and structures even less frequently; his primary job is to respond. Responding by pupils occupied over 65 per cent of the moves and more than 57 per cent of the lines (26:47-48).

Although there were marked differences in substantive material covered in the class sessions observed, the pedagogical moves were similar among the 15 teachers. The greatest differences among teachers occurred relative to the amount of class discussion that was devoted to topics related to the unit they were given to teach.

The largest proportion of classroom discourse was devoted to empirical meanings. Fact stating and explaining made up 50-60 per cent with defining, interpreting, opining and justifying each occurring less than 10 per cent of the discourse (26:85). Forty-six per cent of the teacher's moves were solicitations, with the intended interaction almost always being between teacher and pupil rather than between pupil and pupil (26:129-130). Pupils react twice as frequently to the teacher as they do to other pupils (26:191) and rate other pupils' responses only when the teacher asks them to do so, which is infrequent (26:85). When the teachers in Bellack's sample rated what pupils said or did in the classroom, they were four times more positive than negative in their rating remarks (26:191).

Bellack and his colleagues divided teaching cycles into formally-ordered cycles and temporally-ordered cycles. Markov chains were used to study the temporally-ordered cycles so that it was possible to determine whether one pattern of pedagogical moves tended to influence immediately subsequent patterning (26:204). Using the Markov chain approach, they found that when the prior state was a teacher-initiated cycle, a pupil-initiated cycle followed only 10 per cent of the time. However, if a pupil-initiated cycle was the prior state, a pupil-initiated cycle followed 40 per cent of the time (26:219). Formally-ordered teaching cycles were studied for rate, source, and pattern.

Chapter 9 of <u>The Language of the Classroom</u> is entitled "Rules of the Language Game of Teaching." In this chapter, Bellack describes, in much detail, the general rules of the game as well as the rules for soliciting and responding: for the teacher and for the pupil; for structuring: for both teacher and pupil, for the teacher, for the pupil; for reacting: for both teacher and pupil, for the teacher, for the pupil; and rules for teaching cycles.

The five general rules of the (language) game may be summarized as follows:

1. The basic verbal maneuvers that teachers and pupils make in playing the game are pedagogical moves. Each of the four types of move plays a distinctive role in classroom discourse and each has specific rules governing the actions of the pupils and of the teacher.

2. The teacher is the most active player in the game, making the most moves, speaking most frequently, usually speaking the longest. (Generally, the ratio of teacher speech to speech of all other players is approximately 3 to 1 in terms of lines spoken and 3 to 2 in number of moves made.)

3. If the game is played within the field of economics, the major part of the game is played with substantive meanings specified by the teacher's structuring of the game.

4. Players generally use the empirical mode of thought in dealing with the substantive material under discussion. The analytic mode is used much less frequently, as are evaluative statements.

5. In gauging wins and losses, players should keep in mind that this is not a game in which one player, such as the teacher wins, while another player, such as a pupil, loses. Instead, there are relative degrees of winning and losing. The teacher's winnings are a function of the pupils' performances and the teacher is therefore dependent on his pupils for the degree of success he ultimately achieves in playing the game. (26:238-239)

The eventual aim of the game and the ostensible reason for playing is the pupil's learning of substantive and substantive-logical meanings, usually measured by test performance. If the pupil fails the test, this failure implies that he has not learned and, therefore, the teacher has not taught successfully. However, the teacher typically plays the game with more than one student so that a team point system is used in scoring. The general formula for computing a teacher's final score is determined by a variety of factors and individuals such as administrators, school board members, and the community the school serves (26:239-240).

Bellack pointed out that the rules which define the teaching game are not to be used as a prescriptive guide to teacher behavior but rather as a descriptive model of what actually occurred in the classrooms in the study. Although the Content Analysis System was developed for use in economics classes, it can be, and has been, adapted for use in other subject matter areas. The depicting of the teacher as the most active player in the game should provide a starting point for developing modes of teaching in which such an active role is not required.

Smith and Meux. In 1962 research was reported which emphasized a study of the logic in classroom discourse. A 1970 publication (333) contains a condensation of the preliminary report as well as a more extended logical analysis of classroom discourse. This publication is divided into three parts: (1) material from the preliminary report, (2) a logical analysis of episodic materials identified by procedures described in the first part, and (3) a presentation of problems arising from the entanglement of language, logic, and psychology in the course of instruction, according to the authors, Smith and Meux.

The study was designed to be analytic and descriptive rather than evaluative or experimental. It was an attempt to divide verbal teaching behavior into pedagogically significant units and to analyze these units into logically meaningful ways. Seventeen classrooms in five schools were used. The communities involved ranged from middle class suburbs with some industry to rural areas. Teacher participation was voluntary. The investigators hoped to obtain groups of four teachers each, with the group containing three teachers identified as having high ability and one being average in teaching ability. The content areas of science, English, social studies, and mathematics were investigated. Higher level mathematics was eliminated from the study due to the difficulty the investigators had in recording symbolic operations.

The investigators assumed that teaching is a social phenomenon, fundamentally the same from one culture to another and from one time to another in the same culture. They also assumed that teachers used a variety of strategies with a "strategy" being defined as a pattern of acts that serve to attain certain outcomes and to guard against certain others. In carrying out these strategies, teachers engage in certain logical operations or forms which their verbal behavior takes as the teacher shapes the subject matter in the course of instruction (333:2-3).

For their study, Smith and Meux and their colleagues analyzed tapescripts from the recordings and divided the verbal interaction into episodes, exchanges between two or more speakers, and monologues. Episodes were further analyzed into logical categories and the logical structure of each category was ascertained (333:9-11).

In order to divide the verbal interaction into discrete units, Smith and Meux set up three criteria for a unit. (1) It must be logically analyzable, meaning that it must facilitate the examination of those aspects of verbal behavior most relevant to an analysis of the logical dimensions of teaching. (2) It must be neutral with respect to content, in that its form does not change with the content being discussed. (3) It must be reliable so that a trained analyst is able to identify the same units in a given set of transcripts that any other equally trained analyst would find independently in the same set (333:13).

Smith and Meux developed a 13 category system for analyzing episodes. The categories in this complex system focus on an analysis of how teacher and pupils process content. These categories are:

1. <u>Defining</u>: concerned with how words or other symbols are used to refer to objects.
2. <u>Describing</u>: concerned with representing something by words or drawing.
3. <u>Designating</u>: concerned with identifying something by name.
4. <u>Stating</u>: concerned with asking for statements of issues, steps in proofs, rules, conclusions, ideas, beliefs, etc.
5. <u>Reporting</u>: concerned with telling what a publication says, with a summary or review or something similar.
6. <u>Substituting</u>: concerned with asking students to perform a symbolic operation, usually of a mathematical nature.
7. <u>Valuating</u>: concerned with estimating the worth of an object, event, action or the like.
8. <u>Opining</u>: concerned with the expression of beliefs, usually on the basis of little or no evidence.
9. <u>Classifying</u>: concerned with identifying what class or category a given object belongs to or to the subclass.
10. <u>Comparing and Contrasting</u>: concerned with differences and/or similarities.
11. <u>Conditional Inferring</u>: concerned with antecedents and consequents.
12. <u>Explaining</u>: concerned with six different types of explanations, all of which give a particular consequent and require that an antecedent be supplied.
13. <u>Directing and Managing Classroom</u>: concerned with verbal interactions designed to maintain the flow of classroom activities.

Although episodes are classified in terms of their logical features, using the 13 categories listed above, they may also be considered in terms of their patterns. Smith and Meux found that episodes could be divided in reciprocating episodes in which the verbal interaction alternated between two speakers and coordinate episodes in which the speakers responded more or less directly to the entry (that which began the episode) rather than to the remarks of the immediately preceding speaker.

All of the entries were classified by Smith and Meux. In their first analysis, they found 3,397 entries in the 85 transcripts (118:288). They found different logical operations and that these differed in the frequency with which they occurred. The three logical operations that occurred the most frequently were describing, designating, and explaining. Next were directing and managing classroom, conditional inferring, and stating. The least frequently occurring logical operations were substituting, reporting, and classifying (333:48-49). Smith and Meux also found marked differences from class to class (333:49).

The most frequently used logical operation in the geometry classes involved in the study was describing. When the science classes were combined and considered as a whole, describing and designating were the most frequently used operations. When the sciences were considered by content area, defining and designating were still predominant in the physiology classes.

In physics, the predominant operations were the use of symbols and conditional inferring. More evaluating operations took place in biology and chemistry than in physics and physiology. Biology was high in mechanical and in normative explaining while physics was high in procedural explaining (333:53).

Social studies classes were high in describing and designating, followed by explaining in order of predominance of logical operations. English classes were high in describing and explaining, then in designating and stating. The core program also included in the observations exhibited a predominance of describing operations (333:50-54).

Smith and Meux have concluded that a broadened conception of the psychology of thinking is n. d. They suggested that it could be broadened in several ways. One way would be through distinguishing and investigating different kinds of logical vs. nonlogical behavior. A second would be through determining the extent to which rule following is an accurate description of logical behavior and, if so, the various kinds of rules that are followed. A third possibility is that of determining the relative roles of rule-following and imagination in various kinds of thinking, especially logical behavior. Yet a fourth way would be through the identification of various processes and abilities associated with performance and learning of various kinds of logical behavior (333:96).

Through the use of the category system developed by Smith and Meux, researchers should be able to gather data to determine if certain logical operations are more effective in presenting content in terms of maximum student achievement than are other operations. In time perhaps a theory of classroom instruction can be developed from such analyses.

Summary. Attempting to tie together and summarize the documents categorized as landmark studies is not an easy task. The research reviewed provides evidence that the early attempts to investigate teacher behavior developed from the perceived need to develop more objective methods for supervising teachers as they worked in their classrooms. Descriptive data, while necessary, were not sufficient.

One of the facets of teacher behavior that received attention by investigators was that of teacher-pupil contacts. These contacts have an observable component but also relate to that more intangible part of the learning situation which is sometimes known as classroom climate. Work by Anderson and his predecessors influenced Withall whose work, in turn, provided a focus for that of Flanders. Many researchers have used or have expanded, modified or otherwise adapted Flanders's original 10 categories.

In addition to the work based on classroom climate as inferred from verbal interaction, another research emphasis was focused on the logical and linguistic aspects of verbal communication. The complexity of the systems developed by Bellack and his colleagues and by Smith and Meux and their colleagues may in part account for the fact that the number of studies with this emphasis is not so large as those in which the investigator has used the Flanders system.

Figure 2

INSTRUMENTS DEVELOPED IN LANDMARK STUDIES

DEVELOPER	INSTRUMENT	PURPORTS TO MEASURE
Anderson, H. H.	Integrative Dominant Index	Kinds of teacher contacts, child behavior
Withall	Climate Index	Classroom climate, primarily the affective components
Flanders	System of Interaction Analysis	Teacher control of classroom operations
Hughes	Provo Code for the Analysis of Teaching	Teacher power, teacher responsiveness
Ryans	Classroom Observation Record	Teacher behaviors in the classroom
	Teacher Characteristics Schedule	Attitudes, Activities, Emotional Adjustment, etc.
Bellack	Content Analysis System	Verbal interaction in the classroom
Smith and Meux	Logic of Teaching System	How teachers and pupils process content

The idea of investigating teacher behavior in the classroom from the perspectives of teacher power and teacher responsiveness, developed in the work by Hughes, intrigues this reviewer. Only one researcher, in the literature reviewed for th monograph, provided evidence of having been influenced by the work of Hughes. The Miller-Hughes System listed in Mirrors for Behavior II (329:14.1-1 4), is a direct outgrowth of the Hughes System. In it Miller has group 1 lughes's categories along a dimension called Directive-Responsive, focusing on the teacher's responsiveness to the pupils' trains of thought as contrasted with how much the teacher directs pupils to follow his plans.

Before educators can set about to change, in an organized way, the behaviors of teachers, there is a need to know what is going on in classrooms. A logical way to begin to accumulate data for an answer to this question is descriptive research. The next section of this monograph will be devoted to brief discussions of some descriptive studies.

DESCRIPTIVE RESEARCH

For the purposes of this section, "descriptive research" is defined
as those studies in which the investigators have observed, described, and
made some attempts to interpret what is happening in classrooms. The "what
is" may be reported in terms of teacher behavior, student behavior, the
relationships of teacher and student behaviors, teacher characteristics,
etc. Studies in which the investigators report attempts to measure and
describe teacher behavior in terms of what happened before and/or after
teachers were exposed to some treatment designed to modify their teaching
are reported in the third section of this monograph, under the heading of
"Behavior Change Research" even if no attempt was made to have both an
experimental and a control group.

Again, because of limitations of time and energy, no attempt was made
to engage in an exhaustive survey of the research produced during the 1960-
1970 period. This reviewer is fully aware that any survey that is not
exhaustive must of necessity fail to include some piece of research that
may be of value to investigators working in a particular area. It also
means that the research reported is not necessarily an adequate representa-
tion of that which has been completed in a particular area. It is, however,
a starting point for review and discussion. The decision was made that it
was better to report about a particular area from a limited perspective,
always remaining cognizant of the limitations, than to ignore the area
because it could not be treated in depth and in an exhaustive manner.
Readers who feel that a particular study or group of studies deserves mention
are invited to write the reviewer and to provide information which could be
included in an up-dating of the bibliography.

Not all studies reviewed will be described within each section of the
monograph. Those not described will, however, be included in the bibliog-
raphy at the end of this section of the monograph. Arbitrary decisions had
to be made concerning which studies to describe and which to reference. The
fact that a study is described does not necessarily imply that it is of
better quality than one which is included only in the bibliography although
that inference may be a valid one in many instances. Studies which are
described were chosen because they were considered to be representative of
the research that is being done in a given area or because they provide a
different way of looking at the problem of investigating teacher behavior.

When the descriptive studies were scanned for common topics, twenty-
two different categories were identified. Using a process that can best
be termed "wholesale lumping," five large categories were developed:
descriptive studies emphasizing analysis systems, studies emphasizing teacher-
pupil interaction and relationships, studies concerned with describing teach-
ing skill and strategies, studies focusing on teacher behavior, and studies
describing some aspect of preservice education as it is reflected in teacher
behavior. A few studies do not fit within these categories, however. They
will be discussed at the end of this section.

TABLE II

TYPES OF DESCRIPTIVE STUDIES

TYPE	NUMBER OF STUDIES
Analysis Systems	13
Teacher-Pupil Influence	43
Behavior, Behavior Prediction	11
Teaching Skills and Strategies	25
Miscellaneous	6
Total	98

Analysis Systems Studies. Within this subdivision, at least three
smaller divisions may be identified. The first of these may be termed
studies dealing with "awareness and/or perceptions" about analyzing verbal
behavior and contains four studies [Amidon and Simon (9), Bernard (31),
Crickenberger (427), A. P. Peek (277)].

Amidon and Simon (9) conducted a questionnaire survey to determine the
extent of use of interaction analysis. They mailed out 400 questionnaires
and received 186 returns. Of these 186, 85 were unanswered because the
recipients were unfamiliar with this method. Of the 181 respondents who
had used, or were at least aware of, interaction analysis, 69 reported
limited experience. Eighteen college faculty members said they were using
the technique with student teachers. Eight were using it for research on
teaching. Six were using it both as a research tool and a tool in teacher
education. This report also contains a discussion of some of the strengths
and weaknesses reported, some guidelines for using interaction analysis,
and a list of some of the schools at which interaction analysis was being
used at the time the report was written.

The studies of Bernard and Crickenberger involved pre-service teachers.
Bernard (31) was interested in studying student teachers' perceptions of
the value and influence of the development and use of procedures for analysis
of teacher behavior. Ten student teachers, supervised by the investigator,
identified five areas of concern related to specific sets of teaching behaviors.
Tape recordings and anecdotal records for four teaching sessions for each of
the student teachers served as the data for analysis. Analytic tools were
developed cooperatively by the student teachers and the investigator, using
materials from Bellack, Hughes, Flanders, Aschner, Sanders, and Smith. The
student teachers reported, via a written questionnaire, their perceptions of

(1) the value of the cooperative development of the analytic procedures and (2) the influence of the use of the procedures on their teaching behavior. Seven reported the study of the various systems of analysis had been of value. They preferred analyzing the tapes over other types of practice. They also reported becoming aware of (1) teacher talk, (2) interaction in the classroom, (3) elements of teaching strategies, (4) need for variation and flexibility in teaching.

A. P. Peek (277), working with 52 in-service teachers, attempted to analyze and compare the results obtained by having these teachers make self-analyses of their verbal behavior in the classroom and by having a trained observer make analyses of the same behavior using the Flanders System of Interaction Analysis (FSIA). She also compared the verbal behaviors of teachers according to sex, grade level (elementary vs. secondary), and teaching experience.

Teachers responded to a questionnaire which constituted the self-analysis portion of the study. When data from the self-analysis results were compared with those obtained through the use of FSIA by a trained observer, Peek found significant differences at the .05 level in nine areas out of ten. She concluded that teachers did not appear to be able to self-analyze their over-all verbal behavior except in the area of praising and encouraging students.

From these three studies which may not necessarily be a representative sample, it would appear that (1) despite the many studies of classroom interaction, interaction analysis is not so well-known as those who work with it might have assumed, (2) preservice teachers do value knowledge of various systems of analysis, (3) the use of recording equipment can help preservice teachers focus on their teaching behavior, and (4) in-service teachers need help in improving their self-analysis techniques.

A second sub-division of the "Analysis Studies" section may be characterized by the research studies and reports in which the authors report the use of more than one observational system or procedure in studying interaction. Eight papers represent this area [Belland et al. (27), Wood (382), Galloway (125), Wood et al. (383, 384), Medley and Hill (235), Ehman (86), Emmer and Peck (88), Ober (520)].

The rationale for the studies in this sub-section is not that if one system is good, more systems are better, but that no system is so all-inclusive that the use of that system, and it alone, can provide a comprehensive picture of the total learning situation. Some investigators explored the use of several systems for the analysis of all types of verbal interaction. Others worked with only one facet of it. An example of such a study is one completed by Belland et al. (27) in which teacher questions were analyzed.

Operating from the point of view that the most common teacher behavior is that of asking questions, Belland and his colleagues attempted to compare and contrast two systems of question analysis. They worked with a modification of the Observational System for Instructional Analysis (OSIA), developed by Hough and Duncan, and with the Price-Belland system which they developed as a modification of the Bloom-Saunders work. This study might also be categorized as an experimental one and included in that section of this monograph because the researchers worked with elementary teacher-interns as a part of the study.

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The investigators' primary objectives were to develop an observational system and then compare it with another already-established system in order to evaluate (1) differences in qualities of data and (2) differences in decision-making while categorizing. During the training sessions, their objectives were to have the interns (1) ask higher level questions and (2) elicit higher level responses from the students.

In a pilot study, using a quasi experimental one-group pre- and post-test design, the interns taught 15 minute lessons to randomly selected groups of five students each. The lessons were recorded on audiotape. Following the pre-testing, the interns participated in training sessions in which they worked with the Price-Belland system and read related materials. They then participated in four 20 minute interview sessions with groups of students not involved in the pre-test sessions. These sessions were also audiotaped. The interns then attempted to categorize and diagnose their teaching behavior, listening to one hour of the recorded interaction. After this, they were post-tested by participating in a questioning session with the same group of students used in the pre-test.

Data were analyzed by one of the developers of the Price-Belland system and by an individual trained in OSIA. Data from analyses by each category system were displayed as percentage profiles and used to test the hypotheses of the study. Belland et al. found that the interns did use a lower percentage of memory questions after training and practice and rejected null hypothesis one. Hypothesis two was focused on the interns' ability to ask questions which would elicit higher level responses from the students. This hypothesis was not tested in a formal manner. Analyses of the 15 categories in which change could occur did not provide evidence to support the rejection of hypothesis two.

When differences between the Price-Belland and OSIA data were analyzed, using the Wilcoxon Matched-Pairs Signed-Ranks Test (two-tailed), the categories of "memory," "divergent," "affective," and "other" each showed significant differences. There were so few uses of the "evaluation" category that no differences could be measured. The researchers concluded that, if all the assumptions hold, the decision-making process will influence the category outcomes. They recommend that investigators continue to evolve observation systems which will yield information about the relationship of certain questions and question-asking strategies to educational objectives. This developmental work should include a study of the validity of the products from various decision-making strategies as well.

Galloway (125) studied nonverbal behavior rather than verbal interaction. In his research he compared three independent observational procedures to determine which was most useful and valid for collecting data about a teacher's nonverbal behavior. One procedure required trained observers to use a seven category system forming a continuum from encouraging to inhibiting communication. The second procedure involved writing descriptive narrations of a teacher's communicative behavior in the form of observation records which were interpreted by qualified judges. The third required selected experts (in curriculum, communication, leadership) to observe the teachers and provide a global assessment of the teacher's nonverbal behavior on an encouraging to inhibiting continuum.

Six elementary teachers were observed. When the data were analyzed, Galloway found there was no evidence in favor of any one procedure. He also found that none of the experts agreed with either the observers or the judges in ranking teachers. He concluded that a perfected procedure for observing a teacher's nonverbal communication had not been developed.

Medley and Hill (235) looked at the total interaction, comparing the Flanders Interaction Analysis Technique (FIAT) and the Observation Schedule and Record, Form 4, Verbal (OScAR 4V) in terms of the kinds of information about teacher behavior which each technique provides. Working with 70 first-year secondary school teacher interns, they made four pairs of records in the classrooms of each intern. Using rotated factor analysis procedures, Medley and Hill considered (1) lecturing behaviors, (2) question type, (3) question difficulty, (4) pupil initiations, (5) criticizing behavior, (6) listening behavior, (7) extended accepting behaviors, (8) question source, (9) permissive behavior, and (10) managing behavior.

They found that each system provided information not given by the other. However, they suggested that OScAR 4V be used in situations in which teachers were provided with feedback about their behavior because this sytem contains twice as many basic categories as that of Flanders.

Samuel E. Wood, working alone in a doctoral study (382) and with others (383, 384), investigated multidimensional techniques for observing classroom behavior. In his doctoral research, Wood used the Florida Taxonomy of Cognitive Behavior (FTCB), the Reciprocal Category System (RCS), and the Teacher Practices Observation Record (TPOR) in an attempt to identify and define interrelationships of the three instruments, each of which was designed to reflect classroom behavior from a different theoretical vantage point. The FTCB was designed to measure classroom cognition by level of complexity; the RCS, socio-emotional climate in the classroom through analysis of verbal interaction; and the TPOR, classroom practices from the view point of pragmatism or John Dewey's philosophy of experimentalism.

Wood's doctoral study involved 117 teachers and their students in North Florida classrooms and included all 12 grade levels as well as different subject areas. Three-member observer teams made observations in the classrooms to provide data for factor analysis. This analysis showed a relatively clear 12 factor structure, suggesting that while some reflective overlap exists among the three instruments and between pairs of instruments, each instrument also retains a wide range of descriptive exclusivity.

In a presentation at the 1969 meeting of the American Educational Research Association, Wood (383) continued the discussion of his study. He reported that the results suggested that high levels of student cognition are related to the student-centeredness and warmth (socio-emotional climate) of the classroom environment and to student behavior rather than to the teacher's cognitive level. He found that, in the socio-emotional climate, the components of indirect behavior such as teacher warmth and positive reinforcement were not related in the experimental behavior dimension and that the pattern of teacher behavior was as important as the behaviors themselves.

In the third paper, Wood et al. (384) reported on a study involving 71 student teachers whose behavior was categorized by the use of four observational systems: the RCS, the FTCB, the TPOR, and the Taxonomy of Imagery Provocation (TIP). Again, Wood felt that the multidimensional approach has much to recommend its use because the specific elements of verbal and cognitive behavior exist in a state of dynamic interaction which is not adequately reflected through the use of only one observational system.

Emmer and Peck (88) also used four observation systems to study teacher behavior. The systems were selected to include as broad a range of categories as possible and were the Fuller Affective Interaction Records (FAIR), the Observation Schedule and Record, Form 5 (OScAR 5V), Cognitive Components System (CCS), and Coping Analysis Schedule for Educational Settings (CASES). Observations were made from 138 lessons videotaped in fifth and eighth grade classrooms. Factor analyses were done on the intercorrelations among category systems. Emmer and Peck found 11 behavioral dimensions which represented overlap among factors obtained from each of the four coding systems. The results and relationships identified are discussed in detail in the report.

Ehman (86) took a slightly different approach to the problem of multidimensionality. Using only one system, that of Flanders, he compared three sources of classroom data: teachers, students, and systematic observation. He observed in social studies classrooms, working with 14 teachers in 28 different discussion sessions involving controversial issues. Ehman focused on student talk/teacher talk ratios and student-initiated/teacher-initiated talk ratios in his systematic analysis. He asked teachers to respond, via a questionnaire, about students' freedom to express their opinions during these discussions. A sample of students responded to a similar questionnaire. Ehman analyzed the consistency of these three sources, using product moment correlations as indicators of between-source agreement. Teacher data were found to disagree with the other two sources and teachers were judged an unsatisfactory source of data concerning the phenomenon under study. Ehman inferred that the apparent distortions in the teacher-reported data might be related to the importance which the teachers assigned to student opinion expression as a teaching goal.

Analyses of these diverse studies indicate that the teaching-learning act is a complex process; hence, no one observational system can be assumed to provide an adequate report. Systems developed from different theoretical biases do possess some commonality as well as some uniqueness. Although each observational system has some defects, data secured through systematic analysis of classroom interaction appear to be more valid than those based on teacher perceptions and recollections.

Teacher-Pupil Influence. Another cluster of descriptive studies is composed of those investigations in which the researcher was interested in studying teachers and pupils as they interacted in the classroom [Mason (218), Cooney (424), Rosenbloom et al. (302), Spaulding (342), Bemis and Luft (28), Rathbone and Harootunian (527), Felsenthal (96), Hellebust (463), D. A. Peek (278), Sprague (343), Klein (190, 191), Massialas et al. (219, 220), Blakey (36), Morrison (243), Kranz et al. (197), Friedman and Bowers (447), Dalton (79), Herrell (159), Denero (432), Friedman (113, 114), Poe (525),

Mulligan (249), Brophy (54), Gallagher (121, 122, 123), Gregory (140), Wrape (574), Beker (403), Connors and Eisenberg (422), Wright and Proctor (575), Watson (368), Sugrue (347), Bowers (46, 47), Seperson and Joyce (324), Flint (445), Haupt (151), Ozgener (271), Resnick (294), Brandt (48), Stern and Firth (552), Berk and Berson (406)]. In some of these papers, the emphasis was on teacher influence as measured in terms of student achievement or performance. In others, the researcher focused on teacher expectations and their influence on pupils. Others were more general and two researchers (Klein and Herrill) studied the influence of student behavior on teacher behavior.

Klein's study (190, 191) with its reverse-emphasis: student influence on teacher behavior will be presented first. In it she looked at student effectiveness on teachers by having college students assume the role of experimenters. Twenty-four college teachers, ranging from graduate teaching assistants to full professors, served as guest lecturers in education classes. Six different universities were involved in the study. Selected students in each of the education classes were asked to vary their behavior during the class period. Some students were asked to exhibit positive behaviors; others, negative behaviors during 15 minute intervals of the class period. The class period was divided into four 15 minute periods composed of positive and negative treatment periods and two control periods. The college students were alerted to change their behavior by the placement of a different colored folder at a prearranged place in the room.

Two subject teachers were assigned randomly to each of 12 different counter-balanced sequences of treatment and control periods to reduce the possibility of systematic effects due to treatment orders. Observers in the classroom recorded nonverbal behaviors using the Visual Observational Schedule (VOS) of teacher behavior and Pupils Exercise Reinforcement Instrument (PER) designed for the study. The verbal interaction, recorded on a concealed tape recorder, was analyzed by Interaction Analysis.

Klein found that the teachers in the sample appeared to change their verbal and nonverbal teaching behaviors when the students changed their experimental behaviors. Teachers behaved more positively during periods of positive and natural student behavior than during periods of negative behavior. No significant differences were found during periods of positive and natural behavior (control), indicating that the students' natural behaviors were largely positive. The Interaction Analysis data showed that teacher use of direction and criticism was greater during periods of negative student behavior than during the positive or control periods.

Klein concluded that positive student behavior influenced teachers to use positive behaviors. She also suggested that knowledge about student influence on teacher behavior might necessitate modification of teacher education curricula.

Herrell (159) investigated the problem of whether a teacher's presentation might vary as a function of student set. A guest lecturer was used in each of two introductory psychology classes, one of which had been told that the guest was a "warm" person and the other that he was a "cold" person. The lecture was taped in each class and rated to determine if the lecturer had been influenced by student expectations. Ratings of the verbal behavior

exhibited on the tapes appeared to support Herrell's hypothesis. The raters judged the lecture performance in the "cold-set" class to be more tense and less competent, and "colder" at the end of the period than at beginning, with the reverse being true in the class in which the students were anticipating a warm teacher. Herrell's study differed from Klein's in that the students in his study were unaware of their part in influencing the teacher's behavior.

Mason (218) and Morrison (243) looked at teacher-pupil influence in ways which go beyond verbal interaction. Mason (218) investigated the relationships between the behavioral styles of teachers and the quality of teacher-student interpersonal relations. The theoretical basis of his study was derived primarily from Rogers (the helping relationship), Mitzel (presage, process, and product measures), and Flanders (direct and indirect teacher influence). Mason worked with 24 social studies classes, grades 11 and 12. The students and teachers responded to Barrett-Lennard's Relationship Inventory to provide measures of the quality of their interpersonal relations. Verbal behavior was categorized by use of Flanders System of Interaction Analysis. Mason failed to find significant relationships in his data. He concluded that none of the independent variables used in his study could be considered useful predictors of the quality of teacher-student interpersonal relations. The one possible exception was the use of the revised indirect-direct ratio (i/d) when working with differences in teacher-student perceptions of the quality of interpersonal relations existing between them.

Morrison (243) hypothesized that teacher reinforcement behavior would have a different effect on "internal" children (those who believe that they can affect their environment through their own behavior) than on "external" children (those who feel controlled by fate or influences much stronger than themselves). She worked with 910 children in grade six. When these children were divided into "internal" and "external" categories by means of the Internal-External Control Scale and were pre- and post-tested on the Metropolitan Achievement Test Battery, Morrison found no significant difference between the change scores of the two groups of children for the same degree of teacher reinforcement behavior. She did find, for the entire group, that a greater degree of teacher reinforcement behavior resulted in increased student learning.

If teacher reinforcement apparently promotes student learning, what influence do teacher expectations have? Several investigators reported on this problem [Watson et al. (368), Kranz et al. (197), Blakey (36), Dalton (79)]. Their work is indicative of that stimulated by or related to the Rosenthal-Jacobson report, Pygmalion in the Classroom (306), and subsequent research studies resulting from attempts to prove or disprove the findings of the Pygmalion work (which will not be discussed here, based on the assumption that it is well known). Blakey (36), Dalton (79), and Kranz (197), although working with different teacher-pupil groups and using different methodologies, all concluded that a teacher's perceptions and expectations did influence the kinds and frequency of teaching behaviors or interaction patterns exhibited.

Watson's study (368) varied in that she and her colleagues investigated the magnitude and direction of the congruence of communicated expectations for teachers and students in innovative and conventional programs. The

communications were divided into three categories: (1) explicitly stated expectations, (2) actual expectations, (3) realized expectations. The measurement instrument used was the Watson Analysis Schedule, Form A. The researchers worked with 525 students and teachers in process-oriented American studies classes and 1,207 students and teachers in conventional, content-oriented American history classes. Watson et al. found higher congruence between students and teachers in conventional than in innovative programs. The researchers felt that satisfaction was more highly dependent on the nature of the students' role within a program than on the efficiency with which expectations were communicated.

Studies by Rosenbloom et al. (302), Spaulding (342), and Bemis and Luft (28) represent research in which the investigators considered the influence of teachers on pupils in terms of student achievement. Rosenbloom and his colleagues (302) attempted to answer two questions: (1) is teacher effectiveness related to the pattern of interaction between teacher and student and to the classroom climate created by this interaction, and (2) is teacher effectiveness related to the productive thinking abilities of teachers as reflected in the submission of their daily logs? Data were collected during the consecutive school terms from 1960-1962 and were supplied by 127 teachers who had participated in a field study for the evaluation of the School Mathematics Study Group (SMSG) materials in grades 7 through 12. Rosenbloom found that teaching effectiveness contributed significantly to the attitudes and perceptions of pupils concerning teachers and their methods, the school, text materials, and the class as a group. The teachers judged most effective produced a greater variety of ideas about success and failure in their teaching and offered a greater variety of alternative ways of teaching mathematical concepts.

Bemis and Luft (28) examined the relationships between teacher behavior, student behavior, and student achievement. To do so, they developed an instrument called the Southwestern Cooperative Educational Laboratory Inter-action Observation Schedule (SCIOS) which was designed to assess the degree to which pupils (1) receive, (2) respond to, and (3) value a stimulus. Teacher behaviors were categorized as either tension-reducing or tension-increasing for pupils. Fifteen teachers and 296 first graders in Title I schools were involved in the study. Bemis and Luft reported a significant relationship between teacher and pupil behavior as well as a significant relationship between pupil classroom behavior and pupil cognitive behavior as measured by a standardized test. No attempt was made to validate the SCIOS instrument.

Spaulding (342) reported on a study designed to discover how teaching method and style affected pupil personality development as well as educational progress. Subjects involved were 21 teachers and 507 fourth and sixth grade pupils of high socioeconomic background. Testing eight hypotheses, Spaulding found a significant relationship between the placement of a child in a superior classroom and subsequent self-esteem, academic achievement, and creative thinking. Height of self-concept appeared to be related to socially integrative, learner-supportive teacher behaviors.

Felsenthal (96) viewed teacher-pupil interaction during first-grade reading instruction to investigate if patterns of interaction were a function of pupil sex differences. Her study involved three major phases: measurement

of teacher attitudes, classroom observation of teacher-pupil interaction, and measurement of pupils' reading achievement. All of the teachers (71) involved in the study were female. They worked with 439 children. Felsenthal found that the teachers behaved differently in their interaction with boys as compared with girls. Boys appeared to be subject to higher frequencies of both positive and negative teacher behaviors. Teachers also did not call on volunteering girls as often as they called on volunteering boys. Teachers chose to call on and accept the ideas and feelings of boys more frequently than they did with girls.

Girls scored significantly higher on all areas of the achievement test at the end of the first grade despite the nonsignificant sex differences in readiness to read at the end of the kindergarten year. When the readiness-achievement scores were adjusted for reading readiness scores, the girls still maintained a higher level of reading achievement.

Felsenthal grouped the teachers in her study by attitude into "Progressive" and "Traditionalist" groups. Although she found that differences in pupil reading achievement were associated with differences in teacher attitudes and instructional behavior, Felsenthal also found that the girls scored significantly higher than the boys on reading achievement tests regardless of whether their teacher was classified as progressive or traditional. With teachers classified as attitudinally inconsistent, the sex difference diminished to nonsignificance.

Felsenthal found, as have other investigators, that boys in the early school years have more difficulty in learning to read than do girls. She suggested that pre- and in-service teacher education programs should be designed to make teachers aware that sex differences in learning do exist and should be considered in educational planning.

Four studies form another small cluster within this sub-division because they all relate to an investigation of the structure and process of inquiry into social issues in secondary schools [Massialas et al. (219, 220), Sugrue (347), Sprague (343)]. One of the papers by Massialas (219) reports on the development of a category system to analyze or evaluate issue-centered classroom discussion and will be described in the section on "Instrument Development." Sugrue (347), in the second volume in the series of three, reported on an investigation of the socio-psychological or affective "side effects" of social issues instruction. Specifically, she was interested in teacher/student attitude-congruence patterns and student evaluations of the controversial social issues classes and teachers. She found student evaluation to be favorable. She also found perception was significantly influenced by demographic, attitude, and perceptual characteristics as well as by degree of congruence. She concluded that the likelihood that a student and his/her own teacher would have the same basic attitudes and perceptions regarding the issues and issues-instruction was no better than chance.

Massialas (220) reported, in volume three, that initial analysis of the two audiotaped lessons for each of the 16 classes involved in the study resulted in the identification of three distinct discussion styles: 1) expository, which involved the sharing of background information only; (2) inquiry-nonprobing, involving the giving of hypotheses, opinions, and taking positions; and (3) inquiry-probing, which involved the development

of ideas as well as devoting time to defining, clarifying, evidencing, or testing the ideas. He also reported that students in the probing classes rated their classes highest and did very well on the critical thinking test (Harvard Social Issues Analysis Test). The expository classes were next and were followed by the nonprobing classes which had the lowest ratings and test scores.

Sprague also worked on the social issues project and reported about it at a session of the 1971 meeting of the American Educational Research Association (343). She also looked at the 16 social studies classes, in 15 different Michigan schools, and attempted to analyze the verbal interaction using a system similar to that of Flanders. She found that the level of student participation was greater in the inquiry classes than in the expository classes and that teachers tended to ask more questions and use student ideas more in inquiry classes. She also found the main aspect of teacher influence to be in the type of questions asked.

Another cluster of investigations, relative to teacher-pupil influence, resulted from the work done by James J. Gallagher and others [(121, 122, 123)]. In the 1965 research, Gallagher and his colleagues investigated the productive thought processes in gifted children as these were evidenced within the context of classroom verbal interaction. Five consecutive class sessions in 12 classes of intellectually superior junior high school students were tape recorded in social studies, mathematics, science, and English. The 176 students involved in the study were given a battery of tests which measured both cognitive and attitudinal variables. Results on these measures were compared with classroom performance. Family data were collected also and similarly compared. In order to analyze the verbal interaction, the Gallagher-Aschner classification system was used. This system was developed from Guilford's structure of the intellect model and contains five major categories and 47 sub-categories.

Gallagher found, as did Sprague, that the teacher's questions determined the focus of the classroom operation and that the style of question asking determined the kind of thought operation that the student would be asked to perform. He also found that (1) cognitive memory questions made up 50 per cent or more of the questions asked by teachers in practically all sessions; (2) relatively few evaluative and divergent thinking questions were asked (none in some sessions); (3) teacher questions appeared to be the teacher's method of advancing class discussion, whereas teacher statements reflected the teacher's individual cognitive style; (4) there was a close relationship between the type of teacher questions asked and the nature of student thought expression; (5) variations within teacher patterns appeared to be due to the group of students involved, teacher's goals, and degree of class progress toward those goals; (6) student expressiveness in the classroom as an individual characteristic was consistent despite changes in subject matter, teacher and time; (7) there was a close correspondence between student performance in all categories of cognitive performance; and (8) boys generally appeared to be higher in classroom expressiveness than girls and showed more self-confidence in their own abilities. Girls were more positive towards the world around them.

In a Final Report to the U.S. Office of Education, published in 1968, Gallagher (122) provided information concerning three projects which are analyses of teacher classroom strategies associated with student cognitive and affective performance. The first project reported was designed to develop a system of classroom interaction that would identify and classify signifi- cant incidents or units in the classroom in order to analyze various teacher strategies. An additional goal was the application of this system to various samples of classroom behaviors in order that the range and limitations of the system could be determined.

The Topic Classification System was developed in order to indicate the level of conceptualization, the style of thinking, and the instructional intent of classroom discussion. This is a three dimensional system. In the first dimension a division is made between content and skills. The second dimension consists of three levels of conceptualization (data, concept, generalization). The third dimension reports the logical dimension or style being used by the teacher or student. All topics therefore receive a three digit coding. In order to qualify as a topic, the interaction must be at least 15 lines of written typescript, so length of discussion determines this classification status.

Ten classes of gifted students (118 boys, 117 girls) enrolled in junior and senior high school were used. Each of the 10 classes was tape recorded for five consecutive one hour sessions. In addition, two observers in the classroom took extensive notes about the activities, materials, and nonverbal behavior. Using analysis of variance techniques, Gallagher found that teacher variance was a significant factor in each of the style dimensions, that the teacher provided the most significant variance contribution in both dimensions of instructional intent, and that there was a significant interaction between teacher and class session, representing teacher variation from day to day in some of the classes in the request for skills.

A second study was conducted to investigate variations that might appear as a function of a particular content area. A sample of 30 classroom sessions was obtained by videotaping several demonstration classes of over 100 academ- ically superior children who had been brought together as a part of a train- ing workshop for teachers of gifted students. The teacher participants came from special State Demonstration Centers for Gifted Children in Illinois. Videotapes were collected for social studies, language arts, science and general elementary school instruction.

Analysis through listening to the videotapes presented problems and typescripts were made and used. Three of the four content areas appeared to be relatively constant in their high percentage of content as related to skill topics. The science lessons contained a very strong emphasis on skill topics, with a great deal of emphasis being placed on the interpretation of experiments and how to conduct experiments. (Gallagher reported that the instructional process most favored in the summer workshops was the discovery method or inductive teaching.) When level of conceptualization was con- sidered, there were no major differences except at the data level. This was due to the social studies discussions of family and societal roles. The majority of topics in all groups was found at the concept level. In terms of cognitive style, there were no significant differences with regard to the analyses of variance between content groups.

Of a total of 269 topics identified, only 4 were terminated by a student summary. This piece of evidence relates to Bellack's work and the "rules of the game," one of which is that the teacher is expected to make some kind of summary statement. However, Gallagher did not find a predominance of teacher summaries. There was an average of 17 per cent teacher summary statements in science as compared to only 4 per cent in social studies and elementary classes.

In the third study, six biology teachers and their high ability students working with the concept of photosynthesis and using the Biological Sciences Curriculum Study (BSCS) Blue Version Molecules to Man tape recorded on three consecutive days of discussion lessons. The purpose of this study was to use the Topic Classification System to compare teacher instructional strategies when variables of subject matter, teacher background, student ability, and concept to be taught are held constant. This study was discussed in an earlier section of this monograph and will not be described in detail here. The results did show, again, that diversity is a central fact of human existence. This diversity was found in the teachers' methods of presenting the same curriculum materials.

When Gallagher compared the results of the three studies, he found complete teacher dominance or control over class discussions. This finding paralleled that of Bellack and his colleagues. In each of the three research projects, regardless of the content field, the teachers controlled the introduction of the topics, the completion of topics, and whatever summaries or conclusions that were made.

A single study which viewed teacher-pupil influence in a slightly different way was that completed by D. A. Peek (278). He attempted to describe and compare the verbal behaviors of teachers and pupils in selected classes of a predominantly Negro high school and a predominantly white high school, using 15 different classes in each school. Four English, six history, two mathematics and three science classes were observed in each school and verbal interaction recorded for a period of 30 minutes, using Flanders system of interaction analysis. Peek found a significant difference in the overall verbal behavior in Negro classes as compared to white classes. He used the Darwin Chi Square test (.05 level of confidence) and found that Negro teachers used more indirect verbal behaviors than did the white teachers.

Brophy (54) looked at teacher-pupil influence in terms of the stability of teacher effectiveness. He was interested in studying ordinary teachers who were working with their regular classes in their usual fashion. This study extended over three school years. Eighty-eight second and 77 third grade teachers and their classes were involved in the study. Raw data consisted of individual students' scores on the Metropolitan Achievement Tests which were administered in the fall and were compiled for the school years of 1967, 1968, and 1969. Brophy found that, at least in grades two and three, teachers who are consistent in their relative effectiveness can be identified. The vast majority of these consistent teachers were about equally successful with boys as with girls. Some were also about equally successful across three years in producing gains on the four or five Metropolitan subtests on which data were available. Others produced high gains in language arts and low gains in math, or vice versa. Brophy suggested that these consistent

teachers should be observed in their classrooms as they carried out normal activities, for an observational study or series of studies, if greater payoff in teaching effectiveness research is to result.

Some additional studies [Bowers (46, 47), Seperson and Joyce (324), Flint (445)] were included within this teacher-pupil influence subdivision. Their intent was to investigate the effects of cooperating teachers on student teachers. The cooperating teacher-student teacher dyad may be considered as a form of teacher-pupil relationship. Bowers (46, 47) worked with 20 student teachers and their cooperating teachers as they taught children in the inter-mediate grades. He conducted three series of observations: of the student teachers during their first and last weeks of student teaching and of the cooperating teachers at mid-semester. Bowers used the Flanders System of Interaction Analysis to classify the verbal behavior and found that, while verbal behavior of student teachers did change, the same kinds of verbal change did not take place among all student teachers. He also found that, while the changes were not statistically significant, more than half of the student teachers' verbal behaviors became like their cooperating teachers during the eight week student teaching assignment.

Seperson and Joyce (324), working with 19 teacher interns, obtained samples of the interns' verbal behavior during the fall semester when they were engaged in some observation-participation experiences for comparison with their behavior during full-time student teaching in the spring semester. They were able to correlate student teacher and cooperating teacher behavior for preteaching, early student teaching, and late student teaching periods. The Joyce Conceptual Systems instrument was used for the analyses. This instrument has four general categories: sanctions, information, procedures, and maintenance, as well as 24 subcategories, for teacher oral communications.

The investigators found no evidence of relationships between the student teachers and cooperating teachers in behavior during the preteaching period. They did identify relationships in several indices of teaching behavior shortly after student teaching began and these continued, even when adjusted for the early relationships. Inspection of the difference scores revealed no consistent patterns of influence once the early impact of the cooperating teacher occurred. This influence appeared to happen during the very early weeks of student teaching rather than being the result of a low and cumulative process. How much of this impact results from the cooperating teacher's verbal behavior and how much from the total classroom setting in which this verbal behavior occurs is a question that Seperson and Joyce consider worthy of investigation.

Interaction of teachers with young children was the focus of seven investigations [Haupt (151), Ozgener (271), Resnick (294), Brandt (48), Friedman (113, 114), Stern and Firth (552), Berk and Berson (406)]. Brandt (48) and Resnick (294) observed interaction in informal British infant schools. Brandt (48) observed and recorded behavior using the PROSE system with a stratified random sample of 24 five, six and seven year old children in two classrooms. Nine 100-second cycles of five behavioral episodes were recorded for each child. (PROSE sheets contain 148 categories of behavior and context, including teacher behavior and instructional emphasis.) Brandt

also observed in other classrooms of the school, took field notes, and used a separate teacher interaction checklist. Resnick worked in only one school and focused on teacher behavior.

Resnick (294) reported three major findings: (1) a typical pattern of teacher behavior in which extended substantive discussions with one or a group of children are interspersed with very brief exchanges, usually child-initiated and often concerned with organization or management questions with individual children; (2) extended interactions which are dominated by questioning of the child with respect to substantive (academic), personal, and self-management aspects of the task on which he is working; and (3) brief interactions which are heavily child-initiated and play a classroom management as well as an instructional function. Resnick developed her own coding system for making observations for her study.

Brandt reported that three out of five observations showed the teacher in a relatively nondirective role. He found a slightly higher rate of teacher activity than did Resnick. Much of the teacher behavior was question asking. Brandt also did a Q factor analysis across pupil variables and found three interpretable factors and one error factor which together accounted for 47 per cent of the variance. One factor differentiated children who were high in adult contact from those high in peer contact. A second differentiated children who were distracted from those who were attentive to tasks and class activities. The third differentiated children who were passive from those who were active along energy expenditure lines.

Ozgener (271) investigated the relationship between kindergarten teachers' questions and students' responses, conducting four case studies to do so. Four groups of kindergarten children and their teachers were involved. Discussions in which 9 to 15 children and a teacher participated were tape recorded. Questions and responses were classified according to the Gallagher-Aschner system. Ozgener found the cognitive level of questions differed in frequency with the teacher involved. Generally, questions were asked at the Cognitive-Memory and Convergent levels. He also found a very high incidence of congruence between teachers' level of thinking, as evidenced by questions asked, and students' level of thinking, based on responses given.

Haupt (151) examined relationships between children's questions and teachers' responses in nursery school classrooms. Twenty-six children (13 boys, 13 girls) and eight teachers, in two middle class nursery schools, were observed on a rotated time and program area schedule. Haupt developed her own system for coding the verbatim recordings. She found that boys appeared interested in the physical world, that this interest was stronger than the girls' interest in following their initial questions about the social world, and that the teachers tended to reinforce their position as a prime verbal source of information. Teacher behavior did not appear to be designed to stimulate divergent thinking or probing on the part of the children.

Friedman (113, 114) looked at the extent to which a teacher served as a model for the verbal style of his students. Working with a modified form of the OScAR 4V, Friedman selected four students from each of 24 first grade classes. These students were separated into two groups on the basis of frequency of teacher and peer reinforcement. Verbal characteristics of the

students were scored using six scales of imitative behavior developed from the OScAR protocols. Friedman found that students observing high rewarding teachers imitated significantly more than those observing low rewarding teachers on four of the six verbal categories. He also reported that, in three of the four analyses, differences between frequently and infrequently peer-reinforced students were located and, for three of the analyses, there were also reliable teacher reward x pupil reward interactions.

Friedman hypothesized that, although his data revealed that a high reward-ing teacher did increase the imitative behavior of students, it was quite doubtful that the amount of reinforcement which a single child, in a class of 25, actually received differed greatly between high rewarding and low rewarding teachers. He inferred that it was more likely to be the child's perception of the teacher's reinforcement activity towards each of the other 24 children and towards the class as a whole that most influenced the amount of imitation. Friedman felt it quite possible that the hope of receiving a reward from a teacher who dispenses it frequently was more influential in producing imitation than the actual receiving of reward.

Attempting to generalize or even summarize such a diverse group of studies, even with their common theme of teacher-pupil influence is not an easy task. It would seem that, just as teachers influence their students, pupils also influence teacher behavior as shown in the studies by Klein and Herrell. Teachers' expectations of their pupils' abilities play a part in determining the behaviors teachers exhibit. The teacher behavior of asking questions appears to be important, as shown in the studies by Sprague and by Gallagher. Gallagher's work, like that of Bellack, provides evidence for the idea of teacher dominance in classroom interaction. Teacher effects, at least in the Brophy study, have stability over time. And, teacher effects on students apply to student teachers as well as to public school pupils.

Behavior and Behavior Prediction. A third sub-division of descriptive studies was composed of those investigations and papers which focused on teacher behavior and/or the prediction of such behavior [Otto (269), Merica (514), Treanor (557), Millslagle (240), Schalock and Beaird (321), Beezer (23), Hill and Medley (467), Shepard (325), Babb (399), Bane (16), Murphy and Brown (250)].

Otto (269) looked at student teaching performance of 277 elementary education majors to determine if experiences with children prior to student teaching were related to student teaching rating. He considered hours and numbers of experiences and found that students with more experience in work-ing with children prior to student teaching were rated significantly better (t-test analysis) as student teachers than were those students who had little, if any, experience with children prior to student teaching.

Beezer (23) looked at the influence of pupil socio-economic status and teacher characteristics on teacher role performance as identified in the Six Areas of Teacher Competence booklet published by the California Teachers Association. Sixty female intermediate grade in-service teachers partici-pated in his study. Their verbal behavior was analyzed by using the Joyce system. The teachers also completed a Personal Data Sheet and were interviewed.

Beezer found (1) teacher role performance as "director of learning," "counselor and guidance worker" and "mediator of the culture" was related to the socio-economic status of the pupils; (2) teacher role performance was significantly different (.01 level) in relation to the age of the teacher, with the younger teachers being more active as "director of learning" and "counselor and guidance worker"; (3) teacher role performance was significantly different (.05 level) in relation to length of teaching experience in that teachers with fewer years were more active as "director of learning" and "counselor and guidance worker" and those with more years as "member of the staff" and "member of the profession".

Shepard (325) observed, analyzed, and compared teacher nonverbal behaviors as they were exhibited toward students representing the three social classes. Eleven teachers (six males, five females) were surveyed as they worked with students from kindergarten through grade twelve. These 11 teachers exhibited 12,095 nonverbal behaviors as identified through use of the IDER model of observing, recording, and analyzing nonverbal behavior. Teaching performance was recorded on videotape and the tapes used for analysis purposes. Shepard concluded that a definite pattern of discrimination existed in the nature and number of nonverbal behaviors exhibited to the three social classes.

Shepard found that the teachers as a group exhibited more encouraging nonverbal behaviors than restricting behaviors to all three social classes. Male teachers exhibited more encouraging nonverbal behaviors toward upper-class students. Female teachers exhibited more nonverbal cues to the middle-class group but were more encouraging to the upper-class group. Experienced teachers exhibited more nonverbal behaviors to the upper-class group but were more encouraging to lower-class students. Beginning teachers exhibited more encouraging nonverbal behaviors to upper-class students than to students of the other two classes. All teachers interacted more nonverbally, from a percentage point of view, with students from the upper class. Middle-class students, although greater in numbers than either of the other two classes, received fewer encouraging nonverbal cues. (The material reviewed did not contain information concerning the distribution of teachers by sex or experience among the different social class groups.)

Bane (16) looked for relationships between measures of Experimental, cognitive, and affective teaching behavior and selected teacher characteristics. He used each teacher of a 50 per cent sample of all public school teachers in one Florida county. Each participant was observed for approximately 35 minutes by a team of three observers. Bane used the Teacher Practices Observation Record, the Florida Taxonomy of Cognitive Behavior, the Reciprocal Category System for these observations. In addition teachers responded to a Personal Beliefs Inventory, a Teacher Practices Inventory, and Rokeach's Dogmatism Scale, Form E.

Bane failed to find significant correlations between Experimental behavior and cognitive and affective behavior. Nor did he find any significant relationships between educational beliefs or open and closed mindedness and teacher behavior. He did find significant relationships between fundamental philosophical beliefs and Experimental and cognitive behavior. He found a significant relationship between sex and teaching behavior, indicating that male teachers used a greater amount of warming, accepting and amplifying behaviors in comparison to directing, correcting and scolding behaviors than did female

teachers. He also found a number of significant relationships between subject taught and teaching behavior. Social studies teachers were significantly less Experimental and significantly more positive in affective tone than all other groups of teachers. Math teachers exhibited the most complex cognitive behavior, significantly higher than all other groups except social studies teachers. Science teachers were less Experimental (John Dewey's educational philosophy of Experimentalism) than all groups except social studies teachers. Science teachers scored lowest on the cognitive measure, although their score was significantly below only math teachers. Bane concluded that fundamental philosophical beliefs appeared to have a greater bearing on teaching behavior than do either educational beliefs or belief systems characterized as being either open or closed and that subject matter appeared to be considerably more influential on teacher behavior than was grade level.

Millslagle, Schalock and Beaird, and Murphy and Brown were all interested in predicting teacher behavior. Millslagle (240) took the most conventional approach, used by other investigators interested in this problem of predictiveness, and attempted to determine if evaluations of student teaching performance could predict in-service behavior. Working with 61 teachers of special education who had graduated during the period 1967-1970, Millslagle asked their administrators to rate them with the rating scale used by cooperating teachers and college supervisors. Millslagle found no statistically significant differences existed between the ratings of the college supervisors and the cooperating teachers. He also found that statistically significant differences existed for evaluations by the three groups for first year teachers, by two groups (cooperating teachers and administrators) for the second year teachers, but that there were no statistically significant differences for the three groups for the third year teachers. Millslagle does not indicate, in the document reviewed, if any administrators rated more than one of the special education teachers.

Murphy and Brown (250) were interested in determining if it was possible to predict the teaching styles preservice teachers would use. One hundred thirty-six female home economics student teachers participated in the study. They responded to Harvey's Conceptual Systems Test and, from the responses, Murphy and Brown were able to group the students into three of Harvey's four systems: System 1, unilateral dependence; System 2, negative independence (not present in this study); System 3, conditional dependence; System 4, informational interdependence.

The student teachers were asked to audiotape lessons. Not all of them supplied the three audiotapes the investigators had requested, so, assuming teaching style to be consistent from lesson to lesson, Murphy and Brown randomly sampled a 20 minute segment from one tape. The verbal interaction was analyzed by Joyce's system (four ways of handling information and five categories of applying sanctions). Four teaching styles were identified: (1) lecture, (2) recitation, (3) amplified recitation (narrow teacher question, short pupil response, teacher comments, another teacher question), and (4) reflective (teachers helped students theorize and express themselves). Statistical analyses revealed no significant differences among the three systems with respect to teaching styles. Murphy and Brown inferred this result may have been caused by the fact that all three teacher education programs from which the 136 student teachers were drawn emphasized teaching as giving information and placed a high value on pupil conformity to rules.

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Schalock and Beaird (321) reported on a study which replicated and extended earlier research on the use of situation reaction tests to predict teaching behavior in the classroom. Motion picture representations of classroom situations were used as test stimuli. The original study had involved 40 student teachers. The replication study included 39 experienced teachers and 39 student teachers. The researchers found that they were unable to obtain the same results, in the replication study, for the Simulation Test as had been obtained in the original study. In the original study the Simulation Test had been the most powerful of the three predictors used (Simulation Test and Word and Film Tests). In the replication study it was consistently the least powerful. On the basis of the original study, it had seemed that as tests became more lifelike in their stimulus and response properties, the effectiveness of prediction increased. This was not true in the replication study although the investigators considered that the results might have been influenced by the coding scheme used.

Schalock and Beaird found, in the replication study, that by including measures of situational factors affecting teaching behavior in the prediction equation the amount of variance accounted for was increased. They suggested that more research in this area be done.

Based on this limited sample of studies concerned with teacher behavior and its prediction, this area appears to be in need of more and better-designed research activities.

Teaching Skills and Strategies. It seems appropriate to begin this subsection with a global study on the strategies of teaching [Smith et al. (332)]. The other investigations included in this area tend to focus on one particular skill or on components of it such as questioning [Lockwood (208)], communication skills or presenting behavior [Nearhoof (254), Eggland (85), Carter (419), Shirley (327), Carll and Davis (66), Wright, D. L. (387), Kean (488), Resta and Niedermeyer (529), Pinney (281), Fortune (446), Stuchin (346)], critical thinking [Hunt and Germain (170)], lesson planning [Conrad (423)], working with individual pupils [Neujahr (258)], classroom management [Soar (337), Dadey (78), Crispin (75)], and being a researcher while teaching [Ayllon and McCullen (13), Hall et al. (143)], or other skills [Hoyle (475), Cooney (424), Tinsley (556)]. One final study in this sub-section deals with teacher "survival techniques" within the school organization [Ferren (98)].

Smith and his colleagues (332), working with the same data gathered for the study of the language and logic of teaching reported in the "Landmark" section of this part of the monograph, looked at the larger maneuvers having to do with the control of subject matter of instruction. They referred to these larger maneuvers as strategies. Their purpose in this study, as in the first, was to provide a descriptive account of teaching behavior. Verbal interaction was divided into units of analysis called ventures. Ventures were categorized as concept, causal, reason, evaluation, interpretative, rule, procedural, and particular. Each type of venture was further subdivided into moves.

The 324 page report of this study does not lend itself to a concise descriptive abstract. It consists of 14 chapters, each of which was written by one or more members of the project staff, and two appendices. It is available on microfiche and needs to be read, in its entirety or selectively, by individuals interested in this approach to describing teaching.

Lockwood (208) concentrated on only one teaching skill and attempted to identify elements that would be helpful in explaining the question-asking behavior of teachers in the classroom. He worked with four mathematics teachers, identified by colleagues and administrators as being excellent teachers, and audiotaped and analyzed 47 class sessions ranging from seventh grade math through Algebra II. Lockwood proposed two concepts or elements in teacher questioning: cues and factors. Cues were stimuli which act as signals to ask a question. Factors are elements that have an influence with respect to what question the teacher asks. Lockwood identified 17 factors and 16 cues. Thirteen of the factors were considered to reflect teacher objectives. Cues involved language, absence of language when expected, and visual cues.

Lockwood also identified two general relations for use in explaining and predicting teacher questioning: a go-ahead relation and a modification relation. The result of a go-ahead relation was usually a question that had the effect of moving the discussion to the next point or topic. The modification relation was a question that was usually more specific and leading than the teacher's previous question.

Another exploratory study on a teaching skill was completed by Conrad (423) who investigated the relationship between lesson planning and teacher behavior in secondary school classrooms. Conrad used questionnaires, interviews, and classroom observation via Flanders' system to obtain data. The teachers in his study (N = not given in source reviewed) were placed in three groups based on total planning scores. The source reviewed did not contain information relative to the methods by which the total planning scores were obtained. Conrad found significant relationships between planning patterns and the tendency of teachers to monopolize classroom verbal interaction. Teachers who planned extensively tended to talk less in the classroom. Teachers who emphasized qualitative aspects of planning also involved students in responses requiring independent judgment, opinion, prediction, and conclusion more frequently than did other teachers.

Hunt and Germain (170) examined the relationship between a teacher's critical thinking ability and his classroom verbal behavior and perception of teaching purposes. Their assumption was that if one of the central purposes of schools is to train students in critical thinking, teachers need to serve as models. Hunt and Germain administered the Watson-Glaser Critical Thinking Appraisal to 39 teachers and then observed and videotaped the 10 highest and 10 lowest scorers in their classrooms for three one-half hour periods. Typescripts of the verbal behavior were made and classified relative to amount of student support and type of thought process (using the Gallagher-Aschner system). In addition, the 20 participants completed 10 questions about their teaching purposes and learning goals.

Data analysis showed that teachers who scored high in critical thinking, as measured by the Watson-Glaser instrument, made a significantly greater number of comments in the categories of convergent, evaluative and divergent thinking and in support of students. Their stated purposes and goals were also more manifest in the classroom and were both academically oriented and student-centered. Hunt and Germain suggest that greater emphasis on

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the development of critical thinking ability should be **an** integral part of pre- and in-service programs. They raise an interesting point: who will train the teachers' teachers?

A group of studies focused on communication skills and presenting behavior. Pinney (281) attempted to identify correlates of successful teaching as they might exist in the presentation behavior of pre-intern teachers. Fifty-six Stanford University pre-interns each taught one of six pre-set social studies or English lessons to 25 eighth and ninth grade students. Each of these students took an appropriate 20 item multiple choice comprehension test which was used to determine a mean class achievement score for each teacher. Scores were adjusted for student verbal and quantitative ability and for lesson difficulty. Sixteen high-scoring and 16 low-scoring teachers were selected for further investigation relative to four categories of presentation behavior: verbal, nonverbal, combination, and interaction.

Audiotape, videotape, and/or manuscript records of teacher performance were used in the analysis. Pinney found that behaviors related to success in one sample were different from those in the other sample. As a result, when the two samples were combined, few behaviors discriminated high-scoring from low-scoring teachers. High-scoring teachers appeared to convey essential points of lessons through frequent use of repetition, verbal statements of importance, and/or reinforcement of pupil responses. Verbal behaviors were often accompanied by various non-verbal behaviors.

Several investigators looked at teacher communication in elementary school classrooms [Shirley (327), Kean (488), Stuchin (346), Resta and Niedermeyer (529), Carll and Davis (66)]. Shirley (327) observed and assessed the behavior of five beginning and six experienced teachers in grades three through six during a guided reading activity and found no statistically significant differences between the groups. Kean (488) investigated the linguistic structure of teachers in grades two and five. Analysis of the five 40-minute tape recordings for each teacher did not result in the identification of any marked differences between the two groups. Both groups used normal adult speech patterns not specifically related to any differences that might separate them from their students.

Carll and Davis (66) also compared behaviors of second and fifth grade teachers. The content of the observed lessons was mathematics. Using the Observation Schedule and Record 5V (OScAR 5V), the investigators worked with seven second grade teachers and nine fifth grade teachers and their pupils. Based on their sample, Carll and David found elementary school mathematics teaching to be very direct and teacher dominated. They also found several significant differences between grade levels: (1) fifth grade pupils asked more substantive questions, (2) fifth grade teachers reacted to pupils' responses by approval more than did second grade teachers, and (3) second grade teachers had a higher teacher talk/total talk ratio than did fifth grade teachers.

Stuchin (346) studied the nature and extent of personal communications children in third grade classrooms receive from their teachers. These communications events were also related to the teachers' ratings of their pupils' (a) classroom behavior and (b) needs for personal communications.

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Personal communications were defined as those behavioral events by means of which a teacher conveyed to pupils information about themselves as individuals. Stuchin constructed a Personal Communications Checklist (PCC), consisting of six context and five behavioral categories, to use in her observations. She completed 200 observations in third grade classrooms. She also obtained teachers' ratings of their pupils' social, intellectual and personal attributes by use of a Behavior Rating Scales (BRS) instrument. Teachers were interviewed by the investigator who used a Needs Questionnaire which she developed for these interviews.

Stuchin found patterns of behavior among teachers observed to be fairly consistent, with "praise-blame" being the behavioral category used most. She also found that a small proportion of the children received the greatest percentage of personal information given. Children with high PCC positive subscores were likely to receive high PCC negative subscores as well. Those whose behavior was rated unfavorably by their teachers were likely to receive a great deal of negative information. However, children rated favorably did not necessarily receive a great deal of positive information.

Teachers used an extremely limited repertoire of behavior when communicating personal information. They tended to use considerably more verbal than nonverbal behavior. They did give a great deal of attention to children they had rated as needing much personal communication. However, the teachers were more likely to give negative information to these children than to provide positive communications.

D. L. Wright (387) compared the teaching patterns of secondary teachers with those of elementary teachers in an attempt to gain insight about similarities and differences. Forty-five secondary school teachers and 50 elementary school teachers participated in the study, allowing audiotaped observations to be made in their classrooms. Data from the 40 minute tapes were coded with the Flanders' instrument. Live observations were made and coded by principals who had been trained in the use of the Instrument for Observation of Teaching Activities (IOTA).

Wright found some significant differences between groups. Secondary teachers' classes had more pupil-initiated talk than did those of elementary teachers. Elementary teachers used significantly more teacher praise than did secondary teachers. Both of these measures were obtained from the Flanders' analyses. No significant differences were identified through the use of the IOTA. Wright concluded that elementary and secondary teachers were more alike than different in their teaching patterns.

Nearhoff (254) and Eggland (85) observed communication in secondary school classrooms; Nearhoff, in third year French classes and Eggland, in distributive education. Nearhoff adapted the FLint system (Foreign Language interaction system) of Moskowitz for his use in analyzing verbal behavior in 54 French classes. He found the teachers observed to be using direct teaching styles, predominantly engaged in information-giving, and structuring their classes so that pupils responded only within a narrow and limited range. The pattern of English conversation in these classes generally followed that of teacher-pupil interaction in French.

Eggland (85) audiotaped the interaction of 38 teachers of distributive education and their 672 senior students and analyzed this interaction using the Flanders' system. Additional information was obtained through the use of a structured questionnaire. In his study, Eggland attempted to compare his findings with those of other investigators of classroom interaction. He found that his sample exhibited less criticism and justification of authority, less responsive student talk, and less silence or confusion as well as more teacher talk, student talk, and student-initiated talk.

Neujahr (258) examined teacher communication to individual students when instruction was individualized. His sample was restricted to three sixth grade teachers. A class of sixth grade students was videotaped as the pupils worked for a week in science, in social studies, and in mathematics. Verbal behavior was analyzed using a modification of Bellack's system. Neujahr found much consistency of teacher role as teachers worked with different pupils. The teachers' primary function appeared to remain that of soliciting and the functions performed least often were structuring and responding.

Soar (337), Dadey (78), and Crispin (75) reported investigations relating to procedures for managing the classroom. Soar (337) worked with a national evaluation of Project Follow Through. Data collected over two years came from 70 kindergarten and first grade classrooms involving seven different experimental programs and two comparison (control) classrooms. The primary instrument used to measure teacher classroom management was organized around the concepts of the teacher's methods of control, the pupils' responses to these methods, and the emotional climate as represented by the expression of affect. Soar identified findings which suggested that teachers who feel pressure to give pupils greater freedom may minimize both structure and control by reacting to their own discomfort in ways that do not support pupil growth. With the disadvantaged children involved in this evaluation, negative affect appeared to have little impact. Positive affect was related to cognitive growth.

Dadey (78) investigated the relationship between perceived classroom verbal behavior of teachers and frequency of discipline problems. He selected a random sample of 30 teachers and 300 students from a suburban secondary school in Central New York state. Data were collected by administering the Verbal Behavior Q-Sort to teachers and Student Perceptions of Teacher Influence Questionnaire to pupils. An analysis was made of the actual number of discipline referrals to the administrator in charge of discipline made by each teacher in the sample.

Among findings Dadey termed significant were these: (1) teachers who used more direct influence, as perceived by their pupils, had a higher frequency of discipline problems; (2) experience of the teacher and subject area taught were significant factors in the relationship between perceived verbal behavior of teachers and frequency of discipline problems, but sex was not; (3) teachers who perceived the "ideal teacher" to use more praise and encouragement had a higher frequency of discipline problems; (4) teachers perceived as least effective had the highest frequency of discipline problems.

Crispin (75) conducted a pilot study in which he tested the hypothesis that the number of discipline behaviors by a teacher is the function of the personality of the teacher. He used rained observers in the collection of interaction analysis data in public school classrooms. His first set of observations was collected in one sixth grade classroom in which four different teachers worked, each teaching a different content area (English, mathematics, science, social science) to the same group of students. He next collected data at the high school level and observed four teachers of the same subject who taught homogeneously grouped classes at the same period of the day. In addition, he collected more data in the elementary school using three third grade teachers working in self-contained classrooms conducting lessons in reading, mathematics and social science.

Crispin concluded, after data analysis, that, although the number of teachers involved was small, he had found evidence that some teachers promote discipline problems through their own behaviors. He found that teachers tended to behave consistently. If they employed a high number of acts of discipline with one class, they tended to do this with another class. If they used few or no acts of discipline with one class, this same pattern was true when dealing with different classes and/or different subject matter.

Two other studies relate to classroom management but contain additional emphases [Ayllon and McCullen (13), Hall et al. (143)]. Ayllon and McCullen (13) suggested that a teacher can eliminate behavior problems by increasing his/her effectiveness in the classroom as measured by (1) proportion of time per day spent discussing academic subject matter with the class, (2) daily number of assignments given to each pupil, and (3) proportion of correct work done in a class of children (aged six to nine years) with severe behavior problems. The investigators report that, after a year of behavioral intervention, six of the 14 children were able to be transferred to regular classrooms.

Hall et al. (143) reported a study in behavior modification in which teachers served both as observers and experimenters in attempts to reduce disputing and talking out behaviors of individual pupils and whole classes. Hall and his colleagues concluded that teachers in a variety of classroom settings could obtain reliable observational records and carry out experimental manipulations successfully using resources available in most schools.

Ferren (98) conducted an exploratory study to determine how teachers adapt to the demands of the organization in which they teach. She termed teacher adaptations "survival techniques." The study covered a two year period, in two secondary schools. Data were obtained through semi-structured interviews, observation, and analysis of written documents of the schools. Ninety-two formal interviews were conducted and 80 full-period classroom observations were made.

Ferren hypothesized the use of seven adaptive behaviors which had been reported in industrial research. These behaviors were (1) climbing the organizational ladder; (2) manifesting defense reactions such as projection, aggression, etc.; (3) becoming apathetic and disinterested toward the organization and its goals; (4) creating informal groups to sanction the defense reactions and apathy; (5) formalizing the informal groups, e.g. forming a

union; (6) evolving group norms to perpetuate adaptive behavior; (7) evolving a psychological set that human factors become increasingly unimportant and material factors become increasingly important.

Ferren found the adaptive behaviors in schools coincided in classification with those reported in industrial research. She did not identify any new adaptive behaviors. She also found that all teachers observed or reported using adaptive behaviors but not all teachers used all behaviors. Adaptive behaviors in all seven categories were used but distribution through the categories was uneven. Becoming defensive and becoming apathetic were the frequently employed behaviors. Teachers' perceptions of organizational demands appeared to be related to whether the teachers' locations were central or peripheral in the organization.

Miscellaneous Studies. Having a "miscellaneous" sub-division may be considered as a cop-out. However, it seemed the only way to identify and briefly describe a few studies that failed to fit in the other subdivisions. Two studies related to the verbal behavior of supervisors [Rousseau (308), Michalak (237)], one to the measurement of counselor effectiveness via interaction analysis [Afanador (5)], one to the measurement of college instructor behavior [Fahey (93)], one to teacher behavior in role-playing [Ramirez (290)], and one based on ecological psychology [Gump (142)].

Rousseau (308)was interested in discovering if, and in what ways, supervisory verbal behavior might vary according to the status of the teacher with whom the teacher was interacting. He investigated the verbal behavior patterns of supervisors interacting with student teachers and with cooperating teachers, using in his analysis a system developed by Blumberg. This system, a modification of Flanders' work, contains 15 categories of verbal behavior that can occur during a conference between a teacher and supervisor. Ten categories reflect supervisor behavior; four, teacher behavior; one, silence or confusion during the conference.

Four supervisors were involved in the study. Conferences were tape recorded. Data analysis revealed that these four supervisors did behave differently when they were interacting with student teachers from when they were interacting with cooperating teachers, although this was not true for all categories. The supervisors used more indirect behavior when interacting with student teachers. They gave significantly more praise and asked for significantly more information when interacting with student teachers. These differences in behavior may have been functions of the conferences.

Michalak (237) investigated and tested interdisciplinary models of dialogue settings akin to the supervisory conference in student teaching. He also attempted to gather information about the verbal behaviors university supervisors and supervising teachers used during student teaching conferences. Ten pairs of university supervisors and supervising teachers participated in the study. An instrument was developed for use in data analysis. It was used to classify the behavior in either procedural or substantive areas: informing, interpreting, clarifying, summarizing, evaluating, basic questions, elaborating questions, challenging questions, and listening. Representative 15 minute supervisory conferences were analyzed.

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Michalak found the education model used to be most imilar to that of the social casework interview. He also found that university supervisors, as a group, engaged in more listening behavior than did supervising teachers, although individual supervisors accounted for much of the difference. As a total supervisory group, university supervisors engaged in more verbal behaviors than did supervising teachers. Both types of supervisors exhibited the behaviors of interpreting and informing frequently. However, the university supervisors worked in the substantive area while the supervising teachers were concerned with the procedural area, suggesting that the university supervisors concentrated on lesson content and teaching behavior while supervising teachers stressed classroom management and control, etc. Although there were differences in the verbal behaviors of supervisory pairs, there was no evidence to suggest that either perceived the supervisory function or the needs of the student teacher differently. Patterns did suggest that significant differences in verbal behaviors may exist between the two supervisors when working with the same, or with different, student teachers. These differences may have been due to differences in perception.

Afanador (5) was interested in determining if interaction analysis could discriminate between good and poor student counselors. Afanador's subjects were 16 counselors enrolled in a practicum course of a graduate program in Rehabilitation Counseling. Audiotapes of their verbal behavior during the sixth, ninth and twelfth weeks of the semester were coded for analysis. Supervisors ranked the student counselors, using enumerated traits that characterize good counselors as criteria. Afanador, using analysis of variance procedures on his data, was able to detect no differences between good and poor student counselors.

Fahey (93) investigated the problem of achieving delineation of college teaching behavior. He developed a rating scale which consisted of 13 single adjectives, 12 bipolar pairs, and one single item of global judgment of teaching effectiveness. This rating scale was used by 4,916 undergraduate students in classes of 116 liberal arts instructors in humanities, natural science, and social sciences. Fahey found that (1) only the adjective "stimulating" related highly to the global judgment of effectiveness, (2) the semantic differential scale contributed nothing to the description of instructor behavior, (3) wide variance existed between individual instructors on all the separate items of the scale, including the global judgment of effectiveness.

Ramirez (290) analyzed teacher behaviors conducive to successful student role-playing. Four teachers experienced in role-playing participated in 10 role-playing sessions, which were videotaped. They worked with sixth grade students for these sessions. Flanders' system was used to analyze the verbal interaction. Ramierz identified four role-playing functions: warm-up, to acquaint students with the problem; discussion, for exploration of the problem; role-playing; and summary, of major ideas derived from the session. She found that significant differences existed between the four role-playing functions and in student-teacher interaction between conventional classes and role-playing classes. No significant differences were identified between the two types of classes, however.

Gump (142) attempted to use principles and techniques from ecological psychology to arrive at concepts and methods for describing the classroom behavior setting. He identified the ecological subunits within a third grade classroom setting and specified the qualities of these subunits. Data were obtained by having an observer sit at one side of the classroom and dictate about events which marked the beginnings, ends and major contents of sections of classroom activity. In addition a film record was made. (Gump reported that camera watching was never a serious problem, with the highest rate being about three per cent and the average of camera watching behavior being less than two per cent over a recording period of several weeks.)

Events in each of six third-grade classes were recorded in two-day chronicles. Analysis of the environmental subunits showed these to be clear, ecological units. Actions within one segment were highly interdependent. Actions occurring in separate segments were independent. Gump found it possible to map the school day and to diagram the classroom environment.

Other than that they were descriptive studies in which teacher behavior and verbal interaction were investigated, these miscellaneous studies lack a basis for comparison.

The statement that teaching is a complex process is neither new nor startling. Investigators working in the area of teaching skills and strategies only serve to provide additional data to reinforce this statement. Teaching may be analyzed from the perspective of ventures and moves or from the perspective of specific skills and activities (questioning, presenting information, lesson planning, maintaining discipline, etc.). Two questions might be raised, relative to the research reported in this section of the monograph and to those studies yet to be described in later portions of this section: Is research possible without theory? If there is a theoretical basis to the research being done, are the investigators cognizant of it and do they operate in a manner consistent with all that the theory implies?

STUDIES OF BEHAVIOR CHANGE

The investigations reviewed for this part of the monograph all share the common focus of attempting to produce change in some behavior or cluster of behaviors. The studies were further categorized into the divisions shown in Table III, below. There was a large group in which the focus of the investigation was directed on the medium or methodology used to produce the behavior change rather than on the behavior itself.

TABLE III

TYPES OF BEHAVIOR CHANGE STUDIES

BEHAVIORAL FOCUS	NUMBER OF STUDIES
Cognitive Operations	7
Interpersonal Relations, Skills	25
Teaching Skills	45
Evaluation Skills	10
Media, Methodology Used to Produce Change	80
Total	167

Most of the investigations involved a treatment group and a control group. Some of the research designs were of the post-test-only control group type. Usually the participants were drawn from students enrolled in a particular course or from teachers in a specific school or school system. When possible, individuals were assigned to treatment and control groups on a random basis.

Changes in the Cognitive Domain. Seven research studies [Hogg (163), Torbet (356), Detwiler (434),Quiring (288), Betres (32), Hill (466), Murray and Williams (252)] emphasized behavior changes in the cognitive domain.

Hogg (163) was interested in determining the effect of a cognitive verbal awareness training program on the verbal development of student teachers as indicated by what they said in the classroom. Twenty-four University of Pennsylvania students who were student teaching in secondary school social studies classes were divided equally between treatment and control groups. All student teachers were observed six times during the first three weeks of their student teaching, to obtain data on their level and mode of cognitive

operation. The treatment group was then given 10 hours of training in cognitive verbal awareness (involving the development of a rationale for improving cognitive verbal behavior in the classroom and introduction of a method of systematic observation by using the Instructor Cognitive Operation Inventory). Following the training, all 24 student teachers were again observed for 6 times. Changes in cognitive behavior were analyzed, using the t-test. During this second period of observation, the 12 treatment group student teachers received feedback.

Hogg found that the program had resulted in a positive and significant effect, for the treatment group, on the number of thought units used which were classified as above the search for factual knowledge. The level of cognitive operation did not change significantly for the student teachers in the control group. There was a marked variation in improvement of cognitive operation among the individuals in the treatment group, probably due to factors beyond the scope of the study. There was no change in the mode of cognitive operation (examinatory as opposed to the conventional expository mode) of the treatment group. Hogg reported that the individuals involved in his study were generally unaware of the need for improving the cognitive climate of the classroom, prior to treatment. The material reviewed did provide evidence that the individuals in the control group were enlightened following completion of the study.

Murray and Williams (252) were also concerned by the lack of information concerning cognitive processes in the classroom and the effects of cognitive instruction with pre-service students in teacher education programs. They also worked with student teachers of social studies. Thirty-three subjects (17 in the experimental group, 16 in the control group) were randomly drawn from a stratified sample and controlled on age, sex, and grade point average. The experimental group was provided with cognitive instruction which involved the use of Bloom's taxonomy and the Gallagher-Aschner system for classifying questions as well as a discussion of Mager's work on the formulation of behavioral objectives. In the final phase of the instruction, each student teacher conducted a lesson with peers as pupils in which he attempted to formulate and teach for instructional objectives at various cognitive levels.

Instruction took place during the week prior to student teaching. During student teaching, each of the subjects was observed five times (30 minutes each) by observers trained in the use of the Floria Taxonomy of Cognitive Behavior (FTCB). Data were collected on the behavior of pupils as well as of student teachers in order to determine if the cognitive behavior of pupils increased as the cognitive structure of instruction increased.

The investigators found little statistical significance in behavior of the experimental and control groups at the lower cognitive levels. At the higher cognitive levels, statistical significance was consistently found between the experimental and control groups as well as between the pupils of the two groups. The data appeared to support the hypothesis that cognitive instruction could facilitate the development and use of the higher cognitive aspects of classroom behavior.

Torbet (356) also used Bloom's Taxonomy as an instructional tool for effecting change in classroom behaviors and interaction patterns. Two groups of five teachers each and two eighth grade classes for each teacher were involved in the study. The individuals participating were observed, in pre-test and post-test measures, by use of an observational record the investigator had composed using the Taxonomy categories as a checklist, by Flanders Interaction Analysis System, and by Ryans' Classroom Observation Record. Standardized achievement tests were given to the pupils. The experimental group received instruction in the use of the Taxonomy to promote the use of higher cognitive processes.

Data from Torbet's pilot study did not result in any findings at a level of significance (.05) although the study did demonstrate that the Taxonomy checklist could be used to record classroom observations. Although there were no findings at a level of statistical significance, the teachers in the experimental group were found to be less direct, to emphasize higher level cognitive goals, and to have pupils whose standardized achievement test scores improved.

Two other investigators were concerned with the development of critical thinking skills. Betres (32) investigated the development of critical thinking skills through the use of audio-tutorial materials. A random sample of 60 pre-service elementary school teachers was selected with subjects randomly assigned to the experimental and control groups. All subjects were pre-tested, using the Watson-Glaser Critical Thinking Appraisal (Form Zm).

The experimental group completed four audio-tutorial activities consisting of tape recordings and correlated workbook activities dealing with (1) evaluation of the reliability of sources, (2) fundamental deductive principles, (3) evaluation of deductive arguments, and (4) analysis and evaluation of inductive positions. Each individual was assigned, upon completion of the audio-tutorial materials, to one of six teaching teams and required to develop, implement and evaluate an instructional activity which emphasized the development of a specific critical thinking skill or a general problem solving episode which contained identified critical thinking skills.

All 60 subjects were post-tested with Form Ym of the Watson-Glaser Critical Thinking Appraisal. A series of t-tests of the differences between means was used to test the hypotheses of the study. Betres found significant gains in favor of the experimental group in the critical thinking skills associated with the Watson-Glaser subtest of Recognition of Assumptions. There were no significant differences between the experimental and control groups on the total scores or on the other four subtests of the instrument.

Quiring (288) also used an auto-tutorial approach in her research. Seventy-two randomly selected sophomore university students enrolled in a fundamentals of nursing course were randomly assigned to two treatment groups (A and B) and a control group. Students in treatment group A were given an investigator-prepared learning package emphasizing high level questions. Students in treatment group B were given low level questions.

Quiring hypothesized that if question level was important in concept development in young children, as shown in Taba's work, and was related to achievement on some criterion measures composed of high level questions, the effects of question level on the achievement of adult learners (such as nursing students) should be investigated. The predominant use of low level classroom questions might account for students' difficulties in applying classroom information in clinical situations.

Quiring developed two study units on surgical asepsis and parenteral injections. Each unit consisted of a written study guide, audio/videotape, slides, and specific equipment such as gloves and syringes. Only the levels of the questions included in each unit differed. Students in the experimental groups completed each unit and took an achievement test. Students in the control group attended the usual teacher lecture/discussion and took the achievement test.

Quiring found no significant difference in achievement on the criterion test for students who used study materials containing either high or low questions. Nor were there significant differences for students with either high or low GPA for the two treatment groups. There was no significant difference in comparing cognitive scores of students in the two experimental groups with the control group. She concluded that factors other than question level must be considered because no differences in achievement were evidenced based on cognitive question level.

However, Quiring used a forced-choice answer type of item in her criterion measure. This does not enable the respondent to adequately demonstrate higher level cognitive processes. In addition, the two to four week study period might have been insufficient time for change to result. Another factor that should not be overlooked was that the questions incorporated in the learning package did not require a written or verbal response. Students may have read the questions but may not have thought about possible responses since they were not required to provide evidence of having responded to the questions.

More research needs to be done before accepting Quiring's suggestion that it is possible that knowledge level questions are as helpful to the adult learner in enhancing his ability to develop higher level cognitive skills as are high level questions.

Although there was a scarcity of significant findings (not to mention significant positive findings) in the studies cited in this subsection, research in changing cognitive behaviors should not be ignored as an area of work for future investigators.

Changes in Skills of Interpersonal Relations. A larger (25) group of studies related to problems of producing changes in the behaviors connected with group process skills and with interpersonal relations [Hastings (150), Grubb (141), Widdell et al. (564), Harders (146), Loye (211), Latham (202), Krajewski (196), Kise (188), Gregorich (138), Carr (67), McKnight (504, 505), James (172), Buckner (60), Bolen (40), Bowman (413), Eder (84), Carline (64, 65), Gage et al. (119), Hough and Ober (166), Roeber (533), Aho (392), Blakey (36), Ruff (537), Simon et al. (545), Wulff (575)].

Hastings (150) investigated the changes produced as a result of using a program called TARGET with senior students in social studies education. (TARGET is an acronym representing: topic, affect, role, group, expressiveness, togetherness.) The 39 students were selected at random and assigned to three different groups: TARGET, sensitivity, and traditional methodology (this group served as the control in the study). The treatments, lasting for 15 hours each, extended over a 5 week period. Subjects were rated before and after the treatments with the Teaching Effectiveness Scale and the Teacher Characteristics Scale. Rating was done by the supervising teachers as the seniors participated in a six week student teaching experience. Using analysis of variance and of covariance procedures, Hastings did not find any statistically significant differences between gain score means and difference between means.

Planned orthogonal comparisons showed a .08 level of significance for the differences of gain scores between the three groups when compared independently. Revisions of the TARGET program were made, based on Hastings' findings, and the final T in the acronym was changed to represent "transaction," with the basic concept of the program remaining that of aiming for change by using a topic of concern for group interaction.

Grubb (141) was also interested in group behavior and attempted to assess the effectiveness of verbal instructions and feedback to teachers in developing cooperative behaviors of kindergarten children. Data were gathered, using a time observation sample over a seven month period, in three classrooms. Grubb reported large changes in pupils' cooperative behaviors with the presentation of five to ten minutes of daily feedback to teachers but little or no change with the presentation of the verbal instruction. Based on these findings, Grubb concluded that his research implied that cooperative behavior is "teachable" to entire classrooms of children, using the classroom teacher as the agent of behavioral change. However, traditional deductive methods (provision of generalizations via lectures and textbooks) are less effective than inductive methods. Grubb suggested that inductive teacher training methods should receive greater emphasis, particularly in areas where deductive methods have not succeeded in developing desirable skills.

A cluster of nine studies [Loye (211), Latham (202), Krajewski (196), Gregorich (138), Carline (64, 65), Buckner (60), Hough and Ober (166), Ruff (537), Simon et al. (545)] describe the use of Flanders' System of Interaction Analysis to change teacher influence patterns in working with students. Four investigators reported no significant differences between treatment and control groups or failure to accomplish changes at an acceptable level of significance [Gregorich (138), Carline (64, 65), Buckner (60), Latham (202)]. Gregorich (138), working with parents and teachers in joint microteaching situations focusing on communication, reported findings that did not indicate attitude change more significant than that which could be attributed to the external factors of invalidity contained in the pre-experimental design. He stated that, although teachers and parents were learning and using new skills in verbal behavior with children, these skills were not applied in the interaction of the two groups of adults.

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Carline (64, 65) found that, although an in-service program for elementary teachers in which Flanders' System of Interaction Analysis was used as a feedback technique did produce more indirect teacher behavior, the use of more indirect verbal behavior by teachers did not cause the children of those teachers to achieve at a higher level than children whose teachers were not so trained. Buckner (60), in an analysis of the relationship between inter-action analysis and teacher interpersonal behavior, reported no significant differences between his experimental and control groups (total N = 32 high school teachers of various subjects) in accurate empathy, nonpossessive warmth, and genuineness (self-congruence) as measured by the Truax Relationship Questionnaire (pre- and post-training).

Latham (202) investigated the relationship of limited training (eight 50 minute class sessions) in the use of Flanders' System of Interaction Analysis to selected factors in the Junior Laboratory Program (JLP) at Western Carolina University. The factors selected for investigation were (1) the teaching behavior of university students, (2) the evaluation of the obser-vational and teaching experiences of university students by regular classroom teachers, (3) the self-descriptions of university students, and (4) the per-ceptions of university students about their observational and teaching experi-ences.

During the Junior Laboratory Program, the students observe and participate in the campus laboratory school, teaching a minimum of three 45 minute periods during the quarter. Forty five students in the JLP were randomly assigned to one of three groups: experimental (received limited training in the use of FSIA), control group one (participated in small group activities not related to FSIA), and control group two (continued in the regular instructional pro-gram). The students were administered The Adjective Check List as a pre- and post-test, were rated by the supervising teachers, were observed and their behavior recorded using the Flanders' System, and were asked to describe their perceptions of the pupils they taught and of teaching.

Using various statistical tests, Latham failed to find significant differences between groups relative to teaching behavior. He did identify significant differences among the rankings of the three groups according to their perceptions of the pupils taught (.001) and of teaching (.05) for the experimental group. Students in the experimental group viewed the pupils they taught as being unreceptive and teaching as an unsatisfying experience.

Loye (211), Krajewski (196), and Hough and Ober (166) reported more positive results, using Flanders' System of Interaction Analysis. Loye (211), working with members of the faculty of the Academic Instructor Course within the Academic Instructor and Allied Officer School which is a part of the Air University of the United States Air Force, divided the 14 teachers into an experimental group and a control group. The experimental group attended a two hour training program designed to enable them to interpret, or understand the interpretation of, matrices developed by using Flanders' System. All 14 teachers were videotaped while teaching. All viewed the tapes of their teaching but those in the experimental group used the interaction matrices to analyze their behavior. Loye developed 21 directional hypotheses for testing and found that 16 of these indicated that teachers in the experimental group, when compared with the control group, had changed their classroom

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influence patterns, become more indirect, using more praise and encourage-
ment, and more readily accepting and using ideas of their students, among
other behaviors.

Krajewski (196) also used videotaping and the interpretation of inter-
action analysis matrices in his research with Master of Arts in Teaching
interns at Duke University. The 41 interns were divided into an experimental
group (N = 20) and a control group (N = 21). The interns were matched accord-
ing to subject area, undergraduate records, Demonstration School supervisor's
ratings during the summer, Graduate Records Examination and National Teachers
Examination scores where available, and Minnesota Teacher Attitude Inventory
Scores, and were then grouped by randomization.

The experimental group received videotape recordings and interaction
matrices in addition to the usual supervision. The control group received
only the usual supervision. The Minnesota Teacher Attitude Inventory and
self-ratings were administered as pre- and post-tests. Student and super-
visor ratings were obtained at the end of the teaching experience. When
Krajewski analyzed his data, he found the experimental group had become more
indirect, talked less, praised more, used student ideas more, and had more
student initiated participation and interaction as the school year progressed.
He also found these interns to be less idealistic toward evaluation of self,
more nearly accurate in their self-perceptions, and more positive in attitude
toward teaching than were the interns in the control group.

Hough and Ober (166) reported on a two-year course revision and evalua-
tion involving five experimental combinations of methods for teaching human
relations skills and the analysis of verbal classroom teaching behavior.
The essential independent variable was the use versus the nonuse of inter-
action analysis to describe the verbal behavior of students and teachers.
Data were gathered on pretest scores on three control variables using the
Dogmatism Scale, the Teaching Situation Reaction Test, and the College Student
Problems Q-Sort. There were no significant differences for the five treatment
groups. Post-treatment data were obtained from simulated teaching situations.
Data relative to verbal behavior were gathered by the use of a 13 category
modification of Flanders' System of Interaction Analysis. The students taught
interaction analysis were found to use, in these simulated teaching situations,
significantly more verbal behavior associated with higher student achievement
and with more positive student attitudes. They also used significantly fewer
behaviors found to be associated with lower achievement and less positive
attitudes. Although the investigators could identify clear differences
between groups, they were less certain of reasons for these differences.
They postulated that when interaction analysis skills are acquired, they can
be (and are) used by teachers as a feedback system for behavior analysis and
change.

Harders (146) and Bolen (40) used the Roberson Teacher Self-Appraisal
Observation System in their studies of behavior change. Harders was interested
in determining if an in-service course in which the observation system was
used would cause the teachers to become more supportive in their verbal and
non-verbal expressions. Thirty-eight secondary school teachers volunteered
to participate and were randomly divided into three groups. One group took
the entire in-service course which consisted of six hours of classroom

instruction about the observation system and of coding two tapes of their teaching, using the system. A second group received the instruction but did not code any tapes. The third group served as the control and did not receive any of the in-service course. When Harders compared the groups, he found the group which received the complete in-service course had increased their proportion of supportive verbal responses, as had the group which had received only the instruction. Coding of tapes did not have any significant effect. The non-verbal behaviors of the teachers were not changed by the in-service course.

Bolen (40) used the Roberson Teacher Self-Appraisal system to categorize teacher behavior in the areas of cognitive objectives, affective objectives, methods, verbal expressions, and non-verbal expressions. She worked with 20 elementary school teachers and 31 junior high school teachers who composed the experimental group and with a group of teachers from similar populations who had volunteered to serve as controls. Bolen's vehicle for producing behavioral change was not the Roberson system per se but the use of videotape feedback based on the system's categories. Subjects were videotaped prior to exposure to the system and after they had received eight training sessions. They also responded to a form of the semantic differential used to measure attitude toward teaching, as additional pre- and post-test measures.

Bolen found no significant differences between groups in attitude change toward teaching that could be attributed toward videotape feedback and self-appraisal of classroom performance. Elementary teachers in the experimental group did, however, exhibit significant changes in teaching behavior in the cognitive objectives, verbal expressions, and non-verbal expressions cate-gories. Significant differences were determined for the junior high school teachers in the experimental group in the total teaching behavior observed in the major categories of the system.

Videotaping procedures, in microteaching sessions, were also used by Kise (188) in a study designed to investigate behavior change as supervisors worked with teachers. Kise was interested in determining whether specific or general supervisory behavior produced more changes from the teach to the reteach portions of the microteaching cycle. She worked with 37 graduate students who served as supervisors working with preservice teachers and some graduate students as they taught high school students paid to participate in the summer microteaching sessions. Blumberg's Category Interaction System for Supervision was used to analyze the conferences. Kise found that, as a group, supervisors who utilized specific supportive behavior produced signifi-cantly more change in teacher behavior in the reteach sessions.

An additional study on behavior change in a counseling situation was identified. Carr (67) investigated the effectiveness of training teachers in verbal responses based on core dimensions of interpersonal communication derived from a counseling framework. Four dimensions of communication (affective, specific, understanding, and exploratory) were emphasized. Experimental variables were a micro-counseling model (self-instruction manual and a videotaped model of peer counselors and expert counselors demon-strating desired verbal behaviors) and instructional supervision.

Sixteen teachers participating in an Urban Teacher Education Project were randomly assigned to four treatment groups: micro-counseling and instructional supervision, micro-counseling, instructional supervision, and control. Each participant conducted two pre-treatment interviews, a practice interview, and two post-treatment interviews with paid freshmen volunteers in the same teacher education project. Carr found the F ratio, resulting from a 2 x 2 analysis of variance for fixed effects variables, was significant at the .10 level for micro-counseling versus no micro-counseling for the affective-cognitive dimensions of communication. Instructional supervision versus no supervision was significant at the .04 level for the understanding-non-understanding and exploratory-non-exploratory dimensions. She found that, while both micro-counseling and instructional supervision were effective, instructional supervision was somewhat more effective than micro-counseling.

Some researchers, such as Carr, consider the lack of significant changes in behavior to be due in part to short training periods for the experimental group with which they worked. James (172) conducted a study in which the experimental group received 54 hours of training in interpersonal relations. The experimental (N = 14) and control (N = 14) groups were composed of students who had expressed an interest in taking a course in Interpersonal Relations Training. Both groups made audiotapes of role playing situations before and after the period of instruction. These tapes were rated using the Truax Scales: A Tentative Measure of Accurate Empathy, A Tentative Measure of Non-possessive Warmth, and A Tentative Measure of Genuineness. The two groups did not differ significantly at the beginning of the study. After training, the experimental group did not differ significantly from the control group on the three measures. However, the experimental group exhibited significant increase in the skill of nonpossessive warmth, accurate empathy, and total interpersonal skills. The control group exhibited no significant gains or losses. Apparently, for this sample, extended training was not sufficient to produce significant differences although it may have resulted in significant gains within the experimental group.

S. C. Eder (84) assessed the effectiveness of a group counseling treatment on the classroom behaviors and on the manifest anxiety levels of elementary school student teachers. Forty-four student teachers, nine of whom were male, formed an experimental group (two counseling groups with different counselor teams), a Hawthorne control group (two seminar groups with different seminar leaders), and a control group. The counseling groups received eight weekly treatments with the Problem Identification Model which employed psychodramatic techniques. The seminar groups met for equal amounts of time. The control group received no special treatment.

Instruments used in the study were Flanders' Interaction Analysis Categories with Nonverbal Categories (FIAC/NVC) for verbal interaction (specifically, restricting classroom behavior) and the State-Trait Anxiety Inventory (STAI). The STAI was administered to all subjects prior to, in the middle of, and at the end of student teaching. Two 20 minute samples of each teacher's behavior were obtained. At the end of student teaching, cooperating teachers completed the Confidential Evaluation Form (CEF).

The experimental group did not differ significantly in percentages of restricting classroom behavior nor in decrements of State anxiety over time. No significant relationship existed between level of State anxiety and percentages of restricting classroom behavior. Post-hoc analyses of the CEF data indicated that the counseling group was rated significantly higher (.05 level) than the other two groups on innovativeness and on potential as a teacher. Eder concluded that, although State anxiety levels declined for all subjects as student teaching progressed, some form of group treatment would be helpful for some individuals during their student teaching.

Gage et al. (119) found that teacher behavior could be changed by informing teachers how their pupils described the behavior of their actual teacher and of their ideal teacher. They worked with 176 sixth grade teachers in Illinois, one from each of 176 school districts, and their 3900 pupils. The participants volunteered and cooperated through a series of mailings. Teachers in the experimental group received information concerning their pupils' opinions; the control group was not given this information. Following the receipt of feedback by the experimental group, all teachers again collected pupils' ratings of actual and ideal teachers. The time interval involved varied from 34 to 53 calendar days.

Gage and his colleagues found, as they had predicted, that the differences, for teachers in the experimental group, were smaller for 10 of the 12 items when pupil descriptions of actual teacher behavior from the second rating were compared with descriptions of ideal teacher behavior in the first rating. They also found that the teachers in the group which averaged 53 calendar days from receipt of feedback to administration of second pupil rating approached their pupils' ideal descriptions most closely.

Teachers were also asked to estimate how one of their "typical" pupils would respond on the pre- and post-tests and to indicate how items on the pre- and post-tests were "like" that teacher. Gage et al. found that differences in adjusted means of the experimental and control groups for the post-perception measures were statistically significant for five of the 12 items. The direction of the differences was not consistent and the researchers were unable to explain what their findings meant and could only report them.

Gage et al. concluded that equilibrium theory had been supported, or, at least, not refuted. Feedback not only produced changes in behavior, it also produced corresponding changes in the accuracy of teachers' perceptions of their pupils' descriptions.

Changes in Teaching Skills. Forty-five studies reported on behavior change relative to teaching skills such as classroom management, questioning, refocusing, leading discussion, etc. [Pollack (283), Marlowe (216), Brent (415), Williamson (377), Trosky (361, 362), Rogers and Davis (301), Farley and Clegg (94), Olsen (262), Sorge (340, 341), Schwarzmann (323), Rutherford (310), Rodeheffer (532), Mayhew (507), McFadden (228), Gill (130), Pancrazio (272), Ridout (531), Moskowitz (248), Tinsman (353, 354), Amidon and Powell (396), Amidon (8), Morse et al. (245), Brashear and Davis (51), Zimmerman and Bergan (389), Traill (357, 358), Breed (13), Eicher (440), Duplisea (438), Emmer (441), Ward (561), Savage (539), Enokson (89), Davidson (431), Austin (398), Bondi (42), Bondi and Ober (410), Jones (486), Hemrick (464),

McDonald (502), Hovenier (474), Wong (571), Hoops (471), Emmer et al. (442), Tuckman et al. (559)].

Pollack (283) and Marlowe (216) focused on the use of behavior modification techniques by teachers in efforts to manage the classroom. Marlowe (216) attempted to determine the relative effectiveness of two teacher and two counseling approaches in the reduction of disruptive and inappropriate classroom behavior. The teacher approaches consisted of systematically applying behavior modification principles which focused on a high rate of positive reinforcement for appropriate behaviors and ignoring inappropriate behaviors. One technique emphasized teacher verbal and non-verbal approval. The second included a token reinforcement system along with the approval.

The counseling approaches consisted of behavioral counseling which emphasized counselor approval and token reinforcement, similar to that used in the classroom, and of client-centered counseling. The client-centered counseling technique attempted to change the classroom behavior by helping the student to focus on his inner self in an attempt to become more self-actualizing and involved a warm counselor-student relationship.

Twelve academically low achieving, seventh grade, black male students with reported high rates of inappropriate classroom behavior were observed and their behaviors recorded. They were then divided into three groups: behavioral counseling, client-centered counseling, or no contact control. Teacher techniques were applied concurrently with counseling and after the counseling treatments were completed.

Marlowe found that teacher approval, especially with the inclusion of token reinforcement, seemed very effective in reducing the undesirable classroom behavior of the students. He found some evidence that behavioral counseling was moderately helpful in reducing inappropriate classroom behavior. Client-centered counseling was not helpful for the group involved. Because there was little transfer of learning from the counseling setting to the classroom, Marlowe suggested that school counselors should be involved as teacher-consultants to assist teachers in classroom control and facilitation of optimal learning conditions.

Pollack (283), assuming that many teachers are unaware of the effects of their own behavior on the behavior of their classes, attempted to determine if teachers spend a greater proportion of their time in teaching activities as a result of using behavior modification techniques. Participants in her study were 14 fourth and fifth grade teachers who had volunteered to serve as subjects. Data were collected daily by undergraduate observers, during arithmetic or language arts instruction, for 30 minutes. A time-sampling procedure was used in which individual pupils were observed for a five-second interval and behavior recorded as on-task or off-task at the end of the interval. Teacher behavior was recorded as Teacher Initiated (teaching or managerial activities) or Teacher Reactive (attention to appropriate or inappropriate behavior), using a similar time-sampling procedure. An average of 10 days of data were gathered for base-rate, experimental, and follow-up periods.

During the treatment phase, the experimenter met with the teachers and encouraged them in the use of behavior modification techniques. Daily consultations were held to consider data on class behavior and the teacher's reactive behavior. The teachers' goal was to increase attention to appropriate behavior.

As a result of the consultations, there was an increase in the proportion of attention to appropriate behavior for all teachers, with changes in Reactive Behavior being significant at the .01 level. However, there was no increase in amount of time spent in direct teaching activities. In general, teachers spent increasingly less time teaching over the three phases of the study, with increases in time spent attending to pupils and in managerial activities.

Although observer data did not support the statement, 10 of the 14 teachers reported they had more time to teach. Behavior modification techniques had been successfully mastered by the teachers which suggested that an increased ability to manage the class generalized to the feeling that more teaching was being done. It is also possible, Pollack stated, that there may be a ceiling on the amount of direct teaching that can be done.

Ten investigations [Williamson (377), Torsky (360, 361), Rogers and Davis (301), Farley and Clegg (94), Olsen (262), Zimmerman and Bergan (389), Savage (539), Enokson (89), Davidson (431), Austin (398)] focused on changes in questioning behavior of preservice and in-service teachers. Three studies, those by Rogers and Davis, by Farley and Clegg, and by Olsen involved the use of Bloom's Taxonomy or materials based on this reference. Three investigations (Trosky, Rogers and Davis, Olsen) dealt with elementary school teachers and their pupils. Farley and Clegg (94) worked with preservice secondary school teachers of social studies. The source reviewed concerning Williamson's research did not identify the grade level(s) or content area(s) of the subjects involved. Several papers contain reports of behavioral change although not always at an accepted level of significance.

Williamson (377) evaluated a packaged, in-service training program designed for teacher trainers to use in instructing teachers. Teachers, nonteachers, and trainers of teachers were involved in his study and were divided into three groups: one control and two experimental groups. The participants completed a pretest, provided biographical data, and responded to the Minnesota Teacher Attitude Inventory. Treatment consisted of seven and one-half hours of instruction (one and a half hours per session) in the program. Questions from the post-test were judged on category and quality. Williamson found that special training with the self-contained materials did increase the questioning skills of the subjects (significance or lack of it was not discussed). He found no significant differences between teachers and nonteachers on the post-test. Young teachers performed significantly better than older teachers on the average. Attitudes, as measured by the MTAI, were significant only on pretest scores for teachers.

Olsen (262) worked with preservice elementary school teachers as they taught social studies lessons to second or third grade children. Thirty college students participated, with 10 assigned to the experimental group and 20 to the control group. Half of each group taught second graders, half

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taught third grade children. All were enrolled in a methods class in elementary social studies and participated in the regular class work. In addition, the experimental group participated in an intensive program based on extensive guidance in the use of Bloom's Taxonomy. Near the end of the term, each college student taught a 30 minute social studies lesson to a class in the campus laboratory school.

The lessons were observed by the investigator and an assistant. Questions were recorded, tabulated, and, later, percentages were calculated using the Clegg classification system, a six category system based on Bloom's work as modified by Sanders. Although Olsen's results were not at a level of significance, he found that the experimental group asked fewer memory and interpretation questions and more analysis and application questions than did the control group. The percentages of synthesis (5 per cent) and of evaluation (2 per cent) questions asked by each group were the same.

Rogers and Davis (301) conducted a study to determine whether student teachers' questioning strategy could be modified to increase the use of higher level cognitive questions and also whether student achievement was higher in classes in which the teacher asked more high level questions. Participants in their study were 20 student teachers, pretested for similar questioning behavior, who were assigned to fifth grade public school classes. The 10 student teachers in the experimental group participated in seminars on purposes and use of different cognitive levels of questions (five two-hour seminars over a four week period at the beginning of the semester). Classroom Questions: What Kinds? by Sanders served as the basic source of study in these seminars. Audiotaping, videotaping, microteaching, and role playing were used. The appropriateness of a question to the objectives for the lesson was stressed throughout the seminars. Students taped several of their classroom lessons and these tapes were analyzed by the group and/or individually. No special program was devised for the control group. Their seminar discussions focused on common problems of student teaching.

All 20 student teachers were directed to plan and teach a four-day unit, with a culminating test, on the West Indies. Data were collected by using the Teacher Oral Question Observation Schedule (TOQOS), a modification of an observation system developed by Davis and Tinsley. The 11 categories of the system consist of the seven categories from Sanders' question hierarchy plus four other categories: affective, procedural, textbook, and pupil-initiated. Observers trained in the use of the TOQOS observed the student teachers once prior to the four-day unit and during each day of the unit. Observers rotated so that a different observer was present in each classroom each day.

Data from the pre-experimental period observation and from student scores on an intelligence test indicated no significant differences in questioning behaviors or in student ability. When data on oral questioning behavior were analyzed, five of the seven TOQOS cognitive category variables were found to be significantly different beyond the .05 level of significance. Student teachers in the control group asked a higher percentage of application questions (P .11). There was no significant difference in the groups' use of memory questions. No student teachers in the control group asked

analysis, synthesis, or evaluation questions. Even though the 10 student
teachers in the experimental group asked very few high level questions
during the four-day unit, the difference between groups was a significant
one.

When the written test questions were analyzed, Rogers and Davis found
that the student teachers in the experimental group had formulated a signifi-
cantly higher percentage of questions at six of the seven cognitive levels
than did the student teachers in the control group. Those in the control
group asked a significantly higher percentage of memory questions and did
not compose any questions in categories other than memory and interpretation.
The lack of written questions in the categories of translation, application,
analysis, synthesis, and evaluation in the tests of the student teachers
in the control group provided additional evidence of differences in question-
ing behaviors.

Zimmerman and Bergan (389) attempted to determine if teachers working
with young children asked questions which elicited intellectual operations
in children. Forty-two teachers trained for Follow Through Programs by
use of the Early Education Model and 75-non-TEEM trained teachers were sur-
veyed. Teachers were audiotaped for 40 minutes in classrooms and their
questions classified according to an Intellectual Operations model based on
Guilford's Structure of the Intellect. The investigators found that the two
groups did differ in teaching style. Both groups placed inordinate stress
on knowledge and memory questions which precluded the opportunity to teach
other intellectual operations. However, the teachers trained with the TEEM
process asked fewer cognition and memory questions and more perception
questions.

Farley and Clegg (94) worked with 12 student teachers of social studies,
divided equally between experimental and control groups. Those in the
experimental group received instruction, in eight weekly individual or group
training and feedback sessions, in the use of Bloom's Taxonomy as modified
by Sanders. The control group spent an equal time in instruction with a
placebo-type treatment. The two groups were then compared in their class-
room questioning behaviors.

An additional problem in this study was that of determining if adminis-
trators experienced in the use of the Taxonomy and classroom teachers trained
in the use of the Taxonomy (in a manner similar to that of the experimental
group) could agree between and within themselves as to the cognitive level
of questioning as measured by the Teacher-Pupil Question Inventory (TPQI).

Each student teacher made a weekly tape recording of a social studies
lesson. Tapes from the third, fifth, and seventh weeks were rated by both
groups of observers. Data analysis revealed a significant difference favor-
ing the experimental group in the percentage of above-memory questions asked.
There was no significant difference in the rating scores of the observers.

Trosky (360, 361) conducted case studies of five third-grade teachers'
questioning behavior in the development of reading comprehension and investi-
gated the relationship between teacher questions and a series of supervisory
conferences designed to modify those questions from recall and recognition
to higher levels of comprehension.

The first two conferences in the series were designed to make teachers aware of types of questions and levels of comprehension. The final conference provided the teachers with an opportunity to analyze changes in their questioning behavior. Tapes of classroom reading lessons were made prior to each conference for use during the conference.

Four of the teachers modified their behavior, decreasing the number of recognition questions. Two teachers made the changes at the end of the first conference, the others by the end of the second. Changes for three teachers were significant at the .001 level and for one teacher at the .01 level.

Based on the findings from this limited sample, Trosky advocated the use of supervisory conferences held within a concentrated period of time and supplemented by the analysis of recordings of classroom behavior.

Enokson (89) worked with 21 undergraduate students in elementary education in an attempt to help them increase the number of higher cognitive level questions they used and to increase their use of divergent questions. These 21 constituted the experimental group and were compared to research reports on the performance of similar untrained groups.

Questioning behavior was audiotaped before and after treatment for data analysis. Questions were classified as convergent and divergent according to nature, and low and high according to cognitive level. This provided four question categories: convergent-low, convergent-high, divergent-low, divergent-high. Treatment consisted of having the group study exercise-type materials relative to questioning and of analyzing typescripts produced from audiotapes of their teaching and rephrasing selected portions of their own teaching typescripts.

When Enokson conducted his data analysis, he discovered that his experimental group was not similar to similar untrained groups reported in the literature, making it impossible for him to perform some proposed comparisons. He reported that the experimental group posed a significantly larger percentage of high cognitive level and divergent questions after training, as well as a significantly smaller percentage of convergent-low questions.

Enokson suggested that the greatest value of typescripts might be in their use as a method of short-term feedback, as in microteaching, rather than in extended-term feedback, as in student teaching.

Fifteen investigators [Sorge (340, 341), McFadden (228), Rutherford (310), Schwarzmann (323), Bondi (42), Bondi and Ober (410), Jones (486), Hemrick (464), Mc Donald (502), Hovenier (474), Wong (571), Hoops (471), Emmer et al. (442), Tuckman et al. (559), Morse et al. (245)] considered the effects of feedback on teacher behaviors.

Bondi (42) investigat ' the effects of interaction analysis feedback on the verbal behavior of student teachers. Forty seniors in elementary education were randomly selected and trained in interaction analysis and observed for eight weekly 15 minute periods during student teaching. Twenty student teachers, the experimental group, were provided with feedback in the form

of matrices and information sheets from systematic observations collected by trained observers using a 13 category modification of the Flanders' system. Bondi, upon data analysis, found the experimental group used significantly less teacher-initiated talk and significantly more student-initiated talk, used more praise and more extended use of student ideas, and provided less corrective feedback than did the student teachers in the experimental group. The experimental group also accepted and clarified student ideas more, criticized students less, asked more questions, and gave fewer directions.

Sorge (340, 341) was interested in determining if introduction to and feedback from an interaction analysis system was sufficient to effect change in instructional behavior of teachers who were not provided with prior training in specific mechanics of its use. He was also interested in determining if a degree of predictability could be established between amount of change in teacher verbal instructional behavior and data from the Minnesota Teacher Attitude Inventory. The Purdue Teacher Evaluation Scale was used to measure student attitude toward the instructor. He also attempted to determine if interrelation of various categories in interaction analysis permitted better prediction of students' achievement and attitude toward subject and teacher than did any one category.

A 17 category modification of Flanders' interaction analysis observation system was used, involving four subdivisions of the "asks questions" category, two subdivisions of categories 8 and 9 under "student talk" and three subdivisions of category 10.

Ten graduate students at Purdue University, each of whom taught a class of mathematics for 40-45 elementary education majors, were the subjects of the study. At the beginning of the semester, each teacher completed the Minnesota Teacher Attitude Inventory. An achievement test was administered to all students. During the first week of the semester each teacher was observed once for 15-20 minutes, using the revised Flanders' system (RFIAC). On the basis of the I/D ratio (indirect/direct teaching ratio), teachers were divided into experimental and control groups so that each group had the same total amount of indirectness. Beginning with the second week of the semester each teacher was observed, at two and one-half week intervals, for a total of five 15-20 minute observations. The experimental group received feedback after each observation but the control group received no feedback until the study was completed.

At the end of 13 weeks the Purdue Teacher Evaluation Scale was administered (to measure student attitude toward instructor) as was the H. H. Remmer's scale (to assess student attitude toward subject) and the achievement test was readministered. Data from observations using the RFIAC were analyzed with a computer program developed for the study.

When Sorge analyzed the data that had been collected, he found significant differences in the amount of acceptance and use of student ideas, the number and types of questions (more convergent questions) teachers asked, the amount of lecturing (a decrease), and amount of student talk (an increase). The behavior of the teachers in the experimental group appeared to have changed even though they had not become proficient in the use of the interaction analysis system. Sorge found that teachers who like their students, as

indicated by responses to the MTAI, exhibited behaviors different from those who had lower scores on the MTAI. The teachers with the higher MTAI scores spent more time accepting student feelings, asking more factual and evaluative questions, received more divergent responses from students, and used less criticism. The students of these teachers indicated, in their responses to the items on the Remmers' attitude scale, that they rated their teachers high in the ability to motivate, the ability to control, and in student-teacher communications.

Sorge found significant differences between teachers in the higher and lower "indirect" groups in their use of the interaction analysis categories of (1) accepting and using student ideas, (2) convergent and divergent response, (3) convergent questions, (4) use of praise, and (5) amount of lecturing.

When Sorge studied his data to determine if there were interrelated categories in interaction analysis which predict student behavior, attitude and achievement better than individual categories, he found that prediction of achievement increased from .76 to .99 when the factors I/D ratio, evaluative questions, and lecture were added to the single predictor of "accepts feelings."

Sorge concluded that teachers need not be trained in the mechanics of interaction analysis in order to change their verbal behavior as a result of feedback from interaction analysis, that teachers with high scores on the MTAI made greater behavioral changes than those with lower scores, that indirect teachers promote greater achievement gains in students than do direct teachers but that the amount of indirect teaching is not a sufficient factor for predicting attitude of college students toward teacher or subject, and that student attitude and student achievement can be predicted more accurately by the use of several interaction analysis categories than by the use of only one category.

McFadden (228) investigated the effects of videotape feedback, in the form of viewing one's own teaching performance, on subsequent verbal behavior as measured by the Reciprocal Category System (RCS) instrument. Twenty-seven randomly selected junior elementary education majors were selected to participate in the study. They were given training in making analyses and inferences about teaching from data obtained by the use of an interaction analysis instrument. Beginning with the third week of student teaching they were observed and videotaped. These observations lasted for 15 minutes and were made twice for each teacher, separated by a three-week interval. Student teachers were provided with feedback following the taping and observation. Members of the experimental group privately viewed their tapes. Members of the control group did not see the videotapes of their lessons.

McFadden found that the preservice teachers who had viewed the tapes of their teaching differed significantly from the control group in their use of corrective measures, statements that tended to create tension in the classroom, and rejection or criticism of another's opinion. Apparently, the type of verbal behavior that can readily be identified with overt negative teacher behavior could be reduced through the use of visual feedback.

Rutherford (310), in his research, found feedback from videotape ineffective for producing an increase in the amount of positive feedback teachers used in teaching a block sorting task to a preschool child. The treatment of using a model and videotape feedback and the model videotape treatment were effective in producing this change in behavior.

Schwarzmann (323) designed an instructional feedback system consisting of videotape feedback, perceptual modeling films, and student feedback to use in changing the behaviors of teacher talk and frequency of reinforcing student responses. He compared his system with the conventional supervisory process in a pretest-posttest design involving 20 students randomly selected and assigned to experimental and control groups. The treatment group was videotaped four times during the study, with the first taping serving as baseline data. The next two tapings served as treatment sessions and stressed the two teacher behaviors Schwarzmann wished to change. The fourth taping served to measure any changes in baseline behaviors. All videotaping sessions involved a microteaching format. Student feedback was collected after the first three treatment videotaping sessions and two perceptual modeling films were included in the treatment.

Students in the control group were videotaped at the beginning and at the end of the study to determine any changes in baseline data of the behaviors being investigated. Schwarzmann found that both groups began equal on the variable of teacher talk but that, at the end of the study, the experimental group showed a significant reduction in this behavior. There was no reduction for the control group. The experimental group had used more positive reinforcers at the beginning of the study than had the control group. Both groups made significant gains in this behavior but the experimental group showed a significantly greater number of reinforcers at the end of the study.

Morse et al. (245) investigated the relative effects of different modes of supervisory feedback on the development of preservice teachers' refocusing behaviors. Thirty-nine individuals were randomly assigned to four experimental groups. All were involved in a microteach-reteach cycle over a two week period, with all lessons audiotaped. After the first lesson, group one received no feedback (neither listening to the tape or consulting the instructor). Group two listened to their tapes. Group three listened to the tapes, using a listening guide designed to assist them in identifying their use of refocusing behaviors. Group four listened to the tapes, using the guide, and also had a non-directive conference with their instructor.

Criterion data were secured by having the student teachers rate themselves on a graphic rating scale as a measure of self-evaluation, having peer pupils rate the microteaching lesson using the standard Teaching Laboratory rating guide, having an observer listen to the audiotapes and count refocusing behaviors, and having an observer rate each lesson using the same graphic scale as used in the self-evaluations.

Morse et al., using analysis of covariance procedures, found no significant differences between groups for self-evaluation, peer pupil ratings, and observer ratings. There was a significant difference between groups for the number of refocusing behaviors counted, indicating that group four had

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profited from the treatment. Group three, using the listening guide, did not differ significantly from groups one and two, causing Morse et al. to conclude that the available evidence did not support the value of feedback in the absence of a personal supervisor.

Four reports [Amidon (8), Amidon and Powell (396), Traill (357, 358), Moskowitz (248)] contained information on the use of interaction analysis in teacher preparation to produce behavior changes. Moskowitz (248) included instruction on Flanders' System to add a behavioral science dimension to the education of foreign language teachers. Fourteen foreign language student teachers were pretested, provided with instruction, and post-tested eight weeks later to determine (1) pupil attitudes toward the foreign language, foreign language teacher, and the class; (2) teacher reactions to classroom situations along direct-indirect lines, including possible attitude changes after training; and (3) attitudes and degree of satisfaction of student teachers and cooperating teachers toward each other. Tapes were made and analyzed (of four classes) to obtain interaction data in both grammar lessons and those stressing conversation.

Moskowitz found, for the 14 student teachers with whom she worked, that attitudes toward teaching and the behavior patterns used became more positive and more indirect after training in Flanders' system. The attitudes of the student teachers and of their pupils improved, also. Moskowitz concluded that knowledge of interaction analysis has meaning and application for the field of foreign language.

Amidon (8) conducted a two and one-half year study of the application of interaction analysis to preservice teacher education. Approximately 40 secondary school student teachers were involved in an experiment during each of three semesters to determine the influence of training in interaction analysis or in learning theory and the training of cooperating teachers in interaction analysis or learning theory (the two independent variables) on attitudes, teaching effectiveness, teaching patterns, and pupil perceptions of student teachers (the dependent variables). A 2 x 2 factorial design was used to test the situation. Twelve hypotheses were tested by analysis of variance. Only one could not be rejected: student teachers taught interaction analysis were more indirect, accepting and supportive in working with pupils than were those not so taught. However, these student teachers were not rated as more effective teachers or as having more positive attitudes toward teaching. There was some evidence that their pupils perceived the indirectness. The result indicated no systematic effect of the training of cooperating teachers.

The lengthy report (397 pages) contains several suggestions for modifications if the study were to be replicated. One suggestion is to provide cooperating teachers with more extensive training because they work with student teachers on a daily basis and provide immediate feedback. Similar training provides groups (student teachers and cooperating teachers) with a common language and an effective operational tool, if both know interaction analysis. The paper by Amidon and Powell (396) is a preliminary report on this same study.

Traill (357, 358) used a modification of Flanders' system, the Berkeley Interaction Analysis System (BIAS) in his study with 54 student teachers in elementary education. The BIAS system extends the Flanders' categories for acceptance and clarification of pupil ideas and for asking questions by the addition of three sub-categories for each of these two teaching behaviors and by making a differentiation between silence and confusion by listing these as two sub-categories. The preservice teachers and their supervisors were trained in interaction analysis during the semester prior to their student teaching.

During the student teaching semester the student teachers were randomly assigned to treatment and control groups (but were not told of this assignment). Student teachers in the experimental group received a copy of their supervisor's observations, using the BIAS, after each observation. Student teachers in the control group did not receive this feedback.

Traill was also interested in learning if the treatment resulted in any other changes. To obtain data, he used the Teaching Situation Reaction Test (TSRT) as pre- and post-tests, as well as the Adjective Check List (ACL). The TSRT reflected changes in attitudes toward teaching; the ACL, changes in student teachers' conceptions of what constituted the "ideal" characteristics of a teacher. TRST results showed a significant improvement for the mean scores of the treatment group. No significant findings were identified for the ACL.

Three observations for each student teacher were selected at random for data analysis of BIAS information. Data were put into matrices by use of a computer program designed for the study. Results of the analysis showed that the treatment group had become more indirect in approach and allowed for more pupil participation in classroom verbal interaction. Student teachers in the experimental group used a significantly higher proportion of convergent and divergent questions than did members of the control group.

Traill included a cautionary note in his discussion of results, pointing out the fact that not all student teachers had positive feelings about the use of interaction analysis as a procedure for producing behavioral change. Many felt defensive about the situation. Traill suggested the use of alternative or supplemental procedures with such individuals once they have been identified.

It is impossible to succinctly summarize the sixty-plus reports briefly identified in the preceding pages of discussion concerning behavioral change in the areas of interpersonal relations in the classroom and of specific teaching skills. Succinctness is impossible because of the diversity of individual approaches the researchers used. Many of these studies were doctoral dissertations which, with their emphasis on originality rather than on replication serves to account, at least in part, for the diversity. Some researchers, such as Gage and his colleagues, reported that all that was necessary to induce behavioral change was to inform teachers of their pupils' perceptions of actual and ideal teaching. Sorge stated that feedback from interaction analysis data produced changes in individuals who were unfamiliar with the mechanics of the process by which the data for the feedback were

acquired. Other investigators, such as Amidon and Morse and his colleagues, found that their treatment did not produce the desired effects or did not produce them at a level of significance. Many of the investigations appear worthy of replication. Will they receive this attention?

Changes in Evaluation Skills (of Self, Others). Ten papers were classified as emphasizing research designed to produce changes in the ability to evaluate individual performance (self, others) [Evans (92), Bedics and Webb (401), Codwell (72), Johnston (176), Salomon and McDonald (313), Jensen (173), Webb (370), Osborne (266), Bedics (22), Wenner (372)]. Six researchers (Evans, Bedics, Osborne, Webb, Salomon and McDonald, and Codwell) considered problems of self-evaluation.

M. Evans (92) used the Blumberg category system (another modification of that of Flanders) as the instrument by which college supervisors were expected to analyze their verbal behavior in supervisory conferences. She was interested in learning if supervisors would, and could, learn the system and would then apply it in self-analysis procedures. Sixteen college supervisors working with secondary school student teachers volunteered to participate in the single-semester study. Faculty rank varied from part-time instructor to full professor. The sixteen volunteers were randomly assigned to experimental and control groups. Prior to treatment for the experimental group, all 16 taped a supervisory conference to serve as baseline data. Four two-hour training sessions, one session a week, were provided for the experimental group but attendance at all four sessions was optional. Training ended when the four sessions ended or when a supervisor reached a minimum proficiency level of coding from a tape containing examples of all categories in the Blumberg system with an interobserver agreement of .70 with the investigator and of reading and interpreting the meaning of cell loadings on a prepared matrix, whichever occurred first.

Following training in the use of the Blumberg category system, the supervisors in the experimental group were asked to tape record and self-analyze one conference a week for the remaining six weeks of the semester. During the final two weeks of the semester, all supervisors were asked to record a conference with the same student teacher as recorded on the first tape.

The data, analyzed by covariance techniques, showed no statistically significant differences at the .05 level between the experimental and control groups with respect to the six dependent variables involved. It had been anticipated that supervisors in the experimental group would increase verbal behaviors designed to build and maintain interpersonal relationships. There was no significant difference between the two groups with respect to this behavior. Four supervisors in the experimental group did exhibit increases but the other four decreased their use of categories relevant to "support" behavior. There was no significant difference between the groups in the acceptance and use of student ideas. The only significant difference identified in the study occurred relative to the categories of asking for information and giving information in which the experimental group exhibited a larger decrease in use.

Evans reported that four of the eight supervisors in the experimental group employed the Blumberg category system only once during the six week period following training. She speculated that failure to use the system for self-analysis combined with the short time of six weeks between training and the final supervisory conference may have contributed much to the lack of significant differences contained in her research.

Bedics (22) and Osborne (266) worked with student teacher participants in their studies. Bedics investigated whether differences in self-evaluation existed between student teachers with training in analysis of teacher behavior and those with no such training. Twenty-two female elementary education pre-service teachers were placed in an experimental group and two control groups. The experimental group received special training in the analysis of teacher behavior and was videotaped during the second, seventh, and thirteenth weeks of student teaching. Group two, the first control group, received no training but was videotaped the same three times as the experimental group. Group three, the second control group, received no training and was videotaped only during the 13th week of student teaching. After each videotaping, the student teacher was interviewed with the use of the Alabama Funnel Self-Evaluation Interview Guide designed for the study.

Responses to the interview guide were grouped into five categories: physical aspects, personal aspects, teacher behavior, pupil behavior, lesson. When comparisons of responses in the final interviews of the three groups were made, few significant differences were found. The experimental group was more sensitive to teaching acts categorized under "lesson" and "pupil behavior." Group three, videotaped only once, talked more about "personal aspects," indicating that student teachers tend to talk more about themselves the first time they see themselves on videotape than about other aspects of their teaching.

Osborne (266) investigated the relationships between sensitivity train-ing, changes in self-perceptions, and the observable behavior of student teachers in elementary school classrooms. In his study, the experimental group participated in an intensive laboratory training program in human rela-tions provided by "Encountertapes." A placebo group participated in a treat-ment-like program in leaderless groups using human relations training materials. The control group did not participate in any program but was measured with the same instruments as used for the experimental and placebo groups. The instruments used were the Teacher-Pupil Relationship Inventory and the Effec-tive Teacher Rating Scale, developed by the investigator, (used by cooperating teachers and university staff to rate the student teachers).

Osborne reported "inconclusive" findings with respect to the relation-ship between sensitivity training and changes in self-perceptions. He did identify a significantly positive relationship between sensitivity training and certain observed classroom behavior. (Details were not provided in the material reviewed.) He reported the cooperating teachers found the student teachers who had participated in the human relations training program to be significantly different from the placebo group and control group student teachers. Pupils also perceived a more positive teacher-pupil relationship for the student teachers in the experimental group.

Codwell (72) worked with 51 rural, in-service teachers and their 1,114 pupils in a study designed to demonstrate the effect of an adaptation of microteaching techniques on instructional behavior. The teachers involved in the study were pre-rated by a five-member observational team using the Stanford Teacher Competence Appraisal Guide and the Ryans' Classroom Observation Record. Each teacher completed the Minnesota Teacher Attitude Inventory. Teaching performance was recorded on videotape and used as a basis for suggesting improvements. Following a 12 week "laboratory teaching period," the teachers were again rated, self-assessed, and videotaped.

The videotaped adaptation of microteaching consisted of a 25 minute lesson involving 23 pupils. Videotapes were observed and discussed by the teacher, a trusted colleague, and members of the rating team, in that order.

The 51 teachers were employed in three rural school systems. Codwell reported highly significant improvement for each school systems' participants, although amount of improvement varied with the system. Teacher attitude also improved significantly from pre- to post-assessment. Codwell reported that the variables of sex, level of teaching (elementary vs. secondary), years of teaching experience (five years or less vs. more than five years) made no significant difference in the improvement of teaching performance. He suggested that some adaptation of microteaching might be considered as an alternative to the employment of more supervisory personnel in in-service programs designed to improve teaching performance.

Salomon and McDonald (313) hypothesized that when no standard of "good teaching" is set for self-evaluation of teaching performance, changes in behavior and patterns of information selection would be determined by the teacher's satisfaction with his performance. The smaller the satisfaction, the fewer self-evaluating changes and less teaching-related information noticed. Thirty-eight teacher interns taught a 50 minute lesson which was videotaped. No instructions on teaching standards were provided for the lesson.

Immediately after the lesson and again after viewing the videotape, each intern completed an attitude questionnaire consisting of eight concepts (categorized in two domains relating to the teaching situation and two domains referring to the teacher's self-image). Each intern was interviewed to determine performance perception and satisfaction. The interns were divided into low and high satisfaction groups on the basis of data collected before self-viewing. When the two groups were compared, the investigators found that reactions to self-viewing were determined largely by the predispositions of the interns.

Webb (370) attempted to determine if training in the analysis of teaching behavior affected the self-evaluations of teachers given an opportunity to view and judge their own teaching performance as recorded on videotape. She also looked at the factors on which teachers focused and investigated whether teacher experiences had any effect on self-evaluations. Twenty-two experienced teachers and 44 preservice teachers participated and were placed in experimental and control groups. The experimental group (11 inservice and 22 preservice teachers) received training in the analysis of teaching behavior (30 two-hour sessions). Training included learning to operate the videotape equipment, formulating educational objectives, using two systems of classroom observation, and developing teaching strategies.

At the end of the training period, a thirty minute lesson was video-taped for all participants. All were interviewed, using the Alabama Funnel Self-Evaluation Interview. Webb found no significant differences between the two groups (experimental and control) or between the inservice teachers in the two groups. The student teachers in the experimental group tended to focus on the teaching act and those in the control group focused on themselves as persons.

Webb presented several possible explanations for her lack of significant results. She speculated that the skills taught were too complex to be assimilated and implemented in the fifteen week period. She also thought that the cooperating teachers might have felt no need to accept the frame-work for self-evaluation if it differed from that which they used in the past. In any event, she concluded that the concept a teacher holds of his/her role and behavior as a teacher does not change easily.

The use of videotaping as a tool for supervision and self-analysis was reported in three additional studies [Wenner (372), Jensen (173), and Johnston (176)]. Wenner's investigation (372) focused primarily on instrument develop-ment and evaluation and will be included in the following subsection. Johnston (176) compared instances of self-supervision with more traditional supervision of student teachers to determine the relationships between this variable and teacher attitudes and interaction behavior. Eighty-four student teachers were divided into a self-supervising group and a traditionally-supervised group. The self-supervising group were videotaped (with no supervisor present) in two 20-minute microteaching sessions and analyzed their performance, using interaction analysis. The traditionally supervised teachers received no training in interaction analysis and were observed by their supervisor during the two microteaching lessons, each of which was followed by a 30 minute conference. Pre- and post-tests of the Minnesota Teacher Attitude Inventory and the analysis of the videotapes by the investigator served as the data for analysis. Johnston found the student teachers in the self-supervision group were more indirect and had higher scores on the MTAI than did those in the traditionally supervised group. Both groups of student teachers were very inaccurate in estimating the percentage of indirect teaching they had exhibited.

Jensen (173) examined the effectiveness of videotape recordings as a self-instructional in-service training tool designed to promote change in teacher behavior. Working for a two year period with 65 elementary school teachers in the Corvallis, Oregon, schools, he set up three conditions for his study. Condition one involved self-observation via videotape. Condition two stressed overt self-evaluation during self-observation. Condition three consisted of a workshop in observational and evaluational techniques. Data were collected via questionnaires and behavioral measures. Jensen found that emphasis on individual goal setting combined with video self-evaluation produced moderate changes in teaching methods and attitudes.

In summarizing the few research studies reviewed in this sub-section, it may be said that it is possible to produce changes in self-evaluation but that these changes are not always at a level of significance and do not always result if teachers do not feel threatened by the self-evaluation process. Videotaping appears to be a useful tool in promoting change but

this technique must be used often enough to enable the teachers to get beyond the stage of reacting only to their own personal appearance on the videotape so that they can focus on other aspects of their teaching behavior.

Studies of Media and/or Methodology Used to Promote Behavior Change. Eighty studies were identified as belonging in this sub-section. The classification is an arbitrary one--some of the studies could have been reported in earlier sub-sections of this portion as "behavior change" studies. An additional categorization was made within this sub-section and the studies were further classified as emphasizing the use of videotaping procedures, the use of microteaching, the use of models (perceptual and/or symbolic), the use of a specific training program or procedure, etc. Just as the lines of demarcation that separate sub-sections are fuzzy rather than sharp and bold so, too, does the further subclassification break down. Some of the studies grouped as focusing on microteaching also consider the use of videotape equipment. Some of the reports on the use of models also consider microteaching as a vehicle for demonstrating the skills emphasized by the model protocols. Nevertheless, division and categorization were done to eliminate the necessity for describing a study in more than one portion of the discussion as would have to be done if a study were to be described relative to one facet and then redescribed concerning another aspect of the research.

Studies of Media and/or Methodology Used to Promote Behavior Change - Videotape Feedback: Eight investigators [Fenstermacher (97), Brantley (49), Wiegand (565), Lippe (207), Kearney (185), Adair and Kyle (4), Roush (307), Wenner (372)] assessed the effectiveness of using videotaping to produce some change. Fenstermacher (97) studied the extent to which videotape feedback with self-evaluation could serve as a means of supervision for modifying teacher behavior. Fenstermacher involved 24 teachers in his research. The classroom was designated as the sampling unit and, therefore, the 24 classrooms of these teachers were randomly assigned to two treatment groups. A control group consisted of 12 teachers and 12 classrooms selected from a school district similar to that of the experimental group. Data were derived from raw scores on the Iowa Basic Skills W-1 Section Achievement Test, Forms 2, 3 and 4. Achievement was measured in two ways: post-test achievement and retention-test achievement, with the retention testing being done four weeks after post-testing. Fenstermacher found videotape feedback to be an effective method of supervision when combined with self-evaluation in the improvement of teaching skills basic to understanding maps and globes in grades four, five and six.

Brantley (49) wanted to determine whether feedback of data generated by a systematic evaluation of videotapes in terms of teacher objectives, teacher methods, and teacher expressions would more readily promote change in teacher behavior in the classroom than would the nondirected viewing of videotapes. Twenty-seven sixth grade teachers and their pupils participated in the study, with 12 teachers each being assigned to experimental and control groups and three teachers used in a pilot study.

Those teachers in the experimental group participated in four 30-minute videotaping sessions involving language arts materials. The teachers viewed and coded the first three of their four tapes within 24 hours of the taping,

using the Teacher Self-Appraisal Instrument for coding. Those in the control group viewed their tapes with no specific guidance being provided. All of the teachers responded to the Minnesota Teacher Attitude Inventory in a pre- and post-test design.

Brantley found the two groups to differ significantly only in the area of Methods, with the experimental group exhibiting more change to open approaches to teaching. Brantley reported that the teachers felt that viewing videotapes of their teaching had caused them to change their classroom behavior to a much greater degree but in areas not covered in the TSA instrument. He also reported that, although the teachers had approached the experiment with the idea of identifying their weak areas, they also discovered strengths they possessed but had not previously fully recognized.

Lippe (207) considered nonverbal behaviors as well as verbal in his study to determine the effectiveness of videotape feedback in modifying teacher behavior. He considered the verbal behaviors of questioning, telling, making distractive remarks, and allowing for pupil verbalization. The four nonverbal behaviors were classified as teacher constructive nonverbal, teacher distractive nonverbal, teacher permitting pupil nonverbal, and silence.

Sixty preservice teachers were assigned to one of three groups. The individuals involved were just beginning their work in education. Each group taught two 10 minute microlessons. One group received no supervisory or videotape feedback. The second group received only supervisory feedback between the first and second lessons. The third group received both supervisory and videotape feedback between lessons.

Upon analysis of the videotapes, Lippe found a significant difference in the amount of telling behavior between groups. Significant differences between groups were also identified for proportion of the lesson devoted to pupil verbal behavior and the amount of distractive nonverbal behavior of the preservice teachers. Lippe reported that feedback with videotape replay did not produce as much behavioral change as supervisory feedback alone.

Kearney (185) and Roush (307) reported investigations in which no significant differences between groups were found. Wenner (372) stated that the significant results which he identified were so minimal that no postulations were made about them.

The work of Adair and Kyle (4) was more encouraging for teacher educators and others involved in educational research. In their study of the effects of three types of feedback-evaluation procedures on the question-asking behavior of in-service teachers, Adair and Kyle reported that each of the two videotape-based feedback procedures appeared equally effective and was more effective than standard observation procedures in reducing the percentage of rhetorical questions teachers asked. Each of the three feedback procedures (standard teacher-supervisor conference following observation, self-analysis of videotape, supervisor-assisted self-analysis of videotape) was effective in increasing the percentage of probing questions asked. Three randomly formed groups of sixth grade teachers participated in this study.

Again, as in previously-described areas of research, the general technique or methodology used successfully by one investigator produced "no significant differences" for another. The studies, all using videotaping to produce change, were nevertheless too diverse to enable the reviewer to make any comparisons and speculate concerning the differing results.

Studies of Media and/or Methodology Used to Promote Behavior Change -
Microteaching: Microteaching in its variety of lesson lengths, pupil sizes, and sources of pupils served as the unifying theme for fourteen studies [Klingstedt (493), M. P. Wolfe (380), D. E. Wolfe (569, 570), Emmer and Millett (87), Widell et al. (564), Kallenbach (183), Resnick and Kiss (295), Davis and Smoot (80), Chavers et al. (68), Reed et al. (292), Young and Young (578), Wood et al. (384), Austad (397), Turney (560)]. Five papers contained the report of "no significant differences" between groups involved in the research. Kallenbach (183), although identifying no significant differences, concluded that this lack of significance did have a positive implication for preservice programs.

In Kallenbach's study, 40 teacher interns were randomly divided into two summer groups, one of which participated in an off-campus observation and teaching program while the other participated in an on-campus micro-teaching program. Lessons were videotaped and five minute excerpts, for all candidates, were analyzed using the Stanford Teacher Competence Appraisal Guide and the Instrument for the Observation of Teaching Activities. A similar field follow-up in the fall and in the spring was made for each intern. The fact that no significant differences in performance were identified in the assessments during the field assessments led Kallenbach to conclude that microteaching (which saves time for both staff and interns) could be just as effective preparation as was regular student teaching.

Another possible modification of preservice programs was suggested in the study by Resnick and Kiss (295) who compared discrimination training (contrasting good and poor teacher behaviors and demonstrating the stimulus occasions for these behaviors) with feedback from an instructor in micro-teaching. The participants were divided into three groups: discrimination training, practice and feedback (DPF); discrimination training and practice (DP); practice and feedback (PF). The behaviors studied were tutorial teaching skills. Participants were four to six year old children enrolled in Headstart and kindergarten classes. Videotapes of the lessons (which were not shown to the trainees) were made for data analysis purposes.

When Resnick and Kiss compared pre- and post-test scores on several behavior rating scales, they found consistent and significant improvement of the DPF and DP groups as compared with slight improvement for the PF group. The researchers considered that discrimination training could replace feedback from an instructor in many cases and thus effect substantial economies in teacher education programs.

Reed and Chavers and their colleagues drew the participants in their respective studies from courses in educational psychology rather than from methods courses or student teaching. Reed et al. (292) examined three teaching methods: directive lectures (DL) which were lectures on general technical skills related to teaching; non-directive lectures (NDL) on

interpersonal relationships; and participation in multiple microteaching
sessions (MT). All combinations of the three methods were used in a 2 x
2 x 2 factorial design, with 87 undergraduates placed into eight experimental
treatments.

Data were collected from student responses to a 56 item course evaluation
form and from peer evaluations of teaching skill in the final microteaching
session using the Stanford Teacher Competence Appraisal Guide. Reed et al.
found the MT and DL treatments were each effective in improving teaching
skills while the NDL treatment did not affect skills. Attitudes were more
favorable as a result of each of the lecture methods than as a result of
microteaching. The researchers speculated that the best treatment for both
good teaching skills and positive attitude appeared to be a combination of
one microteaching experience with directed lecture.

Chavers et al. (68) had three basic training conditions: microteaching,
lectures on teaching skills, and sensitivity lectures. Seventy-one students
enrolled in educational psychology were assigned to one of eight treatment
groups. Six different instruments were used to collect data on attitude,
anxiety, divergent thinking, interest, personality and values. Data were
analyzed in a 2 x 8 analysis of variance design.

Chavers and her colleagues found that students with microteaching train-
ing performed better on terminal tests. Students high on flexibility per-
formed better across treatments than others. Two significant interactions
of method and characteristics were found. Students low in objectivity did
better in the treatment involving all three conditions than did those high
in objectivity. Students low in social values did better in the teaching-
skill lectures treatment than did those high in social values.

Wood et al. (384) investigated the effects of two organizational patterns
of microsimulation experiences (concurrently with or sequentially to student
teaching) on the verbal teaching behavior of student teachers trained in the
use of the Reciprocal Category System of Interaction Analysis (RCS) as com-
pared to others who received no RCS training. Microsimulated teaching com-
bined microteaching with simulation, with teachers conducting brief lessons
with peers playing assigned roles.

Forty individuals in methods and student teaching were randomly assigned
to four treatment groups. RCS data for three 20 minute periods in student
teaching were collected for each individual. The concurrent arrangement of
microsimulation was found to be the most effective organizational pattern
of the methods and student teaching block when offered in conjunction with
formal training in a system of interaction analysis.

M. P. Wolfe (380) investigated a problem containing the elements of
microteaching, videotaping, training in interaction analysis via the Far
West Laboratory's Interaction Analysis Training program, and computer feed-
back manifesting verbal behavior. Twenty-eight student teachers of political
science and history were randomly assigned to interaction analysis and con-
ventional training groups. Following training each group was divided into
two groups with each sub-group receiving a different method of feedback
following a microteaching lesson. One group received the interaction analysis

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training program and computer feedback manifesting verbal behavior. A second group was trained in the program and conducted a self-analysis of a video-tape recording. The third group received the conventional training and the computer feedback manifesting verbal behavior. The fourth group received the conventional program and self-analyzed a videotape of their teaching.

Wolfe found that the Far West program produced a greater overall change in verbal behavior than did the conventional training. The type of feedback produced no significant differences between the student teachers trained in interaction analysis.

Two other investigators employed computers in their teacher education studies. Kreider (198) tested the efficacy of computer assisted teacher training system (CATTS) feedback to help preservice teachers of educable mentally retarded children increase their use of pupil ideas. Feedback was achieved by feeding categories of the Flanders-Gess System of Interaction Analysis into a computer which in turn fed information concerning the per-centage of teacher talk time in use of pupil ideas to the cathode ray tube of an oscilloscope. The oscilloscope display was transferred to the class-room through the use of a television camera and monitor, thus providing the preservice teachers with immediate and continuous feedback.

Twelve preservice teachers taught 15 EMR students, with three teams of four teachers assigned to three groups of five pupils. Two of the four trainees of each team were randomly assigned to an experimental condition (receiving CATTS feedback during a four lesson period). Each member of the team taught eight individual lessons to the EMR pupils, with two lessons providing baseline data, four serving as the training period (for the experimental group), and two as a maintenance period. Lesson content and order of presenting lessons were counter-balanced over the three periods.

Although Kreider did not find a definitive answer to the efficacy question, he did find that an interaction existed between feedback and order of presenting arithmetic lessons on teacher use of pupil ideas. The indi-viduals in the experimental group showed a significant increase for teacher use of pupil ideas from the baseline to the training period, with no increase for the control group. A greater amount of teacher use of pupil ideas occurred during the training period when compared to the baseline period. Also, a greater amount of student-initiated talk occurred during the main-tenance period when compared to the baseline period.

Weaver (369) also investigated the use of the CATTS procedure with pre-service teachers of educable mentally retarded students. In addition, he investigated the effects of information designed to alter teacher expec-tations toward EMR pupils and to observe the resultant effect of teacher expectancies on teacher-pupil verbal interaction. He divided 18 individuals into six equal groups. Each person within a group was randomly assigned to CATTS, delayed or control feedback condition. The groups were then randomly assigned to either a higher or lower pupil expectancy condition (via provided information). Thirty EMR pupils were divided into six matched groups and randomly assigned to either a higher or lower expectancy trainee group.

During the baseline period, all preservice teachers attended a workshop which involved an introduction to interaction analysis (Flanders), a focus on the category of teacher use of student ideas, and the opportunity of receiving CATTS feedback during a microteaching session. During five subsequent training sessions, each was instructed to increase the use of student ideas.

Weaver analyzed the teacher-pupil interaction data and reported four findings: (1) trainees receiving CATTS feedback demonstrated greater gains than those receiving delayed feedback, (2) higher expectancy trainees used more student ideas during baseline periods than lower expectancy trainees, (3) lower expectancy trainees demonstrated greater gains during training than higher expectancy trainees, and (4) no significant differences were identified for EMR pupils due to the wide variance between pupil scores. Weaver, like Kreider, considered his results as inconclusive relative to the effectiveness of CATTS.

McCullough (224) studied the effectiveness of a teacher training program in multi-media use when used with a group of teachers selected because of their antipathy to multi-media use. The program (the McCullough Ten Session Curriculum in Media Use) involved a group dynamics approach to teacher attitudes before introduction to media use, basic instruction in media types, a project on sight-sound unit of the teacher's choice, feedback in group meetings, and confirmation of the participating teacher's changing attitudes and self-concept through student reaction and principal's reports. McCullough reported evidence of positive attitude change toward media but inconclusive results relative to the effectiveness, and even necessity, of multimedia use in the classroom.

These studies, involving microteaching and/or computerized feedback, again provide inconsistent results and no general trends for researchers and educators to use as guides. They do, however, identify some interesting approaches to the problem of designing experiences which result in the development of effective teachers.

Studies of Media and/or Methodology Used to Promote Behavior Change -
Modeling: Another method used in teacher education programs aimed at producing behavioral changes is that of modeling. Both perceptual (film, videotape) and symbolic (written) models are used, either separately or in combination. Individuals exposed to models are usually provided with opportunities to practice or demonstrate the modeled behavior and frequently have their performance recorded on videotape or audiotape. Sixteen studies [Eder (84), Murray and Fitzgerald (251), Young (577), Millett (515), Borg et al. (45), Borg (44), Woolman (385), McDonald and Koran (226), Friebel and Kallenbach (112), Fitzgerald (100), Brode (53), Bell (24), Lai et al. (199), Gall et al. (120), Werner et al. (373), Langer and Allen (201)] reported projects in which modeling was used, frequently in combination with other factors in the treatment applied.

Seven of the reports concerned methods and materials developed as parts of the minicourse program of the Far West Laboratory for Educational Research and Development [Borg (44), Borg et al. (45), Friebel and Kallenbach (112), Lai et al. (199), Gall et al. (120), Werner et al. (373), Langer and Allen (201)]. The minicourses are instructional packages designed to promote

change in specific teacher behaviors and involve microteaching, filmed instructional and model lessons, written materials for teachers and supervisors, all of which are used by teachers in a planned self-evaluation program.

Three reports involved the use of Minicourse 1, "Effective Questioning Techniques," aimed at elementary school teachers. In 1968, Borg et al. (45) reported the use of Minicourse 1 with five groups of 15-17 student teachers from three different institutions. While all three groups completed the entire minicourse, one was given no videotape recordings or replay, and a second group did no microteaching and received no feedback. Behavior change was measured by trained raters working with pre- and post-course videotapes (16 minutes long) of each student teacher teaching his entire class. Borg et al. reported that the groups which completed the entire minicourse as designed made more and larger changes in behavior than did the other groups.

In 1969 Borg (44) reported on a study involving 48 teachers using Minicourse 1. The analysis of pre- and post-course tapes showed that teachers made significant gains after the minicourse on 10 of 12 behavior scores and demonstrated a reduction to half the precourse level of teacher talk. When the group was divided according to teacher grade level and compared on four behaviors relating to teacher talk and pupil response, teachers in all grade levels increased their use of higher cognitive questions and students increased the length of their responses. When division was made according to middle and lower class school setting, teachers working in lower class area schools made greater gains on most of the skills. No significant skill differences were identified when the group was divided according to teacher sex. Two months after completion of the course, one third of the group was given a refresher course. Following this, the entire group was post-tested two months later. No significant differences were found between the portion of the group given the refresher course and the rest of the group, indicating that the teachers had retained most of the skills acquired in the minicourse without having a refresher course for reinforcement of skill development.

Friebel and Kallenbach (112) worked with student teachers to determine to what extent student teaching behaviors could be changed as a result of participation in Minicourse 1. Thirty-three student teachers were involved and divided into two groups, one of which did not receive the videotape and microteaching portions of the minicourse. Analysis of pre- and post-treatment videotapes revealed that the microteaching group had made significant gains on 5 of the 11 behaviors while the non-microteaching group made significant gains on four behaviors. There were no significant differences between groups, leading the investigators to conclude that, while the use of the minicourse did produce changes in behavior, microteaching and videotape feedback did not appear to be sufficient to produce significant behavioral change.

Langer and Allen (201) reported on the results of the main field test for Minicourse 4. This minicourse is on interaction analysis. Its objectives are to train teachers to categorize their own verbal behavior, using the Flanders system, to an 80 per cent criterion level, to increase the frequency of indirect behavior (categories 2, 3, 4), and to train teachers in the fundamentals of matrix analysis and its possible significance. The course consists of seven instructional sequences taking approximately 15-16 days.

Twenty-four volunteer teachers participated in the main field test.
Videotaped discussion lessons were collected before and after the course.
Langer and Allen found that coding accuracy was 60-70 per cent (using five
second intervals as the pace). Teachers did become more indirect but this
shift was apparently more the result of the instructional lessons than of
the microteaching. The teachers were inadequate in interpreting the matrices.

The developers hope to follow this minicourse with one aimed at helping
teachers change their behavior, based on analysis of interaction data con-
cerning their teaching.

Lai et al. (199) reported on the use of a different minicourse, one
entitled "Discussing Controversial Issues," designed for use by high school
teachers and their students. The overall course objective is to develop skills
in discussing controversial issues effectively in the classroom. Course
materials include 13 moderator techniques (for teachers to practice) and 13
participant techniques (for students). Lai and his colleagues reported on
field-testing of the course in three school districts using 46 classes with
about 1100 students. Nineteen other classes (about 500 students) served as
a control group.

Behavioral data were collected via audiotape recordings of 25 minute
discussions on a controversial issue, both before and after the course. In
addition, questionnaires, vocabulary tests, weekly logs of issues, subjective
rating scales, and classroom observation were used. Lai et al. found that
two schools (17 classes) deviated markedly from the rest of the sample and,
therefore, analyzed data from these as a separate study.

In the main sample, the investigators found that the course was success-
ful in (1) reducing percentage of teacher talk, (2) reducing amount of non-
moderator talk, (3) increasing the percentage of teachers who ask students
to state differing opinions, (4) increasing the percentage of teachers who
ask students for a review, and (5) increasing the percentage of teachers who
ask students what to do next, at the end of the discussion. For students,
the course was effective in increasing (1) student-to-student interaction,
(2) student talk, (3) acknowledgement of a previous speaker, (4) asking for
evidence, (5) giving reviews, (6) stating different positions, and (7)
discussing how to continue dealing with the issue.

In the smaller study, involving compensatory and opportunity classes,
teachers in the two schools exhibited the desired shift in only two behaviors:
stating the issue and asking students what was the next step at the end of
the discussion. The only variable in which students in the experimental
group in this study improved more than the control group was that of discuss-
ing what to do next at the end of the discussion.

Gall et al. (120) worked with a second minicourse emphasizing questioning,
Minicourse 9 "Higher Cognitive Questioning." The purpose of the study was
to compare the relative effectiveness of two instructional techniques in
changing teacher behavior. Eighty teachers in two school districts were
recruited, on a volunteer basis, to participate in the study. One group of
54 (two of the original 56 dropped from the course) took Minicourse 9 and
were randomly assigned to the video and written versions of the course.

A group of 24 served as controls and were paid $15.00 to conduct a pre-tape and post-tape discussion lesson. The control group teachers differed from the treatment group teachers in generally being older and more experienced.

Pre- and post-course measures of each teacher's discussion skills were collected. Teachers were given a standard one-page stimulus article to be used for a 20 minute discussion with their classes. (Teachers of grades four through six were given a different article than that used by junior high school teachers.) Pupils read the article a day prior to the discussion and taping. One week after the minicourse was concluded, the situation was repeated, using different articles but the same pupils (one half of a class, randomly selected).

Discussions were audiotaped and analyzed by the use of Bloom's categories. Question types other than knowledge were considered as "higher cognitive."

Teachers in the experimental group who received the video treatment had read a teacher handbook explaining the course skills and practiced discriminating and writing various types of higher cognitive questions. They also viewed four instructional and four model videotapes showing teachers using the skills in various classroom situations. Those in the written treatment did not view the tapes. Instead they read transcripts of the tapes which had been derived from the shooting scripts of the videotapes. Narration was put in paragraph form and discussion transcribed as teacher-student interactions.

When the data were analyzed, Gall et al. found that the video and written treatment groups significantly outperformed the control group. However, the video and written treatment groups did not differ significantly from each other. The percentage of higher cognitive questions increased for the video and written groups, primarily because of a sizable reduction in the use of knowledge questions (with an accompanying small increase in use of higher cognitive questions). When student responses were considered, the written group outperformed the control at both grades four through six and junior high levels. The video group outperformed the control only at grades four through six. The written group significantly outperformed the video group at the junior high level.

The investigators had assumed that use of higher cognitive questions by teachers would result in longer student responses. Only slight changes occurred in the treatment groups and the controls made comparable gains. Therefore, the increases could not be attributed to the minicourse.

Probing questions, defined as those which require the student to defend or justify his original response to a higher cognitive question, were identified and analyzed. Only the written group in the grades four through six sample made significant gains in use of this technique. No significant differences between the three groups (written, video, control) were found at either grade level four through six, or junior high.

Gall and his coworkers concluded that the field-test results indicated the course was effective in helping teachers increase their use of higher cognitive questions. They hypothesized that one of the results of the

program was that teachers learned to select lesson material conducive to thoughtful discussion. The teachers exhibited use of higher cognitive questions prior to the in-service training. They did decrease their use of knowledge questions as a result of the training. The written materials were as effective as the video version, perhaps because they had been developed directly from the videotapes.

Werner et al. (373) described a study involving Minicourse 20, "Divergent Thinking," designed to train teachers to use brainstorming to stimulate divergent thinking in students. Fifty-nine in-service teachers in grades one and two took the course. Tapes of brainstorming sessions were made before, after, and seven weeks after the course was completed. All teachers taught English or social studies. The 59 teachers in the experimental group were divided into one group which microtaught with audiotape feedback and a group which taught with videotape feedback. Twenty-seven teachers in a control group were pre- and post-tested.

Teachers in the experimental group improved significantly more than those in the control group in the skills of not evaluating during brainstorming and not making unnecessary comments or shaping student ideas. They did not show improvement in the use of techniques such as categorizing to stimulate more divergent brainstorming. Teaching skills were acquired equally well by teachers who microtaught with audiotape feedback and those with videotape feedback. Control teachers showed no gains in teaching skills.

When student responses were analyzed, the elementary students of experimental group teachers showed significantly greater gains in fluency, flexibility, and originality than did those of teachers in the control group. The secondary sample did not improve. There were no significant differences between experimental and control groups on the Torrance Tests of Creative Thinking given, to students in grades four through twelve, before and seven weeks after the course. Teachers in the experimental group did, however, retain their use of skills after the course ended.

Woolman (385) reported on a study involving locally-developed and produced models used in an in-service program designed to improve instruction. She used five videotaped teaching demonstrations involving single concepts. The tapes were developed for use with teachers of grades four, five and six. Sixty teachers, selected by random sampling, were divided into three groups: a control group which received no information, an experimental group which only viewed the tapes, and an experimental group which viewed the tapes and participated in discussions following the viewings.

Two instruments were developed for use in this research. The Inventory of Teacher Concepts was designed to gather information regarding teacher opinion and understanding of (1) teacher-pupil interaction; (2) provision for individual differences; (3) pupil involvement, interest, and attention; (4) teacher acceptance and evaluation of pupil effort; and (5) appropriateness of the presentation to the age and maturity of the children. The Scale for Estimating Tone and Quality of Classroom Pursuits was designed to estimate the extent and quality of the same aspects of good teaching emphasized in the Inventory and was used, by trained observers, in the classroom. Teachers were pre- and post-tested, with the time between testing being five months.

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Woolman found that videotaped demonstrations had a positive effect on the quality of teaching, with the greatest change occurring in those teachers rated as needing the greatest improvement and also among the highly motivated. Young teachers learned strategies faster than older teachers but the older teachers more effectively adapted learning to the classroom situation.

Two investigators compared the differences achieved by using perceptual and symbolic models to change teaching behaviors. McDonald and Koran (226) studied the teaching skill of analytic questioning, working with 121 intern teachers randomly assigned to three treatment groups. One was a film-mediated modeling treatment (a film portrayal of analytic questioning). Another involved a written model (a text of the film sound track). The third was the control treatment (no model but the interns participated in a microteaching pretest, initial instructions, and two teaching cycles). The results showed that the film-mediated model was most effective and no modeling least effective, with the effectiveness of instructional methods varying from one individual to another with these differences related to trainee aptitudes.

Fitzgerald (100) worked with 52 preservice teachers randomly assigned to experimental and control groups in an experiment designed to determine the effects of perceptual and symbolic models. (Murray and Fitzgerald (251) produced a longer report on this same study.) The skill involved was the use of a modification of Flanders' Interaction Analysis System. The experimental group received instruction through perceptual modeling via a videotape and discussion. The control group received instruction only through verbal means.

All participants were observed in classrooms (five 15 minute observations) and rated by three observers using the modified Flanders' instrument. The experimental group exhibited significantly different verbal behavior and was more indirect than was the control group.

Bell (24) investigated the effectiveness of direct observation in evaluating a videotaped model lesson. The experimental group of 227 preservice teachers had observed six hours or more in public secondary school classrooms. The control group consisted of 60 preservice teachers who had not participated in observation. All of the preservice teachers viewed a model lesson (designed to develop teacher competency in areas defined by the Stanford Teacher Competence Appraisal Guide) and rated it using the STCAG. Bell found, upon analysis of data, no significant differences between the mean criterion scores of the two groups, indicating that direct observation made no difference in ability to recognize and evaluate the components of a model lesson. He also found that individuals with higher grade point averages tended to be more critical in the observing process. He suggested that observational experiences via videotapes might be appropriate in teacher education programs because the tapes could be stopped at any point for discussion and could be replayed. In addition, use of tapes would provide a commonality of observational experiences not possible in direct observation situations in the public schools.

Brode (53) considered a phenomenon which might be appropriately described as that of "unconscious modeling." He investigated whether a teacher's incidental imitation of the verbal behavior patterns of his supervisor influenced his own classroom behavior and whether certain teachers were more

susceptible than others to this influence. He worked with 193 teachers of
grades one through nine. These individuals took the Minnesota Teacher
Attitude Inventory and the Preliminary Situation Test (designed to measure
preference for indirect vs. direct responses). Teachers were assigned to
two treatment groups equated on the bases of age, sex, level of training,
and years of teaching experience. Both groups engaged in a discussion in
which all conditions were identical except for the verbal behavior of the
experimenter. Group A was exposed to predominantly indirect behavior; Group
B, to predominantly direct behavior. Fourteen taped episodes of a sixth
grade social studies class were then shown and the two groups asked to rate,
on a five point scale, the appropriateness of two indirect and two direct
responses the classroom teacher might have made to situations in each episode.
Brode found the responses of Group A to be significantly more indirect,
indicating an effect of the supervisor's verbal behavior.

Brode had predicted that teachers scoring low on the MTAI would have a
greater tendency to imitate the verbal behavior of the experimenter, based
on the statement by the authors of the MTAI that teachers "who make low
scores are essentially insecure socially . . . and frequently have submissive,
uncritical attitude toward authorities over them" (53:5). Differences among
levels of MTAI scores were in the predicted direction but the interaction of
treatment x MTAI levels was not significant.

In reviewing these studies emphasizing the use of models to change
teacher behavior, the use of models does appear to be an effective technique.
Written or symbolic models appear to be as effective as perceptual models in
many instances, particularly if the symbolic model closely resembles the
perceptual one.

Studies of Media and/or Methodology Used to Promote Behavior Change –
Programs: The next cluster of studies is concerned with the reporting of
programs or aspects of programs designed to produce change in teacher behavior(s).
In some instances, the investigators were concerned with the use of a particular
observation instrument. In others, the discussion included more than one
aspect of a program or setting in which the training took place. Thirty-six
papers are included in this sub-section. [Thomson and Cooper (352), Emmer
and Millett (87), Davis and Smoot (80), Smoot (336), Perry (279), Forgan
(105), Brashear (50), Brashear and Davis (51), Gray (136), Joyce (182),
Minskoff (516), Twelker (363), Steen and Lipe (551), Quirk et al. (289),
Sandefur (315), Sandefur et al. (317, 318), Roberson (298), Johnson (484),
Birch (34), Mazer (509), Tardif (349), Gill (130), Pancrazio (272), Tinsman
(353, 354), Hite (160), Bennett (30), Francke (108), Gabehart (449), Searle
(541), Nisenholz (519), McGuire (503), Kelly (186), Aldrich (393), Stone
(554), McDonald et al. (225)].

Five reports involved studies which were conducted with students enrolled
in the Teaching Laboratory at The University of Texas at Austin [Brashear
(50), Brashear and Davis (51), Smoot (336), Davis and Smoot (80), Emmer and
Millett (87)]. Brashear (50) alone and in conjunction with Davis (51) reported
on an investigation of whether or not behaviors practiced in the Teaching
Laboratory (microteaching with peers as pupils) would persist in student
teaching. Fifty secondary school student teachers, divided into experimental
and control groups, were observed twice during student teaching for data

gathering purposes, with the observers using the OScAR 5V (Observation Schedule and Record). The twenty-six student teachers in the control group had not participated in the TL program. Each individual responded twice to a form of the semantic record as proposed by Osgood. This instrument was used to indicate attitudes toward education, teaching, and pupils.

Brashear and Davis found, based on observation data, that the two groups differed significantly only on one of the 18 behaviors measured by the OScAR 5V. Those in the control group made more directing/rejecting statements. Behaviors acquired during work in the Teaching Laboratory appeared not to have persisted.

When data from the form of the semantic differential instrument were considered, student teachers with prior TL experiences rated the role of teacher as lower (p = .01) and their own ability to teach as lower (p = .05) than did the student teachers without the TL experiences. The investigators inferred that the reality-based experiences of the Teaching Laboratory may have induced attitudes in the student teachers in the experimental group similar to those of beginning teachers (who, as a group, have been reported to possess negative attitudes during their first six months of teaching) (51:9).

Smoot (336) and Davis and Smoot (80) reported on a study involving 140 preservice secondary school teachers in which they attempted to determine if individuals who received training in the use of a classroom observation system (a modification of the OScAR 5V, entitled Laboratory Observation Schedule and Record or LOScAR) and who were given informational feedback based on this system would demonstrate teaching behaviors different from those exhibited by preservice teachers who had not received this training and feedback. Students in the experimental group taught five to eight minute TL lessons with feedback and subsequent reteach lessons in two micro-teaching cycles. The skills of clarifying instructional objectives and of classroom interaction were emphasized. The control group had no direct teaching experience. At the end of a seven week period, all individuals taught a 10 minute post-test lesson which was analyzed with the LOScAR. Smoot reported that the individuals who had received training in the LOScAR did differ in teaching behaviors from those with no training. The experimental group asked more convergent questions, was more supportive and considerate of pupil responses and contributions.

Emmer and Millett (87) reported on a pilot study conducted to evalute the effects of a sequence of microteaching tasks on the teaching behavior of preservice teachers. Fifty-four students participated. Those in the experimental group taught 10 lessons in the TL program, using a sequence of instructional and learning tasks. The control group taught two lessons only. All participants made an audio-tape recording of a 10-15 minute lesson which was used for comparison purposes. When the tapes were analyzed, the experimental group was found to be rated significantly higher on three of the four teaching dimensions: determining readiness, motivating, and evaluating. There was no difference between groups on the dimension of clarifying objectives.

When the verbal behavior of the two groups was compared via Flanders' ten categories, the teachers in the experimental group had significantly greater amounts of the behaviors of the use and acceptance of student ideas, questions, directions, student response, and student-initiated talk. The control group had greater amounts of lecture.

Two investigations involved the use of a Guided Self-Analysis (GSA) system developed by Theodore W. Parsons. Tardif (349) reported on research conducted in 10 rural school districts near Fresno, California. Five of the schools (districts) were randomly selected to receive the experimental treatment. Twelve teachers participated in the study, with three fifth grade teachers and three sixth grade teachers in each group (experimental and control).

Training involved helping teachers learn to use a self-supervisory procedure for monitoring and classifying their own oral teaching behavior. Teachers were provided with a detailed model for analyzing their classroom questioning and response strategies and for identifying the functions of their classroom talk. Prior to training, teachers made a videotape considered to be a typical sample of teaching behavior in a social science class setting. During the treatment, teachers in the experimental group learned the coding procedure and analyzed a videotape provided by the trainer. Following training, they made videotapes of their teaching, analyzed performance, modified behavior, made a new videotape, and analyzed it. Four repetitions of this cycle were conducted by teachers in the experimental group before they made a fifth tape for data analysis. Teachers in the control group also made five videotapes of their teaching during the 13 week experimental period. They viewed their tapes without the benefit of training in any analysis system.

No significant differences between groups were identified from the pre-training videotapes. At the end of the experimental period, the two groups of teachers were found to be statistically different in 7 of the 13 variable categories. The GSA-trained teachers (1) asked a significantly greater proportion of higher cognitive order questions, (2) had a greater proportion of questions which were logically related to previous questions, (3) had a significantly lower proportion of responses to pupil talk which served to terminate a current category of thought or previous pupil oral participation, (4) had a significantly greater proportion of responses to pupil talk which served to maintain or elevate pupil participation at the same or a higher cognitive level, and (5) had a significantly lower proportion of teacher talk which served to manage either pupil behavior or classroom procedure. Students of the GSA-trained teachers (1) exhibited a complexity of utterances significantly greater than did pupils of teachers in the control group and (2) had a significantly lower proportion of utterances at the information giving level.

Tardif suggested that an improvement of the relatedness of questions logically suggested that pupils should improve their participation, due to diminished confusion. With a decrease in confusion and an increase in pupil participation, there should be a decrease in the necessity for managerial behaviors by teachers. The results appeared to support these statements.

Birch (34) worked with preservice teachers, rather than in-service teachers as Tardif had done, in his study which involved Guided Self-Analysis materials. Forty-eight student teachers of social studies were involved in the research to determine the effect of a Social Studies curriculum course, self-confrontation on videotape, videotape-coding practice, and Guided Self-Analysis (GSA) upon the nature of teachers' questions, teacher responses, total teacher talk, and teacher/pupil talk patterns.

Birch found that self-coding clearly had an effect on the verbal teaching behavior with the effect being greatest on questioning strategies but also substantial on response strategies and total teacher talk. Self-coding was effective in decreasing the frequency of such negatively-valued behaviors as rhetorical questions, basic questions, closure responses and instruction and in increasing such positively-valued behaviors as leading questions, probing questions, extending responses, and questions and responses in general. No factor other than self-coding and no identifiable interaction of factors was shown to have an effect on verbal teaching behavior. Birch concluded that Guided Self-Analysis did effect behavior change, but that parts of GSA (self-confrontation and videotape-coding) used alone did not.

Roberson (298) used a different self-analysis program to promote behavior change. His Teacher Self-Appraisal Inservice Program involved workshops on behavioral objectives, principal-directed teaching skills sessions, and training in Flanders' Interaction Analysis and in Roberson's Self-Appraisal systems. Throughout the school year, in an attempt to assess change in teacher attitudes and methods and student attitudes and achievement as a result of the inservice program, six videotapes were collected on each of 20 teachers. The tapes were coded and interpreted and used to provide the teachers with feedback. In addition to videotape data, information was acquired via student and teacher attitude tests, pre-post scores on reading tests, on a semantic differential scale, and on Edwards' Personal Preference Scales.

Roberson reported that the program increased the reading achievement of disadvantaged children, that writing behavioral objectives at all cognitive and affective levels seemed to bring about more change in teacher methods than did training in classroom observation systems, and that a teacher's attitude toward the organizational climate of a school may be affected by whether or not he understands the feedback he receives concerning teaching.

Bennett (30) evaluated the effects of participation in the Hilda Taba In-Service Education Program on teachers' self-concept, attitude, and selected personality characteristics. She obtained information on these variables through the use of the Tennessee Self-Concept Scale, the Minnesota Teacher Attitude Inventory, the Guilford-Zimmerman Temperament Survey, and the Rokeach Dogmatism Scale. A non-equivalent control group design was used, with experimental and control groups being pre- and post-tested. These groups were composed of 87 in-service teachers, in a large suburban school district, who had volunteered to participate in the Taba Program.

When the data were analyzed, Bennett found that significant differences (.01 level) existed between the mean scores of teachers who had participated in the program and those who had not for the variables of teacher self-concept, attitude, and personal relations. There were no significant differences

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between groups for the variables of teacher objectivity, thoughtfulness, and dogmatism. She concluded that the Taba Program had been an effective agent in bringing about positive change in certain personal characteristics related to teaching effectiveness.

One researcher, Gill (130) looked at the usefulness of training teachers in group interaction skills in terms of changes in classroom interaction patterns. Fourteen in-service secondary school teachers who composed the experimental group were enrolled in Hill's Learning Through Discussion (LTD) method and participated in group interaction exercises adapted from those developed by the National Training Laboratories. Fourteen in-service teachers matched with the experimental group on grade, subject matter taught, teaching experience, and sex served as the control group. Treatment consisted of 12 weekly sessions held after school and involved training in the use of a structured small group discussion method and activities designed to improve group interaction skills.

All 28 teachers audiotaped one classroom session with their students each week of the 12 week treatment period. Two weekly tapings were made four weeks after the treatment ended.

Gill found that the control group initially made more positive responses to student behavior but, during the treatment, this trend was reversed. At the end of the training period, the experimental group made significantly more positive responses than did the control group. There were no significant differences for treatment, session, or interaction effect for the variable of negative teacher reaction to student behavior. The experimental group asked increasingly more high level questions than did the control group as training progressed and this difference was maintained six weeks after treatment. There were no significant differences for treatment, session, or treatment by session interaction for the behavior of asking low level questions, however.

The teachers in the experimental group had more teacher talk than did the control group at the beginning and also less pupil talk. As the treatment progressed, the amount of teacher talk decreased for the experimental group but remained constant for the control group. Pupil talk in classes of teachers in the experimental group increased significantly compared to the control group, as did the number of student initiated responses (which had also been fewer for the experimental group in the early phase of training).

Perry (279) looked at student teachers' attitudes in his study to determine the extent to which student teachers' attitudes and teaching performance were influenced by participation in a "pro-seminar" designed around the Arizona IOTA workshop rationale. IOTA is the acronym for Instrument for the Observation of Teaching Activities. Using a post-test only, control group design, Perry randomly selected 60 individuals from a volunteer population of 158 elementary education student teachers. Volunteers were stratified into sub-populations of female and male members, and the 60 participants were randomly assigned to treatment and control groups. Student teachers' attitudes were measured with the Minnesota Teacher Attitude Inventory. Teaching was assessed with the IOTA instrument scales.

Perry found that the student teachers who participated in the IOTA pro-seminar improved their teaching performance, particularly in the areas of variety of activities, development and implementation of classroom goals, and exploration of value judgments. They developed attitudes which were more tolerant of children's misbehavior and became more concerned with the child's opinions and feelings.

Gray (136) studied the effects of two kinds of laboratory experiences on attitude change in preservice teachers. Students enrolled in "Speech in the Elementary Schools" received di'ferent treatments in fall and winter sections of the course. Those in the fall participated in team teaching, use of closed circuit television, and role playing as well as having a variety of speech activities as learning tools. Those in the winter quarter worked with children in place of role playing. In both quarters, an attitude scale was given as a pre-post-course measure. Gray found that the fall quarter group were more preoccupied with self, appeared to be less concerned with children, and provided less evidence of respect for colleagues' abilities, preparation, and performance than did the winter group.

Two reports provided information about teacher behavior in Project PLAN, an individualized instruction program. Steen and Lipe (551) reported on the use of the Teacher Observation Scale (TOS) in the development of the PLAN teacher training program. This program consists of a preservice conference and in-service consultant services designed to encourage specific teaching behaviors. The 17 category TOS instrument includes five behaviors on which PLAN teachers are expected to spend more time and five behaviors on which they are expected to spend less time. The five behaviors to be encouraged are diagnostic and didactic inquiry, decision facilitation, leading small group discussion, tutoring, and giving positive verbal and nonverbal messages. The five behaviors to be decreased are solution giving, providing content, giving a negative verbal or nonverbal message, managing records and computer materials, and managing learning material and equipment. Steen and Lipe reported that analysis of teacher behavior, of PLAN-trained teachers and of a control group using the TOS, led to modification of the program so that more emphasis was placed on teacher planning, classroom organization, and use of positive reinforcement.

Quirk et al. (289) observed 66 Project PLAN teachers in 14 San Francisco Bay area schools. Eight observers trained in the use of the TOS collected data to determine if the program, which is more structured at the primary level, did produce differences in behavior in primary and intermediate grade teachers, specifically in the use of group discussion and individual instruction.

The researchers hypothesized that primary teachers would spend signifi-cantly more time in group discussion and that the intermediate grade teachers would spend significantly more time in individual instruction. No signifi-cant difference between the two groups was identified for the use of group discussion time. There was a significant difference in the use of t .e for individualized instruction but it was in the opposite direction than that predicted.

In earlier portions of this section of the monograph, studies reporting the use of behavior modification techniques on children have been cited. One research project involved the use of behavior modification on teachers. Thomson and Cooper (352) conducted an investigation in which two Head Start teachers served as subjects. Baseline observations, training in attending to appropriate child behaviors, and post-test observations were made. The training involved feedback to the teachers every 10 minutes (via a hearing-aid type of receiver) on the appropriateness of their reinforcing techniques. Changes resulted in teacher and in student behavior. Although each teacher had a specific target child with whom she worked, one of the teachers was able to generalize her reinforcement skill to the entire class.

McDonald et al. (225) considered the development of teacher skill in reinforcement behavior in a study of the relative effectiveness of three training procedures (self-administered feedback, experimenter-administered feedback, experimenter-administered feedback with cue discrimination training). When analyses were made of videotapes of the teaching of the interns partici-pating in this study, the group receiving experimenter-administered feedback with cue discrimination training outperformed all other groups. The self-feedback condition was relatively ineffective.

The probable effects of teacher behavior on pupil behavior were studied by analyzing total pupil responses and relevant component responses. Responses of pupils of interns in the groups receiving experimenter-administered feed-back (positive reinforcement of the reinforcing behaviors when observed on the videotapes) and experimenter-administered feedback with cue discrimination training increased from the first to fourth videotaped lessons in the study. Whether this increase was due to increased teacher positive reinforcement or was a function of increased teacher questioning was investigated. Researchers looked for, but did not find, an increase in directly solicited answers and a decrease or no change in pupil-volunteered statements and questions, both assumed to occur if teacher questioning was the cause.

Pancrazio (272) compared three training approaches designed to produce changes in nonverbal behavior. The approaches consisted of the utilization of a programmatic videotape, a lecture-discussion utilizing still pictures taken from the videotape, and a practice session in a microteaching setting. Data were obtained by using a structured-observation inventory. Seventy-four preservice teachers in home economics and social studies participated in the study. No significant differences in performance were identified but the group using the videotape considered the training to have been most helpful.

Tinsman (353, 354) assessed the effectiveness of the application of Instructional Flexibility Training to the education of prospective elementary school teachers. Instructional Flexibility Training is a training system based on the Conceptual Systems theory and is designed to increase a teacher's repertoire of teaching maneuvers. Fifty-eight individuals, divided into an experimental group and a control group, were given a Sentence Completion Test to determine their conceptual level. Initial teaching style was deter-mined by audiotaping lessons (four for experimental group students and two, for control) during a semester of field experience in inner city schools. No significant differences resulted on any of the behavioral indices involved

in the study. The experimental group did, however, manifest a greater degree
of controlled flexibility on the indirect and cooperative behavioral indices.
All subjects in both groups scored at the lower end of the concreteness-
abstractness spectrum. Therefore, Tinsman felt his study demonstrated that
performance skills could be learned, through the use of teaching models, by
individuals having low conceptual levels.

Forgan (105) considered the effects of instructional simulation materials
used to help prospective elementary school teachers deal effecrively with
discipline problems. Twenty preservice teachers were randomly assigned to
experimental and control groups, with those in the experimental group par-
ticipating in a three-day instructional program before beginning student
teaching. The program involved the use of Classroom Management Instructional
Simulation Materials developed by Teaching Research, Monmouth, Oregon.

Each student teacher was observed nine times during student teaching
and data were obtained by use of the Revised Observation Schedule and Record.
Questionnaires concerning difficulty in classroom management were completed
by the student teachers and their cooperating teachers.

No significant differences between experimental and control groups
were found for the relative amount of pupil disorderly behavior, perception
of the difficulty of classroom management, frequency of using desist strategies,
and use of public desist strategies when appropriate. Significant differences
were noted for kinds of desist strategies used and for appropriate use of
private desist strategies. Student teachers in the experimental group used
proportionately more private nonverbal and low-force desist strategies and
used private desist strategies more appropriately than did those in the con-
trol group. Those in the experimental group were less verbal when teaching,
more supportive of pupils, and provided more opportunities for pupils to
assume leadership. The experimental group of student teachers expressed
highly favorable attitudes toward the instructional simulation activities.

Twelker (363) also studied the use of simulation in teacher education.
In his research 92 student teachers in randomized groups received interaction
analysis and/or simulation training or neither. Effects were measured with
simulation tests, classroom performance records, course grades, the Minne-
sota Teacher Attitude Inventory, Edwards Personal Preference Schedule, and
Educational Testing Service Cognitive test. Data analysis showed that students
receiving only simulation training spent more time than other student teachers
in simulation and management behaviors. Students in the group given both
interaction analysis and simulation training were unable to discriminate
problematic cues and respond appropriately on the simulation test, leading
Twelker to infer that interaction analysis training had an inhibitory effect.

There was only one significant interaction between learner characteristics
and training programs. On the abasement factor of the Edwards Personal
Preference Schedule, low scoring subjects who received only simulation train-
ing spent significantly more time than all other subjects on simulation and
management behaviors during student teaching.

Joyce (182) worked with 30 elementary school student teachers and their three supervisors (doctoral students in curriculum and teaching) in his research involving an integrated feed'ack system designed to enable student teachers to analyze their own teaching, set goals for improvement, and monitor their own progress. An "integrated feedback system" as Joyce conceptualized it involved combining behavioral analysis of teaching with tape and film reproduction of teaching episodes in order to assist the student teacher to comprehend what he does as a teacher and to set goals and monitor his progress toward these goals.

The student teachers were expected to learn a system for the behavioral analysis of teaching, make a weekly tape recording of a lesson, analyze this lesson, and be prepared to use the analysis in conferences and seminars with the supervisors. Supervisors were expected to have weekly conferences with the student teachers in which they assisted the student teachers in analyzing their teaching, setting goals for improving their teaching, and learning to judge their progress, using the behavioral analysis technique. Supervisors were also expected to lead weekly seminars in which they helped groups of student teachers analyze teaching and set group and individual goals for improvement as well as assisting the student teachers to develop strategies for coping with common problems in teaching.

Joyce reported that the three supervisors were inexperienced in feedback techniques and were uncomfortable with the system to a great extent throughout the year. He considered that the effectiveness of the feedback system was handicapped by the inexperience of the faculty, their insecurity with the procedures, and their consequent varying morale. The students did learn to analyze their teaching as recorded on films and tapes and were able to analyze one another's teaching in seminars.

Data analysis of seminars revealed that a large percentage of communi-cation was devoted to administrative matters (e.g. "Do we go to the schools on Columbus Day?") when faculty members were present. When student teachers or cooperating teachers led the seminars, teaching was examined almost exclusively whether the feedback system was used or not. (There was no way of knowing if the attention to teaching was due to a lack of any indi-vidual to whom to ask administrative questions.)

Supervisors and student teachers did not agree on the areas in which the student teachers were improving or the areas in which they were having difficulty, except for that of disciplinary problems. The construction of the feedback system did not, therefore, appear to increase supervisor and student teacher agreement. Joyce was unable to explain how the two groups could work together for an entire year and still fail to agree on areas of progress and difficulty other than discipline. He concluded that simple reliability in using a behavioral-analytic system was insufficient to produce close communication on all phases of supervision.

He recommended that the implementation of feedback systems require extensive staff training and support and, at least in the initial years, a rather definite specification of faculty roles. Supervisors need to know how to help students analyze their teaching, set goals and monitor progress.

Supervisors also need specific advice on how to train students to provide feedback to one another. Faculty need to recognize their own effects and to modulate them in behalf of students. The processes by which students and faculty learn to analyze teaching need to be scrutinized very carefully, to avoid the lack of agreement identified in this research.

Sandefur et al. (318) produced a report, in 1969, of the findings of a study designed to examine the changes in teacher behavior exhibited during student teaching and those behaviors exhibited during the last three weeks of the subjects' first year of teaching. Fifty secondary teachers were involved in this study, 25 of whom had been participants in the experimental preservice program which emphasized indirect teaching behaviors.

Data on the 50 first-year teachers were secured through the use of the Classroom Observation Record, developed in the large-scale study directed by Ryans, and of a 16-category system of interaction analysis. Pre-first-year teaching data were available from a previous research study.

The researchers reported numerous findings. Among these were: (1) Teachers trained in the experimental program differed significantly (.01 level) in certain behaviors from those exhibited during student teaching and had become more responsible, more understanding, more kindly, taught with more originality, were judged to be more attractive, poised, confident, mature, and integrated, and demonstrated more breadth in teaching. (2) Those trained in the conventional program were judged to differ, from their student teaching behavior, in five areas, having become more steady, more broad in teaching content, more fair as opposed to partial, and more poised and confident. (3) Fourteen of the 18 behaviors identified in the COR were found to have changed significantly for the total group, at the end of their first year of teaching. (4) Changes in pupil behavior as a result of teachers' experience were not observable.

Sandefur and his colleagues concluded that teachers sensitized in the experimental preservice program to the use of indirect teacher influence, specifically to the acceptance of feeling, praise and encouragement, and acceptance of students' ideas, seemed to expand the use of these categories as compared to their use of direct categories.

Sandefur, in three reports (315, 317, 318), discussed experimental programs in teacher education. Three experimental programs were described in a paper presented to the 1971 meeting of the North Central Association of Colleges and Secondary Schools (315). The research results reported in this speech indicated that the experimental programs produced more functional teacher behavior than did the traditional program and that certain teaching behaviors were significantly modified by teaching experience.

Sandefur et al. (317) produced a final report on a study, conducted at Kansas State Teachers College in Emporia, to compare the behavior of 52 secondary education students in a conventional program with that of 62 students in an experimental program. The experimental program coordinated laboratory experiences of observation and participation with selected readings and seminars in the foundation areas of psychology, philosophy, sociology, and anthropology. Data were derived from the Classroom Observation Record,

a system of interaction analysis, the National Teachers Examination, and student teaching grades. Significant differences in the teaching behavior of the two groups were identified. Students in the experimental group received more desirable behavioral ratings. Students in the control group made significantly higher scores on the "professional education" section of the NTE. The investigators concluded that programs stressing possession of factual information about professional content are less likely to produce desirable teacher behavior than are those stressing laboratory experiences which are made relevant to content and theory.

Although the reports of Sandefur and his colleagues provide evidence that more and more reality based experiences make a difference in the behavior of beginning teachers, Kelly (186) in work with a different student population produced different findings. He conducted a study to determine if participants enrolled in a three semester on-site teacher preparation sequence would demonstrate significant differences in classroom teaching activities from those participants enrolled in a one semester on-campus and two semester on-site sequence. Kelly worked with 39 students who volunteered to participate and who were randomly assigned to the two groups.

Group A spent three semesters on-site, working in observation/participation activities and attending weekly on-site seminars. Participation activities increased throughout the program until the final semester consisted of student teaching. Group B spent the first semester on campus and worked in activities involving microteaching, group dynamics, set induction theory, preparation of a unit of instruction, training in the use of interaction analysis, effective utilization of audiovisual materials and participated in seminars. The second and third semesters' activities paralleled those of group A.

During the final semester all students in both groups were post-tested with the 14 observational scales of the IOTA instrument. Two 45 minute live observations were made for each student teacher. When data were analyzed, no significant differences were revealed in the mean behavior of the two groups as measured by the IOTA.

Francke (108) conducted research with another experimental teacher education program, the Nebraska University Secondary Teacher Education Program (NUSTEP). Specifically, he looked at changes in the ability to produce pupil achievement when given specified content to teach to secondary school students in English classes. Thirty undergraduates participated. Fifteen had been randomly selected from the NUSTEP program and 15 randomly selected from each of 15 secondary English classes for use in the lessons which were videotaped. Data were collected prior to student teaching and no grades were involved for the participants.

The behaviors selected for analysis were those considered by the NUSTEP staff as representative of the model of instruction taught in the NUSTEP program: specification of objectives, pre-assessment, instruction, and evaluation. Francke found that individuals in the NUSTEP program demonstrated closer approximation to the model than did those enrolled in the conventional program. Francke also identified a positive relationship between the NUSTEP preservice teachers' abilities to produce pupil achievement and their use of teacher behaviors related to the NUSTEP model of instruction.

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Hite (160) conducted a follow-up study to an investigation, completed in 1966, which attempted to assess the effects of reduced loads and in-service help on the classroom behavior of 120 beginning teachers. The 1966 study had provided the information that the experimental group which had a modified internship had exhibited at least 25 per cent higher scores on teaching performances than had the control group. The follow-up study was designed to determine if the relative differences in teaching behavior had persisted and involved 10 randomly selected members of each of the original four experimental groups. No significant differences, one year later, were identified. Differences among the four groups tended to become smaller. Most of the variability was accounted for by the atypical scores of five individuals. Judged by means of observer ratings, the total group of 40 tended to show small positive gains in teaching performance standards.

Seale (541) looked at a different aspect of preservice teacher education, that of arrangement of courses rather than the content of the courses. He investigated the change in attitudes of subjects enrolled in elementary education methods classes using the block-of-time approach as compared to four separate methods courses. His subjects were 184 elementary education majors placed in experimental and control groups and further subdivided, in each group, into high academic achievers and low academic achievers. Data on attitude change were obtained by use of the Minnesota Teacher Attitude Inventory and the Teacher Characteristics Schedule. Subscales of these two instruments provided eight variables for investigation.

Seale found a difference in the mean vectors of the attitudes toward teaching and teacher classroom behavior between the two groups, with this difference being at the .05 level of significance. No significant difference was identified when simultaneous confidence intervals were used but when associated discriminant function was used, three variables made important differences in the mean vectors of the two groups with the experimental group exhibiting more favorable change in attitudes. These variables were (1) the attitude toward being stimulating, imaginative, and original; (2) the attitude toward being warm, understanding, and friendly; and (3) the attitude toward democratic classroom behavior. There were no significant differences in the mean vectors of attitudes for the high academic achievers and low academic achievers of the two groups.

In summary, the studies cited in this portion of this section of the monograph provide evidence that it is possible to produce behavioral change. The amount of change and degree of success vary with the study under consideration. Some researchers appeared to have randomly selected groups which were more amenable to change than did other investigators. In the very few studies of preservice teachers in which behavior changes produced on-campus during the preservice program were assessed during student teaching, those in which the preservice teachers were involved in microteaching experiences utilizing public school pupils rather than peers as pupils (Far West Laboratory's minicourses vs. University of Texas Teaching Laboratory) appeared the more effective, though no one-on-one comparison studies were made. Stability of behavioral changes appears to be influenced by factors in the teaching situation as well as by the training provided, as evidenced in the study by Hite. The report by Joyce serves to emphasize not only the desirability but also the necessity of providing training for supervisors if they are to help teachers change.

STUDIES OF TEACHER PERSONALITY FACTORS AND
ATTITUDES AS THEY AFFECT TEACHER BEHAVIOR

Eighty-two studies were classified as emphasizing the investigation of
teacher personality factors and teacher attitudes as these variables relate
to behaviors exhibited in the classroom. The majority of these studies are
descriptive in nature although a few involve some degree of experimentation.
Although teacher behavior is a focus of concern, the research was broader
in scope than that identified in the two previous sections. Again, clusters
of studies were identified and the topics involved are shown in Table IV,
below.

TABLE IV

TYPES OF PERSONALITY, ATTITUDE STUDIES

FOCUS	NUMBER OF STUDIES
Self-Concept, Personality	21
Attitudes	10
Beliefs, Values	4
Teacher Performance	10
Predictive Factors of Teaching Effectiveness	15
Reactions to Educational Innovations, Change	7
Concerns of Teachers	6
Interpersonal Relations, Pupil Control Ideology	6
Cognitive Factors	3
Total	82

Forty-eight of the studies were doctoral dissertations and were obtained from
the two-year period searched in Dissertation Abstracts. One or two more were
papers presented at annual meetings of the American Educational Research
Association, a forum frequently used by individuals to disseminate the results

of their recently-completed doctoral investigations. Whether this distri-
bution of research (doctoral research vs. other) has any implications for
the educational profession is a matter of individual philosophies and biases.

Self-Concept and Personality Factors

Studies Related to Self-Concept: Within the sub-category of teacher
personality factors and self-concept studies, some further divisons could
be made. Four investigations [McCreary (222), Passmore (275), Cropper (428),
Garrison (127)] were focused on self-concept. One of the accepted goals of
most teacher education programs, whether it is expressed in written form or
commonly understood, is to produce teachers with adequate self-concepts so
that these individuals may, in turn, promote the development of adequate
self-concepts in their pupils. Passmore (275) worked with the problem of
determining the relationship which might exist between self-concept and
personality characteristics and success in elementary school student teaching.
She also looked at possible relationships of self-concept and personality
factors to age and grade point average. One hundred eight preservice teachers
(only three of whom were male) were asked to respond to the Tennessee Self-
Concept Scale, the Bills' Index of Adjustment and Values, and the Omnibus
Personality Inventory. Cooperating teachers and university supervisors
rated these 108 individuals, using the Professional Judgment of Student
Teacher Competence Scale.

Passmore studied the mean differences of the scores of the preservice
teachers on the two self-concept measures and the personality inventory by
grouping the scores of the upper and lower one-thirds and comparing these
scores with the ratings of teaching effectiveness. She found that teaching
effectiveness ratings were significantly related (.05 level) to three of
the scales of the Tennessee Self-Concept Scale, to two of the scales of the
Bills' Index, and to three of the scales of the Omnibus Personality Inven-
tory, suggesting that self-concept was related to success in student teaching.
She found that student teachers with higher grade point averages differed
particularly in the area of personality characteristics from those with
lower grade point averages, as indicated by significant relationships (.05
level) between grade point average and one scale of the Tennessee, two scales
of the Bills', and five scales of the Omnibus instruments. Age was not
significantly related to self-concept as measured by the two instruments
used in this study. Age was related (.05 level) to the "practical outlook
scale" of the Omnibus Personality Inventory. Passmore suggested that self-
concept measures and personality inventories be used early in a student's
professional preparation for counseling purposes.

McCreary (222) studied self-concept and cultural awareness in preservice
teachers. He attempted to measure the effects of experiences-in-being on
the self-concepts of 71 preservice teachers, to measure the effects of cultural
awareness training on the interpersonal understandings of these individuals,
and to measure the combined effects of the experiences-in-being and cultural
awareness training on self-concept and interpersonal understanding.

The preservice teachers were randomly assigned to three experimental groups and one control group. All were pre-tested with the Tennessee Self-Concept Scale, the Rokeach Dogmatism Scale, and the Ulibarri Cultural Awareness Questionnaire. The first experimental group received nine hours of experiences-in-being. The second group received nine hours of cultural awareness training. The third group received both treatments while the control group received no treatment. Six weeks after pre-testing, all individuals were post-tested. McCreary found no significant differences betwen groups relative to treatment. The control group changed essentially as the other groups changed.

Garrison (127) reported on a study conducted to design a system of testing and interviewing which would bring into some relationship the personal characteristics of teacher education students and the external or setting demands made on public school teachers. This document, entitled "Appendix U. Self-Concept and Teaching: An Exploration," is a part of the ComField Model Teacher Education Program developed at the Northwest Regional Educational Laboratory, Portland, Oregon. The project involved 40 preservice teachers, 20 of whom met with the experimenter for five of six weekly interviews (one hour long) to discuss the interaction between the student's personality profile compiled from a test battery and his philosophical commitment, as well as to analyze a videotape record of the student's performance in student teaching. The relatively unsophisticated nature of the research leaves unresolved the problem of whether the process involved could be generalized to a different student population.

Studies of Personality Characteristics as Related to Verbal Behavior: Five dissertation studies involved the investigation of personality characteristics and verbal behavior of teachers [Bahneman (14), Myers (253), Fedigan (95), Poston (285), Mulligan (249)]. Bahneman's study (14) contained three problems involving the determination of (1) significant relationships between personality and verbal behavior of physical education teachers, (2) the prediction of verbal behavior (from personality characteristics) of physical education teachers and (3) significant differences in the selected personality characteristics and in the verbal behavior for male and female physical education teachers.

Forty-two in-service physical education teachers (21 male, 21 female) volunteered to participate in the study. The California Psychological Inventory and Flanders' system of interaction analysis were used to obtain data. One entire class period was audiotaped for each teacher and used to obtain interaction data.

Bahneman found that, among male teachers, indirect verbal behavior was associated with high scores on Dominance, Achievement via Independence, Flexibility, and Feminity and with low scores on Good Impression. Among female teachers, indirectness was associated with high scores on Social Presence and Socialization and with low scores on Dominance, Self-Acceptance, and Tolerance. Lack of Flexibility was related to direct behavior in both male and female groups. He also found that female teachers used significantly less criticism than did male teachers and their students initiated more talk than did students of male teachers.

Poston (285) investigated the relationship between teachers' focus of control and their classroom verbal behavior. Working from the social learning theory developed by Rotter in which Rotter states that an individual's expectation of reinforcement and the value of reinforcement determines his behavior, Poston classified teachers as "external" and "internal." "Internal" teachers are those who are aware of a causal relationship between their behavior and its consequences and who view themselves as in control of reinforcements. An "external" teacher or individual is unsure of outcomes associated with his behaviors and sees other forces in control of reinforcements.

Fifty-five teachers of fourth and fifth grades in suburban schools responded to Rotter's E-I Scale. Sixteen were observed and their verbal behavior analyzed via Flanders' interaction analysis. Only the eight most internal and eight most external teachers were selected for the classroom observation. Teachers were observed four times, twice in mathematics lessons and twice in social studies.

Poston found no significant differences in influence exerted by the two types of teachers or in the common interaction patterns or in the quality of praise bestowed. She did find significant differences between verbal behaviors used by individual teachers, between verbal behaviors used in mathematics and in social studies, and between verbal behaviors used by teachers when they were divided according to years of teaching.

Myers (253) analyzed the differences in the use of classroom verbal interaction occurring between student teachers who possess positive self-acceptance and those who possess negative self-acceptance. The Bills' Index of Adjustment and Values was administered to 60 student teachers. Fifteen with the highest and 15 with the lowest scores constituted the positive and negative samples respectively. Flanders' ten-category system was used to analyze the verbal interaction.

Myers found that the positive sample of student teachers used criticism to a greater extent than did the negative sample and was more willing to justify the teacher's role in the verbal interaction and to be critical of students' conduct. The positive sample accepted their students' ideas and then expanded on these ideas. They appeared to foster the use of extended student responses to a greater extent than did the negative sample. The positive sample of student teachers also asked questions which required extended answers while the negative sample used questions which elicited short student responses.

Fedigan (95) investigated information processing styles, characteristics, and verbal behaviors of students in the Teaching Laboratory at The University of Texas at Austin. The instruction consisted of non-directive modeling of an interaction teaching task. He reported that preservice students classified as belonging in a "high integration" group used significantly more interaction of all kinds than did the "low integration" students. Only one major category on the Laboratory Observation Schedule and Record III (LOScAR III) instrument used in the study revealed significantly greater and more consistent change after instruction than did the low integration group.

Mulligan (249) investigated the relation of five selected teacher characteristics and twelve patterns of pupil-teacher interaction. A random sample of 42 teachers was drawn and the Teacher Characteristics Schedule administered to determine characteristics. Each teacher was observed for four 20-minute periods to obtain interaction analysis data. Mulligan reported that only 13 of 60 possible correlations between teacher characteristics and patterns of interaction were significantly related. Based on his findings, Mulligan concluded that school administrators who want teachers who will allow for more actual student participation in the classroom should place a priority on recruitment of the warm-spontaneous teacher rather than the well-organized teacher. He also suggested that methods instructors would profit from researching the objectives and methods of the cooperating teacher with whom a student teacher was placed. In addition, he hypothesized that well-organized teachers could profit from serious consideration of some of the strategies for analysis of pupil-teacher interaction.

Personality Factors Related to Dyadic Settings: Pittinger (282) analyzed patterns of verbal interaction and attempted to identify their relationship to self-reported satisfaction ratings and to a measure of empathic accuracy in selected secondary student teaching supervisory conferences. He used the Multi-Dimensional System for the Analysis of Interaction in Clinical Supervision to study the verbal interaction of the conferences.

Pittinger randomly selected 20 student teachers of English from a group of secondary school English majors and identified 20 supervisory dyads for study by randomly matching each student teacher with either a cooperating teacher or a university supervisor. Each dyad was asked to make two audio-tapes, one early and one late in the student teaching experience. After each taped conference, both individuals completed a copy of a satisfaction scale developed by the investigator. Approximately one month after the eight-week student teaching period, all took Dymond's Empathy Test, modified for the study. The student teachers and university supervisors also took Hogan's Empathy Test.

Pittinger lost nine dyads through a variety of circumstances. When he analyzed the data from the remaining 11 dyads, he found that student teachers contributed significantly more thought units and spoke diagnostically to a significantly greater extent than did the supervisors (public school, university) but the supervisors controlled the initiation of discourse. He found that early conferences were significantly more analytical than were late conferences. He also identified a significant correlation between satisfaction ratings and both analytic and complex discourse. In addition, the more student teachers talked, the less the supervisors were satisfied with the conferences. None of the correlations between the scores of either empathy test and any of the ratios was found to be significant.

Two other investigators chose dyadic settings for their research. Lucasse (212) explored the relationship between the degree of personality similarity within the student teacher-cooperating teacher dyad and six aspects of the directed teaching experience. One hundred twenty-three male and female student teachers were subjects of this study. The Myers-Briggs Type Indicator was used to measure four dimensions of the intra-dyad

personality difference. Cronbach D^2 method was used to produce a Global intra-dyad difference score. Measures for the dependent variables of communication, stress, evaluation of the student teaching experience, and motivation were obtained from questionnaires and rating scales used by student teachers, cooperating teachers, pupils and college supervisors.

Among the major conclusions which Lucasse reported were these: quality but not quantity of intra-dyad communication was positively related to intra-dyad similarity on the personality dimension of extra-version-introversion. Cooperating teacher and student teacher evaluations of each other were generally favorable and were most favorable when the intra-dyad differences were least on the Global score as developed from the four personality dimensions of the MBTI. The grade which a college supervisor assigned to a student teacher was unrelated to measured personality differences. By the time the individuals had become student teachers, their motivation to teach was so fixed that it appeared impervious to the supervisor's evaluation and grading or to the degree of intra-dyad difference.

Jones (179) looked at dyadic interactions of student teachers and their pupils. He attempted to determine if objective differences in teacher-student dyadic interactions were associated with differences in student introversion, student achievement, student sex, teacher achievement, and teacher introversion. Sixteen female student teachers and eight students from their classrooms participated in the study. The student teachers were selected according to their scores on the introversion and efficiency (achievement-orientation) scales of Veldman's Adjective Self Description and were selected so as to form four groups of four student teachers each: high achievement-oriented introverts, high achievement-oriented extraverts, low achievement-oriented introverts, and low achievement-oriented extraverts. Pupil selection was made on the basis of teachers' perceptions of introversion and achievement and sex in order to place a male and a female student in each group corresponding to the four teacher groups.

Jones found that student characteristics were highly influential in determining the type and frequency of teacher and student interactions. Teachers had significantly more positive and more frequent interactions with high-achieving as compared with low-achieving students and with extraverted as compared to introverted students. The variables of teacher introversion-extraversion and teacher achievement-orientation were not as important as student characteristics in determining type and frequency of teacher-student interaction. The similarity-attraction hypothesis was not supported by Jones's findings.

Personality Characteristics and Teacher Performance: Bonnin (43) inspected personality characteristics to determine whether the personality characteristics of teachers successful in more difficult teaching assignments differed from those successful in less difficult assignments. He worked with 194 first-year teachers who were involved in a graduate intern program.

Personality characteristics were assessed by the Omnibus Personality Inventory, using experimental Form D (385 items which produce 12 scales). Ratings of teacher performance and difficulty of assignment were provided by public school administrators and university supervisors who completed

evaluation forms designed for use with the intern teachers. Performance was rated in eight specific areas of teacher activity and in two comparisons with other beginning and with other experienced teachers. Difficulty of assignment was rated on the basis of many elements of the school-community environment beyond the control of the teacher.

A two-by-two factorial was employed to define four experimental groups: high performance-high difficulty, high performance-low difficulty, low performance-high difficulty, and low performance-low difficulty. Twelve problems comparing the groups were formulated.

Bonnin found that first-year intern teachers who were successful in more difficult teaching assignments could not be distinguished, on the basis of their OPI scale scores, from those successful in less difficult teaching assignments. In the five problems which compared higher and lower performance, six scales showed perfect consistency of scoring direction. The higher performing groups produced higher scores on Lack of Anxiety and Response Bias and lower scores on Religious Liberalism, Impulsive Expression, Schizoid Functioning, and Social Introversion.

P. J. Johnson (175) investigated the causes underlying the unsuccessful professional laboratory experiences of student teachers at St. Cloud State College in an attempt to identify the personality characteristics of the unsuccessful individuals. He examined records and case histories of successful and unsuccessful student teachers. He also made a comparison between data from Cattell's 16 Personality Factor Questionnaire and college supervisor comments and judgments. He found that unsuccessful student teachers displayed deficiencies in communication ability and in planning and organizational ability, along with personality inadequacies that limited them in their relationship with other people.

McKallor (231) looked at personal characteristics of teachers in an attempt to determine differences in competency effected by two experimental training programs for church teachers and to determine relationships between teaching competency and personal characteristics. He worked with 96 volunteer church teachers. At each grade level teachers were randomly assigned to treatments. One-third received laboratory training using master teachers and videotape recordings. One-third received an INSTROTEACH workshop defining church teacher competency in all its dimensions. (INSTROTEACH stands for Instrument for the Observation of Teaching Activities in the Church.) One-third received no treatment.

Measures of teaching competency were recorded by a qualified observer using the 27 scales of the INSTROTEACH instrument. Additional data came from the Henmon-Nelson Mental Ability Test, S-O Rorschach Test, the Minnesota Teacher Attitude Inventory, and the Study of Values.

Five major experiments were involved in the study. McKallor reported that workshop participants had a mean score in total teaching competency significantly greater than that of the control group for two of the five experiments. Treatment with laboratory training significantly increased total teaching competency above that of the control group in only one of the five experiments. In the aggregate, workshop participants had a total mean

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teaching competency score significantly higher than the laboratory partici-
pants and the control group. No significant correlations were identified
between teaching competency and mental ability, nor between teaching compe-
tency and value structure. Significant correlations were identified between
teaching competency and total attitude and between teaching competency and
personality.

Two researchers used more global approaches in their studies of per-
sonality factors. Reed (293) performed comparative analyses of selected
personality characteristics of prospective secondary teachers at the University
of Alabama and attempted to determine whether there were personality differences
among students in secondary, elementary, and physical education majors. The
subjects of her study were drawn from those students enrolled in sections of
an educational psychology course and involved 199 secondary, 166 elementary,
and 59 physical education students. Reed obtained data through the use of
the One Word Sentence Completion and the Directed Imagination tests. She
reported that the Interpersonal Characteristics score for secondary education
students was generally lower than that of other groups. Secondary education
students scored lower than elementary education students on Interpersonal
Attitudes. Females tended to score higher on all individual profile vari-
ables and appeared more "affective" than males.

Donnelly (82) worked with 95 elementary student teachers and 89 experi-
enced elementary teachers (from three school districts) in her investigation
designed to solve three problems. These were (1) to determine if there were
significant differences in the personality traits and attitudes toward selected
concepts of a semantic differential between preservice and in-service teachers;
(2) to determine if there were significant differences in attitudes of teachers
toward selected content areas and teaching those areas; and (3) to investigate
the influence of grade level taught, years of teaching experience, and the
size of the community in which the teaching was done on personality traits
and attitudes. In addition, she examined differences in personality traits
of teachers with more positive or less positive attitudes toward teaching
the selected content areas. She used the Gordon Personal Inventory, the
Gordon Personal Profile, and a semantic differential instrument to gather data.

Donnelly reported 16 pertinent findings. Among these were (1) elementary
student teachers held significantly more favorable attitudes toward teaching
science in the elementary school than did experienced elementary teachers,
(2) elementary student teachers possessed significantly more favorable
attitudes toward the area of mathematics than toward the concept of teaching
mathematics in the elementary school, (3) elementary teachers held signifi-
cantly more favorable attitudes toward the general areas of art, science,
and language arts than they did toward teaching in these areas, (13) elementary
student teachers with more positive attitudes toward teaching science scored
significantly higher on the personality traits of Personal Relations, Ascen-
dency, and Sociability than did student teachers with less positive attitudes
toward teaching science, (14) elementary teachers with more positive or less
positive attitudes toward teaching science in the elementary school did not
differ significantly on their scores for the selected personality traits, and
(16) elementary student teachers who possessed more positive attitudes toward

teaching art and science scored significantly higher on the personality traits of Ascendency, Personal Relations, and Sociability than did student teachers with less positive attitudes toward teaching those content areas.

Calliotte (62) investigated the effect of Basic Encounter Group participation on (1) the personality traits of secondary school student teachers, (2) the development of those behavioral characteristics in these teachers that are thought to facilitate intellectual and emotional growth in their students. Forty-two seniors involved in student teaching were equally divided into experimental and control groups. The 16 Personality Factor instrument revealed no significant differences between the two groups on the 16 P.F. variables either before or after the experimental group participated in the Encounter sessions which met for two hours each week for the duration of the student teaching semester.

Four characteristics (accurate empathy, genuineness, non-possessive warmth, concreteness) were considered as being important in facilitating intellectual and emotional growth in students. The Truax Relationship Questionnaire, administered to one class of each student teacher at the end of the semester, indicated no significant differences between the experimental and control groups on three of the four characteristics. Concreteness was significantly higher for the control group but in the opposite direction to that predicted by the researcher.

When pre- and post-measures on the 16 P.F. instrument were considered for the experimental group, a significant change on the variable of Surgency (Factor F) was identified. In research related to the 16 P.F. this variable has been found to be the most consistently related personality factor to teaching effectiveness.

Facilitative personality characteristics were studied by Waggener (365) and by Close (70). Waggener investigated the feasibility of using a specially structured group experience to produce measurable changes in the levels of positive regard, genuineness, and empathy at which teachers operate in a classroom situation. A special group experience was designed for use with students (16) chosen from among volunteers in three sections of a secondary education methods course. Another 16 were chosen to be the control group.

A microteaching laboratory was a part of this methods course. Each student taught one session each week for three successive weeks. Sessions two and three were audiotaped. The group experience occurred between sessions two and three. Randomized four-minute segments of the audiotapes were analyzed for levels of operation of the teachers in the three variables, using scales based on the Carkhuff scales and specially adapted for class-room interaction. Changes in levels between the two sessions were computed for each subject and for the two groups. Although changes exhibited by the students in the experimental group were greater than those exhibited by the control subjects, this difference was not statistically significant. Results may have been influenced by the fact that the pupils in session three were not the same individuals who had served as pupils in session two.

Close (70) investigated relationships that existed between student perceptions of their teachers in the areas of empathy, warmth, and genuineness and the total facilitative triad and the job satisfaction of the teacher. He also considered as variables total years of teaching experience, hours completed in education, in the present teaching field, and in other areas since completion of undergraduate work. Thirty-eight teachers and 803 pupils in grades nine through twelve in content areas in which the principal method of teaching was lecture or lecture-discussion were involved in the study.

Student perceptions of teachers were obtained by use of the Truax Relationship Questionnaire (modified) and raw scores converted to scale scores along the dimensions of the Carkhuff and Berenson Five Point Scale. Teachers completed a Job Description Index and a data sheet. Close reported a positive relationship between the criterion variables of empathy, genuineness, and total facilitative triad and the independent variable, job satisfaction. The highest multiple correlation for the criterion variable of total facilitative triad was obtained by the joint action of the independent variables of job satisfaction, total experience, and hours completed beyond the bachelor's degree in education. Close concluded that students are a valid source for determining the facilitation levels of teachers and that there was a low but positive relationship between level of total facilitation and job satisfaction.

Main (215) conducted a comparative study of personality and behavior of selected secondary school science and non-science teachers. He obtained data relative to classroom behavior through the use of Ryans' Classroom Observation Record and to personality factors through the use of the 16 Personality Factor Questionnaire. In addition to comparing science teachers with teachers of other subjects, Main compared science teachers rated high on the Classroom Observation Record with those rated low on the instrument.

Eighty in-service secondary school science teachers in three school systems in North Carolina were compared with 35 non-science teachers within the same three school systems. After Main had analyzed the data collected via the two instruments, he found that science teachers were generally more reserved, calm, and mature, more serious and taciturn, and more self-sufficient and resourceful than their colleagues teaching in other content fields. No significant differences were identified when male science teachers' scores on the 16 P.F. instrument were compared with the scores of the other male teachers. Female science teachers were found to be more emotionally stable, tough-minded, resourceful, and self-sufficient than female teachers of other subjects. When male and female science teachers were compared, female science teachers appeared to be more outgoing, warm-hearted, participating, and trusting than males. Male science teachers were more tough-minded, self-reliant, realistic, relaxed and tranquil than female science teachers.

Science teachers rated in the upper quarter of Ryans' instrument appeared less venturesome and less socially bold than those in the lower quarter. Female science teachers in the upper quarter were more timid and more imaginative than those in the lower quarter.

The study of personality factors and their possible relationship to teacher behavior appears to be an area of interest to many beginning researchers (doctoral students). All studies cited in this cluster were, with one exception, doctoral dissertations. Most studies contained reports of no significant differences between groups or few correlations at a level of significance. Several questions might be raised: were sample sizes not sufficiently large for significant findings to result, was the problem too global to be researchable, was the treatment design or instruments chosen not appropriate for the researcher's purposes? Some investigators appeared unable to formulate any inferences concerning their lack of significant findings.

Teacher Attitudes as Related to Teacher Behavior

Another cluster of studies related to the question of the effect of teacher attitudes on teacher behavior [MacNamara (214), Neely (255), Oswald (267), Wilborn (376), Foster (107), Semmel et al. (542), Rosenthal and Rubin (535), Kelsey (187), Good and Brophy (134, 135), Jose and Cody (181)]. Again, all but one were done to fulfill the dissertation requirement of doctoral programs.

MacNamara (214) attempted to isolate several variables of ability and attitude that might be considered as components of a teacher's personality and to explore the relationship, if any, with the proportion of learner-centered verbal behaviors observed and placed in the various categories of the Social-Emotional Classroom Climate Index developed by Withall. MacNamara worked with 60 social studies student teachers and administered the Test of Economic Understanding, Carey Problem Solving Attitude Scale, Berger Acceptance of Self and Others Scale, and the Gough-Sanford Rigidity Scale. Each student teacher was observed, using the Climate Index, while teaching a lesson of economic import.

MacNamara reported that the variables of teacher possession of subject matter knowledge and teacher expressed acceptance of self and others were positively and significantly related to the proportion of learner-centered verbal behaviors observed. The variable of teacher rigidity was negatively and significantly related to the proportion of learner-centered verbal behaviors observed. The variable of teacher attitude toward problem solving was positively but not significantly related to the proportion of learner-centered verbal behaviors observed. MacNamara considered this finding to be the result of the instrument used in the study.

Wilborn (376) considered the problem of the relationship of teacher attitudes (as measured by the Minnesota Teacher Attitude Inventory) and teacher ratings of children's behaviors on the Behavior Maturity Scale (BMS). He worked with 16 teachers and 408 pupils in four schools as an experimental group and a control group consisting of 16 teachers and 337 pupils in four schools. Wilborn found that MTAI total scores were not significantly related to how the teacher viewed the behavior maturity of pupils. He concluded that conditions under which teachers work, as well as teacher attitudes, appear to affect teacher perception of pupil behavior.

Neely (255) studied teachers' attitudes toward selected features of a program of self-evaluation using the Evaluative Criteria (from the National Study of Secondary School Evaluation, 1970). Working with a random sample of 125 teachers drawn from faculty lists of Oregon secondary schools, Neely investigated four features of the self-evaluation program: (1) preparation for self-evaluation, (2) participation in self-evaluation programs, (3) the Visiting Committee, and (4) benefits of self-evaluation. He mailed the 125 teachers a survey form consisting of semantic differential scales, one set for each of the selected features of the self-evaluation process. Neely reported that attitude scores of the respondents fell in either the "Neutral" or "Slightly Favorable" position on the attitude rating scale. He considered his findings to be more realistic than those of other studies reporting only direction of attitude, which he considered too optimistic in stating that teacher attitude toward the self-evaluation program was "Favorable."

Foster (107) investigated the differences on specific variables of performance and achievement between secondary education student teachers with high positive attitudes toward educational concepts and those with low positive attitudes. In order to differentiate these groups, Foster used a battery of seven semantic differentials. Scores of 75 randomly selected student teachers were summated and ordered and the upper one-third selected to constitute the high positive group and the lower one-third, the low positive group.

Seven individual performance scores and two academic achievement scores were collected for each subject. Achievement measures were grade point average and score from the School and College Ability Test.

Foster reported that student teachers in the low positive group scored significantly higher on the SCAT test and had significantly higher grade point averages than did the high positive group. The high positive group was significantly higher than the low positive group in self-evaluation both before and after student teaching. No significant differences between groups were identified with respect to extracurricular activity participation, evaluations after student teaching by the university supervisor and by the cooperating teacher, potential for teaching appraisals by education professors, or appraisals by the student teacher of the university supervisor. Foster pointed out that although grade point average is a commonly-used factor in the selection process for education majors, the students in his study who had the lowest grade point averages had the most positive attitudes toward education.

Oswald (267) considered the influence of dogmatism in a study to determine if a significant relationship existed between levels of dogmatism of student teachers and supervising teachers and change in attitude of student teachers during student teaching. Oswald worked with 92 elementary school student teachers and their 85 supervising teachers. The Minnesota Teacher Attitude Inventory was administered as a pre-post measure to student teachers and the Rokeach Dogmatism Scale to both student teachers and cooperating teachers. Both pre- and in-service teachers were grouped as H (high in dogmatism) or L (low in dogmatism) and assignments were made so that four groups were formed, on the basis of dogmatism: HH (both student teacher and cooperating teacher high in dogmatism), LL, HL, and LH.

When data were analyzed, Oswald found no significant change in attitude in any of the four groups. Nor were the groups significantly different from each other. No significant relationship between change in attitude and grade level of student teaching or pattern of student teaching was identified. There was no significant relationship between supervising teacher dogmatism and age, grade level taught, nor number of years of experience.

Kelsey (187) examined the influence of open and closed organizational climate schools on the attitudes of open and closed-minded student teachers. Twenty-one Indiana high schools were ranked in terms of relative rigidity and authoritarianism on the basis of responses to the Organizational Climate Description Questionnaire. The seven highest and seven lowest ranking schools were used in the study. Sixty-four secondary school student teachers served as subjects. Data were analyzed for the 48 who worked in the 14 schools used in the study. A two group pretest-posttest design was used to assess attitudes of student teachers prior to and following student teaching. The student teachers responded to an abridged version of the Rokeach Dogmatism Scale and to the Bown Self-Report Inventory (SRI). This latter instrument was used as a measure of student teacher attitudes toward self, others, children, authority, work, reality, parents, and hope. The SRI total score was used as a general measure of an individual's outlook on life.

Kelsey found that school climate did not significantly differ in influence on attitudes of student teachers. In fact, the organizational climate of the school did not appear to be a factor in the influence that the school had on student teacher attitudes. Open-minded and closed-minded student teachers did not differ significantly in their attitudes prior to student teaching but open-minded student teachers did have more positive attitudes toward self, work, and life in general prior to student teaching than did the closed-minded group. The student teaching experience tended to have a neutral or positive influence on the attitudes of open-minded student teachers and a neutral or negative influence on the attitudes of closed-minded student teachers, but attitudes were not significantly different from pretest to posttest.

Good and Brophy (134, 135) reported on the behavioral expression of teacher attitudes in a study involving nine first grade classrooms. This study was part of a larger one to investigate the relationships between teachers' performance expectations and their behavior toward different children. Sixteen two and one-half hour observations were made in each classroom, using the Brophy-Good Dyadic Interaction observation system which yields a variety of measures of the quality and quantity of teacher-child interaction, separately recorded for each child in the class. The resulting data pool contained information on teacher-child interaction patterns for 270 children.

In late September, each teacher supplied a list of children in her classroom, ranking them in order according to the levels of achievement expected from them. In December, after all observations were completed, each teacher was mailed a questionnaire to complete. Teachers were asked four questions: (1) If you could keep one student another year for the sheer joy of it, whom would you pick? (2) If you could devote all your attention

to a child who concerns you a great deal, whom would you pick? (3) If a parent were to drop in unannounced for a conference, whose child would you be least prepared to talk about? (4) If your class was to be reduced by a few children, which would you have removed? Teachers were asked to name at least three children for each question. Replies constituted the attitude data.

Good and Brophy found that roughly equal numbers of boys and girls appeared in the attachment, indifference, and concern groups (questions 1, 2 and 3) but that twice as many boys as girls were named in the rejection group. Achievement status was related to all four attitudes. The attachment group was composed mostly of high achieving students, with mostly low and average achievers in the other three groups. Low achievers appeared mostly as objects of concern (especially if they were girls) and of rejection (especially if they were boys).

When interaction data for the four groups were analyzed, the researchers found that teachers' attitudes did correlate with differential teacher behavior and that all four teacher attitudes led to diffential teacher behavior. The teachers provided the children in the attachment group with additional support in subtle ways but did not exhibit gross favoritism. Children in the indif- ference group did not approach the teacher nor did the teacher approach them. These children were seldom praised or criticized in academic work situations. When they did have contact with the teacher, it seldom resulted in strong evaluative comment. Teachers appeared to avoid initiating contact with the rejected children. Also they often failed to provide these children with feedback about their work. When they did provide feedback, it was much more likely to involve criticism than feedback given to other children. Teachers sought out concerned students for more contact and stayed with them longer following both success and failure. They did not praise or critize these children significantly more than their classmates.

Although the number of teachers and schools studied was small, data analyses indicated that the school environment (upper middle class white, lower class white, lower class black) had little effect upon how the dif- ferent attitude groups were treated in the classroom. But, the researchers concluded, attitudes teachers hold toward students do influence the ways in which teachers interact with those students, affecting the quality and quantity of contacts.

The problem of investigating attitudes and their influence on teacher behavior appears to be as complex as that of determining the relationship of personality variables and behavior. The work by Good and Brophy appears to merit extending this type of investigation to secondary school populations to identify differences and similarities.

Jose and Cody (181) performed an experimental study in which they looked at teacher-pupil interaction as it relates to attempted changes in teacher expectancy of academic ability and achievement. The teacher behavior of attitude with which they were concerned was that of "teacher expectancy" for student progress. This was a partial replication of the study of Rosenthal and Jacobson and, therefore, one of the basic concerns was whether students

identified to teachers as "bloomers" would show greater increases in intellectual growth than a control group of students. In addition to the intelligence test, a standardized achievement test was also administered. An interaction analysis scale was included to measure changes that might occur in teacher behavior toward students after establishment of expectancy.

Eighteen teachers (9 first grade, 9 second grade) and 144 children (8 from each classroom) were randomly selected from public elementary schools. These individuals were randomly assigned to experimental and control groups with equal numbers of males and females in each group. The study was presented to teachers as two separate investigations: one as a testing program to identify for teachers students who would be "late bloomers" and the other as an analysis of teacher-pupil interaction.

Prior to giving the false information to teachers, an IQ test (The Test of General Ability) and the reading and arithmetic subtests of the Metropolitan Achievement Tests were administered to all students in 18 classrooms. A premeasure of teacher behavior was obtained by three trained observers through the use of the Interaction Analysis Scale adapted from Bales scale and developed for this purpose. The scale concerns both verbal and nonverbal behavior.

Teachers were then given information indicating that the four experimental students in their class had scored high on a test predicting "academic blooming" and that they could be expected to perform better academically in the near future. Observations were made of teacher behavior after one week and every four weeks thereafter for a period of 16 weeks. Post-tests of the Test of General Ability and the Metropolitan Achievement Tests were administered to experimental and control students. Each teacher completed a questionnaire concerning changes in the students' behavior and grades in arithmetic and reading. Two weeks after post-testing, teachers completed another questionnaire to determine whether the information given to teachers had established, modified, or in any way affected their expectations.

A separate three-factor analysis was used for IQ, reading achievement, and arithmetic achievement. Only the main effect of grade level was judged statistically significant. Experimental treatment conditions resulted in little or no difference in the performance of experimental and control subjects in any of the areas investigated.

When the interaction analysis data were analyzed, the investigators found little consistency in the direction of change in the teachers' behavior after the information concerning the experimental children was given to them. Any change in behavior which occurred after this information was provided tended to be in the same direction for both experimental and control students. There were few differences in teachers' behavior toward experimental and control students throughout the investigation. When experimental and control students grades were compared for differences from first semester to second semester, no significant difference was identified as being associated with teachers' favorable expectations. It appeared that the false information did not influence teachers' assessments concerning the academic performance of the experimental students. Questionnaire results also suggested little advantage associated with teachers' favorable expectations with respect to student performance.

The second questionnaire provided information showing that 11 of the 18 teachers had not expected more from the children predicted to "bloom academically." Seven teachers stated they did expect more as a result of the information given them. Of these seven, only four indicated they felt the children really had shown improvement. The experimental children of these four teachers showed less improvement on the standardized tests in reading and arithmetic than did the control students in these four classrooms. There were no statistically significant differences in the behavior of these four teachers.

The investigators concluded that the attitude of "expectancy" as used in their study had little or no effect on student performance and/or teacher behavior. They suggested that further research be done concerning the nature of expectancy as well as concerning the means of modification or establishment of expectancy. They consider that expectancy involves much more than just the reception of information.

Teacher Beliefs, Value Systems

Beliefs and value systems also influence attitudes. Four researchers looked at teacher value systems or teacher beliefs in their studies [Mifflen (238), Allee (6), Goggin (131), Harvey et al. (149)].

One study appeared less closely related to teacher behavior but was considered relevant because the investigator looked at faculty who participated in the preservice education of secondary school teachers. Goggin (131) attempted to evaluate understanding of the concept of humaneness by two groups of instructors (professional education and liberal arts who prepare prospective teachers. Thirty-seven education instructors and 67 liberal arts instructors composed the subjects of the study. They were asked to complete a five part semantic differential instrument designed by the investigator. The five parts of the semantic differential related to autonomy, creativity, identification, knowledge, and valuing, all of which were considered to comprise the concept of humaneness.

Goggin reported that his subjects failed to attain the mean scores called for by the seven point scale employed. There were no significant differences between group responses to each of the five parts of the instrument nor between group mean responses to all five parts. He did find significant differences within each group and for all subjects, however. Goggin identified some significant correlations (.05 level). For the education instructors, these were between knowledge and creativity, knowledge and identification, valuing and creativity, and valuing and identification. For liberal arts instructors, these were between creativity and identification, creativity and knowledge, valuing and identification and valuing and knowledge. Using Duncan's Multiple Range Test, Goggin found significant differences (.05 level) (1) between the concept of identification and each of the other four for education instructors, (2) between valuing and each of the other four for liberal arts instructors, and (3) between identification and each of the other four for all subjects.

Goggin concluded that university instructors who train secondary school teachers do not understand fully the many aspects of the concept of humaneness and that professional education and liberal arts instructors hold similar notions regarding the nature of humaneness. He recommended that the concept of humaneness become central to teacher education programs and that teacher educators use activities which point in the direction of utilizing practices demanded by the concept of humaneness.

Allee (6) studied the beliefs held by preservice and in-service teachers in an attempt to determine relationships between selected interpersonal variables and perceived need satisfaction of student teachers. Seventy-one student teachers and their cooperating teachers were studied. They responded to the FIRO-B scales, the two inventories of Brown's Experimental Scale (Form A-B), the Personal Beliefs Inventory, and the Teacher Practices Inventory. In addition, a Maslow-type need satisfaction scale (an adaptation of Poeter's Need Satisfaction Questionnaire) was given to the student teachers two weeks before their student teaching assignment ended.

Allee reported that, when taken alone, none of the measures of inter-personal compatibility was significantly related to total perceived need satisfaction of student teachers. All of the correlation coefficients were positive. However, the only statistically significant relationship was between interpersonal compatibility and satisfaction of social needs. The relationship between congruence of beliefs about teaching practices and perceived need satisfaction was statistically significant (.05 level).

Mifflen (238) conducted doctoral research in which he attempted to provide descriptive theory about value systems and teaching methods, to set forth theoretical statements relating the two classes of variables, and to show that these statements can be related to observable data. He considered research done by Anastasiow and by Harvey. Anastasiow has investigated the relationship of the affection-hostility and autonomy-control dimensions of teacher personality to certain aspects of teacher behavior and especially to the way teachers structure information about teaching. Harvey has investigated the relationship of teachers' belief systems, on a dimension of concreteness-abstractness, to some performance variables and to teacher effectiveness as judged on some generally accepted criteria.

Mifflen developed definitional systems for the two classes of variables, value systems and teaching methods. He formulated a way of characterizing types of value systems in terms of the centrality of certain value clusters. He also developed a system for classifying teaching methods. In addition he presented a series of theoretical statements relating value systems and teaching methods along with procedures required to operationalize these theoretical statements.

Harvey et al. (140) conducted an investigation of the influence of teachers' overt classroom behavior, which he had earlier shown to be a function of their belief systems, upon the learning and performance of students in 118 kindergarten and first grade classes in a rural and urban school district. The 90 teachers involved were measured by Harvey's Teacher Rating Scale on which observers score attitude toward children and flexibility. Teachers

also responded to Harvey's "This I Believe" Test and the Conceptual Systems Test. Scores for each class of students were obtained with Harvey's Student Rating Scale on which observers rated student cooperation, participation and initiative. Each teacher was observed once, for a two-hour period.

Data obtained with each instrument were factor analyzed. Student data were grouped into seven clusters: cooperation, student involvement, activity level, nuturance seeking, achievement level, helpfulness, and concreteness of response. Three teacher factors were extracted: resourcefulness, dictatorialness, and punitiveness.

The investigators found that abstractness was (1) positively correlated with resourcefulness; (2) negatively correlated with dictatorialness and punitiveness; (3) positively related to student ratings on cooperation, involvement, activity level, achievement, and helpfulness; and (4) negatively related to student ratings on concreteness and nuturance seeking. They concluded that the concreteness-abstractness of teachers' belief systems affects their overt resourcefulness, dictatorialness, and punitiveness in the classrooms. In addition, they inferred that not only did the abstractness of teachers' beliefs influence their classroom behavior, it also affected the performance of their students.

Teacher Beliefs and Interpersonal Relations

Another group of investigators [Rexford (296), Goldenberg (133), Jorkasky (180), Laney (200), Epperly (90), Limberg (498)] studied teacher behavior as it related to teachers' pupil control ideology or to interpersonal relations. Rexford (296) investigated the relationship between the pupil control ideology and classroom behavior of teachers by using Flanders' system of interaction analysis and the Pupil Control Ideology Form (PCI) to gather data from 131 in-service secondary school teachers. Based on the results of responses to the PCI Form, Rexford selected the 12 most humanistic and the 12 most custodial for observation. He found that custodial teachers used a larger portion of class time in teacher talk than did the humanistic teachers, suggesting a slight relationship between pupil control ideology and the amount of teacher talk in the classroom. Rexford concluded that, for his sample of teachers, teacher indirect and direct influence was more closely related to teachers' pupil control ideology than was the percentage of teacher talk.

Goldenberg (133) also researched the problem of whether pupil control ideology of teachers differentially affected their operational behavior in the classroom. He administered the Pupil Control Ideology Form to 260 elementary teachers and selected 20 to form two experimental groups: those with the highest scores (custodial) and those with the lowest scores (humanistic). He also used Flanders' interaction analysis system to analyze verbal interaction. Each teacher was observed for three 20-minute observation periods.

Goldenberg found no significant difference between the proportions of indirect verbal behavior, of direct verbal behavior, and of student verbal behavior. However, the two groups of teachers differed in the frequency of their use of (1) accepting and developing student ideas; (2) lecturing,

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giving facts or opinions; and (3) student-initiated verbal behaviors. In each instance, the humanistic group used significantly more of the indirect verbal behaviors than did the custodial group. Goldenberg concluded that the pupil control ideology of the teacher did differentially effect selected verbal behaviors in the classroom.

Jorkasky (180) used Withall's Social-Emotional Climate Schedule (developed and tested in the United States) with a Latin American population in her study to investigate differences in verbal behavior of secondary school teachers in San Jose, Costa Rica, and to study the relationship of these behaviors to differences in professional preparation, sex, and subject taught. Her study involved eight observations each of 36 teachers in a randomized block equal-cell distribution (for professional preparation, sex, subject taught).

Although no significant variation in the composite score of social-emotional climate was attributed to differences in professional preparation, significant differences did appear in the distribution of statements in categories. Sex of the teachers did not discriminate differences in the composite score. Only differences in subject taught were significantly related to differences in the composite score of social-emotional climate. Social studies and science teachers were more learner oriented than were mathematics teachers.

Laney (200) studied relationships between university teachers' inter-personal orientation and their verbal behavior in the classroom. He gathered his data by using the Alcorn-Erb Interpersonal Orientation Scale and Flanders' category system for analyzing verbal interaction. The 30 randomly selected university teachers were observed for 30 minutes of one class period to gather interaction data.

Laney reported some "positive (albeit in most cases weak) correlations" between teachers' scores on the Alcorn-Erb Scale and their verbal behaviors. This terminology lends itself to the interpretation that these positive correlations were not at a level of significance. Nevertheless, Laney went on to draw conclusions. He concluded that more altruistic teachers were more likely to ask questions and to spend a greater portion of talk in indirect behaviors than were the more manipulative university teachers.

Epperly (90) explored the relationships which might exist between a teacher's pattern of needs and his preference for varying amounts of contact with pupils. He worked with 170 teachers to whom he administered the Edwards Personal Preference Schedule and the Teaching Situations Simulation Form (which he developed for his study).

Epperly then selected all secondary male and elementary female teachers in order to test the hypotheses of his study, using factor analytic procedures to classify these individuals into subgroups whose members shared similar profiles on the Edwards instrument. He found that when compared to traditional teaching, subjects' preferences for simulated teaching situations increased as the amount of teacher-pupil contact provided by these situations increased. He found no significant relationship of subjects' preference for pupil contact

as provided by the TSS Form and their classification on the basis of needs
or years of teaching experience. He did find that his subjects differed
significantly from both college and adult norms on several needs measured
by the Edwards Personal Preference Schedule.

Teacher Concerns

Work has been, and is being, done at The University of Texas at Austin
in which the concerns of teachers provide the research focus. Fuller (115)
published a report in 1969 in which the focus was that of examining inten-
sively the developing concerns of small groups of prospective teachers and
reexamining findings of other investigators in an attempt to discover what
the teachers are concerned about and whether their concerns can be conceptu-
alized in some useful way. Fuller reported that other investigators stated
beginning teachers were concerned about class control, about their own con-
tent adequacy, about the situations in which they taught, and about evaluations
by their supervisors and by their pupils as well as about the evaluation of
their pupils. These concerns appeared to be common among the different
populations surveyed.

One of the studies contained in Fuller's report was based on data obtained
from group counseling sessions which were substituted for conventional weekly
student teaching seminars. During the first quarter of the study, a counsel-
ing psychologist met for two hours each week with six student teachers. The
supervisor was not present. All sessions were tape recorded and typescripts
made. During the second semester, two counseling psychologists worked as a
team with a group of eight student teachers. These sessions were also recorded
and made into typescripts.

Each statement in the typescripts of these sessions, for the two semesters,
was classified according to its main topic by two judges using an inductive
method. During the early weeks of the student teaching semester, student
teachers appeared most concerned with the parameters of the new school
situation and with discipline. During later weeks concern with pupils and
pupil learning became more frequent. This pattern held for combined fre-
quencies and for each group separately. Student teachers began with a concern
for self which continued during most of the semester but more concern was
shifted to pupils toward the end of student teaching.

In a second study, 29 different student teachers, supervised by four
different supervisors, were asked at the beginning of informal luncheons
with a counseling psychologist to write "what you are concerned about now."
These individuals were surveyed at approximately two-week intervals.

Responses were classified into three categories: (1) Where do I stand?
How adequate am I? How do others think I'm doing? (2) Problem behavior of
pupils, class control: Why do they do that? and (3) Are pupils learning?
How does what I do affect their gain? Twenty-two of the 29 student teachers
expressed concerns classified as category (1). Six expressed concerns in
both (1) and (2). One student teacher expressed concern in only category (2).
None of the 29 expressed concerns classified as in category (3). All were
concerned with self-adequacy and/or class control.

When studies completed by other investigators were dichotomized into those reporting principal concerns with self and those reporting principal concerns with pupils, all six studies reported early concerns to be with self and none with pupils. No study supported the proposition that beginning teachers were concerned with instructional design, methods of presenting subject matter, assessment of pupil learning, or with tailoring content to individual pupils. However, these are topics often included in education courses which preservice teachers study prior to student teaching.

When preservice teachers and in-service teachers were compared relative to the concerns reported in the studies, they were found to be similar in their principal concern with self. How long do self concerns persist? Few studies of concerns of experienced teachers are available. Fuller identified two such studies and reported these indicated concerns with pupils. Concerns of experienced teachers rated as superior seemed to focus on pupil gain and self evaluation as opposed to personal gain and evaluations by others.

Parsons and Fuller (274) presented a paper at the 1972 annual meeting of the American Educational Research Association in which they reported research on teacher concerns which had been completed since the publication of the 1969 report (just described). They provided information on three studies. One was about reliability information for the Teacher Concerns Statement. A second was primarily concerned with establishing the bipolar nature of teacher concerns. The third examined the relationship between concerns and teaching experience.

The Teacher Concerns Statement, discussed in the first study, is an open-ended questionnaire. Replies are coded using a six category system developed by Fuller and Case. The six categories are (1) concerns about role orientation; (2) concerns about self-adequacy as a teacher; (3) self-benefit concerns, classified into concerns about whether the teacher is liked by pupils and concerns about what his pupils are like; (4) concerns about whether pupils are learning what is being taught; (5) concerns about whether the pupils' individual learning needs are being met; and (6) concerns about improvement of the educational system.

Rater stability correlations were based upon the codes of two raters scoring a set of 50 protocols twice, with two weeks intervening. The 50 protocols included 20 from experienced teachers, 16 from student teachers, and 14 from preservice teachers with no formal classroom teaching experience. Stabilities for both coders were relatively high for four of the six codes, with those for (4) and (6) appearing to need improvement.

The second study was conducted to determine if the Teacher Concerns Statement was tapping a bipolar factor whose ends were self-benefit concerns and pupil-benefit concerns. Results of a principal components factor analysis followed by a normalized varimax rotation provided evidence to support the postulated bipolarity.

The third study, of the relationship between concerns and teaching experience, involved 1309 preservice teachers and 251 in-service teachers. The researchers hypothesized that preservice teachers would have higher mean scores for the self-benefit concerns than would in-service teachers.

Conversely, in-service teachers were expected to ha e higher mean scores for pupil-benefit concerns than were preservice teachers. All code mean scores differed significantly for the two groups in the predicted directions, with the exception of the code for concerns ab ut whether pupils are learning what is being taught (no significant di_erence for group mean scores).

Parsons and Fuller reported that the psychological sophistication and special training required to use an exhaustive content category system in concerns research make implementation of such a system impractical. They stated that the development of a forced-choice questionnaire for the assessment of teacher concerns was proposed, in which respondents will be forced to choose between a self-benefit concerns alternative and a pupil-benefit concerns alternative matched for social desirability. If a structured, machine-scorable instrument can be developed and its reliability established, it can be used in validation studies.

Three kinds of validation studies are proposed. First, a large construct validation study in which three groups of individuals will participate: preservice teachers with no classroom teaching experience, student teachers, and in-service teachers. Second, studies to discover the degree to which teacher concerns are malleable. Third, studies to discover whether matching curriculum content to the concerns of teachers produces greater involvement, satisfaction or learning than does content not matched to teacher concerns.

On a smaller scale, S. L. Clark (69) conducted an investigation to determine if there were significant relationships between student teachers' anxiety levels and their assignation of letter grades under simulated conditions. The study design was a single-variable, single-group predictive investigation involving a repeat test administration format. Anxiety was measured by the IPAT Anxiety Scale Questionnaire, Self Analysis Form by Cattell. Grading practices were quantified through the use of the GraPi, an instrument developed for the study. Measurements were obtained at the beginning, middle, and end of a 10 week student teaching experience.

Clark found that the student teachers' professed grading practices could be affected by a planned series of experien 3. Students who scored high in covert anxiety awarded lower marks than did subjects who scored low on covert anxiety. However, student teachers who scored high in anxiety did not assign a more narrow range of grades than did t se who scored low in anxiety, nor did students who scored high in anxiety place more importance on social-moral pupil characteristics than did those who scored low in anxiety.

Masling and Stern (217) produced a report entitled "The Pedagogical Significance of Unconscious Factors in Career Motivation for Teachers" in which they attempted to determine the influence of a teacher's motives on her performance and effectiveness in the classroom. Eighty-six teachers of fourth and fifth grades in schools in Central New York State were involved in the study.

The Teacher Preference Scale (TPS) was designed to assess teacher motives and consisted of two scales of 100 items each. One scale assessed the teacher's attitudes or philosophy of teaching (Form A) and the other, the gratifications received from teaching (Form G). The Stern Activities Index

was also developed to assess teacher personality. Teacher and pupil behavior was observed directly in the classroom (five and one-half hours per teacher). When data were analyzed, the TPS instrument was not found to relate in any consistent manner with pupil behavior, academic achievement, or sociometric results. The Stern Activities Index proved to be a better instrument for predicting pupil behavior and achievement than the TPS.

The researchers found that teachers who scored high on the need for achievement, emotionality and interest in humanities had pupils with the highest achievement scores in vocabulary and spelling. Pupils showed less fear and increased participation in class activities when their teachers had high scores on objectivity, emotionality, and need for achievement. The evidence obtained did, in the researchers' opinions, document the importance of classroom climate in influencing classroom behavior.

Additional papers in the area of teacher concerns were written by Garrard (456) and Fuller et al. (448).

Personality Factor Variables as Related to Teacher Performance

Ten investigators were interested in predicting teacher performance using a variety of variables for this purpose [Gerfen (129), Hogan (162), Kanitz (184), McInnis (230), Henderson (157), Dugger (437), McCulloch (223), Schluck (322), Millslagle (240), Hartranft (148)].

Gerfen (129) analyzed relationships between six variables in the preparation and performance of secondary school teachers. These variables included administrative evaluation, grade point averages, test scores for admission to teacher education program, letter grades in education courses, evaluations by cooperating teachers and by college supervisors, and self-concepts. In addition he explored relationships between these variables and teacher self-concepts. Gerfen used a questionnaire to measure self-concepts and received replies from 235 of his original group of 261 teachers.

Gerfen reported few findings at a level of significance. He concluded that letter grades in education courses are not significant predictors of effective teaching, as defined by administrative ratings of teachers. Nor did Gerfen consider affective domain variables, as measured by the self-concept indices used, to be of much significance as predictors of superior teaching effectiveness. A low or negligible relationship was found to exist between student teaching ratings by cooperating teachers and college supervisors and subsequent teacher ratings by administrators.

Hogan (162) assessed the effectiveness of the Dogmatism Scale (Form E) of Rokeach in identifying the potentially unsatisfactory among newly employed teachers. Two hundred elementary and secondary teachers in three suburban school districts and 30 administrators responded to the instrument. Hogan was interested in learning if rigidity was associated with teacher failure. Administrators were asked to supply three ratings for each teacher: satisfactory-unsatisfactory, quintile ranking, and rehire: yes or no.

When the relationship between the attitude patterns of administrators and the attitude patterns of teachers in terms of ratings was analyzed, no significant differences were identified for the reemployment decision or for quintile ranking. A significant difference (.05 level) was found for the satisfactory-unsatisfactory ranking. Hogan found that "flexible" administrators assigned all unsatisfactory ratings and that no "rigid" teachers were rated unsatisfactory. He concluded that the Dogmatism Scale was not an effective instrument for identifying potentially unsatisfactory teachers. The youngest and oldest teachers in terms of both age and experience tended to receive the greatest percentage of unsatisfactory ratings regardless of attitudinal pattern. These factors appeared to influence teacher ratings more than the attitudinal pattern did.

Kanitz (184) examined the relationship between phenomenological criteria of effective teacher characteristics and selective noncognitive factors. Seventy-three students serving as teacher aides and involved in an inner-city classroom simulation training experience were involved in the study. Data related to personality variables were secured through the use of the Edwards Personal Preference Schedule, the Myers-Briggs Type Indicator, the Rokeach Dogmatism Scale, and To ance Tests of Creative Thinking. Materials in the Inner-City Simulation program served as problem protocols.

Kanitz found that effectiveness, especially in the sense of the "good" helper, was found to be related to various noncognitive variables: high verbal fluency, low manifest need change, and low manifest need heterosexuality. Effectiveness was considered to be a global factor rather than the result of a number of differing perceptual variables as originally hypothesized.

McInnis (230) investigated semantic flexibility as a predictor of teacher communication patterns, specifically a teacher's ability to receive and transmit information. The Guilford Word Association Test was used to measure convergent and divergent thinking and was considered to also measure semantic flexibility. The instrument was given to 201 students enrolled in a block methods course at Boston University and to 154 sixth grade children in the Boston Public Schools as well as to 182 sixth grade children in the Newton Public Schools.

Four high Guilford teachers and four low Guilford teachers were selected from the college student group. From each of the urban and suburban classes four high Guilford and four low Guilford children were selected. Eight children were assigned to each teacher, with children being categorized as high or low on the Guilford instrument and as urban or suburban.

A story was specially written for the study and was tape recorded and played to the preservice teachers. These individuals then tape recorded their versions of the story and played it for the children who told the final version of the story. Stories of the teachers were compared to the original for number of words and details that overlapped between the two versions. Children's versions were compared to teachers' versions for the same overlaps. The number of words and details included from the story were considered an estimate of information transmitted.

High Guilford teachers included a statistically significant number of details from the original story but not a statistically significant number of words. In six of the eight groups, high Guilford children included a statistically significant number of words and details from the teachers' stories. In three out of four groups assigned to high Guilford teachers, the suburban children included a statistically significant number of words and details from their teachers' versions. In only one case did the suburban children include more of the low Guilford teachers' details. In no case did they include more of the words. The interaction effects of both high and low Guilford children were more productive on both number of words and details included when assigned to a high Guilford teacher. If words and details could be considered estimates of information transmitted in a message, then high scores on the Guilford Word Association Test did predict the inclusion of more words and details from the stimulus message. A high Guilford score predicted the transmission of those words and details in a form that produced a higher inclusion of words and details in the listener's version.

Henderson (157) attempted to predict student teacher success by use of videotaped critical incidents. He also attempted to determine relationships between student teachers' scores on the critical incidents and selected personal and academic information. Fifty-one student teachers in secondary education responded to 20 videotaped critical incidents. These videotapes were produced at the University of Nebraska in 1968. Each incident plus its three possible solutions is approximately two minutes in length. The student teachers viewed the videotapes prior to student teaching. At the end of the student teaching semester, they were evaluated by university supervisors using an evaluation form adapted from the 1960 Yearbook of the Association for Student Teaching. These ratings were correlated with the responses to the critical incidents which had been placed in predicted success categories of strong (24 individuals), adequate (22), and weak (5). The number of student teachers in the observed success categories were 32 in the "strong" category, 17 in "adequate" and 2 in "weak." A significant relationship was found to exist between observed student teacher success as measured by the evaluation scores and prediction of student teacher success as determined by the scores from the videotaped critical incidents. There were no significant differences in the critical incident scores for 13 of the 15 academic and personal items investigated.

Schluck (322) conducted a study to determine whether relationships existed between a student's scores on a personality inventory and his behavior as a teacher at a later time which might make prediction of this teaching behavior possible. The Minnesota Multiphasic Personality Inventory (MMPI) was administered to 70 students who were entering a Master of Arts in Teaching program. Six months after these interns had started teaching in their own classrooms, data collection on classroom behavior was begun. Each was observed four times by the same team of observers over a period of four months. The observers used the OScAR 4V and Flanders' IA.

Schluck reported that she found enough significant relationships to lend hope to the prospect of being able to use the MMPI as an aid in predicting teacher behavior. When the data for the total group were analyzed, prediction equations with significant regression coefficients were obtained through stepwise regression for 28 of the 42 interaction analysis combinations and for

6 of the 8 OScAR factors, using the .05 level of significance. Hypochon-
driasis (Hs), Masculinity-Feminity (Mf) and Depression (D) were found to be
the best predictors of classroom behavior for the total group. Many sex
differences were found. Schluck suggested that in future prediction studies
of this type, relationships between the MMPI and any criterion measures should
be investigated separately for men and women.

McCulloch (223) attempted to determine the predictive relationship
between selected personality characteristics, as identified through the use
of the 16 Personality Factor Questionnaire, and performance of social studies
teachers. Data analysis from his group of 37 student teachers resulted in
inconclusive results. Dugger (437) explored the relationship between expressed
acceptance of self, expressed acceptance of others, and supervising teachers'
predictions of their student teachers' probable success in teaching. He
worked with seven sections of junior level students (29-39 individuals per
section) and their supervisors (a different supervisor for each section of
students). Dugger was forced to report that the positive trends which he
found in his study were not sufficient to justify individual prediction of
the type he had postulated.

Hartranft (148) attempted to determine statistical relationships between
admission and eligibility factors and success as a first-year teacher as
judged by employing principals. He also attempted to determine if any or
several of the factors had sufficiently strong relationships with first-year
teaching success to enable them to be used as predictors of teaching success.
He considered Scholastic Aptitude Test scores, scores on the Sequential Tests
of Educational Progress, Teacher Education Examination Program scores, grade
point average for the first years of college, final grade point average, student
teaching grade, and score on the National Teacher Examination.

One hundred fifty-three elementary and secondary teachers served as his
subjects. Data from these individuals and their principals' ratings were
analyzed. Grade point average for the first two years of college, final
grade point average, and the student teaching grade appeared to have signifi-
cant relationships with first-year teaching performance. However, Hartranft
concluded that admission and eligibility factors did not offer sufficient
dependability for use in predicting first-year teaching success.

Personality Factors and Teacher Effectiveness

Researchers who conduct studies in which they attempt to determine pre-
dictive factors are interested in locating methods for identifying individuals
who will develop into effective teachers. Other researchers begin their work
by studying individuals who have been labeled as effective teachers, in the
hope that they can specify the behaviors and characteristics which constitute
"teacher effectiveness." Fifteen investigators used this approach [Bannister
(17), Clarke (421), McDonald (227), Park (273), Ray (291), Schackow (319),
Smith (334), Wellington (563), Wilson (378), Knapp (192), Hoyt (167), Over-
street (270), Browne (58), Brown (417), Smith (549)]. More than ten of these
papers were identifiable as being doctoral dissertations.

Some investigators studied teacher effectiveness with certain student groups or in certain educational environments. Schackow (319) attempted to identify and analyze selected personality factors of successful American overseas teachers. He asked the chief school administrators of 133 American community schools to select a successful teacher in each of the elementary and secondary grades and provided some guidelines to assist the administrators in making their choices. The teachers were then asked to complete Cattell's 16 Personality Factor Questionnaire. Test results were profiled and compared to occupational norms established by use of the 16 PF instrument with stateside teachers. Schackow found that successful American overseas teachers differed significantly (.02 level) from stateside teachers on five of the 16 personality factors. They were significantly and consistently more intelligent, venturesome, tenderminded, imaginative, and forthright.

Another study of teachers working in schools outside the continental United States was conducted by Park (273). He worked with a Korean population in his study in which he attempted to do three things: (1) to identify relationships between teacher effectiveness as rated by the school principal in Korea and certain variables of the teacher under the principal's supervision; (2) to determine the levels of significance of these relationships; and (3) to present recommendations for the improvement of the administration of the nation's teaching personnel. Park mailed a survey questionnaire to 20 high school principals selected at random. The questionnaires were designed to elicit information concerning 60 effective and 60 least effective teachers. Park found that teaching experience was related to the principal's rating of teacher effectiveness as were the nonprofessional variables of teacher rank, salary, grade level assignment, marital status, age, and sex. Only the professional teacher variable of level of teacher training was found to be related to rating of teacher effectiveness.

Bannister (17) attempted to identify teachers who were judged to be effective in inner city schools. He wanted to obtain data about the aspects of teacher behavior which are taken into account when judgments are made regarding teacher effectiveness. He also wanted to determine the extent of consensus among individuals making these judgments. He involved students, teachers, and administrators from an inner city school in his research.

Bannister found that teachers used stage presence and process orientation criteria while administrators considered the interpersonal orientation criterion to be particularly important. Students in track one (college bound) considered stage presence as the most important criterion for determining teacher effectiveness. Students in track two considered empathetic justice as the most important criterion. Students in track three considered a combination of the interpersonal and student orientation to be most important.

Bannister concluded that effective teachers must have the capacity to relate as well as to teach students in inner city schools. On the basis of analysis of student responses, he concluded that it is necessary to increase the number of culturally sensitive black personnel in inner city schools. At present there are few black teachers who are particularly sensitive to the needs of inner city learners in Bannister's opinion.

Ray (291) examined the relationship of teacher effectiveness to teacher characteristics in a teacher-desegregated secondary school system. He used a questionnaire to obtain information about teacher performance and characteristics, perceptions and commitments to faculty desegregation in a county in Tennessee. Ray received a return of 416 usable questionnaires for data analysis. Teacher performance was evaluated by principals who assisted in the distribution of the survey instrument. This instrument contained 11 perceptual items and 32 commitment items.

Ray found more difference between the groups in teacher performance (rated as low, high, average) than toward commitment to faculty desegregation. An overall positive reaction to faculty desegregation existed, with black teachers and low performers showing more positive commitment than any other group. Age and total teaching experience were the most important variables indicating differences in performance and commitment. The principal was the most important factor contributing to a positive commitment toward faculty desegregation.

Overstreet (270) was interested in testing the assumption that teachers employed in changing schools would be more open-minded and more creative than teachers employed in stable schools. Principals in schools in Kentucky's Title III Region IV-B were asked to rank their schools in one of four organizational or program categories ranging from changing to stable. Returns were grouped and rank ordered by judges. Five changing and nine stable schools were selected to participate in Overstreet's study. The teachers in these 14 schools were asked to respond to the Rokeach Dogmatism Scale and the Torrance Test of Creativity.

Overstreet found differences between the mean scores of teachers, grouped by changing and stable schools, on both measures to be significant at the .05 level. This finding combined with other evidence from data analyses caused Overstreet to conclude that teachers in changing schools were more open-minded and creative than were teachers in stable schools.

Other investigators, although they worked with specific groups of pre-service or in-service teachers to gather data, had less specific teacher effectiveness concerns. Smith (334) attempted to solve two problems in his study: (1) do individual differences exist among teachers with respect for their capacity to teach the various ability levels of students and (2) is a teacher's stated preference for an ability level of students an indicator of the level at which he is most effective? Smith worked with 11 teachers and 1063 second grade and 1091 third grade children. Teacher preferences were identified through individual interviews. Smith found that teacher preference appeared to bear a strong relationship (.05 level) to the teacher's effectiveness.

McDonald (227) investigated relationships among the perceptions of student teachers, supervising teachers, and pupils relative to the student teacher's effectiveness as measured by selected teaching behaviors. Twenty-five secondary school student teachers, their cooperating teachers, and their pupils completed questionnaires related to 12 teaching behaviors. McDonald considered correlations on each of the 12 variables as these related to three pairs of variables: (1) student teacher's self-perceptions and cooperating teacher's perceptions of the student teacher, (2) student teacher's

perceptions and pupil perceptions of the student teacher, (3) perceptions of the cooperating teacher and of the pupils of the student teacher. All pair-wise comparisons exhibited positive correlations. However, only 9 of the 36 comparison scores were significant at the .05 level. Five of these nine were found in pair-wise combinations of student teacher-pupils scores, two in student teacher-cooperating teacher scores, and 1 in cooperating teacher-pupils scores.

D. T. Wilson (378) attempted to identify factors related to student ratings of teachers. He worked with 1180 teachers and 51,966 secondary students in 2,101 classes during a two year period. Student ratings of the teacher were measured by the Teacher-Image and Student Opinion Questionnaire. Teachers responded to the Class and Teacher ID Forms.

Of all the predictor variables analyzed, teacher perception of the class was the factor most strongly related to student ratings of the teacher. Other predictor variables which yielded better than chance prediction of performance on criterion measures were type of community, community socio-economic status, student grade level, class size, teacher marital status, teacher college degree, teacher graduate major, teacher experience, and teacher age. Type of community and community socio-economic status were related to student ratings of the teacher and to teacher human-centeredness, but not to teacher classroom control. Teachers from suburban communities with middle class socio-economic status were perceived more favorably than teachers from urban areas with low socio-economic status. Students in grades six and 12 rated teachers highest. Classes of 36 or more students perceived their teachers less favorably than did classes with fewer students. Class subject showed little relationship to student ratings of teachers. Married teachers, 36 to 45 years of age, with 10-14 years of teaching experience, represented those teachers perceived as most effective. Teachers with a master's degree were viewed more favorably than those with a bachelor's degree. Teachers taking graduate work in science, mathematics, and administration obtained significantly higher rankings than those taking graduate work in fine arts and guidance and counseling. Sex and undergraduate major of teacher showed little relationship to student ratings of the teacher.

Knapp (192) used principals as judges of teacher effectiveness in his study in which he attempted to determine the relationship between teacher personality characteristics and teacher effectiveness (as rated by principals) and to determine the relationship between principal personality characteristics and those of teachers rated as effective or ineffective. Ten male elementary school principals, 60 of their teachers selected on the basis of principal ratings, and 30 randomly selected elementary teachers constituted the subjects of the study. All responded to the Minnesota Teacher Attitude Inventory, the Edwards Personal Preference Schedule, and the 16 Personality Factor Questionnaire.

Knapp found that the attitudes, needs, and personality traits of teachers rated as highly effective by their principals did not differ significantly from those rated as highly ineffective. The psychological factors measured by the MTAI, EPPS, and 16 PF, combined statistically in a multiple regression analysis, did not account for a major proportion of the variance when teachers rated as effective or ineffective was used as the criterion variable.

Attitudes, needs, and personality traits of teachers in both groups differed significantly from the attitudes, needs and personality traits of the rating principals. Specific personality traits, needs and attitudes of an individual teacher appeared to be less important in determining effectiveness than simply the number of years of teaching experience.

It is assumed that when school administrators interview applicants for positions in their schools, the administrators are attempting to infer possible effectiveness based on recommendations and the applicant's behavior during the interview. Browne (58) attempted to analyze and compare the judgments of qualified school administrative personnel who participated in a traditional teacher selection process and a proposed classroom-observation teacher selection process. Videotaped employment interviews were used as part of the traditional selection process. Videotaped classroom teaching segments of the candidates were used for the classroom-observation selection process.

The administrative personnel who participated in the study were given training in the use of the Instrument for the Observation of Teaching Activity (IOTA). Five teachers were deliberately selected who were as nearly homogeneous as possible in terms of age, sex, grade level taught, personal physical characteristics, teaching environment, and lack of training in the IOTA.

Browne found that the 12 judges failed to reach a significant expressed degree of agreement at the .05 level after evaluating credential information (treatment A), viewing the videotaped interviews (treatment B), and viewing the videotaped classroom observation segments. He concluded that individual school administrators essentially applied a different standard in evaluating the competence of candidates under each of the three treatments. Browne found a negative correlation of -.60 between judges' composite rankings of the videotaped employment interviews and the videotaped classroom teaching segments. He therefore concluded that administrators applied totally different standards when evaluating the competence of a teacher in an interview and when evaluating the competence of the teacher in action in the classroom.

Hoyt (167) conducted an evaluation experiment in an attempt to discover the relationship between specific types of teacher behavior and success in teaching as shown by student progress in relation to defined objectives. Students in 708 undergraduate classes at Kansas State University rated their progress in gaining factual knowledge, learning fundamental principles, applying principles to practical problems, understanding themselves, learning professional attitudes and behavior, developing skill in communication, discovering implications of the course for personal and professional conduct, and developing greater cultural understanding and appreciation. Fifty-eight items were used to evaluate teacher behavior and effectiveness.

Classes were sorted into large (50 or more students), medium, and small (fewer than 30). Separate analyses were made of large and small classes for each of the eight student objectives. A number of specific items were found which were related to success (student progress) on each objective for both large and small classes. A few items were selected regardless of objective or size of class. A few others were generally related to success in either small classes or large classes, but not both. Hoyt concluded that there were some teaching procedures which are generally helpful, some helpful with

classes of a given size, and others helpful when a given objective is stressed. A comprehensive account of effective teaching behaviors appeared to require at least 16 overlapping, yet distinct, descriptions.

Teacher Innovativeness

Seven studies [Beckerman (21), Brennan (52), Horton (164), Corl (73), Zimmerman (390), Walsh (367), Forman (106)] were concerned with the characteristic of teacher innovativeness or with teacher reactions to educational innovations. Beckerman (21) examined the relationship between selected characteristics of teachers and their attitudes toward educational innovations. He used a sample survey method to collect data and contacted the superintendents of all 18 public school districts in Onondaga County, New York. He received responses from 11 school districts and was supplied with rosters of all elementary teachers employed by these districts. Using these rosters, 500 teachers were selected to participate. Teachers supplied personal information and responded to Miller's Inventory of Change-Proneness as well as to items about specific innovations. No significant relations were identified although Beckerman did report that "teachers, on the average, had the tendency to accept educational innovations on a moderate basis."

Two investigators considered the factor of teacher innovativeness in their research studies. Corl (73) attempted to gain a better understanding of the relationships between student teacher innovative behavior and selected attitudes, perceptions, and personality characteristics. He chose 73 individuals classified as "high innovators" and 67 classified as "low innovators" from a group of 400 secondary school student teachers on the basis of their scores on the Innovator Scale which Corl developed for his study. He designed and administered a questionnaire to obtain information about the student teacher's perceptions of his teaching situation. Additional information was obtained from student records and included scores from an Opinion, Attitude and Interest Survey (OAIS) and a reading test.

Corl formulated twenty-eight subhypotheses that would differentiate high innovators from low innovators. Data analysis showed that the two groups did differ on 15 of the 28 sub-hypotheses. Among these findings were that the student teachers classified as high innovators liked the school in which they were teaching better than did the low innovators, felt their cooperating teachers would be more supportive of innovations by student teachers, perceived their cooperating teachers as being more creative, felt their students were more able to handle creative situations, and scored higher on the test for reading speed, on the "creative personality scale" of the OAIS, and on the "social science interest scale" of the OAIS than did the low innovators. In addition, Corl found female student teachers were more likely to be innovative than were males and that factors that related to innovative behavior were different for women than for men.

Forman (106) also looked at differences between most innovative and least innovative teachers when a number of personality and situation measures were compared. The measures focused on organizational climate, teachers' cognitive complexity, leadership style, and pupil control ideology. They included items referring to teachers' reference group orientation, environmental support, and job satisfaction. Forman worked with in-service teachers,

using a group of 314 primary and secondary teachers in New Jersey who had applied for minigrants from the Teacher Innovation Program. Funds were awarded to 157 teachers who were thus defined as "most innovative," with the 157 unsuccessful applicants being classified as "least innovative." Questionnaires were mailed to the 314 teachers and used to provide data for analysis.

Forman reported no significant differences between groups in terms of cognitive complexity, leadership style, perceived organizational climate, frame of reference, and environmental support. Significant results were obtained relative to the job satisfaction variable, indicating that the most innovative teachers were more satisfied with their jobs than were the least innovative. The most innovative were also shown as significantly more custodial than the least innovative teachers. He also reported that significantly more teachers high in cognitive complexity, in the most innovative group, perceived their environment as being open as compared to those teachers in the least innovative group, suggesting that innovativeness among cognitively complex teachers is associated with open climates.

One may assume the existence of a large group of teachers even less innovative than those labeled as "least innovative" in Forman's study: those teachers who did not even apply for minigrants. Details concerning their personality and situational factors remain uninvestigated.

Zimmerman (390) attempted to identify the personality characteristics and school-related perceptions that differentiated the innovative secondary school teacher from the non-innovative teacher, as well as to compare biographical features of the innovative and non-innovative teacher. His population was restricted to teachers in selected rural high school districts in North Dakota, based on prior participation in the North Dakota Statewide Educational Needs Assessment Study. The Purdue Teacher Opinionaire, the Teacher Selection Form, and the 16 Personality Factor Questionnaire were used to gather data about teachers' school-related perceptions, teacher innovativeness or lack of it, and personality characteristics, respectively.

Zimmerman reported that innovative teachers were found to be significantly more venturesome, imaginative, and assertive than non-innovators. The PTO factors did not correlate significantly with the criterion of innovativeness. The factor of rapport among teachers was found to be negatively correlated with innovativeness, a finding at variance with Zimmerman's expectations. No biographical characteristics of innovators were found to be significantly related to innovativeness.

Horton (164) investigated whether personal characteristics influenced teachers' acceptance or rejection of new curricular ideas. He looked at teachers' responses to a teaching score instrument which contained 40 statements descriptive of teaching practices in the areas of social studies, mathematics, language arts, and science in the elementary school. Twenty of the 40 statements described new curricular ideas and 20, older and established practices. All teachers in self-contained classrooms in two school districts in New Mexico were asked to participate in the study. Ninety of the 104 teachers returned completed instruments. Horton, after analyzing the data, found no significant teaching score differences among teachers of different personal characteristics.

Walsh (367) looked at relationships between selected personality characteristics of elementary teachers and the degree of their implementation of an innovative curriculum program. He examined dogmatism, age, sex, years of teaching experience, and voluntariness of teaching the innovation. Walsh randomly selected 86 elementary school teachers who were currently teaching an innovative curriculum program, MINNESOTA PROJECT SOCIAL STUDIES. The teachers were asked to respond to a biographical data questionnaire, the Rokeach Dogmatism Scale Form E, and the Curriculum Implementation Index-Part I. Data analysis revealed no significant relationships between the factors Walsh labeled as "personality characteristics" and degree of implementation of the innovative curriculum program. Eighty-four per cent of the teachers in his study scored in the open-minded end of the dogmatism continuum.

Brennan (52) explored the relationship between Everett Rogers' characteristics of an innovation, Roland Lippett's forces that facilitate and hinder classroom innovation, and the acceptance or rejection by teachers of a new classroom practice called Project Read. Brennan developed a 10 question interview guide for use in obtaining data. Forty-two elementary school teachers were randomly selected for interviewing. A teacher summary sheet was used to provide data on school, grade level, teaching experience, and teacher sex as well as to classify teachers' responses into one of five categories (favorable, qualified favorable, qualified unfavorable, unfavorable, neutral). Brennan found that 22 teachers accepted the idea of continued use of Project Read while 22 rejected it. He concluded that his findings suggested that a relationship may exist between acceptance and rejection of Project Read and some of Rogers' characteristics of innovation.

Cognitive Factors Related to Teacher Behavior

Three papers relate to what may be called "cognitive domain factors." R. C. Oswald (268) investigated the association between conceptual level and teacher behavior and attitudes in a minimally-structured type learning activity (a simulation episode). Twenty preservice teachers were asked to complete the Paragraph Completion Test to determine conceptual level and were then divided into two groups: high conceptual level (HCL) and low conceptual level (LCL). Each was asked to present the same lesson (an episode from a simulation) to five randomly selected elementary school students. Lessons were tape recorded for later analysis. At the end of the lesson, each was asked to complete a Teacher Questionnaire designed to identify his attitudes relating to the lesson.

Oswald found that LCL teachers used significantly less indirect teaching behaviors than did HCL teachers (.005 level), engaged in more teacher talk (.001 level), used more time in introducing the activity (.005 level), expressed less satisfaction while using this type of activity (.025 level), perceived significantly more teacher effort during the activity (.001 level), and during the debriefing stage used significantly less indirect teaching behaviors (.01 level). Oswald concluded that there was a stronger relationship between satisfaction and success of the group for LCL teachers than for HCL teachers. He also concluded that LCL teachers may restructure the lesson in such a way that they could play the role of teacher as "normatively" defined by them while HCL teachers tended to alter their behavior relative to the nature of the lesson.

Pavlovich (276) looked at cognitive types of teachers and pupils in relation to classroom interaction. Primary concepts investigated were reflectivity-impulsivity of teachers and pupils, internality-externality of pupils, and directness-indirectness of teachers. Pavlovich used the Matching Familiar Figures Test (Adult Version) to measure cognitive types, Michigan Student Index to measure internality-externality, and Flanders' interaction analysis to measure teacher verbal behavior. Sixteen sixth grade teachers and 360 sixth grade pupils in eight different schools in Metropolitan Detroit were used in the study.

Pavlovich found no significant differences in indirect behavior, flexibility, or amount of pupil reinforcement between reflective and impulsive teachers. She did identify a relationship between the reflective measure and the internal measure, indicating that internality was associated with reflectivity. She found t at the predominant verbal behaviors associated with reflective teachers were praising and encouraging pupils, accepting and using ideas of pupils, and pupils responding. For impulsive teachers, the predominant verbal behaviors were asking questions, lecturing, giving directions, and the initiating of their own ideas by pupils.

Medley and Hill (236) conducted a study of the relationship between teacher knowledge and teaching style. Fifty-three teacher interns who had responded to the Common Examination of the National Teacher Examination were observed four times in the classroom by a team of observers, one trained in Flanders' interaction analysis and one in the OScAR 4V. The investigators reported that their tentative findings indicated a correlation between lecturing behavior and performance in the NTE examination, with science-oriented teachers lecturing more and listening less while those interns with high scores in literature and in the history and philosophy of education and teaching practices favored a dialogue approach. They considered a close connection to exist between a teacher's knowledge of teaching principles and practices and his teaching style.

This section on teacher attitudes and personality characteristics as these factors relate to teacher behavior has been a depressing section to review and analyze. When one considers the fact that most of the studies were doctoral dissertations, feelings of empathy add to this depression. Researchers engaged in dissertation projects hope to add something of value to the profession in addition to fulfilling the dissertation requirements for the doctoral degree. Yet the majority of the studies resulted in inconclusive evidence or findings of no significant difference or of lack of significant correlations. It is possible to differ with the methodology used, in whole or in part, in some studies and these differences will be addressed in a later portion of this part of the monograph. In addition some questions must be raised. Did the depressing situation result because the research reported consists in large part of the first efforts of researchers? Were the problems researchable? Were they worthy of the time and effort involved both by the investigator and by the individuals who served as the subjects of the studies? Was the design and/or methodology and instrumentation used inappropriate? Or are teacher personality and attitudes, as well as teacher effectiveness, so complex that educational researchers have yet to realize the full extent of the complexity?

Another area of research related to teacher behavior is that in which the investigator examines teacher behavior as it is perceived by pupils [Rosenshine (304), Klein (190, 191), McKeachie et al. (232), Steele et al. (345), Heath (153), Hayes et al. (152), Lepard (204), L. M. Smith (547), Turner (362)]. Some of the studies previously cited and discussed contain relevant information. These studies were discussed in previous parts because student perception of teacher behavior was only one sub-problem of the study or perhaps was inferred from data obtained. Those studies included in this section have student perception of teacher behavior as a primary concern.

Although the number of studies in this sub-section is relatively small (nine) when compared with the sub-sections relating to descriptive studies or to studies of behavior change, this category was used in order to emphasize the investigative approach. In most teacher behavior studies, there is only one investigator or, at the most, an observer team. In studies of pupil perception of teacher behavior, the whole class serves as observer. In addition, most observational studies report findings gathered over a relatively limited period of time. Pupils usually report their perceptions as these have developed from extended contact with a teacher. If student achievement as influenced by teacher behavior is important, the analysis of pupil perceptions as these relate to student learning would seem to be of importance.

Additional related research is that which focuses on teacher behavior as reflected in student achievement. The majority of studies on this topic have been cited in previous parts of this section of the monograph in those subsections to which they were considered most relevant. Studies of teacher behavior as reflected in student achievement did not constitute a large enough segment of the research identified to constitute a separate section for discussion. This situation holds true in science and in other content areas.

One individual who has spent a large amount of his time in search of studies in which teacher behavior has been studied in relation to student achievement is Barak Rosenshine (303). He has produced a book, first published in 1971, in which he reviewed these studies relative to the relationship between observed behaviors and student achievement and has summarized more than 50 studies (1959-1970). Rosenshine's primary concern is with correlational studies but experimental studies are also included in his review.

Rosenshine's book is divided into nine chapters. The introductory chapter includes explanations and discussion of the elements in his research, comments on statistical procedures, and a lengthy table in which are presented a summary of the studies reviewed and the criterion tests used in the studies. Chapter two is devoted to the topic of teacher approval and disapproval; chapter three, to teacher cognitive behavior; chapter four, to flexibility and variety; chapter five, to enthusiasm; chapter six to amount of teacher-student interaction; chapter seven, to general ratings of teacher behavior; chapter eight, to time; and chapter nine, to antecedent and demographic variables. A summary is provided, at the end of each chapter, for the research related to the chapter topic. In addition, the book contains a one-page test bibliography and a nine-page list of references.

Klein (190, 191) conducted a study of student influence on teacher behavior. This study has been reviewed in an earlier portion of this section of the monograph. Information concerning the study is available on microfiche as well as in an article published in the May, 1971, issue of the American Educational Research Journal.

Three researchers collaborated on the publication of an article on student ratings of teacher effectiveness. McKeachie, Lin, and Mann (232) focused on validity studies. Their research was designed to explore the problem of what the factors of skill, overload (difficulty), structure, feed-back, group interaction, and student-teacher rapport (warmth) have to do with effective teaching. They completed five studies to test their hypotheses. These hypotheses were that the "skill" factor would relate positively to teacher effectiveness as measured by student performance on the Introductory Psychology Criteria Test. Also, "group interaction" was hypothesized to relate positively to teacher effectiveness on this criterion as was the factor of "feedback."

In the first study 297 male and 392 female students of 17 teachers in 33 general psychology courses completed the teacher evaluation form. Data analysis confirmed the hypotheses. In addition, "rapport (warmth)" was also significantly related to effectiveness.

Next, the results of the first study were reanalyzed, taking each sex separately and using as a second criterion measure, the mean score on a test of knowledge consisting of 25 items taken from old final examinations. In this reanalysis, the researchers hypothesized that "difficulty," "struc-ture," and "feedback" factors should relate more positively to success for women than for men (based on the rationale that women would be more likely to meet instructor demands if these are clear). Also, "group interaction" should be more positively related to effectiveness for male students than for female (because of men's greater assertiveness and women's fear of out-shining males). The third hypothesis was that high "warmth" should be more effective for women than low "warmth" (because of women's greater sensitivity to interpersonal relations and higher need affiliation). The fourth hypo-thesis, for which the second criterion measure was used, was that "structure" should be more positively related to knowledge outcomes than to thinking and "group interaction" should be more positively related to thinking measures than to knowledge.

In the reanalysis, "skill" dropped out of the picture. "Feedback" did prove to be effective for women (as predicted), "structure" turned out as expected for the criterion test of thinking (as predicted), a high degree of "group interaction" seemed to be effective for men, and women did well with "warm" teachers (as predicted).

The second study was done to replicate the first. This time the sample was 348 men and 406 women enrolled in 32 sections of the general psychology course taught by 16 teaching fellows. In this study, "skill" and mean student achievement were negatively correlated. "Feedback" and "warmth" were positively correlated with effectiveness but "group interaction" was negatively correlated with mean scores on the Introductory Psychology Criteria Test. "Difficulty" was positively correlated with effectiveness on the knowledge criterion. "Structure" was again slightly more important for women than for men on the "thinking" criterion.

The third study reported was one which had been done before the researchers had used factor analysis procedures and before the Introductory Psychology Course had been developed. The fourth study also looked at data from an earlier sample using students in second year French. The fifth study included the analysis of attitudinal as well as cognitive changes.

When analyses from all five studies were reviewed and synthesized, the investigators found (1) in four of the five studies, teachers rated high on "skill" tended to be effective with women students; (2) in all five studies, teachers rated high in "structure" tended to be more effective with women than with men (in general, the more structured instructors tended to be ineffective with male students); (3) teachers high in "rapport" tended to be effective on measures of student thinking; and (4) teachers whom students rated as having an impact on beliefs were effective in changing attitudes.

McKeachie et al. reported that student ratings had some usefulness. They also decided that the major slippage in the validity studies was due to differing goals of teachers and students. The researchers concluded that teaching effectiveness is not a unitary concept but is one involving a number of complex interactions. Therefore, when educational researchers and administrators consider the problem of which teachers are most effective, they need also to consider asking "effective for which objectives?" and "effective for which students?"

Steele, House, and Kerins (345) were interested in assessing instructional climate. They defined "instructional climate" as that aspect of environmental press which is defined by the characteristic demands of the classroom environment as perceived by the students to whom these demands are directed. Steele et al. wanted to look at classroom transactions in the cognitive and affective domains to see what mental and emotional demands were being made upon students. To gather data, they used a 25 item instrument called the Class Activities Questionnaire (CAQ). This instrument was administered to both students and teachers. It was extensively field-tested. Grade six was determined to be the lowest level at which students could understand items and appropriately interpret the statements.

Teachers were asked to report their intended classroom emphases and also to predict what the students as a group would say. Students were asked to agree to or disagree with, on a four point scale, statements describing general kinds of activities which characterized their class. These activities implied either levels of thinking or affective classroom conditions. Each item was paired with another to compose a factor, resulting in 16 factors which provided a profile of the class.

The researchers felt students, rather than teachers, were a good source of information about what actually occurred in the classroom. They cited, as an evidence of the accuracy of student observation, a study conducted of 32 classes comparing the teachers' and median students' estimates to the actual percentage of teacher talk recorded by an observer using Flanders' system of interaction. The median student estimate was within five per cent of the actual talk in almost one-third of the classes and within ten per cent in fifty-eight per cent of the classes. No teacher estimates were within five per cent of the actual amount of talk and only sixteen per cent

of the teachers' estimates fell within ten per cent of the actual talk.
Fifty-nine per cent of the teachers' estimates produced discrepancies of
over twenty per cent. Most greatly underestimated the amount of their talk.
In one instance, the actual amount of teacher talk was seventy-three per
cent. The teacher had estimated twenty-five per cent. The median student
estimate was seventy-five per cent.

In their study, Steele et al. used 131 Illinois classes in language
arts, science, mathematics, and social studies in grades six through twelve.
The 41 male and 52 female teachers, varying in age, training, and teaching
experience, taught 31,138 students. Classes consisted of 62 "gifted" classes
and 69 "average" classes.

Differences identified between average and gifted classes can be
summarized as follows:

1) most average classes emphasize few (two or less) thought processes
   while most gifted classes emphasize many (three or more);

2) most average classes emphasize one (if any) of the higher thought
   processes while most gifted classes emphasize two or more;

3) average classes, as a group, emphasize three of seven levels of
   thinking (translation, interpretation, analysis) while gifted
   classes, as a group, emphasize six of the seven levels;

4) a high amount of teacher talk occurs in average classes but only
   a moderate amount in gifted classes;

5) average classes have little opportunity for or involvement in
   discussion compared to much opportunity for or involvement in
   discussion in gifted classes;

6) test/grade stress is characteristic of average classes as a
   group but this stress is not characteristic of the gifted
   classes as a group;

7) enthusiasm is absent in the majority of average classes but
   is present in almost all gifted classes;

8) there is little opportunity for independence in average classes
   as compared to much opportunity in gifted classes;

9) the teacher is an information-giver and students are passive
   recipients as compared to active roles for students in gifted
   classes.

The investigators reported that the most striking characteristic in the
affective classroom climate dimension was that of lack of enthusiasm. In
over half of the average classes, students were negative and uninterested in
class activities. Students in less than 25 per cent of the classes were
excited and involved. Students in gifted classes were excited and involved
in class activities.

Steele et al. suggest that low-inference student judgments, such as those obtained by use of the CAQ, be used as a resource by teachers to analyze their instruction and to improve their class activities. However, use of an instrument such as the CAQ is threatening to teachers and must be carefully presented in order to reduce this threat. The CAQ is not useful below junior high school, in terms of student understanding and interpretation of items, and was designed to be used only in classes where group methods of instruction are used. The investigators also caution that the CAQ or a similar instrument should not be used until the classroom group has been stablized and a pattern of teacher emphasis is present.

Heath (153) explored two questions: (1) is the student-perceived ability of white teachers to relate to students a function of the ethnic background of the student group and (2) are different characteristics of teaching style associated with white teachers' ability to relate to student groups of differing ethnic background? Heath used as his source of data videotapes produced during the Stanford teacher education program. These tapes showed 50 white teacher interns each presenting a single five to seven minute lesson on the topic of Black Power.

These 50 tapes were randomly grouped into 10 groups of five teachers each. Each of these groups was combined into a single videotape for use in the study. These tapes were used with 100 high school students (50 white, 50 black) who had responded to announcement in their schools of the need for paid (six dollars) pupil participants in the study.

Two rating scales were used. Scale A had a rating format from low to high and included four graphic rating items, each intended to reflect an aspect of the ability to relate. Scale B had seven questions in graphic rating scale form about characteristics of the teachers' style of teaching and, with the exception of item one, ratings were in the opposite direction to Scale A (going from high to low). Items in both scales had been produced by a committee of black parents and project personnel.

Rating sessions for black students were held in a storefront office in a shopping center in a black community. The sessions were conducted by black parents. Students were randomly selected in groups of five to rate one tape with scale A only. Then they viewed a different tape, using scale B. This procedure was followed until all teachers had been rated on both scales and all students had rated two tapes. The same procedure was followed with the white students who met in a university audiovisual center and were supervised by white adults.

Heath found that white students, on the average, rated the 50 teachers higher on the ability to relate, as measured by Scale A, than did the black students. However, black students rated 13 of the 50 teachers more favorably than did white students. Students in the two racial groups did not respond similarly in their ratings of teachers. On ability to relate and on three of the seven characteristics of teaching style, correlations of ratings between racial groups was negative although small. The same teacher was viewed quite differently, relative to other teachers, by the two racial groups.

Heath concluded that ability of teachers to relate to students was likely to vary substantially as a function of the ethnic background of the student group. In addition, characteristics of teaching style contributed to ability to relate differentially in student groups of differing ethnic background.

Hayes et al. (152) reported on the continuation of an earlier project to determine if student achievement and attitude toward school subjects (1) can be improved by increasing feedback to teachers concerning pupil and/or trained observer reaction to teaching, (2) correlate significantly with attitude of teachers toward their pupils, and (3) can be improved to a greater degree by face-to-face feedback to teachers than by standardized feedback via mail. Eighty teachers and 1,912 sixth grade students in seven Pennsylvania school districts participated in the study. Student attitude toward teaching was measured by the Hayes Pupil-Teacher Reaction Scale.

Teachers received one of four treatments. Treatment one consisted of having students rate their teachers four times in the fall. After these ratings, half of the teachers received face-to-face feedback and half were mailed feedback. In the spring students rated their teachers twice. Treatment two involved systematic recording of classroom teacher-pupil interaction, by two observers, four times in the fall and twice in the spring. Feedback was again provided by one of the two methods. Treatment three teachers received feedback of both student ratings and observations, based on two visits in the fall and one in the spring. In treatment four, teachers were rated by their students and were observed twice in the fall and once in the spring. They received feedback only on the pre-test results of pupil achievement and attitude toward the subjects.

Class means were used in the data analysis. Hayes found that student achievement and student attitude toward school were not significantly improved by systematically providing feedback to teachers of pupil ratings, of the results of classroom interaction analysis (Flanders), or of a combination of the pupil ratings and interaction data. Neither student achievement nor student attitude toward school subjects was significantly correlated with attitudes of teachers toward their pupils. When class means were used as data, there were no significant achievement or attitudinal differences between face-to-face feedback and standardized feedback via mail.

When individual scores were analyzed, significant results in achievement were obtained in favor of written feedback only over face-to-face plus written feedback. When individual student ratings of teacher behaviors were analyzed, significant differences were identified in favor of written feedback only and of treatments one and three versus treatment four. (Treatments one and three shared the element of feedback to teachers of results of student rating). Analysis of individual scores in classes whose teachers received written feedback only indicated significant differences favoring treatment one over each of the other three treatments in both student achievement and student ratings of teachers.

Lepard (204) completed a dissertation project in which he developed an instrument for using elementary school students' perceptions of their teacher's behavior. He was interested in investigating the nature of possible relationships among various student-assessed teaching behaviors and other specific

teacher, school, and student demographic data. Using Remmers' Purdue Rating Scale for Instruction (PRSI) as an acknowledged teacher rating instrument, Lepard adapted it and produced the Elementary Classroom Teacher Rating Scale (ECTRS). In the ECTRS instrument, Lepard asked children to assess the teacher behaviors of likes to teach, helpfulness, friendliness, fairness, listens to ideas, explaining things, sense of humor, habits, looks, and fun in learning. He administered the ECTRS to 20 fifth and sixth grade classrooms.

Lepard reported that the ECTRS was found to have overall reliability coefficients, utilizing the Horst Formula, of 0.96, significant at the .01 level. Individual children within classes varied in their ratings, with more students tending to rate their teachers unfavorably on listens to ideas and explaining things. Teacher looks, sense of humor and fun in learning resulted in the highest standard deviations in the sample. He concluded that diversity existed among student perceptions of teaching behavior. This diversity may be due, in part, to variations in instructional behavior directed to individual students.

Students were one of the three groups involved in a study by Turner (362) in which he attempted to determine the congruency of perceptions of 31 pre-tenure teachers, 915 students in their classes, and the 21 principals who evaluated the effectiveness of these teachers.

The instrument used to gather data was the official school district teacher evaluation form. Turner found that there was a difference significant at the .05 level of confidence between the principals' and teachers' perceptions of the instructional skills of pre-tenure teachers. However, there was no significant difference on this point when principals' and students' perceptions were compared. Nor was there a significant difference concerning teachers' instructional skills when the perceptions of students and teachers were compared. In the material reviewed, Turner did not specify if perceptions differed but at a level less than that chosen as significant.

The method of studying teacher behavior via pupil perceptions shows promise in research if one accepts the evidence that Steele et al. provide in their paper in support of the contention that pupils are more accurate observers of what takes place in classrooms than are teachers. If the use of pupil evaluations can be handled in a manner so that the threat to the teacher's ego is minimized, this should prove a useful tool not only for those interested in research but also those primarily interested in preservice and in-service activities aimed at improving teacher behavior and only second-arily interested in conducting research studies. However, if teacher educators (as opposed to educational researchers) do use this method, it seems only logical that they would conduct some type of action-research in order to determine the success of the method.

STUDIES ABOUT INSTRUMENT DEVELOPMENT

This section of the third part of the monograph consists of studies in which the investigators have described the development of an instrument used to obtain data concerning teacher behavior either as it occurs in the classroom, for descriptive studies, or to measure behavior change, in experimental studies. In some of the papers, information was provided concerning the group used in field testing or pilot testing the instrument. In others, only the instrument was described.

The studies within this area fall into several clusters. The largest group relates to instruments designed for the observation of classroom verbal interaction. Some of these emphasize only one type of verbal behavior, such as questioning or reinforcement. Others look at verbal behavior from a more general perspective. Another cluster of studies contains discussions of instruments designed to measure both verbal and nonverbal behavior. Still a smaller cluster relates to only nonverbal behavior. Several of the instruments were developed to measure a teacher's behavior in terms of evaluation (self, others) or in terms of the classroom environment or social climate. A few of the research efforts involved the development of manuals relative to teacher behaviors or to the use of observational systems. In addition, there is a group of studies which can best be termed "miscellaneous" in that each of the investigators reported on a different topic relative to instrument development.

A breakdown of the number of studies in each area is shown in Table V.

TABLE V

TYPES OF INSTRUMENT DEVELOPMENT STUDIES

Category	Number of Documents
Verbal interaction	35
Verbal and nonverbal behavior	5
Nonverbal behavior	12
Evaluation (self, others)	9
Classroom environment	5
Manuals, Models	8
Miscellaneous	8
Total	82

One source of information concerning some instruments used to obtain data on teacher behavior is Part III "Major Variables and Areas of Research on Teaching" (pp. 448-813) in the Handbook of Research on Teaching (118). The information contained in this volume relates to the studies used in the various chapters and, from these studies, information about observational instruments can be obtained.

Another excellent source of information is Mirrors for Behavior II (329). Edited by Simon and Boyer, this publication is a special issue of the "Classroom Interaction Newsletter" produced in cooperation with Research for Better Schools, Inc., a regional education laboratory in Philadelphia. Mirrors was first published in 1967 and contained 26 observational systems which had been identified as the result of a search for the best instruments to use for a research study. The first publication has been up-dated and expanded. Mirrors II contains 79 observational systems, in two volumes. Volume A presents an overview and contains a discussion of the "meta-language" of communication, the components of meta-languages, and technology and current applications of interaction systems, as well as some of the systems themselves. Volume B contains the remainder of the 79 systems.

For each system a brief overview is presented along with a display showing (a) settings in which the system is used, (b) subject of observation, (c) number of subjects observed, (d) uses reported by author, (e) data collecting and coding methods and personnel, (f) category dimensions of the system, and (g) coding units. The categories of the system are then provided, along with operational definitions (if any). Information concerning ground rules or the study in which the system was originally used must be obtained elsewhere. Mirrors is, in its present format, a valuable tool or reference for the researcher.

Interaction systems may be classified as cognitive or affective or multidimensional. Cognitive systems are those in which the observers look at the behaviors involved in teaching and learning as they deal with the acquisition of information. In affective systems the observational emphasis is on the emotional climate of the classroom. Multidimensional systems are those in which the observer attempts to gain information concerning both cognitive and affective factors in the classroom.

Verbal Interaction Analysis Systems

The first group of studies to be discussed deal with verbal interaction and are, for the most part, cognitive systems. The investigators looked at verbal interaction or some aspect of it. In those research studies reported in Dissertation Abstracts, the authors were unable, due to space limitations, to provide information concerning the categories involved in their systems. Categories will be reported for those papers in which this information was available.

For example, Good and Brophy (134, 135, 458) developed a system for the analysis of dyadic interaction (one teacher: one child). They were interested in developing a method of interaction analysis in which the individual child was the unit of analysis, to complement traditional studies treating the class as the unit. They felt their method would provide information concerning

intra-class variation in teacher-pupil interaction patterns. In a typical traditional study teacher and class are treated as a unit. Such studies require data-gathering in a large number of classes for statistical reasons since each class constitutes only a single observation within the design used. In studies using the class as the unit, intra-class individual differences are left out of the model altogether or are included only as error variance.

Good and Brophy's system of dyadic interaction enables the researcher to make finer discriminations. Five different types of dyadic interaction situations are coded: (1) response opportunities, in which the child publicly attempts to answer a question posed by the teacher; (2) recitation, in which the child reads aloud, describes some experience or object, goes through arithmetic tables, or makes some other extended oral presentation; (3) procedural contacts, in which the teacher-child interaction concerns permission, supplies or equipment, or other procedural matters concerned with the child's individual needs or with classroom management; (4) work-related contacts, in which the teacher-child interaction concerns seat work, homework, or other written work completed by the child; and (5) behavioral contacts, in which the teacher disciplines the child or makes individual comments concerning his classroom behavior.

Each type of interaction has its own place for coding on the coding sheets. In addition, coding distinctions are also made concerning the nature and sequence of the interaction observed. For every interaction, coders note whether the initiator was the teacher or the child. They also code information concerning the teacher's message or response to the child during the interaction. In addition, coding of response opportunities and recitation turns also includes information concerning the type of question asked and the quality of the child's response, both of which are coded before coding the nature of the teacher's feedback. The latter coding also includes preservation of the sequential order of events, so that the chain of action and reaction sequences within these interactions is maintained (55:5).

Good and Brophy consider the coding of response opportunities to be perhaps the most difficult coding in the system. Several aspects of the interaction have to be coded and the sequence of events within the interaction must be maintained and indicated in the coding. Going from left to right on the coding sheet, the observer first indicates the code number of the child making the response and the type of question he is responding to. Then the level of the question is coded, followed by the quality of the child's response. Then the teacher's feedback to the child's answer is coded.

The manual for coding the dyadic interaction system (55) contains a six page discussion of general coding conventions relative to the problem of validity. Nine general conventions, or ground rules, are specified and elaborated upon.

After Good and Brophy produced their manual in 1969, they did additional work which was published in an appendix to the manual (416). This appendix contains suggestions for changes in the way level of question is coded, modifications of the child's answer categories for simplification or expansion, and new distinctions for coding the teacher's feedback following correct

responses from the children. In addition, the researchers describe new categories for use at the secondary level. These have been added to cover affective aspects of teacher-pupil interaction and increased student activity (student initiated response opportunities, joking, and personal conversation).

Two basic types of measures which can be derived from the dyadic system are discussed: simple frequency counts (quantitative) and percentage scores (qualitative). Twenty-six of the more useful frequency measures are listed. Also, 50 percentage measures of teacher-child interaction are listed under various categories.

Good and Brophy used their instrument in the study discussed earlier in this section of the monograph in which they investigated the effect of teacher attitudes about children as reflected in their behavior toward these children.

Medley (234) described an observation instrument which was invented for a specific project involving 2,000 four-year-old ghetto children. Called the Personal Record of School Experience (PROSE), the instrument does not provide an observer rating type of classroom record. It requires only the objective recording of observable events. The observer watches only one child at a time and records all his activity. This data is coded in the class-room by use of PROSE "language" based on 11 word statements which can be fed directly to the computer. Items such as subject matter, class organization, and instructional materials are also recorded. The 11 word statements code all aspects of a student's current activity, including level of attention, physical activity, and manifest affect.

The other instruments described in studies within this cluster are of the traditional type in which the class as a whole serves as the unit for analysis. Brun (59) conducted a research study to develop and test a system for observing and recording teacher-pupil interaction in the cognitive domain and to suggest uses of the system in teacher education. The Brun Cognitive Interaction System (BCIS) contains six categories for teachers and six cor-responding categories for students. These are (0) unrelated stimulation or response, (1) recall or obtain information, (2) use or select and apply know-ledge, (3) analyze-compare-contrast, (4) judge-evaluate-determine significance, and (5) generalize or create. Brun's report indicates that interobserver and intra-observer reliability were established but does not specify what the reliabilities were.

Brun used her system in a study of the videotaped teaching and learning behaviors exhibited in ninth grade classes of 20 selected home economics teachers. Behaviors were collected from two different days on which teacher-student discussion was the teaching technique used. Brun found that teachers exhibited behaviors in all categories except for the (0) category but that these behaviors were exhibited with decreasing frequency (less than 0.4 per cent in category five but 50 per cent of the tallies were in category one). She found a close positive relationship between the level of teacher stimu-lation and student response, with 88.4 per cent of the tallies in the cells where teacher stimulation and student response were at the same level. Brun concluded that she had successfully demonstrated the usefulness of the BCIS for describing cognitive behaviors of teachers and students in home economics classrooms.

Gallagher et al. (123) designed a system of topic classification for a classroom interaction study. His system was designed for use of observers, teachers and researchers and involves a three-dimensional model. These dimensions are content-skills, concept level (data, concept, generalization), and style (focusing on description, expansion, explanation, evaluation-explanation, and evaluation). Classroom discussions are subdivided into topic, topic division, topic focus, theme definition, summaries, and topic returns. Classification of topics is by content-skills and levels of abstraction (data, concept, generalization). Discussion styles include description, explanation, evaluation-justification, evaluation-matching, and expansion. Auxiliary categories include management, structuring, and activity. A coding system for classification of topics is included in Gallagher's report.

Bloom and Wilensky (37) reported some preliminary results of a classroom observation scale based in part on a Skinnerian learning orientation (the shaping and control of behavior by reinforcement contingent upon the occurrence of a response). In their scale, the researchers hypothesized four dimensions of a teacher's behavior as being important in mediating classroom learning. These dimensions are (1) information giving (IG) which refers to any teacher behavior by which a fact or portion of a concept is verbally transmitted by the teacher to the pupils; (2) response elicitation (RE) which involves any teacher effort to involve pupils actively in the learning activities by asking them specific questions relevant to the lesson or by giving pupils instructions to respond motorically; (3) feedback (F) which is any indication by the teacher of the correctness or incorrectness of a response to a learning activity as well as any teacher statements which guide pupils toward a desired response; and (4) teacher control (C) which refers to any effort by the teacher to maintain or redirect pupil attention in relation to a learning activity.

Bloom and Wilensky used their scale to observe a cognitive enrichment program for underprivileged preschool children and conducted observations in four nurseries, each averaging 13 children, a teacher, and a teacher's assistant. Each observation was made for a five minute period. From 34 to 42 observations were collected for each of the four teachers.

After data analysis, the investigators felt that their observational scale, although used in a very limited study, did differentiate among teacher styles, especially in regard to the response elicitation and feedback dimensions.

Alsworth (7) developed and tested an instrument for use in the structural analysis of verbal interaction in large college classes. The observation instrument (not named in the dissertation abstract) enabled Alsworth to investigate five phases of verbal behavior: (1) definitive, (2) developmental, (3) evaluative, (4) exploratory, and (5) non-definitive. Each of these phases was considered to be characterized by certain sub-categories, producing a total of 15 sub-categories. Ten randomly selected large classes of various content areas comprised the sample of the feasibility study.

Alsworth found that verbal interactions were variable and tended to follow an instructor-to-student-to-instructor pattern. The instructor engaged more frequently in stating behavior; the student, in questioning behavior.

Widmayer (375) developed an observation schedule to categorize and analyze teacher reinforcement behavior. This schedule involved multiple, behaviorally defined items in three major categories: rewards, feedback, and deterrents. The instrument includes 28 categories plus sub-categories, with examples to illustrate each item. Four experienced teachers were trained to use the instrument. The percentage of observer agreement on recording during the study averaged .82.

Ten elementary school teachers identified as "competent" were observed for ten randomly-selected half-hour periods over a three week period and their reinforcement behaviors recorded, using Widmayer's instrument. She concluded, after data analysis, that the instrument exhibited sufficient reliability and validity to justify its further use in teacher education, both preservice and in-service.

Bomont (41) also focused on a specific kind of teacher behavior or class of behaviors, those exhibited by teachers as they provide phonics instruction. He reported an inter-rater consistency of .80 (using Scott's formula) for his training period in the use of his instrument. Bomont concluded that his instrument was feasible for use in conducting objective observations of a reading lesson for the purpose of measuring the phonics content of teachers' verbal behaviors, for identifying and measuring the phonics behaviors at different cognitive levels, and for determining the degree to which teachers require active pupil responses to phonics-related teacher behaviors.

Nelson et al. (257) and Reynolds et al. (297) reported on related research. Nelson and his colleagues had worked on a study whose purpose was to develop paradigms of verbal interaction for problem solving discussions. Taking selected definitions from previously published work (Taba, Bellack, Flanders, Smith, Smith and Meux), they built categories which classified verbal moves. Models of verbal interaction were then developed, using the categories. These models subsumed such verbal interaction concepts as the venture, move, cycle, and module (as defined in other research studies). These models were then used in conjunction with the Classroom Observational Record to conceptualize and research classroom interaction.

Reynolds (297) described the Classroom Observational Record. This instrument is divided into five types of moves, each of which is further subdivided. Structuring moves (I) are statements which establish a center of cognitive focus and do not directly elicit a verbal response. The three categories of Structuring moves are reviewing (0), informing (1), and directing (2). Soliciting moves (II) consist of any question which (a) initiates a new transaction by establishing a new center of cognitive focus and/or (b) maintains an existing center of cognitive focus. There are four categories of Soliciting moves: recalling (3), collecting data (4) processing data (5), and evaluating or verifying principles and/or conclusions (6). Reacting moves are those responses which (a) accept or reject or (b) elicit evaluation, clarification, or explanation of an immediately preceding move. The eight categories of Reacting moves are accepting (7), rejecting (8), rejecting personal behavior (8'), calling for clarification (9), calling for evidence or explanation (10), calling for the opinion of another person (11), answering a raised hand (N), and repeat (R), which involves repeating a preceding move(s). Responding moves are those statements in response to a Soliciting or Reacting move.

There are five categories of Responding moves: recalling (3'), presenting
data (4'), processing data (5'), evaluating or verifying data (6'), and
I don't know (K). The fifth and final type is the Non-Move which is used to
categorize any occurrence which is not categorizable under the four preceding
sub-divisions. There are two categories of Non-Moves: silence (12) and
confusion (Z).

Observers begin recording data after the first Structuring or Soliciting
move, using a two-column tally sheet (one column for the teacher, one for the
pupils). The use of the two columns eliminates the need for separate cate-
gories within the instrument for pupil and teacher talk. A tally is recorded
for the move in progress every three seconds, using a system of check marks
and slashes to indicate changes of speaker or cognitive focus.

The reliability of this 22 category instrument was determined. The
results indicated coefficients of observer agreement ranging from .64 to .99
for the 22 categories. Coefficients of discrimination ranged from .68 to .99.

Teachers who want to improve their instruction can plan a strategy of
interaction using one or more of the paradigms developed by Nelson et al.,
use the strategy and be observed by an individual trained in the use of the
COR, and receive feedback relative to how closely the strategies were actually
being followed. COR data can also be used to indicate where any deviations
from the planned strategy may have taken place, as well as the character of
the deviations in terms of resultant kinds of interactions and the cognitive
levels on which such interactions occurred. The COR can also be used as a
research instrument as well as to provide systematic feedback to teachers.

Ober (259) developed the Reciprocal Category System (RCS) to record and
assess teacher-student classroom verbal interaction. This instrument is
composed of nine verbal categories, applicable to either student or teacher
and, as such numbered differently, and the additional category of silence or
confusion. The nine verbal categories are (1) "warms" the climate, (2) accepts,
(3) amplifies the contributions of another, (4) elicits, (5) responds, (6)
initiates, (7) directs, (8) corrects, and (9) "cools" the climate. (The
comparable student category numbers range from 11 through 19 for these nine
verbal categories.)

Data may be collected "live" in the classroom or recorded for later
analysis. Only the verbal aspects of the interaction are analyzed, with
observations recorded at a minimum rate of every three seconds. One column
of data on the tally sheet represents approximately one minute of classroom
interaction. Data are plotted on a 19 by 19 matrix for a visual representation
of behavior patterns and the frequency of their occurrence. The matrix may
also be used to determine percentage relationships among patterns, flexibility
of classroom behavior, and the occurrence of behaviors in any of the four sub-
matrices (teacher-teacher, teacher-student, student-teacher, student-student).

The Reciprocal Category System may be used as a research tool to con-
ceptualize and measure many verbal behaviors. It may also be used as a train-
ing tool to sensitize teachers to subtle and uncommon verbal behaviors so they
are able to control and plan their verbal behavior.

Massialas et al. (219) developed a category system to analyze or evaluate issue-centered classroom discussion. This system was developed for use in a project about the use of social issues in secondary schools. Some of the research resulting from this project has been cited earlier in this section of the monograph (Massialas, Sprague). The system which was developed was entitled the "Michigan Social Issues Cognitive Category System" and resulted from approximately 15 revisions. The system views the discussion of issues from three bases: request for cognitive operation, non-cognitive operations, and performance of cognitive operation. The basis of Request for Cognitive Operation is divided into four categories: (1) exposition, speaker requests statements to provide general information or to summarize the discussion; (2) definition and clarification; (3) positions and hypotheses; (4) grounding, speaker requests reasons supporting a position or hypothesis.

Non-Cognitive Operations contains only one category (5) but this is further sub-divided into 5.0, request for non-cognitive operation; 5.1, directions and classroom maintenance; 5.2, restatement of speaker ideas; 5.3, acceptance or encouragement; 5.4, non-productive responses; 5.5, negative responses; 5.6, fragmented discussion.

Performance of Cognitive Operation contains four categories: (6) exposition, (7) definition and clarification, (8) positions and hypotheses, and (9) grounding. The category of grounding (9) is sub-divided into 9.1, general knowledge; 9.2, authority; 9.3, personal experience; 9.4, experience of others; 9.5, consequences; 9.6, position-taking; 9.7, no public grounds.

All 26 of the categories of the system are defined in terms of a class-room speaker. No single category is restricted to teacher statements or to student statements. Observers work from typescripts, using a three column coding sheet (R = request, P = performance, NC = non-cognitive). Coders work from 19 guidelines or ground rules. Coding is a team operation and on completion of a typescript, the two coders attempt to arrive at consensus. Massialas reported a reliability coefficient, using Scott's formula, of .80.

The Michigan Social Issues Cognitive Category System enables a teacher to look at simple and complex cognitive operations in the classroom, to assess value judgments in terms of their justification or non-justification, and to determine if the classroom climate is primarily open or closed.

Whitley (274) presented a relatively simple-to-use instrument at a Pupil Personnel Services seminar for the Grafton, Illinois, schools. His "Classroom Observation Schedule" was designed to be used for recording data in 15 minute intervals (ten minutes for observing, five minutes for recording). The COS involves the use of three symbols for student behaviors and five for teacher behaviors. Student symbols are O = out of seat, T = talking out (without permission), and X = behaviors other than O or T. Teacher symbols are (1) physical contact, (2) verbal positive (statements of affection or praise), (3) verbal negative, (4) facial, (5) proximity (teacher standing or walking within one classroom desk space of the student).

Whitley's system, like that developed by Good and Brophy, considers the interaction of the teacher with one student at a time. Whitley suggested that the classroom be videotaped so that the teacher could analyze his or her behavior when interacting with different students.

Affective Analysis Systems

Three investigations concerned research on interaction in the affective domain [L. H. Jones (177), Geisinger (128), Bemis and Liberty (29)]. Jones (177) attempted to develop a classification system for the elements of student and teacher evaluative dialogue which could account for (1) the content area (task centered vs. peripheral and open vs. closed), (2) the psychological tone (accepting vs. rejecting and neutral vs. judging), (3) possibility for reflective thinking (long vs. short and repetitious vs. singular), and (4) logical structure (entry vs. sustaining). The classification system developed by Jones consisted of six criteria which were related to the three areas he wanted to investigate. Judging statements were rated on these criteria, each of which was arranged to form a continuum as follows: entry to sustaining, singular to repetition, accepting to rejecting, neutral to judging, task-centered to peripheral, open to closed.

Jones used his system in a study consisting of 20 students enrolled in an art education methods class. The 20 students were assigned to 10 teams. In each team one individual was to act as a student and to draw the same still life with identical materials. During the course of the 90 minute studio period the work of each student was photographed in process as well as at the end of the studio period. Before the next studio period each student met independently with his teacher (played by the other member of the team) for the purpose of evaluating his work and setting up goals for the next studio period. During this evaluative session a tape recording of the dialogue was made. After four studio periods had alternated with three evaluative sessions, the team members exchanged roles and completed four more studio periods and three more evaluative sessions.

Judges listened to the tape recordings, stopping the tape each time either the teacher or the student made a judging statement in order to categorize the statement. Criteria were judged in pairs. Each judge worked with only one criterion pair.

Jones found that closed teachers used more "entries" (significant at the .10 level) or new statements than did open teachers. No significant relationship was found between strategy of student or teacher and any measure of verbal behavior used in the study. The important distinction was predisposition rather than strategy. Jones also found that when students became teachers they acted differently. Some patterns of verbal behavior were almost reversed.

Bemis and Liberty (29), working at the Southwestern Cooperative Educational Laboratory in Albuquerque, developed a classroom observation instrument entitled the Southwestern Cooperative Interaction Observation Schedule (SCIOS). This instrument was designed to record pupil-teacher behavior. Classification of pupil behavior was based on Krathwohl's theory of the three lowest levels of the affective domain: receiving, responding, and valuing. Teacher behavior was based on Sullivan's social-psychological theory of personality, for two major categories of teacher behavior: behavior that results in tension-reduction and need satisfaction for the student and behavior that increases student tension or anxiety.

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Use of the SCIOS in the classroom takes 16 minutes. An additional five minutes are needed for form information (teacher's code number, data and time of class). During this first five minutes in class, the observer records subjective impressions of visual aids and classroom atmosphere. Teacher and student behaviors are then recorded on an observation schedule composed of eight sections. The items in each of the eight sections are tallied each time they occur during a two minute time segment. No individual pupil's behavior is scored more than once during a two-minute period. To promote ease in scoring, the 38 items of the SCIOS are coded on the observation schedule. Twenty items refer to pupil behaviors; 18 to teacher behaviors.

Geisinger (128) used Flanders' interaction analysis behaviors as a model from which to construct an instrument for use with value-clarifying responses by teachers. He called his instrument "Interaction Analysis of Value-Clarification Behaviors" (IAVCB). The instrument has four categories of teacher indirect influence: (1) choosing; teacher asks questions leading students to select, elect or choose a value (a) freely, (b) from alternatives, (c) after consideration; (2) prizing: teacher asks a question leading student to express liking for a value by (a) cherishing or (b) affirming; (3) acting: teaching asks questions leading student to (a) do something or (b) do repeatedly; and (4) asks question: teacher initiates question on a value.

There are three categories of direct teacher influence: (5) lecturing: teacher gives own opinion on values, using various forms of verbalization; (6) rebuking and/or punishing: teacher rejects pupil's questions and/or values, devaluates the worth and competence of the question of the pupil; and (7) dissonant responses: teacher uses dissonant responses to distort pupil's utterance, discredit it, counter it, etc.

Student talk is divided into four categories: (8) student talk-response: student responds to teacher's value-clarifying question (categories 1, 2 or 3); (9) student talk-value indicator: student expresses his own attitude, interest, purpose, aspiration, past or intended activity; (10) student talk-inquiry; student initiates a question to the teacher about a value or asks a question in response to the teacher's question; and (11) silence or confusion.

Geisinger provides five ground rules to be used with the IAVCB system. Data are recorded with the IAVCB in the same manner as with the Flanders' system. An interaction matrix is formed from 11 columns rather than 10 for analysis in terms of percentages of teacher talk and student talk. As with Flanders' system, Indirect/Direct ratios can also be computed.

Flanders-Based Analysis Systems

Geisinger was not the only investigator to use Flander's category system in developing an interaction analysis system. Nine other papers [Zinser (391), Suiter and Queen (348), Forbes (104), Rosenshine et al. (305), Baldwin (400), Handy et al. (461, 462), Blumberg and Cusick (38), Fink (99)] used Flanders' work as a basis for their research. Zinser (391), working for the Cleveland (Ohio) Public Schools, developed a method for making the product of observation systems readily available to school personnel. His input system consisted of three OpScan recording sheets and the output system

of print-outs for each recording sheet as well as summary data. The first OpScan recording sheet provides basic data: observer, teacher observed, school, grade, subject, time, data. The second and third OpScan sheets were constructed to record data gained via OScAR 5V and Flanders' Interaction Analysis System.

Suiter and Queen (348) conducted a study to develop a series of instructional modules to teach inservice teachers the Flanders System of Interaction Analysis. Sixteen performance or behavioral objectives were developed as a result of field-testing. Their report provides details of the nine sessions and includes a copy of the evaluation instrument.

Forbes (104) presented a discussion of the Micro-PIC, a simple form of the Profile of Interaction in the Classroom. The PIC is a feedback method of interaction analysis created especially for teachers and supervisors of instruction in in-service and preservice programs. With the exception of the matrix, it provides all the functions of Flanders' system and is intended to present the teacher with a comprehensive, detailed record of as much as 40 minutes of classroom interaction. The Micro-PIC was developed for use in situations when 40 minutes of interaction data are not required or available, such as in micro-teaching lessons. The Micro-PIC method contains the fundamental concepts and methods of interaction analysis.

Operating on the assumption that wherever interaction analysis is used with teachers in classrooms, the important factors for analysis and discussion are the ratio of indirect to direct teacher behaviors, the relative amount of time consumed by each of the categories, and their sequence of occurrence, the developers of Micro-PIC incorporated these into their observational system. Behaviors in Flanders' categories 1, 2 and 3 are indirect and are always totaled together for revised I/D ratios, so these were tallied in the same column. The most frequently occurring teacher behaviors are 4's and 5's, so there is a column for each behavior. Behaviors 6 and 7 are direct and are always totaled together for revised Indirect/Direct ratios, so these were tallied in another column. Student behaviors 8 and 9 are significantly different so each is provided with a separate column.

Markings employed in the Micro-PIC are the same as those used in the PIC. Tallies representing behaviors are recorded in the three seconds-or-faster rhythm. The sequence of events is maintained, although less precisely. There are three somewhat different methods of marking the Micro-PIC, depending upon the purpose for which the system is being used.

Forbes suggested that the Micro-PIC is most useful when only information concerning the ratio of indirect to direct teacher behavior, the ratio of student to teacher talk, or the ratio of self-initiated to response-to-teacher student behavior is desired. When it is necessary to differentiate between the different types of indirect or direct behavior, the PIC is preferable. When the sequence of events is of primary importance, observers should use the Flanders' system.

Several research reports [Baldwin (400), Handy (461, 462)] concerned the development and use of the FAIR Scale, the Film Analysis of Interaction Record Scale, using the Amidon-Flanders Interaction Analysis Scale to analyze films of 15 minute lessons taught by student teachers.

Rosenshine et al. (305) used the Expanded Interaction Analysis System (EIAS), developed by the Amidons, in a study to investigate whether data from previous research could be used to validate a new observational category system. In the EIAS instrument the original ten categories of Flanders are subscripted in order to identify more specific behaviors which correlate with student achievement.

In the EIAS, category 1 (of Flanders), accepts student feelings is subdivided into acknowledges feelings (1a), clarifies feelings (1c), and refers to similar feelings of others (1r). Category 2, praises contains praises with no criteria (2w), praises with public criteria (2P), and praises with private criteria (2p). Category 3, accepts student ideas becomes acknowledges ideas by simple reflection (3a), clarifies ideas (3c), and summarizes ideas (3s).

Category 4, asks questions is split into asks factual questions (4f), asks convergent questions (4c), asks divergent questions (4d), asks evaluative questions (4e).

Category 5, lectures is composed of factual lecture (5f), motivational lecture (5m), orientation lecture (5o), and personal opinion lecture (5p).

Category 6, gives directions becomes gives cognitive directions (6c) and gives managerial directions (6m). Category 7, criticism contains criticizes with no criteria (7w), criticizes with public criteria (7P), and criticizes with private criteria (7p).

Category 8, predictable student talk is divided into factual student talk (8f) and convergent student talk (8c). Category 9, unpredictable student talk consists of divergent student response (9d), evaluative student response (9e), and student-initiated talk (9i). Category 10, silence or confusion becomes silence (10s) or confusion (10c).

Using audiotapes, typescripts, and residual student achievement scores from an original study, completed in 1970, by Wright and Nuthall, Rosenshine and his colleagues reanalyzed the data via the EIAS. In the Wright and Nuthall study, 17 teachers presented three ten-minute lessons on the black billed gull to intact classes of third grade pupils.

Rosenshine reported that, in this sample, the major advantage of subscripting was found in categories 3 and 4. Using the entire category 3, the researchers found a correlation of .15 with achievement. Subscript 3a yielded a correlation of .30 with achievement. In category 4, the total frequency of questions yielded a correlation of .18. Subscript 4f, asking factual questions, had a correlation of .55 with student achievement, with the high correlation appearing to reflect the factual nature of the material of the lessons analyzed.

Because of sample size (N = 17), differences between correlations had
to be 55 points or more before significant results were obtained. None of
the correlations in category 3 were significant. Significant differences
were obtained only in categories 4 and 9. However, employing subdivisions
for category 9 was not as useful as leaving the category intact. In this
instance, a breakdown into smaller categories reduced the predictability of
each of the smaller components.

Rosenshine suggested that different investigators conduct their tests
on the same data so that, when several category systems are tested with the
same data, more information on the predictive validity of the concepts being
used in each system will result.

Fink (99) developed an interaction analysis system for use in observing
classes of the emotionally handicapped. The Fink Interaction Analysis System,
based on Flanders, has 16 teacher categories and 16 different pupil categories.

The teacher categories are grouped under the headings of "learning
task" (3 categories), control behavior (12 categories), no interaction (1
category). Pupil categories are grouped relative to task (1 category),
self-involvement (1), verbal interaction (3), physical interaction (3), verbal
aggression (3), physical aggression (3), generalized disturbing (1), refusal/
resistive (1).

The discrete teacher categories are as follows:

1. giving: task directions, etc.   9. causal
2. asking   10. exclusion
3. feedback   11. internal rearrangement
4. planned ignoring   12. visual/gestural
5. authoritative   13. reward
6. change tone   14. punishment
7. appeal to value/law   15. manipulation of task
8. surface behavior response   16. no interaction

The separate categories for pupil behavior are:

1. task   9. verbal aggression/self
2. self-involvement   10. verbal aggression/peer
3. verbal interaction/self   11. verbal aggression/teacher
4. verbal interaction/peer   12. physical aggression/self
5. verbal interaction/teacher   13. physical aggression/peer
6. physical interaction/self   14. physical aggression/teacher
7. physical interaction/peer   15. generalized disturbing
8. physical interaction/teacher   16. refusal/resistive

Fink conducted tests to determine inter-observer reliability and reported
reliability coefficients greater than .85, using the Scott formula.

Fink used his system to study a sample of 15 classrooms for the emotion-
ally handicapped, working with public elementary schools and clinics. He
reported the aggregate teacher activity was found to be almost equally divided
between task and non-task behavior. Forty per cent of pupil behavior was

non-task, directed almost equally at peers and teachers. One-fourth of all deviant behavior was accounted for by generally disruptive and resistive behavior. Fink found that classrooms taught by female teachers were more disruptive in that female teachers made greater use of direct commands, appeals to established rules, and in-depth interview techniques while male teachers made greater use of planned ignoring as a control technique.

Curtis and Donlon (77) developed a behavior rating scale designed for use with a videotape protocol for examination of multiple handicapped deaf-blind children. The behavioral rating scale consists of five sections: (1) unstructured orientation of child in examining area, (2) child's task orientation and ability to perform simple everyday tasks, (3) stimulus orientation in which child is bombarded with sensory stimuli, (4) interpersonal orientation, and (5) interview with person working with child. Each of the five sections involve rating the child's behavior in eight categories: auditory, visual, tactile, and gustatory-olfactory reception; object and people centered communication; and tactile-motor and oral expressive communication. The paper containing information about this scale also contains explanations of each section's purpose, the materials and setting required, the role of the examiner, and the time permitted for the section.

Blumberg and Cusick (38) conducted a study to develop and test a method for describing, in a systematic and quantifiable fashion, the nature of the interaction taking place between a supervisor and a teacher. After tape recordings of 50 supervisor-teacher conferences were collected, these were analyzed by use of a 15 category interaction analysis system developed by Blumberg. Blumberg's system was based on the work of Flanders and also of Bales. The system consists of 10 categories for supervisor behavior and of 5 for teacher behavior.

The categories of supervisor behavior are, as follows,

1) support-inducing communications behavior: statements, other than praise, used to build a "healthy" climate
2) praise
3) accepts or uses teacher's ideas
4) asks for information
5) giving information
6) asks for opinions
7) asks for suggestions
8) gives opinions
9) gives suggestions
10) criticism

and the teacher behavior categories are:

11) asks for information, opinions, or suggestions
12) gives information, opinions, or suggestions
13) positive social emotional behavior: not task-oriented but helps to build a "healthy" climate
14) negative social emotional behavior: tends to disrupt the supervisory relationship or produce tension, etc.
15) silence or confusion.

When Blumberg and Cusick analyzed the data obtained in their explora-
tory study, they found the supervisor-teacher interaction to be largely a
"telling" situation, with the primary supervisor behavior being that of giving
information. Supervisors seldom asked teachers for ideas about action or
problem-solving. Teachers rarely asked a question of the supervisor.

The investigators concluded that the data raised questions about the
ultimate productivity of supervisor-teacher interaction. They also concluded
that the Blumberg system could be used in training and feedback situations
as well as in research.

Capelle et al. (63) described two systems developed for use in observing
and describing classroom behavior of teachers and students in foreign language
classes. The first observational system (OS1) analyzes the verbal interaction
from the perspective of Flanders and, not unexpectedly, contains ten cate-
gories: (1) comment: accepts feelings, tension-reducing behavior; (2) response:
praise, reinforcement behaviors; (3) model: provides examples, gives stimulus
for drill; (4) probe: questions about language or conversation questions;
(5) lecturing; (6) direction; (7) correction; (8) (student) response;
(9) (student) initiation; (10) untitled, indicating silence or confusion.

OS2, the second observation system, was designed to reflect the use of
language in the classroom and the teacher's command of the foreign language.
The unit of scoring was the sentence (defined operationally rather than
linguistically). Fourteen categories are found in OS2.

Forty class hours of tape were coded twice, once with OS1 and once with
OS2. The investigators found that the teacher performed two-thirds of the
units of behavior (66.5 per cent) while students performed only 24.5 per cent.
More than half of the total time was devoted to grammar (52 per cent), drills
or explanations. Thirty-six per cent which was described as "general use"
was heavily laden with grammatical intentions on the part of the teacher.
On the whole, teachers used French with a high degree of correctness (91 per
cent). The teachers appeared primarily as lecturers, with 38 per cent of the
lecturing being done in English. The students were primarily respondents.
Nearly half (46 per cent) of the responses were by individuals. More than
one-fourth (27 per cent) were choral repetition responses.

Additional studies in this section are by Garfunkel (452, 453), Ruther-
ford (538), Sharpe (543), Woodley (572), Smith (546).

If one were to attempt to generalize concerning the studies in this
"interaction" cluster, the variety of approaches and methods for interaction
would preclude the development of valid generalizations. Many of the studies
were doctoral dissertations. In many, if not all, of these dissertations,
the researcher felt obliged to develop his or her own analysis system. Most
of the researchers looked at the verbal interaction in "normal" or "average"
classes. Two (Fink, Curtis and Donlon) studies were concerned with atypical
student groups: the emotionally handicapped and the deaf-blind. Good and
Brophy proposed that more research be done relative to dyadic interaction.
Rosenshine suggested that if researchers feel the necessity for developing
a new interaction analysis system, they should use their system with a common

data base to provide more information concerning the predictive validity of the concepts involved. Both of these ideas would seem to merit consideration by researchers.

Nonverbal Behavior Analysis Systems

Another but smaller cluster of studies centered around the development of observation systems designed to analyze nonverbal behavior [Teresa (350, 351), Victoria (364), Galloway (124, 126), Gasson (457)]. Victoria (364) chose to work in art classes. Victoria developed a typology of nonverbal gestural communication behavior as evidenced by student teachers in art. Data from a pilot study and from the analysis of videotapes of 15 lessons, each 30 minutes in length, were used to produce the final instrument. Victoria's instrument contains a typology of seven categories of nonverbal behavior and seven categories of terms descriptive of affective qualities. These are outlined below:

TYPOLOGY OF NONVERBAL BEHAVIOR | TERMS DESCRIPTIVE OF QUALITIES

Transactional Behavior
(Interactive and Spatial)
Eye Contact
Facial Motion
Body Motion
Arm-Hand-Finger Motion
Directed Arm-Hand-Finger
Motion

Supportive
1. Enthusiastic

2. Receptive-Helpful

3. Clarifying-Directive

4. Neutral

Non-Transactional Behavior
(Image Reflective)
Head Motion
Body Motion
Directed Arm-Hand-Finger
Motion

Unsupportive

5. Avoidance-Insecurity

6. Inattentive

7. Disapproval

The categories descriptive of qualities are seen as a continuum on which qualitative effort is rated as being supportive or unsupportive. Each category of gestural behavior is judged relative to a particular category descriptive of qualities on the continuum.

An observation schedule was constructed wherein categories of gestural behavior were organized sequentially beginning with Eye Contact and ending with Arm-Hand-Finger Motion. Space was provided under each gestural category so that judges could record a numeral associated with a particular category descriptive of a quality.

To determine the reliability and validity of the instrument, the researcher and six judges used it in observing three student teachers randomly selected from the videotaped sample of 15 student teachers. Findings indicated that the judges were able to obtain an adequate level of agreement.

Victoria reported that student teacher gestural behavior and the qualities evoked by that behavior were found to be objective elements within contexts of art teaching-learning situations. Nonverbal behaviors were identifiable as to type and kind. It was possible to describe patterns of affect based on terms descriptive of qualities evoked by gestural behaviors.

Head Motion, Body Posture, Facial Motion, and Body Motion were the predominant gestural behaviors observed in the sample of three student teachers. These behaviors evoked predominantly those qualities categorized as "clarifying-directive," "receptive-helpful," and "neutral." The overall qualitative effect of the gestural behavior was observed to be highly supportive and only negligibly unsupportive in the contexts of art teaching-learning situations.

Teresa (350) conducted a study to ascertain whether, in an educational setting, teachers and students are able to identify nonverbal cues in the form of visuo-gestural channel expressions by assigning affective meaning to individual nonverbal emotional expressions. He worked with 413 fourth, fifth and sixth grade students and their 19 teachers in areas classified as fringe-urban and suburban. Among the instruments Teresa used was a 16-mm film (of a trained actress) which depicted nine emotional expressions: fear, disgust, happiness, surprise, suffering, anger, contempt, determination, and joy.

Students and teachers viewed the film episodes and completed a feedback sheet which included a semantic differential as well as items designed to obtain demographic information. In addition, three students were taken out of each class and interviewed to obtain the same information as that gained by the paper and pencil instrument.

Teresa reported that teachers and students were capable of correctly identifying the non-verbal emotional expressions with respect to categorizing affective meaning. When responses were factor analyzed, fear, disgust, anger, determination, and suffering were found in one cluster referred to as the negative cluster. The positive cluster included happiness and joy. A third cluster contained surprise and contempt. This cluster was classified as neutral. Both teachers and students clustered along these three dimensions. Analysis of factor scales revealed some significant differences between teachers and students for specific emotional expressions. The activity dimension factor scales of calm-excitable, still-active, and relaxed-tense were interpreted differently by teachers and students, perhaps due to the greater verbal sophistication of the teachers.

Differences between students' ability to interpret nonverbal communication were related only minimally to sex and I.Q. differences. Difference in school location was an important factor in the students' ability to perceive and interpret nonverbal emotional expressions. There were significant differences in grade level interpretation, with the greatest differences occurring between the fourth and sixth and fifth and sixth grade levels. However, these differences in maturation related only to specific factor scales for specific emotional expressions.

Teresa and Francis (351) presented an interpretation of this same research at the 1972 AERA meeting. In their presentation they discussed implications of the research findings. They suggested that teachers need to be more careful

of communication in those nonverbal cues relating to fear, anger, determination and surprise. Teachers can, however, rely more on the congruence of their nonverbal cues for other emotions. The authors consider it important for teachers to know which kinds of nonverbal cues pupils tend to perceive similarly with them and which pupils do not.

Galloway (124, 126) in his work related to nonverbal communication in the classroom has provided a model for observing teacher nonverbal behavior. His instrument consists of 12 categories developed through the use of two dimensions: encouraging-inhibiting and teacher-initiated to teacher-response. Galloway considers encouraging nonverbal activity to have six characteristics: (1) congruity between verbal intent and nonverbal referents, (2) responsive to feedback, (3) positive affectivity, (4) attentive and listens to others, (5) facilitative by being receptive to others, and (6) supportive of pupils or pupil behavior. Nonverbal communication that is inhibiting is characterized by (1) discrepancy between verbal intent and nonverbal referents, (2) unresponsive to feedback, (3) negative affectivity, (4) inattentive to others, (5) unreceptive to others, and (6) disapproving of pupil behavior.

Galloway's model appears as follows. The left side of the model is communication that is teacher initiated and the right side is viewed as teacher response.

Teacher Initiated	Teacher Response
Congruity-Incongruity	Attentive-Inattentive
Responsive-Unresponsive	Facilitative-Unreceptive
Positive-Negative Affectivity	Supportive-Disapproval

When this model is translated into a category system, it appears as:

	Encouraging	Inhibiting
Teacher	1. Positive Affectivity	7. Negative Affectivity
Initiated	2. Responsiveness	8. Unresponsive
	3. Congruent	9. Incongruent
Teacher	4. Attentive	10. Inattentive
Response	5. Facilitating	11. Unreceptive
	6. Supporting	12. Disapproving

Observers are required to make inferences concerning the influence and instrumental effect of the teacher's nonverbal behavior on a pupil or pupils. Observers note the occurrence of a nonverbal message relating to the encouraging-inhibiting continuum by recording the number that represents the category for the action in a vertical column. Three kinds of nonverbal behaviors are particularly important: facial expressions, gestures and body movements, and vocal intonations and inflections. There is no arbitrary time limit, such as three seconds, set for categorizing.

Galloway has stated that greater advances in the development of valid observational systems have been made with verbal rather than with nonverbal behaviors. He has also written, in 1967, that there were no observational techniques that provide valid data regarding the communicative effects of

pure nonverbal expressions independent of the verbal. Galloway suggested that any analysis of teacher-pupil interaction must include the nonverbal as well as the verbal components.

Verbal-Nonverbal Analysis Systems

A number of researchers have developed observational systems in which they look at both verbal and nonverbal behaviors [French (109), French and Galloway (110, 111), Heger (155, 156), Schalock (320), Olivier (261), Jones (178), Amidon (394), Walker and Adelman (366), Medley (511), Dodge (81)].

Dodge (81) completed a doctoral study in which he devised, tested, and validated an instrument for assessing teachers' nonverbal interaction patterns and interrelated the verbal and nonverbal patterns. He used Flander's system to collect verbal data. He worked with seven nonverbal attributes, in polarized form (+ or -), and a neutral attribute. The nonverbal attributes were level of feeling toward pupil, level of reinforcement, level of response to need, handling conflict, matching verbal and nonverbal, using humor, being attentive or inattentive, and no nonverbal interaction. Judges were used to ascertain which nonverbal attributes would be expected to occur in association with each verbal category.

Classroom interaction was videotaped for data analysis. Eighteen trained observers, using both verbal and nonverbal instruments simultaneously, achieved an average nonverbal reliability coefficient of 64.0 per cent, calculated against the mean response, and 50.1 per cent based on inter-judge correlation. Four hours of training were provided prior to the reliability check.

Schalock (320) described a system for measuring instructional and management parameters of teaching through a method of classroom observation in which live observers, as well as tapes, record teacher and learner behavior (both verbal and nonverbal) and the social-political-physical characteristics of the setting. The instrument is called the Teaching Research (TR) system. Two separate interaction analyses are made in the TR system, one involving face-to-face observation as instruction occurs and one involving an analysis of audio- or video-tape of the instruction after it has occurred. The face-to-face observation provides data on (1) the focus of both teacher and learner interaction, (2) verbal and nonverbal instructional operation used by the teacher, and (3) the affective qualities accompanying both teacher and learner behavior. It also provides a running record of the classroom activities accompanying instruction. Tapes are used to obtain data for analysis of the content of the teaching-learning process.

The basic unit of measurement employed is defined in terms of a message or unit of meaning. This is subdivided into two other units: the interact and the interactive exchange. An interact is defined as a message that is directed to another. The interactive exchange consists of a series of interacts exchanged sequentially by two or more people that are interrelated or that have a common base through the fact that the entire sequence of interaction grows out of and relates to the interact that opened the exchange.

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In recording live in the classroom, the observer must do four things.
He must identify each interact (verbal or nonverbal) exchanged between
teacher and student. He must classify each interact in terms of its focus,
its affective qualities, and the instructional or management operation it
represents. He must record the various interacts in patterns which correctly
reflect the situation. He must record the subject matter area and classroom
activity within which the interaction is occurring. All observations are
recorded in running record form, by hand, on an observation sheet. The ob-
server's attention is focused on the teacher. Any behavior in the classroom
that does not involve the teacher's attention is not recorded.

Teachers are assumed to influence behavior and development of their
pupils. Three broad classes of teacher behavior have been identified:
caretaking, socializing, and teaching. If the focus of teacher behavior is
other than teaching, no further analysis is made after the focus is identified.
If the focus is on teaching, this is further analyzed relative to whether it
represents training, instruction or enculturation and whether it is an instance
of focal or facilitatory influence. Teaching operations are classified into
three categories: exposure to information, precipitation of performance, and
evaluation of performance.

When teaching behavior is analyzed on the basis of its structural
properties, it is analyzed for teaching tactics and teaching moves. Both
tactics and moves refer to how messages are transmitted or the form in which
they are transmitted.

Additional levels of analysis are explained and illustrated in Schalock's
paper as are sources of evidence for the utility of the TR system in research,
based on tests of reliability and validity.

Walker and Adelman (366) devised an observational recording system to
record classroom events so that the sequence of both verbal and nonverbal
events could be identified. Rather than using videotaping procedures or
closed circuit television, they made 35mm stills from 16mm film of the class-
room. The stills were then synchronized with audiotape recordings. These
investigators were stimulated to begin their research by reading about the
work of Louis Smith (Complexities of an Urban Classroom, Holt, Rinehart, and
Winston, 1968). Smith found that if an observer spent several weeks or months
in one classroom he became aware of the classroom interaction of teachers and
children as part of an on-going process in which there is continuous change.
Although Walker and Adelman did not develop a specific verbal-nonverbal obser-
vational system for their research, their work is cited here because it
identifies another possible method for analyzing teacher-pupil interaction,
both verbal and nonverbal. In addition to being used as a research tool,
their method lends itself to preservice and in-service teacher education
programs.

The next series of papers within this cluster of studies about verbal
and nonverbal behavior was produced by researchers who worked with Galloway
while they were doctoral students. French (109) completed a dissertation
in which he studied communication events and teacher behavior: verbal and
nonverbal. Working with Galloway, French developed the IDER system. The

name for the system was taken from the Flanders' conceptualization of teacher influence as Indirect or Direct and from the French-Galloway conceptualization of nonverbal cues as Encouraging or Restricting.

The IDER system may be represented as follows:

Indirect - Direct (verbal)	Encouraging - Restricting (nonverbal)
1. Accepts student feeling	
2. Praises or encourages	Congruent-Incongruent
3. Uses student idea	Implement-Perfunctory
4. Asks questions	Personal-Impersonal
5. Lectures--gives information	Responsive-Unresponsive
6. Gives directions	Involve-Dismiss
7. Criticizes or justifies authority	Firm-Harsh
8. Student talk (response)	Receptive-Inattentive
9. Student talk (initiated)	Receptive-Inattentive
10. Silence or confusion	Comfort-Distress

An additional instrument used to gather data for French's study was the I-P-T model of classroom communication, designed by French. Later papers by French (110, 111) refer to the model as PIT rather than I-P-T as in his dissertation. Regardless of the sequence of initials, the model refers to classroom communication as the events of this communication may be classified as institutional, task, personal, or mixed. Institutional events are related to managing the classroom and meeting the expectations of the institution. Task events are focused on teaching and learning subject matter. Personal events center on personal needs, goals, and emotions of a pupil, a group of pupils and/or the teacher. Mixed events are those containing elements of two or more of the preceding types. Duration of a communication incident is recorded by tallying dots after the appropriate symbol at three second intervals as long as the event continues.

For his doctoral research French worked with 12 junior high school teachers and their pupils. All of the individuals were in one junior high school. The content areas of English, mathematics, science and social studies were represented, with three teachers of each subject being involved in the study. Classroom interaction was recorded on videotape.

French found that the IDER system could be used to describe classroom interaction and events. He reported that his data showed that what teachers did was as important as what they said and that there was no direct proportionate relationship between verbal and nonverbal influence. The nature of one could not be assumed from the content of the other.

French also reported that both the content and process of communication appeared to be significantly related to the institutional roles and expectations of both teacher and pupils. There was a lack of pupil talk even during personal communication events. Teachers controlled and initiated most events, even of an individual nature. Teacher influence was direct during many communication events of all types. The behavior and communication patterns of the male and female subjects of the study were similar. The

instructional procedures in the junior high classrooms of French's study tended to focus more upon the group than upon the individual students within the group. In addition, there was a lack of emphasis placed upon personalized communications in the classrooms.

Heger, who also worked with Galloway, developed the Mini-TIA system for analyzing interaction (155). This system, the Miniaturized Interaction Analysis System, was developed to permit improved analysis of classroom communication in conjunction with videotaping. Each of the seven event categories is sub-divided into two categories according to the nature of the nonverbal events paralleling them. Categories were developed from three key concepts about teaching. One, both teachers and students have classroom roles. For teachers, these include an institutional or control role, a knowledge conveyance role, or a role as developer of student personalities. For students there is a learner role or a role as a developing personality. Two, the interaction process is the sum of verbal and nonverbal events, usually in some combination. Three, work with Flanders' Interaction Analysis System has demonstrated the desirability of maintaining the direct-indirect teaching concept.

The 14 categories of the Mini-TIA are as follows:

ROLE	CATEGORY NUMBER	VERBAL EVENTS	NONVERBAL EVENTS		
The teacher's role in personal development of the students	1	REINFORCEMENT BY THE TEACHER: Teacher accepts student feeling, praises, encourages student. Any teacher expression rein-forcing student except use of student idea	+ Sincere Supportive Appropriate	vs vs vs vs	- Insincere Non-supportive Excessive
	2	USE OF STUDENT IDEA BY THE TEACHER: Significant development of idea first introduced by a student. More than a mere repetition of idea.	+ Implementing Sincere Supportive Appropriate	vs vs vs vs	- Perfunctory Insincere Non-supportive Excessive
The teaching role	3	CONTENT PRESENTATION BY TEACHER: Teacher lectures and questions.	+ Spirited Responsive Congenial	vs vs vs	- Monotonous Unresponsive Uncongenial

ROLE	CATEGORY NUMBER	VERBAL EVENTS	NONVERBAL EVENTS		
The institutional role	4	CONTROL OF STUDENTS BY TEACHER: Teacher directs, commands, orders, corrects, criticizes or justifies authority.	+ Facilitating Adjusting Concerned	vs vs vs vs	– Punitive Corrective Disdainful
The learning role	5	STUDENT TALK ABOUT CONTENT: All student talk which is relevant to student learning whether directly connected to lesson pattern or not.	+ Responsive Supportive Eliciting	vs vs vs vs	– Unresponsive Non-supportive Suppressing
The personal growing role	6	STUDENT TALK ABOUT PERSONAL NEEDS: All student talk which is un-related to any cognitive learn-ing but which relates to personal needs, desires, wants, or frustrations.	+ Supportive Eliciting Concerned	vs vs vs vs	– Non-supportive Suppressing Disdainful
		SILENCE OR MULTIPLE TALKING:	+ Comfort Purposeful Productive	vs vs vs vs	– Distress Aimless Non-productive

An observer using the Mini-TIA records a sample of the classroom inter-action every three seconds for the duration of the lesson. It is not necessary to make a detailed and instaneous judgment each three seconds because the concern is with events rather than minute details. Tallies are recorded in columns that are 20 tallies long. Once the data are recorded in tally form, numbers are paired for placement in a matrix.

Heger (156) reported an observer reliability study involving students enrolled in a general secondary methods course and their instructors. Students in this course were usually taught the Flanders system and were considered successful in their achievement when they had reached a .60 level of reliability. Of the 52 students randomly selected to participate in this study, 39 achieved reliability of .60 or igher on a single viewing of a complex 15 minute lesson.

A second study which Heger reported involved an investigation of the relationship existing between the Mini-TIA and the affective response to classroom communication events when observers were held constant. The

Davidson-Lang checklist was selected to measure affective response. The checklist was modified to include three additional items relating to the indirect-direct concept of the verbal dimension of the Mini-TIA.

Two randomly selected videotapes of junior high school lessons (English, science) were selected for the study. Nine individuals were randomly selected from students, enrolled in an introductory freshman survey course in education, who had volunteered to participate. The students viewed the videotapes and immediately completed the adjective checklist. They were then instructed in the use of the Mini-TIA system and were given a week in which to learn and practice the skills involved in its use. Following this, they recorded the interaction on the same tapes. The students were then asked to participate in an open discussion and to prepare informal written reports about the use of analytical systems and the nature of the two lessons viewed.

Heger reported that the verbal categories revealed little difference between the two lessons, except that more time was spent in teacher talk in the science lesson which had included a significant amount of demonstration with reptiles. The nonverbal Mini-TIA categories revealed significant differences between the two lessons. The English lesson included a greater amount of incongruence, stress, and negative nonverbal elements. When the items on the D-L checklist were considered, Heger found the students had given a mean overall rating of .306 to the English lesson and a mean rating of 3.71 to the science lesson. Nineteen of the 27 individual items differed in favor of the science lesson. Thirteen of these differences were of a magnitude greater than the cumulative mean. The science teacher was generally viewed more favorably in a nonverbal sense. When correlations between Mini-TIA and D-L data were computed, no significant relationships were identified.

Two other papers [Olivier (261), Jones (178)] provided information about the System for the Analysis of Classroom Communication (SACC) which has been devised for the systematic observation of verbal and nonverbal classroom behavior. Olivier (261) described data collection and reduction procedures in his report. Coders employ data sheets which contain numbered cells for recording behavior at five second intervals. Each sheet contains 180 numbered cells. Recording of behavior is facilitated by a timing device which emits a click and a flash of light every five seconds. When an observational session has been recorded, data from the coding forms are tabulated on tally sheets and summed to obtain categorical frequency totals. Then data are transferred to a summary sheet. Inter- and intra-observer agreement are estimated through the use of the Scott coefficient.

Jones (178) assessed the reliability of the SACC, using the Scott coefficient. Her sample consisted of six schools. Twenty teachers working in eight different subject areas and with eight different grade groups were involved. In some cases there were repeated measures on individual teachers. Most of the students came from homes of average socio-economic status. Most were "Angelos" but some Mexican-Americans were involved. Sessions (defined as coherent curricular units) varied in length from seven to thirty-four minutes. Two observers participated in the study.

The SACC instrument is a category system with 12 major dimensions. Five dimensions refer to teacher behavior, five refer to pupil behavior, and two refer to either or both. Within the major dimensions are varying numbers of subcategories, the number depending upon the kinds of distinctions that coders have been able to make. The total number of categories is 31, with four additional symbols used for special situations. Coders are expected to memorize the system.

Eleven nonindependent coding sessions took place. Inter-observer agreement, using Scott's coefficient, was about 75 per cent. This was considered sufficiently high to permit use of the instrument for evaluation purposes. Two weeks of half-time work seemed adequate to train coders. Some teaching experience appears necessary to provide background information relative to understanding the category system.

Systems for Analyzing Classroom Climate

Because teaching does have cognitive and affective dimensions, as well as psychomotor aspects, the use of observational systems, such as those described in this subsection, for the analysis of nonverbal as well as verbal behavior is both desirable and necessary in order to provide a comprehensive picture of the interaction. There are research problems which do not involve both verbal and nonverbal variables, and there are behaviors that teachers wish to improve that are predominantly verbal. For such situations, a verbal observation system will suffice. However, if a more complete picture of teacher-pupil interaction is desired, to consider only verbal or only non-verbal behavior seems ill-advised.

Nonverbal behavior and verbal behavior may be considered to influence the climate developed in a classroom. The climate may be inferred from results obtained via some of the observation systems already described. However, other research studies dealt more directly with classroom climate [Hedspeth (154), McMillan (233), Bohlken and Giffin (409), Coates et al. (71), Barclay (19)]. Hedspeth (154) developed a five category instrument. The categories were I. Classroom Environment, II. The Teacher, III. The Pupil, IV. Teacher-Pupil Interactions, and V. Curriculum Areas. He also developed a training manual and a recording guide to accompany his instrument. Each item in the instrument was categorized as positive (implying good teaching practices or classroom conditions), negative (less desirable teaching practices or classroom conditions), and neutral (little or no relationship to teaching practices or classroom conditions). Hedspeth used his instrument in a pilot study and then in two different school districts. In the final field test, the principal of the school trained the observers. Details concerning the specific items or the results were not available in the material reviewed.

McMillan (233) developed an instrument to measure the degree to which desirable outcomes and beneficial results of various group procedures considered aspects of the group dynamics movement were achieved in sensitivity training. He looked at both verbal and nonverbal techniques of communication. His instrument, named the McMillan Affective Relationship Scale (MARS), contained 64 items. Respondents checked each item on a nin-point continuum ranging from "Never" to "Always." McMillan developed the items in his

instrument from an analysis of group process literature which had resulted
in the identification of 16 distinct categories of outcomes and benefits.
Thirteen nonverbal techniques of communication, identified from a literature
search, were used as independent variables in McMillan's investigation.

Twenty university graduate students randomly assigned to one of two
groups participated in the study. Both groups interacted verbally for five
hours, following which each person rated himself and each of his fellow
group members on the MARS. Each group acted as its own control. Following
the first session, one group interacted verbally for the next 35 hours. The
second group interacted verbally and was also exposed to the 13 nonverbal
techniques of communication. At the conclusion of the second session, the
rating procedures were again used.

McMillan reported that 15 of the 16 categories indicated a test-retest
reliability coefficient of .80 or greater. Ten of these coefficients were
.90 or more. Fifteen of the 16 categories produced inter-item consistency
percentages of only one point variation on the nine point continuum in 87
per cent of the 400 ratings obtained. Both sensitivity group experiences
involving verbal interaction only and sensitivity group experiences involving
verbal interaction plus selected nonverbal techniques of communication resulted
in significant self-perception changes and changes in perception by others.
Neither the verbal-only nor the verbal plus nonverbal group changed signifi-
cantly more than the other, however.

Barclay (19) designed the Barclay Classroom Climate Inventory to measure
self-competency skills, peer evaluations, vocational awareness, and teacher
judgments of elementary school children. The BCCI can be administered to
third through sixth graders. It takes 45 minutes of classroom time. The
various items of the self scales are based on skill competencies grouped
through internal consistency into four basic categories: artistic-intellectual,
realistic-masculine, social-conventional, and enterprising. Group choices
are then made regarding the individuals who can best do these same type of
skills. In addition, there are items relating to reticent and disruptive
behavior for the group scales. The vocational awareness scales are grouped
in the same categories and ask about interests in various kinds of occupations.
The final section of the instrument is a list of 62 adjectives descriptive
of personal and social adjustment as well as effort and motivation. The
teacher checks only those adjectives which typically apply to the child's
behavior. The BCCI yields 23 independent scales and nine total (summary) or
non-independent scales. Barclay reported his instrument to provide not only
information concerning the behavioral and social skills of individuals in
the classroom but also concerning the group characteristics of the classroom
which foster a learning environment.

Coates et al. (71) presented a paper, at the 1970 AERA meeting, in which
two process-oriented classroom observation scales were described. They also
provided information about a research study which offered further support for
the validity of the instruments. The two observation scales, developed by
O. J. Harvey and others, are the Teacher Rating Scale and the Student Rating
Scale. The Teacher Rating Scale was devised specifically as a measure of
classroom atmosphere. The Student Rating Scale was constructed to assess
certain effects of different teacher behaviors and classroom climates upon
the students.

The instrument used as a criterion against which the replicability of the apparent validity of both scales was tested was the "This I Believe" (TIB) test. This instrument measures concreteness-abstractness and classifies respondents into one of four principal belief systems.

The research involved preliminary administration of the TIB and repeated usage of both observation scales as part of an evaluation of a teacher retraining program in a large suburban school district.

The observation scales are not provided in the AERA paper. However, tables showing results of factor analysis are included. Factors for the Teacher Rating Scale fell in two clusters: I. Fosters Exploration and II. Dictatorialness. Within Cluster I are twelve items whose factor loadings range from .94 to .73. Within Cluster II the nine items have factor loadings ranging from .91 to .70.

The Student Rating Scale had four factor clusters. Cluster I, Self-expression, contains five items (factor loadings range from .82 to .71); II. Task Attentiveness, 12 items (.91 to -.62); III. Creativity, five items (.89 to .72); IV. Respect for Peers, four items (.87 to .75).

Results of the study reconfirmed the earlier findings of Harvey that the concreteness-abstractness of teachers' beliefs affects their behavior in the classroom and that this differential behavior, in turn, influences the performance of the students. The replication of both the validity and reliability of the two rating scales indicated that these two instruments could be used effectively to assess certain kinds of teacher behavior or classroom climates as well as the effects of these behaviors and atmospheres upon the students' performance. These rating scales focus on the process of teaching and not upon specific content. Therefore, they may be used with various teaching approaches and subject areas. In the form reported in the 1970 paper, the scales are more applicable to elementary grades than to higher grade levels and to situations in which the classroom is more under the control of a single teacher rather than a team of teachers.

Coates et al. warn against possible contamination of ratings which may occur when the same observer rates both teacher and students. In the research reported, the observers concentrated on and rated the behavior of the students as a class before turning their attention to the teacher. Previous work had indicated that the relationship of student and teacher ratings made in this way by the same observer was no higher than that between separate ratings of the teacher and students made by different observers. Complete absence of contamination did not result but the procedure apparently produced more valid ratings than those yielded by using two observers.

Analysis Systems for Assessing Teacher Performance

Additional instruments were developed for use in assessing teacher performance and judging effectiveness [Flora (103), Bogard (39), Hunt (169), Johnson and Bauch (174), Lesniak (205)]. Bogard's (39) research problem involved establishing construct validity of the Shawnee Mission Instrument for the Observation of Teaching Activities. Data obtained via the SMIOTA were compared with those obtained via the IOTA. Forty-seven secondary school

teachers were observed by six trained observers. Observers worked in pairs with each member of the pair using a different observational instrument (IOTA, SMIOTA). Bogard found the median percentage of agreement between raters to be .87 when the IOTA formula was used and .847 when the Scott Pi formula was applied, revealing a marked to moderate relationship between the two instruments.

Flora (103) developed an instrument to use diagnostically in a methods course designed for prospective teachers of secondary school mathematics. His instrument, the Teaching Situation Reaction Test for Teachers of Secondary School Mathematics (TSRT-TSSM), is a 50 item test which defines a mathematics teaching assignment and a number of teaching situations which are hypothesized to occur during the course of a school year. Each item is designed to measure one of ten teacher behavior characteristics defined for the study. The ten scores produced (one for each of the characteristics) provide a profile purported to indicate the beliefs of an individual concerning these characteristics.

Flora administered his instrument to a group of experienced teachers, each of whom had been classified as highly effective or minimally effective in teaching secondary school mathematics; a second group of in-service teachers; preservice teachers with no teaching experience; and preservice teachers who were enrolled in student teaching. He concluded that test scores for highly effective teachers were significantly higher than those for minimally effective teachers of secondary school mathematics and that for a number of teacher behavior characteristics being measured, profiles of the two groups were significantly different. He indicated he had found satisfactory test-retest reliability and that the instrument was resistant to faking. Flora felt his instrument could be used to predict the degree of success in a first mathematics methods course and in student teaching in mathematics.

Lesniak (205) determined the validity and reliability of the Classroom Control Task as a means for assessing specified characteristics in urban teaching interns. He also attempted to determine whether the characteristics of "strength" and "sensitivity" were innate or developmental in the subjects. "Strength" refers to an overall impression given by a teacher which indicates that he is in control of himself, his pupils, and the factors which make up the classroom environment. "Sensitivity" refers to the ability of an individual in a teaching role to predict how a pupil will act and feel in a variety of classroom situations.

The reliability study utilized 54 applicants to the Urban Teacher Program of Syracuse University. All individuals were given the same feedback of information to help improve their performance in the task and were asked to repeat the task. Ratings were made by the same raters, using the Classroom Control Task observation sheet.

The problems of validity and of the developmental characteristics were investigated, using 20 individuals enrolled in the Urban Teacher Preparation Program. These individuals were rated on a task observation sheet by three role players and two raters. They were then observed during the six week Summer Demonstration School as well as during their Fall and Spring

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internship. The internship ratings were made by two different raters, using the task observation sheet. In the validity study, Lesniak identified relationships between the task and Summer classroom observations in eight of the nine characteristics at the .05 level of significance. No significant relationships were discovered between the task, Summer videotaping, and Fall or Spring classroom observations. There was an upward linear trend in observation scores significant at the .01 level in eight of the nine characteristics studied, suggesting that the characteristics are developmental and subjects can be prepared for them. The reliability study showed relationships between the total characteristic scores of "strength" and "sensitivity" in administration of the task, time one and time two, to be significant at the .01 level. Lesniak concluded that the results, although favorable, were not conclusive without research with a larger and more experienced teaching population.

Hunt (169) developed a situation test to assess the sensitivity and flexibility of teacher trainees in situations where the learner's frame of reference differs from the trainee's. Entitled the "Communication Task," the method involved having the trainee communicate, in 15 minutes, the concept of "balance of power in federal government" to a role player. The background of the role player was sketched as that of a 30-year-old Venezuelan immigrant who worked in New York City as a waiter and who hoped to pass the citizenship examination. The immigrant had had two or three sessions on state government. The individual playing the role of the immigrant was provided with five questions he could ask the trainee through which he could supply the trainee with implicit information about his frame of reference.

Trainee behavior was rated on several dimensions by at least one observer. Trainee reaction to each of the five predetermined questions was rated on a nine-point adaptation scale ranging from "1" which was completely insensitive to "9" which involved modulating the trainee's frame of reference in a flexible fashion. Inter-rater reliability was found to be a function of the experience of the raters and, for experienced raters, ranged from .85 to .92.

Hunt provided information about the results of the adaptability rating. The Communication Task was used in two pretraining assessment programs of Peace Corps trainees. For 178 trainees, correlation was .21 ($<$ .01) and for a sample of 53 Peace Corps trainees to be trained as teachers in Tanzania, the correlation was .33 ($<$ .01) between adaptability and final board rating.

Although the Communication Task was a specific one and provided information about only one skill component, that of adaptability or sensitivity, this component is an important one. Hunt reported that trainees high in sensitivity did not always perform most effectively in classrooms of culturally disadvantaged students. Further investigation provided evidence that this lack of correlation might be that another component was operating--that of ability to regulate and control classroom behavior.

To test this hypothesis, a Control Task was designed. It consisted of having three students play roles as sixth graders in a culturally disadvantaged school who presented discipline problems by talking without permission, leaving their seats, acting bored, etc. Using the Control Task in

combination with the Communication Task provided a very general pattern of an individual's capacity on both the sensitivity and strength components. Hunt suggested that the prospective teacher's performance be videotaped and used as feedback to enable him to modify his behavior.

Johnson and Bauch (174) developed a four-part checklist designed for use in determining the extent to which elementary school personnel at various levels (teacher, teacher's assistant, teacher aide) have acquired particular competencies. Part 1 of the instrument is entitled "General Behaviors, Qualities and Competencies Characteristic of Teachers in Early Childhood and Elementary Schools" and contains 19 items, each of which includes three possible descriptive responses. A sample question from this part of the checklist might be: Does the person show sufficient patience and understanding with children? Part 2, "Specific Behaviors Performed by Certified Teachers in Early Childhood and Elementary Schools," contains 84 items with four possible responses. Responses range from "performs this behavior with a high measure of skill and efficiency" to "not applicable or no basis for judgment." Part 3, "Specific Behaviors Performed by Teaching Assistants in Early Childhood and Elementary Schools," contains 37 items. Part 4, "Specific Behaviors Performed by Aides in Early Childhood and Elementary Schools," contains 31 items. Each of these parts has the same four choices for use in responding to items as those mentioned relative to Part 2.

An additional group of researchers looked at the problem of self-evaluation instrument development [Hartford Public Schools (147), Roberson (299, 300), Shibata and Roberson (326)]. A teacher evaluation checklist (147) was designed for use in the Hartford, Connecticut, public schools for the purposes of teacher self-evaluation as well as for use by administrators. One of the purposes of the checklist was to provide criteria for objective observations and to assess the quality of teaching activity. The individuals involved in the development of the instrument used as a model a similar document produced by the Cupertino, California, School System in collaboration with San Jose State College. The Connecticut document consists of a descriptive discussion of teacher performance in eleven areas, rating scales, and appropriate observational forms. The 11 areas of concern are (1) effective use of instructional materials, (2) utilization of attractive interest centers, (3) variety in classroom activities, (4) identification of learning difficulties, (5) cooperative teacher-pupil planning to develop and achieve goals, (6) maintaining classroom control, (7) teacher awareness of pupil behavior, (8) subject matter preparation, (9) relevance and utilization of current application of subject matter, (10) teaching for democratic values and attitudes, and (11) provides opportunity for wide student participation. Each of these areas of concern has a five-item scale for use in evaluation. For example, the scale relating to the concern of "identification of learning difficulties" contains these items:

The teacher

A. Disregards individual learning difficulties.
B. Identifies most cases of learning difficulties; and provides effective individual and group instruction.
C. Is skilled in identifying learning difficulties; provides effective and relevant instruction for both individuals and groups.

D. Identifies obvious learning difficulties; ineffective in providing help.
E. Identifies general learning difficulties; provides group instruction accordingly.

The materials related to the checklist are an observation guide for use in the classroom, a profile form for permanent recording of the evaluation results, and an interview guide to be used in evaluating non-classroom activities such as teacher-parent relationships, professional growth activities, etc.

Roberson (299, 300) developed the Teacher Self-Appraisal (TSA) instrument for use when teachers assess their performance by viewing it on videotape. The instrument is divided into three sections: methods, objectives, and expressions. Methods are considered as being closed or open. Closed methodologies are lecture, demonstrate, direction, question (for specific information), mastery, and problem solving (problem is set by teacher, has a predetermined solution). Open methods include clarification (by student), inquiry, and dialogue.

Objectives are classified as affective or cognitive. Affective objectives consist of receive (student listens), respond (teacher intends for the student to comply), and value (teacher intends for student to realize the worth . . .) Cognitive objectives include know, comprehend, apply, synthesize, and evaluate.

Expressions are considered as either verbal or nonverbal. Verbal expressions include support, helping (teacher gives cues), receptive, routine, inattentive, unresponsive, and disapproval. Nonverbal expressions are support (facial expressions, voice tone), helping, receptive (eye contact), routine, inattentive, unresponsive, and disapproval.

Behaviors relative to methods and objectives focus on the teacher. Objectives focus on the student in that the objectives are specified in terms of what the teacher intends that the student do. The nine levels of objectives are based on Bloom's taxonomy, with three objectives in the affective domain.

A TSA coding card was developed for use with the system. Teachers using the system play the videotape, observe their behavior, and mark it in the appropriate area at regular intervals (ten seconds). They then compare their actual performance with the objectives and methods which they had planned for the lesson prior to teaching it.

In another document relative to his TSA system, Roberson reported that reliability in use of the instrument is usually established after five hours of training. Master training tapes are used to establish observer reliability. A chi square adaptation is used in estimating observer reliability.

The deck of TSA cards that results from the videotape analysis can be computer processed to provide feedback. The print-out will show (1) percentage of time spent using certain methods, (2) frequency of student participation, (3) range of cognitive responses obtained from students, and (4) percentage of encouraging, routine, and inhibiting expressions the teacher displayed.

Roberson also described what he termed a "feedback agent observation system." The feedback agent may provide five levels of feedback to the teacher. The observation system provides six categories of feedback agent talk as well as two categories of teacher talk. The five levels of agent feedback are (1) congruence, talk concerned with establishing consensus between the teacher and feedback agent with respect to the intent of the lesson/task/situation(s) observed; (2) description, talk concerned with describing the information collected during the observation period; (3) analysis, talk concerned with comparing collected data and/or observations with the intent of the lesson/task/situation(s) observed; (4) alternatives, talk concerned with suggesting or recommending changes or alternatives with respect to what might be done in the future to improve the degree of accomplishment of the original intent or to implement a different set of objectives, methods, facilities, content areas, or organizational structures; and (5) talk, talk not directly related to any of the previous levels.

The six categories of feedback agent talk are (1) accepting feelings, (2) praise or encouragement, (3) accepting ideas, (4) asking questions, (5) lecture and direction, and (7) criticism. (No number 6 in document.) The two categories of teacher talk are (8) response and predictable talk and (9) initiation and unpredictable talk.

Interaction is coded at ten second intervals, marking the level of feedback and category of talk. Audiotaping is preferred to videotaping because the emphasis of the feedback agent observation system is verbal.

Roberson provided the same information concerning the establishment of reliability for the feedback agent system as for the TSA. When information from the feedback agent observation system is recorded on a profile sheet, various things can be computerized: percentage of feedback agent talk and teacher talk, levels and pattern of feedback.

Shibata and Roberson (326) developed a teacher guide for self-appraisal as a part of an in-service program funded under ESEA, Title III. This guide included a section concerning the writing of instructional objectives based on Bloom's taxonomy, including examples and exercises. Shibata modified Roberson's TSA system by rearranging the order of the sections and by eliminating the category of "dialogue" from the teacher methods section. This behavior had been described, in the TSA, as "teacher allows students to interact, react, and discuss a topic or idea with interjections, but not inhibiting behavior."

The in-service program was designed to take place in four three-hour modules. Following the training, teachers were to videotape their teaching (on a voluntary basis). Teachers were urged to view and analyze their tapes as soon as possible after teaching, with immediate analysis considered as providing maximum benefit.

The self-evaluation system designed by Roberson appears more conducive to objective observation and analysis than does that developed for use in the Hartford Public Schools. In addition the information obtained by use of the TSA can be recorded directly on cards for computer processing. This method eliminates both time and effort that are required when most observation

instruments are used in transferring data from observation forms to coding sheets so that the data can be put on computer cards. While feedback is valuable even if there is a time lag between observation and analysis, the more immediate the feedback, the more time a teacher has to determine ways in which he may modify his behavior.

Manuals, Models Related to Analysis Systems

A group of papers shared the common characteristic of the development of manuals or models related to teacher behavior [Garfunkel (455), Gregory (140), Miltz (241), Byars (61), Sobol (338), Baral et al. (18), Openshaw et al. (521), Hansen and Anderson (145)]. Miltz (241) developed and evaluated a manual for the improvement of teacher effectiveness in explaining. The design of the manual was aimed at helping teachers understand major aspects of good explanations and providing practice to improve those aspects. The manual was evaluated through an experiment in a preservice teacher education program, using a class of 60 preservice students. The students were randomly divided into two groups, only one of which used the manual. All were given a pretest which required them to answer orally and extemporaneously three questions asked by the experimenter. Following the training period, all were again post-tested, using three different questions.

Tape recordings of the pre- and post-test sessions were randomly transferred to another tape and were played to 10 raters (seventh and eighth grade students). The raters judged each answer on four dimensions: organization, clarity, quality, and rank, using a prepared rating sheet. Post-test answers from six randomly selected individuals (three experimental, three control) were selected for transcribing. The transcribed explanations were rated or coded on six dimensions: content validity, logical organization, verbal emphasis, rule-example-rule, lesson divisions, and vagueness. This analysis was conducted to determine whether the content and other properties of the sample explanations in the experimental group's answers reflected the emphasis of these six dimensions as found in the "How to Explain" manual. Miltz reported that the training procedure was effective in helping students in the experimental group improve their effectiveness in explaining and that it resulted in differences between means significant at the .01 level for all four rated dimensions. The experimental group was significantly superior to the control group on the content validity, logical organization, and verbal emphasis dimensions. The mean for total number of examples was significantly higher for the experimental group. Miltz concluded that his manual and the total treatment were useful in helping teachers to develop more effective explanations.

Gregory (140) developed and tested a set of microteaching tasks with a problem-solving orientation for use in the Teaching Laboratory at The University of Texas. He tested his materials on 90 juniors and seniors enrolled in four sections of an introductory general secondary methods course. Two sections used Gregory's problem-solving manual while two sections used the conventional TL manual. Data were collected by use of the Laboratory Observation Schedule and Record II (LOScAR II), to measure changes in verbal behavior associated with each manual, and by an anonymous questionnaire, to obtain opinions about the two manuals. Although both groups became more

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indirect in their teaching, Gregory concluded that the problem-solving tasks would be more appropriate in a special methods course rather than in the general methods course. Gregory found that the students preferred a manual that had a high degree of structure.

Byars (61) developed, tested, and refined a model of teaching behavior for teachers of a first course in algebra. Byars stated, in his model, that teachers of ninth grade algebra should (1) be indirect and flexible in the use of teaching influence, (2) frequently employ techniques designed to encourage student discovery of mathematical procedures and principles, (3) emphasize the structure of the mathematical system being studied, (4) obtain a high level of student participation in class, and (5) carefully plan and evaluate lessons. He designed a modification of Flanders' instrument for use in mathematics classrooms. Each of the ten categories of Flanders' original instrument was expanded, with several of the sub-categories focusing directly on behaviors that would occur in a mathematics lesson.

Category 1, accepts student feelings was left intact. Category 2, praises or encourages became (2) positive reinforcement of student response, (2a) verbal habit positive reinforcement, (2g) general encouragement of individual or class, (2h) use of humor. Category 3, accepts or uses ideas of students, expanded into (3) acceptance and development of student idea, (3e) request for student to explain or expand his previous statement, (3q) referral of student statement to class especially as a question, (3r) repetition of student statement. Category 4, asks questions, contains (4) general questions, (4a) question of factual nature with limited response set-specific answer desired, (4d) question of a developmental or discovery nature with broad response set, (4p) request for proof or reason for statement, (4q) request for student questions. Category 5, lecturing, became (5) general lecture, (5e) examples, (5p) proof or reasons for statements, (5x) explanation at the request of a student.

Category 6, giving directions, includes (6) directions to individual or class, (6a) assignment, (6s) student required by teacher to respond. Category 7, criticizing or justifying authority, contains (7) criticism of individual or class, (7n) criticism of incorrect answer, (7d) criticism of disciplinary nature, (7t) defense of self or procedure. Category 8, student talk-response, includes (8) general student talk initiated by teacher, (8n) indication of lack of knowledge or unwillingness to respond, (8b) student at board explaining his work of a mechanical nature, (8bp) student at board giving proof or reasons for statements, (8p) student giving proof or reason for statements, (8q) student question in response to teacher question. Category 9, student talk-initiation, includes (9) general student initiated talk, (9b) student at board explaining his work of a mechanical nature, (9bp) student at board giving proof or reasons for statements, (9q) student initiated question not in response to teacher question. Category 10, silence or confusion, contains (10) silence or confusion, (10b) student(s) working at board and not explaining work to class, (10m) mechanical adjustments, (10s) student seatwork.

The special symbol, /, is used to indicate a change in student speaker without intervening teacher talk. The symbol // is used to indicate a change in the nature of classroom activity. The symbol - indicates gatekeeping by teacher who indicates who is to speak among volunteers.

Byars trained a second observer to a high degree of reliability with himself (Scott coefficients of 90 per cent for major categories and 80 per cent for subcategories). He then used his instrument to categorize the verbal behavior of 10 teachers as each worked in three ninth grade algebra classes. A pretest of mathematics ability and post-tests of algebraic achievement and attitude toward the teacher were administered to the pupils. No significant differences were found between student achievement and attitude in relation to ratings of teachers on (1) years of teaching experience or (2) number of semester hours of credit in mathematics. Teachers who had high correspondence to the model had higher student achievement and significantly (.05 level) higher student attitude toward the teacher than did those teachers with low correspondence to Byars' model.

Sobol (338) completed a dissertation in which he described a unified, well-integrated observational system. After surveying related literature, he considered existing systems to have limitations and proposed a computerized teacher observation system. This system would offer the user fewer limitations than single instruments, have more comprehensive behavioral descriptors, greater objectivity in defining teacher functions, and more flexibility in developing observational schedules and storing observational data. Some of the computerized teacher observation system's operations include (1) the storage of a large pool of descriptive statements about teacher classroom acts; (2) the generation of lists of the behavioral descriptors; (3) the modification of behavioral descriptors through addition, correction, or deletion of items; (4) the construction of observation forms using rating, counting, and a combination of rating and counting descriptors; and (5) the storage and retrieval of observational data on teachers, observers, subject matter taught, grade level, and observational setting.

Three case studies were included to demonstrate the system's use by supervisors of teachers, educational job analysts, and educational researchers. Several system limitations related to the size of the item pool, computer program deficiencies, and data analysis were discussed.

Sobol's work, completed at Stanford University in 1972, no doubt was based on a project at Stanford which was described in a progress report by Baral et al. (18). Published in 1968, this report contained information on the development of a taxonomy of teaching behaviors. An item pool, derived from searching the literature and from items written especially for the project, contained 1137 items subsumed under 19 categories. A preliminary classification of the item pool resulted in the following display:

1. Personal characteristics of the teacher: 78 items.
2. Speech, voice, gestures, language patterns: 108 items.
3. Lesson planning, goals, aims: 70 items.
4. Evaluation: 84 items.
5. Motivation: 71 items.
6. Discipline: 80 items.
7. Teacher-Student Interaction: 110 items.
8. Lecturing: 56 items.
9. Questioning and responding: 69 items.
10. Assignments: 42 items.
11. Instructional materials and Audio-Visual aids: 37 items.

12. Feedback and reinforcement: 28 items.
13. Review and summary: 21 items.
14. Introducing unit, pacing, transfer: 37 items.
15. Inductive teaching and problem solving: 22 items.
16. Discussions and small group work: 68 items.
17. Oral reports and panel discussions: 31 items.
18. Individualization of instruction: 30 items.
19. Unclassified: 95 items.

The item pool is stored on-line in a computer at the Stanford Computation Center. Each item stored in the computer consists of three parts: item number, item statement itself, and classification of item as ratable, countable or both. In 1968 two programs were available, one of which allowed the investigator to select those items which he wished to examine or to use for a specific research project. The program produced a listing of the items required on a deck of IBM cards with one item punched and printed on each card. The second program generates rating forms for use in classroom observation. An observer can request up to 25 items from the pool for a single observation. These items are printed on the rating form, along with the appropriate scales for rating and counting behaviors observed in the classroom.

The item pool enables investigators to look at five dimensions of classroom behavior: source of behavior, type of behavior, pedagogical content, affective component, and learner level of processing content. The source of behavior is considered to be either the teacher or the student. Types of behavior are verbal, nonverbal, ratable, frequency count, both. Pedagogical content is divided into structuring, stating, soliciting, responding, reacting, evaluating, and controlling. The affective component of behavior consists of praise, encouragement, acceptance, neutral, rejection, and criticism. Learner level of processing content includes ignoring, monitoring, orienting, attending, receiving, and higher order processing.

Baral reported that while it is relatively inexpensive to store the item pool on-line and to develop methods of item selection, costs increase substantially as the system is regularly used to generate rating forms. A long-range goal for the system would be to have it thought of as a type of educational data bank. Specific research studies and teacher education projects could be planned with appropriate sampling from the item pool. These studies would in turn contribute data and special findings to more general item analyses, teacher performance analyses, and model development. In time the system could incorporate the use of videotape and time-lapse photography for recording classroom behavior.

Miscellaneous Studies on Instrument Development

The papers grouped in the "miscellaneous" portion of this section on instrument development are single studies on a particular topic which do not easily fit into one of the previous subsections of the topic [Popham and Baker (284), Lawrence (203), Evans (91), Hansen and Anderson (145), Solomon (339), Perlberg and O'Bryant (524), Morse and Davis (244), Klein (189)]. Klein's research efforts (189) concentrated on demonstrating the importance of cross-validating an instrument intended for use in a future study. This instrument was the Teachers' Practices Questionnaire (TPQ) devised in 1963

to measure teachers' subjective role expectations. The instrument presents problem situations typical of those encountered in the classroom. Respondents are asked to rate the four alternative courses of action presented. Each choice is to be rated independently of the other three. Each choice is to be judged as extremely appropriate, very appropriate, fairly appropriate, extremely inappropriate, very inappropriate, or fairly inappropriate.

Klein reported that the original 120 item TPQ had been given to 175 individuals (undergraduate and graduate students attending Schools of Education in the New York metropolitan area). Factor analysis showed that Counselor, Motivator, Referrer, and Disciplinarian role factors were in evidence in the responses to the TPQ. Two additional roles proposed by the authors of the instrument disappeared as factors in this analysis. Those roles were information-giver and advice-giver. A revised, 28 item TPQ was given to 245 subjects. The same four factors emerged from the factor analysis of their responses but the intercorrelations between items comprising some of the factors were judged to be too low to be psychometrically valid.

Items were added and/or rewritten. A second revision of the TPQ containing 40 items was designed so that all four roles were equally represented by items. This was administered to 689 individuals. The four role factors were clearly delineated by factor analysis. With only one exception, each item was positively correlated with its appropriate factor and with no other factor. Internal consistency reliability estimates of the role factors ranged from .80 to .90.

Klein considered her work to emphasize the necessity for determing if results similar to those obtained by the developers of an instrument are obtained when this instrument is used with a subsample of the population in which the second researcher is interested.

Popham and Baker (284) conducted an investigation concerned with teacher competence and its relation to teacher preparation and the value of attitudinal measures as predictors of teaching behavior. They were attempting to validate the Instructional Procedures Preference Inventory (IPPI) which was designed to measure a teacher's attitude toward certain aspects of the instructional process. The inventory presented 12 problems, with four possible courses of action for each problem. Respondents were to judge each course of action on an "appropriateness" continuum from highly appropriate to highly inappropriate.

The criterion behavior in this study was a subject's behavior in a contrived teaching situation where he was free to vary his instructional techniques. Prior to the formal validation study, a pilot study involving preservice teachers teaching a spelling lesson to elementary school pupils was conducted. Findings from the pilot study led to some revisions for the formal validation study which involved 50 preservice teachers. Ten different sixth grade pupils were trained to serve as "pupil-accomplices" who provided information concerning the subjects' behavior in a contrived teaching situation.

Popham and Baker were interested in determining what relationship, if any, existed between subjects' scores on the IPPI and their observed use of the principles regarding which the IPPI purportedly measured attitudes. They reported a significant (.10 level) between IPPI scores and observed use of the five instructional principles about which the IPPI supposedly measured attitudes.

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Lawrence (203) reported the use of systematic classroom observation to validate a measurement of teacher beliefs about teaching. The paper and pencil instrument consisted of statements about teaching practices appropriate for students of ages 10 through 14. Respondents were asked to accept or reject each statement. Items on the instrument were such as "Students seldom or never ask for clarification of what is discussed in classwork" and "When students analyze their own accomplishments the learning outcome is superior to that which is accomplished through teacher evaluation."

A paper and pencil instrument consisting of 244 items was administered to 320 teachers in eight schools. Twenty of the teachers whose responses most agreed with the scoring key and 20 teachers in least agreement with the scoring key were identified for observation. Neither teachers nor observers were aware of the basis of selection. Each teacher was observed 12 times over a period of several days. Each observation lasted for five minutes. Observations were made in sets of three on four different occasions. Four observation instruments were used: the Reciprocal Category System (RCS), the Florida Taxonomy of Cognitive Behavior (FTCB), the Teacher Practices Observation Record (TPOR), and the Florida Climate and Control System (FCCS). These four instruments categorize over 300 different elements of teacher and student behavior: cognitive and affective, verbal and nonverbal, procedures and climate. The TPOR and FCCS were used "live" in the classroom while the RCS and FTCB were applied to audiotapes of the lessons.

The strength of each paper and pencil item was statistically checked by biserial r and discrimination index, for item correlation with total score on the instrument; difficulty index; loading on a factor; and correlation with observation data. Through these criteria, 97 of the 200 items analyzed were eliminated. Of the 103 items which remained, four-fifths correlated both statistically and logically with one or more sets of observation data. Correlations ranged from .30 to .60. The teacher attitude represented in the response to each item had a counterpart in an observable behavior pattern. The 20 teachers whose responses most agreed with the scoring key were also ranked as high scorers on the observation data.

Forty-five of the 103 items loaded in factors. A total of 19 factors emerged which logically matched the theoretical categories of items. Half the items loaded into small factor sets of two to five factors per item. A reliability estimate of .80 (Spearman-Brown Prophecy Formula) for the total 103 items was obtained by creating equivalent halves. Twelve of the 103 items neither correlated with observation data nor loaded into factors. Nevertheless these items were retained because they discriminated well between high scorers and low scorers.

Although work is still being done on the paper and pencil instrument and further field testing is proposed, Lawrence concluded that this experience showed that systematic observation discriminates between teachers in many useful categories and should be continued until research shows important correlations between teacher behavior and long-term pupil growth.

Evans (91) reported about a classroom observation rating scale which effectively differentiated British and American open classrooms from American traditional classrooms. The instrument consists of 50 items which relate to one or more of eight dimensions of the classroom setting: provisioning for learning, diagnosis, instruction, evaluation, humaneness, seeking opportunities to promote growth, assumptions (ideas about children and the process of learning), and self-perception of the teacher.

Evans considered that the findings from her study refuted the common assertation that open education is vague and imprecise. The rating scale showed that expectations for children, the physical arrangement of the classrooms, the role of the teacher, the use of curriculum materials and tests, the direction of activities, the use of time and priorities for children were fundamentally quite different for open and traditional groups. Traditional teachers were much more in control of the learning environment. The physical environment was uniformly arranged. The teacher could see the children and their activities. In general, children were supposed to use standardized curriculum materials. Teachers gave academic achievement a top priority and used testing for grouping children and for grading them in comparison with their peers. Open classroom teachers allowed children more freedom in use of time, choice of activities, and ways of working. Children used "books" written by classmates as part of their reading and reference materials. The teacher provided intensive diagnostic help rather than whole group instruction. Children were encouraged to use other areas of the building and the school yard during school time.

The socio-economic setting had an influence on classroom characteristics. More features of open education were found in upper socio-economic classrooms for all three comparison groups (British, American open, American traditional). The lower socio-economic open groups in England and in the United States had more features of open education than did the upper socio-economic traditional groups.

Evans suggested that the rating scale could best be used as a survey instrument in a school system that is beginning to experiment with open classroom techniques. It is less reliable as a diagnostic measure for individual classrooms. An experienced observer can rate the 50 items in only a few minutes. The measure was designed for primary grades and may not be appropriate with other normative groups.

Hansen and Anderson (145) in developing a trainer's manual in interaction analysis also developed a system for analyzing the content of classroom instruction. They considered that such a system was needed because few systematic observation procedures focus on this aspect of teaching. A 13 point category system was developed to meet this need. The developers were influenced by the work of Aschner, Gallagher, and Taba in the development of this system which is to be used for in-class supervision followed immediately by a conference. The supervisor tabulates a category at least every three seconds during an observation. Observations are expected to last for a minimum of 20 minutes. Tallies are recorded in two vertical columns, one for teacher involvement and one for student involvement.

Categories 1-4 represent cognitive-memory type thinking and are (1) seeks information, (2) gives information, (3) seeks labels and groups, and (4) gives labels and groups. Categories 5 and 6 represent convergent thinking: (5) seeks interrelationships, (6) gives interrelationships. Categories 7 and 8 represent evaluative thinking: (7) seeks inferences and generalizations, (8) gives inferences and generalizations.

Categories 9 and 10 represent divergent thinking: (9) seeks predictions and hypotheses, (10) gives predictions and hypotheses. Category 11 relates to classroom management and is called "procedural remarks." Category 12, focus, refers to those statements made to keep students working toward the proposed objectives. Category 13, nonverbal, refers to all classroom activity that is nonverbal or that does not contribute to the lesson (including confusion and out-of-focus remarks).

Solomon (339) developed a Taxonomy of Image Provoking Teacher Behavior in order to determine those behaviors necessary for planning and assessing imagery in the classroom and a classroom observation instrument (Taxonomy of Image Provocation Profile) to accompany it. The taxonomy contains three levels: 1.00 Concrete-imagery, 2.00 Representational, and 3.00 Abstract-imagery. Each of these levels is subdivided into specific behaviors.

The TIP Profile is a sign system. Observers watch and listen for signs of the behaviors described and record these behaviors. There are 12 separate two minute observation periods in each 24 minute observation. As a measure of teacher behavior, the TIP profile can be used alone or in conjunction with other systematic observation instruments and other evaluative techniques and procedures.

Solomon reported that the TIP Profile had been used with preservice teachers at West Virginia University. These individuals were able to use the instrument in observations of simulated teaching and were also able to behaviorally demonstrate the various levels to achieve any profile requested. Solomon considered his instrument to possess its greatest strength when it is used in self-evaluation by an individual teacher.

Morse and Davis (244) developed the Questioning Strategies Observation System (QSOS) for use in a specific research project in the setting of the Teaching Laboratory at the University of Texas at Austin. The instrument contains 24 categories grouped in three main sections: initiation of the question, response to the question, and reaction to the response. The QSOS instrument shows the influence of Bellack and his colleagues as well as that of Bloom. All recording begins with a teacher question. The three major sections for grouping the categories arise from Bellack's classification of teacher moves.

Questions within the initiation grouping are classified relative to the designation of pupil(s) expected to respond and to the cognitive level of the question. Questions may be categorized as MDES (mass designated) in which the entire class is expected to respond; NDES (no one designated) in which the teacher asks the question without indicating who should respond; GDES (group designated) in which the teacher asks the question and then calls on a specific pupil to respond; and IDES (individual designated) in which the

teacher names the pupil and then asks the question. (Probing and redirecting questions are also considered to belong in this grouping although neither category elicits an initial response.) The cognitive levels of the questions refer to the categories in Bloom's taxonomy of the cognitive domain plus AFEC (affectivity) for questions dealing with pupil opinion, attitudes, feelings, and beliefs; and PROC for questions dealing with classroom organization, routine or management.

Within the response area, the five categories are based on whether the questions asked were answered as expected or in some other way. DES (designated) is used for those questions in which the response was the expected one. IND (independent) is used for those responses which have occurred voluntarily. INT (intercept) is used when a pupil other than the one called upon to respond answers or the teacher answers the question itself. NOR stands for "no response." ABT (abort) refers to those situations in which the teacher asks a question but something interferes with the interchange to displace the response.

Reactions refer to the teacher's means of acknowledging pupil response and may be either positive or negative. The categories are NOEV (no evaluation); APPR (approves); ACC (accepts); REJ (rejects); CRIT (Criticizes) which includes such teacher comments as "You know better than that" or "That's a terrible answer."

Using the QSOS, investigators can sum frequencies of category events separately for each category as well as frequencies of events in two or more categories. In addition, investigators can look at (1) question quantity or the sum of all frequencies in all categories of teacher questions; (2) cognitive quantity or the percentage of teacher questions categorized as cognitive, which is obtained by dividing the sum of the six categories from Bloom's taxonomy by the sum of these six categories plus AFEC and PROC questions; (3) cognitive quality which is obtained by assigning weights to the six cognitive categories (knowledge = 1, evaluation = 6), with the frequency of events in a category being multiplied by the weight, the resulting products summed, and an arithmetic mean calculated as the score for cognitive quality; (4) tactical versatility obtained as a count of the total number of QSOS categories used out of the 19 possible; (5) question success which is the percentage of all questions which result in designated and independent pupil responses; and (6) reaction quality which is obtained from the average level of teacher reaction to pupil responses by weighting the categories as follows: ACC = +1, CRIT = -3, REJ = -1, APP = +3, NOEV = 0, and conducting the proper mathematical operations to arrive at an arithmetic mean.

When an observer uses the QSOS, each interchange in the classroom setting is categorized four times in the same column on the QSOS form. The observer first categorizes the teacher's initiation question on the basis of how it was directed to the class (one of six categories). Then the question is categorized to identify the cognitive level (one of the categories marked 7 through 14). The third categorization identifies the type of pupil response (categorizes 15 through 19). The last classification categorizes the teacher's reaction to the pupil response (categories 20 through 24). Pupil questions and textbook questions are not included in the category system.

The QSOS was used with 86 beginning teacher candidates in the Teaching
Laboratory setting. Analysis of audiotapes of their questioning behavior
showed that the seven measures appeared to be highly related. Question
success, of all seven measures, seemed to be independent. Its items are not
included in another measure. Most of the measures were not statistically
independent but their relationships were quite low. Proficiency in using
the QSOS appeared to be achieved after 15 hours of training, over a one week
period. Inter-observer reliability coefficients over a training tape ranged
from .66 to .74 over all QSOS categories. Observers had difficulty in dif-
ferentiating the KNOW and COMP categories which were the most frequently
used cognitive categories. For the seven derived measures, reliability
coefficients ranged from .91 to .94.

In general, the section on "instrument development" is similar to the
sections which preceded it in that the majority of the investigators developed
their own instrument or instruments rather than adapting a previously developed
instrument. Some of the researchers did acknowledge the influence of previous
researchers whose work is described in the "landmark studies" section. It is
true, as Klein pointed out, that an investigator using a previously-developed
instrument should test its validity on a portion of the population to be
studied. The item pool developed at Stanford appears to be a source that
should be more widely and heavily used in future teacher behavior studies.

STUDIES ABOUT PROBLEMS ENCOUNTERED IN OBSERVATIONAL STUDIES
OF TEACHER BEHAVIOR

The papers reviewed in this section share the characteristic of concerns
about problems encountered in investigating teacher behavior. The researchers
discuss such topics as determining reliability and validity, factors which
influence observers' ratings, and problems of data analysis, among other con-
cerns.

TABLE VI

STUDIES OF PROBLEMS
IN TEACHER BEHAVIOR RESEARCH

TYPE OF PROBLEM	NUMBER OF STUDIES
Methodology	7
Reliability, Validity	13
Data Analysis	7
Total	27

Problems of Methodology

Adachi (3) conducted a dissertation project in which he attempted to ascertain the level of agreement between the IOTA consultants and workshop participants on each of the fourteen observational scales of the Instrument for the Observation of Teaching Activities (IOTA). The IOTA, published by the National IOTA Council in Tempe, Arizona, contains 27 scales of two types: observation and interview. Only the 14 observation scales were used in Adachi's study. Adachi collected four random samples for each of three classroom observations of the 17 IOTA consultants and 534 workshop participants. Consultants were compared with participants, elementary teachers were compared with secondary teachers, males were compared with females, and participants were compared on the basis of years of experience. Adachi found that workshop participants needed three observations in order to arrive at scores which were consistent with the IOTA consultants' scores of the same teacher's performance. He also found that when males were compared with females, the comparison groups could reach agreement after three observations, but that during the first and second observations there were some divergencies relating to interaction with grade level and years of experience. When elementary and secondary teachers were compared, similar findings resulted but the divergencies were due to the interaction of sex and years of experience. He concluded that his information verified the effectiveness of the IOTA workshop program.

Piele (280) was interested in testing the validity of a previous study conducted under simulated teaching conditions. In this study it was found that open minded teachers used indirect influence more than did closed minded teachers. He hypothesized that the need to maintain classroom control influences the behavior of teachers under actual teaching conditions. Thirty-four high and low scorers on the Rokeach Dogmatism Scale were selected from a group of teachers untrained in interaction analysis and asked to tape record six 20 minute segments of regular class sessions. These segments were then analyzed using the Flanders system of interaction analysis. Piele found that, under actual teaching conditions, closed minded teachers (as compared to open minded teachers) tended to monopolize classroom talk through a variety of verbal behaviors and therefore seemed excessively concerned with classroom control. Some of the verbal behaviors used by closed minded teachers to control student behavior are recorded as "indirect influence" by the Flanders system. The Flanders system measures indirect influence on the basis of the number of times certain verbal behaviors are used, rather than _how_ they are used.

Piele questioned the assumption that Flanders' concept of indirect-direct influence is theoretically linked to Anderson's, Lippitt's, and Cogan's concepts. He also questioned whether Rokeach's concept of open and closed mindedness was generically linked to Flanders' concept of indirect and direct influence.

Ryans (312) produced a paper in which he reported the application of factor analysis to a large data matrix involving some 800 variables to determine the principal dimension of teacher characteristics. Ryans used the resulting scales in testing hypotheses about similarities and differences in teacher characteristics across subcultures identified by national/racial lineage, sex, and grade or level of students taught. In his discussion of "effective teaching," Ryans wrote that, as in the original Teacher Characteristics Study, what is referred to as effective teaching varies greatly

from one community to another, or even one teacher education program to another. Therefore, efforts to determine "universals" that relate to teacher effectiveness should be viewed with great caution.

Komulainen (194, 195) reported on research conducted at the Institute of Education, Helsinki University, Finland. In one paper (194) he discussed the examination of classroom interaction through the use of the factor-analytical P-technique. Data were provided via the analysis of 25 videotaped lessons using a modification of Flanders' system.

Komulainen developed a 13 category system. Categories 1 through 7 refer to teacher talk, as follows: (1) accepts, praises or encourages; (2) corrective feedback; (3) uses pupil ideas; (4a) asks narrow questions; (4b) asks broad questions; (5) expresses information or own opinions; (6) gives directions; (7) criticizes pupil behavior. Categories 8 and 9 refer to pupil talk; (8) answers to a question; (9a) relevant spontaneous talk and suggestions; (9b) irrelevant spontaneous talk. Category (10) silent work, individual work or guidance and (Z) tumult, confused situation complete the category system.

Komulainen found that the teacher's way of influencing the pupils was distinctly in evidence in several dimensions. He stated that the differentiation of this way of influencing supported the views of those investigators who have criticized the unidimensionality of the i/d ratio. It is important, in discussing the i/d ratio, to know which cells are being considered. In addition, the pupils' spontaneous activity is also an important consideration and the type of activity needs to be identified. Komulainen also reported two principal sources of variance: the teacher and the subject matter. A third possible source consisted of the interaction between teacher and subject matter. Nevertheless, he considered that concentration on only these sources was not sufficient to explain variation. Komulainen hypothesized that if some particularly active pupil were to be absent, substantial changes in the teaching situation would take place.

Komulainen (195) used the same data to conduct a study in which he examined the quantification of the instructional process through the use of Markov chaining. A Markov chain is a stochastic process where the future of the system depends exclusively on its present state and not on the past phases of the process or on the way its present state was arrived at, according to Komulainen (who cites a publication by Feller published in 1968). The second order Markov chain is a stochastic process in which the transition probability of the system depends, at any particular moment, on its present state and the immediately preceding state but not on any more extensive developmental context.

The instructional process is largely a time-dependent process, and Markov chains were used to describe it. Komulainen considered that the second-order Markov chain was very suitable for use in the analysis of the general characteristics of the instructional process common to various lessons. A sequence could be described by following the route of highest probability. The stimulus value of any given state could be investigated by identifying the states whose probabilities of occurrence were enhanced by it. The Markov chain model had merits in its exactitude and mathematical clarity, in Komulainen's opinion.

In this paper, Komulainen raised five points which, in his estimation, are open to criticism when Flanders-type interaction analysis is used. (1) The method is suited only to teaching situations where the group of pupils acts as an undifferentiated system under the direction of the teacher. (2) The Flanders-type method records only interaction within an instructional system in a vertical direction (teacher-pupil). Action within a group of pupils is not recorded unless one pupil's speech is immediately followed by another pupil's speech without an intervening teacher remark. Nor does the Flanders-type method lend itself to a comparison of various instructional groupings and forms of teaching. (3) If the number of categories is increased, the number of cells in the interaction matrix will increase as the second power of the number of categories. The number of combinations of second-order Markov chains will increase as its third power. The relevant matrices will then be too thin for ordinary research purposes. If the number of categories is small, the method will be so simple that no investigation will be necessary for determining the results. (4) The content and cognitive structure of interaction systems may vary widely although the systems appear outwardly similar. (5) If a non-symmetric taxonomy is used in which there are different systems of description for the parties concerned, no comparisons can be made. Classification concerning pupils is not sufficiently differentiated and requires improvement, Komulianen stated.

Brown and Bane (57) presented a paper which relates to some of Komulainen's criticisms. They discussed the development and implementation of a program for simultaneous use of three classroom observation systems which measure different dimensions of student behavior. The systems were the Teacher Practices Observation Record (TPOR), focusing on the education of students in the process of reflective thinking; the Reciprocal Category System (RCS), measuring behavior along the humanistic dimension; and the Florida Taxonomy of Cognitive Behavior, emphasizing education as the acquisition of knowledge. These observation systems were used in a research project which measured attitudes toward these behavior categories. A group of 109 teachers was involved in the study.

These teachers represented grades 1-12 and ten subject areas. Teams of three observers each simultaneously observed the same sample of teacher's behavior with each observer using a different observational system. All of the teachers completed three paper and pencil instruments: the Personal Beliefs Inventory (PBI), the Teacher Practices Inventory (TPI), and Rokeach's Dogmatism Scale, form E.

The researchers found only one statistically significant (.05 level) relationship. That was between an affective variable extracted from the RCS and cognitive behavior as measured by the FTCB, $r = .34$. There was a tendency for teachers who behaved frequently at complex cognitive levels to also be warmer, more encouraging, more acceptant, and more concerned with student contributions than were teachers who behaved only at relatively simple cognitive levels. There were no significant relationships between educational beliefs or the dogmatism scale and teacher behavior. Statistically significant relationships were found between fundamental philosophical beliefs and experimental and cognitive behavior. As teachers' beliefs came into greater agreement with Dewey at the fundamental level, their practices were found to be more experimental and more cognitively complex.

No significant relationships were found between teacher behavior and race, age, and experience. A significant relationship for sex indicated that male teachers used greater amounts of warming, accepting, and amplifying behaviors in comparison to directing, correcting, and scolding behaviors than was true for female teachers.

Differences in teacher behavior across grade levels were not significant. There were a number of significant relationships between subject matter taught and teacher behavior, however. Social studies teachers were significantly less experimental yet significantly more positive on the affective measure than all other groups. Science teachers also scored low on the experimental dimension. Science teachers were the lowest on the cognitive measure and math teachers were the highest. None of the subject matter areas scored particularly well on the experimental and cognitive measures although there were statistically significant differences on the process measures.

The researchers concluded that the three instruments did not measure the same thing or, stated differently, the things the three instruments measured were not necessary concomitants of one another. They concluded that it would not be wise to select teachers by subject matter area or other characteristics for training in the use of one or two observational systems to the exclusion of other systems. Brown and Bane concluded that teaching is far too complex a process to be studied from a single all-embracing theoretical framework. The use of a number of theoretically different observational systems results in more insight into teaching than would be possible if only one system were to be used.

In order to gather information on teacher behavior, it is necessary that this behavior be observed, either as it occurs in the classroom or as it is recorded on video- or audio-tape. It is possible to infer teacher behaviors from responses to paper and pencil instruments but there is no guarantee that the inferred behaviors ever occur. Samph (314) conducted a study to determine whether the presence or absence of a classroom observer and the prior knowledge or lack of knowledge that an observation was to occur would affect the verbal behavior of teachers. The Flanders' system was used to analyze verbal behavior. Ten (female) elementary school teachers were involved in the study. Four experimental conditions were established: (1) teachers were not informed of observation, no observer present in the classroom, (2) teachers were informed, an observer was present, (3) teachers were informed, no observer was present, (4) teachers were not informed, an observer was present. A remote microphone was used for each of the four conditions. Teachers were consistently told that their students were the subjects in a study for which they constituted the control group. Microphone use was explained as an attempt to reduce observer effect on students.

Each teacher responded to a questionnaire designed to assess perception of the ideal teacher (ITS) and also level of manifest anxiety. Ten days after the installation of the microphones, baseline observations under condition 1 were begun. Observations occurred weekly. Observations under all four conditions occurred on Tuesdays for three months.

Samph analyzed the data obtained and concluded that his results clearly indicated that the presence or absence of an observer in the classroom was significantly related to the teacher's behavior. When an observer was present, teachers exhibited more "indirect" behaviors. He suggested that observers should visit often enough and stay long enough so that they become "pieces of furniture," but provided no criteria concerning the time required for this change in perception to take place. He also cautioned against evaluating student teaching performance solely on the basis of short intermittent direct observations. Despite all of the implied errors in data, Samph concluded that direct observation was still the most realistic procedure for noting and analyzing what occurs in the classroom—provided observer effects are not ignored.

Problems of Reliability, Validity

While the observer may have an effect on teacher behavior, it is also important to consider problems related to the instrument used to compile the data. Several papers were concentrated on problems of reliability and validity [Komulainen (193), Priselac (286), Abramson (1, 2), Luft and Bemis (213), Webb and Brown (371), McGaw and Wardrop (229), Gregory (139), Smedchens and Roth (330)]. Priselac (286) was interested in determining if training could establish audio data as reliable as direct observation during interaction process analysis. Trainees were randomly assigned to the roles of direct observer, videotape data taker, and audiotape data taker. Initially a pool of 70 individuals was simultaneously trained to use the categories described in the Bales' Observation System. An electronic beep system was incorporated into the earphones, for the tapes, to indicate the exact unit to be assessed every fifth second. Each trainee maintained a minimum of 92 per cent agreement with the Bales' standard criterion during training sessions. Priselac found no significant differences between the categories assessed by each of the three groups after training ended.

Luft and Bemis (213) reported a study to validate a technique for establishing inter-rater reliability on the Southwestern Cooperative Interaction Observation Schedule (SCIOS) when it was impractical to bring observers to a common site. Observers met in pairs to view a videotape of a typical classroom situation. All eight observers viewed the same tape within a one week period. Correlations of each observer with all others were averaged and this average correlation was compared with correlations of observers normally working together. The mean for correlations of paired observers was .904 and that for observers working together was .457. Bemis and Luft considered their method of training in pairs to be superior to that of bringing the total group together for training.

Webb and Brown (371) reported on a study designed to (1) compare two types of reliability in the observation of teachers' behavior, (2) explore the relationship between observer reliability and the validity of their systematic classroom observations, and (3) investigate the effects of training, observer beliefs, and the passage of time on reliability and validity estimates. Thirty-two experienced classroom teachers were involved. Sixteen attended five two-hour training sessions in the use of the Teacher Practices Observation Record (TPOR). All 32 responded to the Personal Beliefs Inventory and the Teacher Practices Inventory. Both groups viewed two films of

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classroom teacher behavior and used the TPOR to record observed behavior twice. One use occurred 10 weeks after training and the second, 20 weeks after training. Webb and Brown found that if observers shared a common perceptual framework, as this group did, between-observer agreement could be achieved easily with little or no training but that within-observer reliability was difficult to achieve. They suggested that training should focus on establishing the reliability of the individual observer.

Abramson (1) developed an analysis of variance model which permits the calculation of an overall reliability coefficient and the partitioning of the sources of variation for the typical observer team situation in which the team visits a number of different teachers only once and where the team does not necessarily contain the same members for all visits. The paradigm was developed for those situations in which there are "n" observations per item per observer as well as when there is only one observation per item per observer. He tested his model using data based on the observation schedule of the School University Teacher Education Center (SUTEC). This schedule is designed to investigate seven aspects of classroom behavior: teacher mobility, involvement of children, materials present, materials in use, directed behavior, spontaneous behavior, and irrelevant acts.

Abramson (2) reported the use of his analysis of variance model in a study in which ten observers viewed five teachers through a one-way mirror and rated the teachers on the SUTEC schedule. The overall reliability coefficient was .37 and the reliability coefficients for the mobility, involvement and irrelevant acts items were .72, .67, and .69 respectively. When the observer factor was treated as a fixed factor, the item reliabilities became .84, .85, and .90 respectively. Seventy-five per cent of the variance was accounted for by teachers and items for the overall reliability calculation, while approximately 70 per cent of the variance was attributed to the teacher factor for the individual item reliabilities. Abramson concluded that, within the limited scope of the study, different variance components models could be applied in different situations to estimate the reliability of either the entire observation schedule or parts of it.

Komulainen (193) discussed the reliability of coding problems discussed with observation studies. He examined the coding reliability by applying the customary profile method of Flanders to two coding occasions separated by a three-month interval in order to determine both within-occasion reliability (agreement) and between-occasion reliability (constancy). In this investigation, Komulainen was also interested in developing a method for the measurement of the reliability of any one individual category and in considering the coefficients obtained according to school subjects, coded pairs, coding occasions, and the order of coding. The instrument used was the 13 category modification of Flanders' system which was described earlier in this section. He analyzed videotapes of 10 lessons in four different subjects (civics, arithmetic, religion, Finnish).

For both coding occasions, four observers coded the same lesson simultaneously but independently. The differences between school subjects were not statistically significant. There were statistically significant differences when agreement between pairs of coders was considered. Observer 2 was systematically lower as compared with the other three observers. The

coefficients for the first coding did not differ significantly from those of the second coding. Inter-coder agreement was high both times. Between-coder constancy was rather poor, Komulainen reported. Codings completed for the first time, shortly after training, were better estimates of "correct" codings than those completed for the second occasion. All coders had changed in the same direction, however, by the second time they coded.

Komulainen suggested that constancy control through time is necessary. In his opinion, it is not advisable to code any material in chronological order because trends due to the observer's behavior may then be shown by the measurements. To avoid this situation, the order of coding should be randomized. Another situation to be avoided is the acceptance of the assumption that the units assigned by various coders to a category are the same if they are equal in number. Observers may make mistakes which offset each other, resulting in marginal distributions that are identical and producing an excessively high value for Scott's coefficient. In studies where reliability has been examined unit by unit, agreement coefficients 10 to 20 per cent lower in value have been obtained on the average. Therefore, the overall reliability method must be supplemented by a method by which the reliability of any individual category can be determined.

Komulainen developed a method for estimating the reliability values for each of the 13 categories in his interaction system. This method has three requirements: (1) Each category must be dichotomized, so that use can be made of his probability model. (2) The unit has to be such that each of two coders would actually base his categorizing on the same unit. (3) All of the categories are to be considered simultaneously to ensure that all the reliability results would rest on activities comparable to original coding and that they would not be unrealistically high.

In addition to these requirements, Komulainen's method involves the acceptance of two assumptions. One, instances of reliable coding are those where two independently acting coders show that they have simultaneously perceived the occurrence of a behavior belonging to a given category. Perception of the absence of a behavior is not regarded as reliable categorizing. Two, the true frequency of events in a category is the mean of the frequencies observed by the coders. The correct frequency is unknown, but the mean is supposed to be the best available estimate of it.

Following Komulainen's method, the two observers watch the videotape for ten seconds. During the next ten seconds, they record their observations on the coding sheet. Periods of observation and notetaking alternate (10 seconds each) for 30 minutes. A seconds counter is used to maintain uniformity. Komulainen reported that experiments have shown that the 10-second observation period is suitable and that, when all 13 categories of his system were used, each period generally contained from one to four behaviors. There were considerable differences in reliability between categories, with categories 3, 4b, and 9b the poorest in this respect. However, the values for all the categories definitely exceeded the corresponding mathematical expectations.

Gregory (139) reported on a FORTRAN program for calculating Scott's reliability coefficient. The formula is the ratio of the actual difference between obtained and chance agreement to the maximum difference between

obtained and chance agreement. The computer program can be used with two to twenty observers and can include any number of observations as long as the product of the observations times the observers does not exceed 200. The observation system cannot exceed 30 categories. The four outputs of the program include the average reliability coefficient of all possible pairs of observers, the average difference between all possible pairs of observers for each category, the percentage of each observer's total assignments found in each category, and each observer's average coefficient of reliability with all other observers. The data deck arrangement and program listing are included in his report.

Smidchens and Roth (330) described a computerized system which assists in collecting and processing interaction analysis data. The observed behaviors are classified into one or more of 10 different categories. A digit is assigned to describe each category. A touch telephone data set is used by the observer for transmitting the appropriate number code for each behavior directly to the computer. Computer feedback includes a sequential tally of each code used, an interaction analysis frequency matrix, an interaction analysis relative-frequency matrix, a redefinition of categories, and a value for several variables derived from the frequency matrix.

McGaw et al. (229), publishing in the "American Educational Research Journal," discussed the errors of classroom observation schemes. They contended that although the term "reliability" has been clarified through the recognition of its several meanings, there is no clear guide for the selection of an appropriate reliability coefficient nor is there any resolution of the problem of interpreting differences in the values of the various coefficients for the same test. Additional problems arise when the reliability of observation schedules is considered. Interobserver agreement becomes an additional source of errors of measurement.

The authors considered that a major problem with a series of reliability indices, each of which measures the effect of only one or two sources of unreliability, is that there is no way of obtaining a "total" picture of the combined effects of all relevant sources of error. Unreliability occurs when two measures of the same teacher or classroom (or object) tend to differ too much either because the behaviors being observed are too variable or because independent observers cannot agree on what is happening. Unreliability may also be due to the smallness of differences among the objects of observation on the dimensions observed. It is possible that observational systems for which the level of inter-judge agreement is very high may be quite unreliable in spite of the judges' consistency.

McGaw et al. outlined the generalizability theory approach to the estimation of reliability and developed a design in which systematic variations in behavior over differing situations are separated from random fluctuations. Three coefficients of generalizability (reliability) are proposed: a measure of the reliability with which teacher behavior may be observed, a measure of the reliability with which situations may be distinguished, and a measure of the reliability with which systematic differences may be detected among teachers in their changes in behavior from situation to situation.

The observers as well as the system(s) they use are important, also. Worle (386) examined the effect of training on the variance of raters using different types of rating scale items when rating the same subject. Four types of rating scale items were used: behavioral unscaled, behavioral scaled, global unscaled, and global scaled. Worle used 116 college students randomly assigned to three experimental groups and a control group. Two 25-minute videotapes were used as training instruments. One tape dealt with the psychology of rating. The second tape dealt with rating scales and rating methods used.

One group viewed both tapes. A second group viewed only the tape on the psychology of rating. The third group viewed the second tape only. The control group received no prior training. All groups then viewed five 20-minute videotapes of five teachers. Each rater was asked to rate the teachers, using the form provided.

Worle reported greater variance in the responses of raters when they used global type items than when they used behavioral type items. Greater variance existed when raters used unscaled items than when they used scaled items. Apparently when a rater had specific behavior items upon which to focus his attention, the ratings tended to become more uniform. Training did significantly alter rater variance. Variance increased significantly although only 20 minutes of training were involved in this study. Worle suggested that a longer period of time is necessary to produce dependable ratings.

Purvis (287) sought to determine whether training in and use of a special observational system would affect principals' perceptions of those teacher classroom behaviors consistent with a specific value position. For this study, he chose to consider Dewey's philosophy of experimentalism. Twenty-six elementary and secondary principals and 144 teachers from two public school systems participated. Purvis used the Personal Beliefs Inventory and the Teacher Practices Inventory, the Teacher Practices Observation Record, and a teacher classroom behavior rating scale in a pre-test, treatment, post-test design.

Among the findings Purvis reported were these. Principals in the experimental group perceived their teachers as less experimental in their classroom practices than did the principals of the control group. Elementary teachers were significantly ($p < .005$) less experimental than secondary teachers in those personal beliefs related to Dewey's philosophy of experimentalism. Elementary teachers differed significantly ($p < .01$) from secondary teachers with respect to desired classroom practices consistent with Dewey's philosophy of experimentalism, with the practices advocated by the elementary teachers being more experimental than those of the secondary teachers.

Rummery (309) was concerned with identifying sources of inter-rater variation in ratings. Rated events were 10 minute segments from videotapes of high school classes in four different subjects. A 50 minute composite videotape was produced and was viewed by 83 individuals (teachers, teacher trainees, school administrators, graduate students) who used a 21 item questionnaire. The questionnaire assessed three aspects of teaching behavior: intended objectives, teaching style, and interpersonal climate. Rummery

conducted principal component analysis of covariances and correlations between rows on his extended matrix. He concluded that analytical procedures offered the possibility of providing more information about the quality of ratings than was provided by more traditional reliability estimation procedures. The analytical procedures also provided a basis for selecting raters having certain rating styles of particular interest.

Crosson and Olson (76) looked at teacher behavior ratings from a different perspective. They conducted a two-part experiment to determine if consistent, predictable differences existed in teacher encoding ability. This skill was considered to be composed of the ability to formulate messages containing the essential information, to anticipate information needs of the listener, and to modify or recode the message from listener feedback.

Twenty-eight teacher-encoders each taped instructions for a verbal task and a geometric task for sixth and twelfth grade levels in a controlled series. Students from those grade levels decoded the messages. Analysis of the resulting student scores showed significant differences in teacher encoding ability. The order in which the teacher taught the lesson also made a difference. Sixth grade students were less able to decode if the instructions they received had been recorded after the instructions for the twelfth grade students had been recorded. The investigators found that known teacher characteristics did not predict differential success in encoding. When the instructions were analyzed, redundancy and clarity tended to increase encoding effectiveness, although not significantly. How well a teacher transmits information to students no doubt governs the teacher behaviors which follow. These behaviors are influenced by the teacher's perception of his success in encoding and the student's success in decoding.

Data Analysis Problems

Five additional reports relate to data analysis problems [Maxey (221), Mortensen (247), Long (209, 210), Limbacher and Rosenshine (206), Yamamoto et al. (388)].

Maxey (221) presented a discussion of three common problems in the analysis of observational data. These problems are (1) researchers base the degrees of freedom for the analysis on the number of students rather than the number of teachers, even though the teachers represent the sampling unit and the researcher wishes to generalize the results to teacher training or behavior; (2) the validity of the design and data are inconsistent with the generalizations reached; and (3) the statistic used to calculate coder reliability is often inappropriate and yields values that are misleading. Maxey used a simulated study on the effects of observational training on teacher performance to illustrate each of the problems he identified. He presented hypotheses, research procedures, information on observer reliability, data analyses, results, and conclusions as parts of this simulated study. He then criticized the study in terms of the three problems previously described.

Mortensen (247) described and analyzed the technical procedures and instrumentation used in observing and recording classroom interaction behavior. Audio recordings, still photography, motion pictures, and closed circuit television were used in this research. Mortensen assumed that many investigations in classroom interaction behavior have been conducted and are being conducted

where research designs may be well conceived per se but which employ inappropriate and inadequate kinds of techniques and technology to carry out the research. Mortensen made a detailed search of current practices and concluded that his assumption was a valid one. The majority of research reports in the field of classroom interaction research lacked sufficient information about the instrumentation used. Although there was some occasional discussion of technical matters, there was also an almost universal lack of rationale for the choices of equipment and the techniques used. Mortensen advocated that classroom researchers need to be as accountable for the technical variables in their research as they are for the theoretical dimensions. He considered that some of the situation is due to the lack of informative literature in the field as well as to lack of appropriate training of research personnel in the use of recording technology at academic institutions.

Long (209, 210) conducted a study to determine whether the medium employed in the codification process had an effect upon classroom verbal interaction data. He was also interested in learning if a media effect existed, was it more pronounced with increased complexity of the observational system used in the codification process. Long used two Flanders category systems: a ten category system and a twenty-two category system. Observations were made in the classroom, recorded on audiotape and videotape, and written up as typescripts. Eight university students quantified the interaction data gathered on 16 elementary school teachers in grades two through six.

Each category system was used by four observers. Two observers were physically present in the classroom, each using a different category system. Long analyzed the data using a 4 x 4 Latin square repeated measures analysis of variance. He found that for certain specific verbal behaviors, the medium used in the observation did exert a significant influence on the data obtained. In the ten category system, categories 4 (asks questions) and 9 (student talk-initiated) showed a significant media effect. In the 22 category system, the categories of 4.2 (asks broad questions), 9.1 (student talk-initiated), and 10.2 (silence or confusion-productive) exhibited a significant effect attributable to the medium employed in the codification process. Using Tukey's HSD test, Long found that most of the significant differences, when pairwise comparisons were made, could be attributed to deviations of audiotape, videotape and live observation from typescript. Few differences were obtained between data obtained via live, audio, and videotape observation.

Long (210), in reporting his research at a session of the American Educational Research Association's annual meeting, stated that the results of his study did not seem to substantiate the position that as the number of categories increases, making distinctions between the behavioral categories finer and forcing the observer to choose from a greater number of alternatives to decide how to classify a behavior, the media effects become more pronounced. In Long's study, data obtained under the typescript medium form were quite different from those obtained under the other three medium forms used. He suggested that it is unwise to adopt the assumption that "data are data" and to ignore the medium employed in the observation-codification process. Therefore when investigators attempt to extrapolate information from several research studies in order to compare or contrast findings, they need to consider how the information was obtained.

Limbacher and Rosenshine (206) discussed the relationship of high-inference and low-inference observation measures. They consider high-inference data to be exemplified by information obtained through the use of fairly specific

questionnaires while lower-inference data are obtained through the use of observational category systems.

The data which Limbacher and Rosenshine used were obtained from a previous study of two groups of social studies student teachers. Each group contained 25 students and was observed twice, during the first week and the last week (sixth) of student teaching. A 30 minute videotape was made of each observed lesson. Taping was followed by a pupil evaluation of the same lesson.

The high-inference measure for each lesson was obtained by using the 10 item Teacher Performance Appraisal Scale (TPAS) developed by Aubertine and Johnson. Pupils were asked to rate the lesson on each item, using a scale from one to seven. The items were: (1) learning aims understood, (2) learning aims developed, (3) content meaningful, (4) content organized, (5) method used appropriate, (6) method stimulating, (7) method successful, (8) contact with learner, (9) participation encouraged, (10) feeling of accomplishment. The last ten minutes of the period were used to rate the student teachers. The investigator read a definition of each of the items and attempted to describe the results a pupil should have seen for various levels of each item.

The low-inference observation measures were obtained by having trained observers categorize the videotapes into the ten categories of Flanders' interaction analysis system.

The two groups of student teachers had received different training prior to student teaching. Separate analyses were made for each group. An additional instrument, the Illinois Teacher Evaluation Questionnaire (a high-inference measure), had been given upon completion of student teaching. The ITEQ measured pupil evaluation of total teacher performance. The investigators attempted to establish correlations between the high-inference measures of the TPAS and ITEQ and the lower-inference measures of the Flanders' system. There was no correlation between a Flanders behavior and a TPAS which held up across trials and across groups.

Analyses were made for only those students for whom the investigators had a complete measure on all three scales, reducing the number to 17 from both groups. The ITEQ measure again gave only scattered and inconclusive correlations. Again, the researchers were unable to get, for this kind of population, steady correlations between the Flanders variables and high-inference measures. None of the correlations which developed for several IA categories for the first observation held up across observations.

Teacher scores on the high-inference measure were slightly lower on the second administration. If pupil evaluation of lessons is also a measure of attitude toward the student teacher, this decrease in positive attitude was a fairly universal phenomenon and one to be expected in a longitudinal study. The variables on the Flanders category system moved both up and down.

Additional data analysis was done, and the researchers decided that, for this population of secondary school pupils, when the student teacher conducted a lesson in which the pupils were free to initiate verbal behavior, these same pupils subsequently judged that lesson low on the organization of its content. The search for low-inference behaviors comprising "organization" apparently revealed a specific classroom behavior, the quantity of self-initiated student talk, which produced a negative effect on the perceived

level of this important high-inference variable. Limbacher and Rosenshine think that educators who attempt to train their students to present lessons most likely to achieve high ratings on clarity or organization and to use methods designed to elicit or encourage self-initiated student talk should be aware of this finding.

Limbacher and Rosenshine also concluded that the difficulties encountered in attempting to relate high-inference variables to low-inference variables when data are collected at two points in time may cast doubt upon the results obtained when data are collected only once. Their findings may also suggest the fallibility of attempts to relate ratings of teachers by students to counts of specific behavior.

Yamamoto et al. (388) wrote an article in which they emphasized the need for more explicit information concerning the rationale for the selected mode of data reduction used in classroom observation studies. They pointed out that many of the current observational instruments fail to deal with some important aspects of the unique dynamics of the classroom group. One source of difficulty is the confusion among several units of behavior and, hence, the equation of what happens in a group with what is done to the group, what the individuals share as group members, or what the group does as a group. In addition, various observation systems tend to describe different facets of the underlying interaction. Conclusions drawn from the observational data are circumscribed by the selected mode of data reduction.

The authors illustrate these problems by use of a study involving two teachers who worked with seventh grade students in a rural high school. Students in this school were "tracked," with track A representing the highest achievement group and track C, the lowest. One teacher taught tracks A and C in mathematics. The second teacher taught history to tracks A and B. Teachers were observed twice, at a one week interval, by the same observer who used the OScAR 5V. The OScAR 5V uses simple, non-inferential criteria to classify classroom verbal behavior, primarily of teachers, into one of 18 categories. Pupil talk is entered into the record only when the teacher attends to it.

When the data obtained were analyzed in terms of behavior categories, little evidence of differential patterns of teacher verbal behavior was found when teachers were working with students of different achievement levels. When the data were considered in terms of classroom events, and when the frequencies of events themselves rather than of event categories were examined, a vastly different picture emerged for both content areas. When the data were considered in terms of runs of events, the results were suggestive of some differential tempos of interaction when the same teacher interacted with students at different achievement levels.

Yamamoto and his colleagues theorized that conclusions in any study are circumscribed not merely by the question, subjects, or instrument for information gathering but also by the way the information is processed. Conflicting conclusions may be drawn from different means of analysis applied to the same data. The authors concluded that the study of classroom dynamics, in the final analysis, begins and ends with a matter of judgment. What is needed are more efforts to make these judgments explicit.

The section of studies of personality and attitude factors as related to teacher behavior was depressing to review when the amount of significant findings were weighed against the inferred time and effort involved. This section on problems related to behavior studies produced a more positive feeling as studies were reviewed. Individuals concerned with teacher behavior are aware of problems related to pursuing research in this area. Both individuals and groups are attempting to find solutions to these problems. Although the concerns voiced by Komulainen and Yamamoto and others are still valid, these concerns as well as possible solutions to the problems identified are being reported to the profession. Researchers are reporting to their colleagues via papers presented at national meetings and in professional journals. Persons who conduct classroom behavior research studies or who guide doctoral students in their research need to remain current in terms of problems concerning reliability, validity, methods of information processing, and technical procedures and instrumentation used to record data.

PAPERS, REVIEWS RELATED TO BEHAVIOR STUDIES

This final section is concerned with identifying and briefly describing occasional papers or reviews of research related to classroom observation/ teacher behavior studies. These materials were identified as a part of the computer search of the ERIC document base which was made prior to beginning this monograph. Although the papers are not research studies, they are included for the benefit of readers who do not have computer facilities available for searching the ERIC system.

Reviews of Research. Two reviews were related to self confrontation counseling literature [Baker (15), Fuller et al. (116)]. Baker (15) reviewed the literature in which work was done with film and videotape feedback in self confrontation counseling. Self confrontation counseling is defined as facing an individual with inconsistencies in his motivation or evasions. The process contains two elements: the playback to a subject of his videotaped activity to allow him to view himself as others view him and feedback to the subject in relation to the videotape. Baker's review examined research studies which indicate that subjects with high and low self concepts tend to act in accordance with their self concept and that a low self concept reduces the probability of experiencing dissonance between present behavior and future valued goals. The bibliography contains 147 references.

Fuller et al. (116) have also compiled a selective review of literature related to self confrontation counseling. This survey ended with material published in 1971. The review also contains a discussion of the implications of self confrontation counseling for teacher education. The reviewers suggest that this procedure not be considered as a remediation measure to be used with "weak" teachers but as a kind of higher education in interpersonal interaction for only those teachers who are already assessed as "excellent." A 21 page bibliography is included with the document.

Goldberg (132) reviewed studies which evaluated teacher style and verbal behavior as it related to pupil achievement, with particular emphasis on teachers for disadvantaged children. Eleven references are cited in the bibliography.

Ornstein (263) also reviewed the literature relative to selected teacher behaviors considered as a basis for reporting recommended strategies for teaching the disadvantaged. He cited 142 references, most of which were published in the 1960's.

Rosenshine (303) completed a review which focused on the stability, or consistency, of teacher effectiveness. In his review "teacher effects" refer to residual class mean achievement scores in which a measure of prior achievement or student aptitude was used to adjust posttest scores by regression. Nine studies were concerned with the generality of teacher effects across two instructional periods.

Hanley (144) produced a review of research involving applied behavior analysis in the classroom. Hanley considered seven criteria in his review: (1) applied, relative to the importance of the research problem to society as well as to how important the behavior under study was to the subject of the research; (2) behavioral, involving the objective definition and measurement of the behavior under investigation and the reliability evaluations of the measurement techniques; (3) analytic, involving the assessing of the reliability of the processes or procedures used in effecting changes in students' behavior; (4) technological, which involves the assessing of the completeness and clarity of the description of the procedures used; (5) conceptual, referring to the basic concepts of the science of human behavior; (6) effective, referring to the question of whether the effects were large enough to be useful; and (7) generality, referring to whether the behavioral change was relatively permanent over time and if the change not only occurs under the specific conditions of training but also spreads to other settings and other behaviors. A 64 item bibliography is included.

Ornstein (265), in a paper entitled "Research on Teacher Behavior, Approaches, Limitations, and Recommendations," cited 200 references in the bibliography. He postulated that research on teacher behavior yields no clear conclusions because of three factors which involve the theoretical framework whereby the investigator systematizes the concepts of research, the identification, and the measurement of behavior. Ornstein considered that teacher behavior research methods fall into one of three categories: models systems, instructional processes, and teacher behavior characteristics. He discussed each of these methods and cited studies to illustrate his points. He ended his paper with a list of 27 recommendations for the guidance of future research on teacher behavior.

Hoetker and Ahlbrand (161) produced an occasional paper in which they reviewed observational studies of teacher questioning behavior. They presented a chronological review covering 1893 to 1963, citing formal and informal classroom observational studies. The authors considered these studies to show that teachers talk during the majority of classroom time, asking or reacting to factual questions posed to students.

Papers. Sandefur and Bressler (316) wrote a state-of-the art paper, with a 42 item bibliography, on classroom observations in preparing school personnel. Their paper is divided into four parts, with part two containing a description of selected classroom observation systems grouped as affective, cognitive, and

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multidimensional. Five general conclusions are presented: (1) classroom observation systems have received their greatest usage by researchers and have not yet achieved widespread usage in either preservice or inservice teacher education programs, (2) the best known observation systems and those receiving the most widespread use are those dealing with the affective climate of the classroom, (3) classroom observation systems can be used profitably in conjunction with microteaching, and role playing, and other preservice laboratory teaching experiences to provide feedback for teachers in training, (4) classroom observation systems, with their emphasis on teaching behaviors, have exerted an influence in teacher education programs leading to more laboratory experiences in the preservice program, and (5) classroom observation systems concerned with the affective climate of the classroom are contributing to the "humanization" of teaching through their emphasis on indirect teacher influence.

This paper, by Sandefur and Bressler, is also included in "Interaction Analysis: Selected Paper" (117). This document is also known as ATE Research Bulletin No. 10 and also contains papers by Furst and by Johnston. The first paper included in the bulletin is a review of research studies designed to teach the Flanders behavioral system to preservice teachers. The material is divided into early studies, attitude studies, The Ohio State University study, and studies in secondary education programs,and ends with a section on areas for future research. (The third paper, by Johnston is entitled "Supervisory Conferences in Selected Institutions.")

Brown et al. (56) produced a publication, "Systematic Observations: Relating Theory and Practice in the Classroom," in which five papers were presented. The first of these, by Brown, presented suggestions for the development of in-service education programs for training school staff members in the use of observational systems and provided lists of systems with suggested uses. The second paper is a discussion of three different theoretical approaches which have influenced the development of observational systems. This paper also contains a description of the development of the Teacher Practices Observation Record. In the third paper, criteria for use in developing an observational system are presented and illustrated in the development of the Florida Taxonomy of Affective Behavior in the Classroom. The fourth paper uses the FTCB, the TPOR, and the RCS to illustrate points for using systematic classroom observation instruments in curriculum building. The final paper contains a review of literature and research to compare traditional and emerging models of the student teacher supervisory conference.

Tom and Woodley (355) abstracted more than 30 studies for a publication produced by the ERIC Clearinghouse for Social Studies/Social Science Education and the Social Science Education Consortium, Inc. The sections of the publication are entitled as follows: Some Reasons for Classroom Observation and Analysis, Perspectives for Viewing the Process of Instruction, The Components of Instruction Amenable to Analysis, Classroom Observation Systems, and Feedback from Observation and Analysis. The document also contains a supplementary bibliography of 23 items.

Ornstein (264) has produced a third paper entitled "Methods for Conducting Teacher Behavior Research: With Implications for Teachers of the Disadvantaged." In it he discussed four broad areas of measurement: observation,

student behavior and achievement, ratings based on recall, and personality tests. He also considered such problems as the noncumulative nature of early research; having to distinguish, control and analyze the variables; and teachers' lack of enthusiasm for researchers, particularly those working in inner-city schools.

Hermanowicz (158) discussed studies of teaching and their impact on future developments in teacher education and presented a proposal for utilizing present descriptive studies of teaching for the improvement of teacher education. This document precedes one by Corrigan (74) entitled "The Study of Teaching." In this second publication is a paper, by Sharpe, which focuses on problems of dissemination and application of research on teaching. A bibliography of 158 items is included in Corrigan's publication.

Galloway (126) produced a paper entitled "An Analysis of Theories and Research in Nonverbal Communication," which was published by the ERIC Clearinghouse on Teacher Education. Galloway considered that difficulties in conducting research in nonverbal communication have been due to difficulty in data collection, the complexity of human communication, analyzation difficulty, inadequate measures of reliability and validity, and the absence of useful categories. An 83 item bibliography concludes this document.

Smith (335) has prepared an annotated bibliography on nonverbal communication. His document is distributed by the ERIC Clearinghouse on Reading and Communication Skills. The bibliography is divided into four parts. Part I cites several recent bibliographies more extensive than that of Smith. Part II refers to textbooks which can be used to provide a foundation for teachers just developing an interest in nonverbal communication. Part III cites books which deal with particular research areas. Part IV contains information on research articles.

Dow (83) edited a collection of 23 papers which were presented at a workshop for college supervisors and coordinators of student teaching. At least two of these papers appear to have relevance for individuals interested in teacher behavior: "Some Current Practices and New Applications in Focused Observation in Student Teaching" and "Ranking of Statements on Feedback Instrument for Analysis of Teaching Behavior."

The Ohio Education Association (260) produced "Teacher Evaluation: Interface on Learning." This document contains a collection of papers from a variety of sources, all with a common topic of teacher evaluation. Chapter four contains four models of appraisal procedure: classroom observations, rating scales, the Redfern Model, and the Battelle Self Appraisal Guide. A review of research on teacher appraisal and teaching effectiveness is contained in chapter five while chapter six contains an analysis of research findings.

In 1971 the U.S. Office of Education sponsored a conference called "How Teachers Make a Difference." The seven papers from this conference have been produced in a book which bears the title of the conference (242). At least four papers appear to be relevant: "A Tool-Development Strategy for Research on Teaching" by N. L. Gage, "Structure and Teacher Performance:

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A Prologue to Systematic Research" by D. C. Lortie, "New Directions for Research on Teaching" by Rosenshine, and "A National Coordinated Program of Research on Teaching Effectiveness" by Flanders.

In addition to the Mirrors document already described in this third section of the monograph and the "Classroom Interaction Newsletter" (frequently cited by both Balzer and Evans), Research for Better Schools, Inc. produces technical papers and other documents. One technical paper is entitled "Technical Tools for Teaching" (328). It is divided into several parts, as follows: Observation Systems, Psychological Distance, Research from Hopeful to Helpful, The Flanders System—Overview, Summary, and a 40 item bibliography.

Additional sources of reference are Theory and Research in Teaching (25), edited by A. A. Bellack; The Nature of Teaching, A Collection of Readings (256) by Lois N. Nelson; TEACHING: Vantage Points for Study (171), edited by R. T. Hyman; Handbook of Research on Teaching (359), a publication of the American Educational Research Association and now available in a second edition; Analyzing Teaching Behavior (102) by N. A. Flanders; Research in Teacher Education (331), a symposium, B. O. Smith, editor; Contemporary Research on Teacher Effectiveness (33), edited by Bruce Biddle and William Ellena; Teaching: Description and Analysis (165), by John Hough and James Duncan; and Selected Studies of Classroom Teaching: A Comparative Analysis (137) by Selma Greenberg.

Additional papers were written by Bellack (404), Berman and Usery (407), Dauterman (430), Galloway (126, 450), Hite (468), Hoehn (469), Hunkins (476), Hough (473), Johnson (483), McDonald (501), Meehan (512), Parsons (522), Pereira and Guelcher (523), Schalock and Hale (540), Young (576), Snow (550).

The reviews of research, papers, books, and bibliographies identified in this section of the monograph when combined with the studies described in each of the three parts of the monograph as well as those studies cited but not described by each of the three reviewers should provide individuals interested in classroom observation and teacher behavior studies with an ample display of sources of information.

DISCUSSION

Balzer, writing the first part of this monograph, reviewed studies concerned with instrument development for the analysis of teacher behavior in science classrooms. In his discussion section, he attempted to compare studies and to generalize concerning areas of research as well as areas in which research was lacking.

Evans, who reviewed primarily studies which focused on teacher behavior in science classrooms, divided his review into three major sections emphasizing the nature of the independent and dependent variables involved. In his discussion section, Evans included 21 conclusions based on reviewing research concerned with teacher effectiveness, training research, and studies of relationships.

This third portion of the monograph was concerned with reviewing studies from fields other than science and, because of the variety of content areas, grade levels, problems, populations and methodologies, does not lend itself to being neatly drawn together for purposes of comparison and synthesis. If some common findings can be identified, they include the following statements. Almost without exception, research in which verbal interaction was studied resulted in the finding that teachers dominated classroom talk. Students seldom initiated the interaction and, when they did so, they most often asked questions concerning procedures rather than developing a new topic for discussion.

There were more studies which might be categorized as experimental as opposed to descriptive, a situation Balzer also found to be true in reviewing science education research. Many of the experimental studies were set up to compare treatment A with treatment B or an experimental program with a conventional one. Many of the investigators reported that the individuals involved had volunteered to participate. Details were not supplied, in abstracts of the studies, concerning what information was provided when participation was requested. The question of what incentives were offered or what pressures were inferred that resulted in agreement to participate remains unanswered. In some instances, experienced teachers were involved in an in-service program which was the experimental treatment. In other studies participation resulted from having enrolled in a specific course or portion of a preservice program, such as the Teaching Laboratory at The University of Texas. It would seem unwise to assume that participation always produced a Hawthorne effect.

Many of the studies dealing with teacher personality factors or attitudes as these variables related to teacher behavior produced inconclusive results. Few studies, either descriptive or experimental, were longitudinal. Some teacher behavior studies were concerned only with just that--teacher behavior. A few investigators considered the effect of the teacher's behavior on pupils, in terms of student achievement or in terms of student perceptions. The majority of the studies which considered both teachers and their pupils treated the pupils as a group rather than considering the individuals who make up the group. Good and Brophy exemplify work which is in contrast to this in their investigations of dyadic interaction (teacher and one pupil).

Some researchers tested Rosenthal's "Pygmalion hypothesis" and met with mixed results. To cite again the work of Good and Brophy, a teacher's expectations about, or attitude toward, a student does make a difference in the way in which the teacher interacts with that student regardless of what information she or he has, or has not, been given concerning the student's latent abilities.

This finding leads to speculation concerning the relative lack of research emphasis on teacher behavior as it influences classroom climate. Most of the instrument development reports as well as other types of research dealt with cognitive aspects of the teaching-learning situation.

Many of the experimental studies focused on developing some degree of skill in a specific teaching technique. The term "teacher training" as opposed to "teacher education" was commonly used in these reports. Just as Evans reported, the majority of these investigations resulted in the finding that the skill or behavior did not transfer to the reality of the classroom. Those studies in which there was some transfer usually involved experienced teachers or inexperienced teachers working with public school pupils in microteaching situations, as opposed to using peers as pupils. Those investigators who considered possible causes of their lack of success usually concluded that the length of time involved in the training period was insufficient for lasting behavior change to take place.

Evans reported a general conclusion that student feedback, regardless of form, was not an effective means of changing teaching behavior. This finding does not apply to the studies reviewed for this third part of the monograph. Apparently researchers in fields other than science were, in most instances, successful in using some type of feedback to produce behavior change.

Balzer deplores, and rightly so, the use of what he terms "patchwork instrumentation" which he defines as the adoption of an existing instrument with slight additions or modifications for desired features. However, many of the investigations of classroom interaction were made by using some modification of Flanders' original ten category system. In some studies, additional categories were developed to categorize nonverbal behavior as well as verbal. In others, the additional categories expanded the types of possible responses made by students. A number of investigators stayed with the original ten categories but subdivided most of these in order to more specifically describe the behavior observed.

The number of studies reviewed as well as their diversity precludes more than spotty highlighting of certain areas already identified within the body of this part of the monograph. Rather than continuing to point out and re-emphasize things which have already been written, it would seem more important to present some recommendations for improving the state of the art relative to research about teacher behavior.

RECOMMENDATIONS

Balzer presented 19 recommendations relative to research as well as 5 recommendations concerning teacher education and practice. Evans also provided numerous recommendations for future research and practice. The majority, if not all, of their combined recommendations apply as well to research in content areas other than science as they do to the field of science education. Rather than attempting to combine their approaches to the task of producing recommendations and then to parallel the results of this attempt at combination, a different method has been chosen.

The recommendations presented in this third part of the monograph have been grouped according to the topics of (1) the problem investigated, including the population or subjects involved, (2) the methodology used, including treatments, instrumentation, and statistical analysis, and (3) the findings which resulted.

The Problem Investigated

One of the first recommendations that might be made is that any investigation which is undertaken in the area of teacher behavior should have more reason for being than that of fulfilling a dissertation requirement. This is not to imply that doctoral dissertations are of no value other than completing degree requirements. However, they often suffer from lack of research expertise on the part of the doctoral student and insufficient guidance on the part of the doctoral student's major advisor.

In addition, there seems to be a lack of communication between institutions and among faculty at major institutions so that the majority of dissertation research studies on teacher behavior is noncumulative. The researchers investigate different aspects of the teaching-learning situation as well as using different terminology, methods, and rationales.

In an effort to produce a study which will merit the doctoral degree, the beginning researcher may include so many variables (sex, years of teaching experience, years of post-secondary education, hours in content courses other than education, hours in education, scores on several paper and pencil instruments, results of classroom observation, grade point average at the end of the preservice education as well as at intervals during these four or more years, scores on rating instruments used by the subjects, their pupils, various supervisors, administrators, etc., etc.) in his investigation that the end result may best be termed the "quantification of trivia."

The saddest part of the whole situation lies in the fact that doctoral candidates do not set out to perform dissertation research merely to fulfill yet another requirement. In their eager naivete, they hope to contribute something of significance to their profession as well as to earn a degree. However, many end up having to report their inability to discover any significant relationships among variables or any significant differences between groups.

Ornstein, in his paper entitled "Research on Teacher Behavior, Approaches, Limitations and Recommendations," contends that doctoral candidates tend to "play it safe" and therefore choose trivial problems and that they lack one or more of the following: sufficient time, financial aid, staff assistance or manpower, expertise, equipment, facilities. He recommends that

> ... doctorate candidates should no longer be encouraged to conduct research on teacher behavior, unless it is a part of a more comprehensive study with sufficient funds, directed by some authority in the field (265:38).

This suggestion may have some merit.

A second recommendation which is closely related to the first is that, regardless of the status of the researcher (beginner vs. experienced), the problem which is studied should be clearly delineated and the theoretical base underlying the study should be made clear. A reviewer considering whether the study provides anything worthwhile to the field is frequently unable to make a sound decision because he is unable to ascertain the dimensions of the theoretical framework within which the research was conducted.

Recommendation three relates to recommendations one and two. If the problem is more than a trivial one and if the research base is defined and the theory identified, reviewers still encounter difficulties when they attempt to compare studies because of differences in terminology. As a third recommendation for future research on teacher behavior, it is suggested that a common vocabulary of terms be developed and operational definitions be provided. Such a task could very well serve as dissertation research for several investigators. This thesaurus of operational terminology should then be made available to the education profession so that it becomes widely used and commonly accepted.

Related to this recommendation is a plea for more standardized usage of phrases and titles that are already rather commonly known. In some studies the ten category system of Flanders was referred to as Flanders' System for Interaction Analysis and abbreviated as FSIA. Other investigators wrote of Flanders' Interaction Analysis System. This may be a picayune point, but are readers to assume that both titles refer to the same instrument or does the slight revision in word order signify a modification of the system as well as of the title?

A fourth recommendation is that more research be conducted using the bank of items available for observation system construction at Stanford. The idea of recommending a one or two year suspension of any research studies aimed at developing new observation systems has merit. Many of the systems developed as a part of or as the major problem in a doctoral dissertation have received no further testing since the original research was completed. In most instances, the developer reported that the system appeared to be a workable one which satisfied the purposes for which it was constructed. Can other people use this same system? If they do use it with a group roughly comparable to that involved in the original research, what results will be obtained? Does the system merit further use?

When one considers all of the systems identified in Mirrors for Behavior and extrapolates from these to the other systems assumed to exist but which are not in the collection, the sensible course of action appears to be to collect and identify the additional systems. This would result in a third edition of Mirrors or in a comparable publication if, for some reason, further expansion of the special edition of the "Classroom Interaction Newsletter" was not possible. This could very well become an ERIC publication, possibly produced jointly by the ERIC Clearinghouse for Teacher Education and a second ERIC Center. It could also be a cooperative project of professional education organizations, perhaps science and social science.

A fifth recommendation relates to the areas in which teacher behavior research has been conducted: more work needs to be done in research on non-verbal behavior. Teachers' gestures, facial and postural expressions, body movements, etc. need to be studied in more detail and in more varied situations. More descriptive research relative to the effects of nonverbal behavior is necessary in order to more adequately depict classroom interaction.

Related to this, the sixth recommendation is that more emphasis needs to be placed on using both verbal and nonverbal observation systems in classroom research. Some investigators have developed systems or modified already existing systems so that their instruments include both verbal and nonverbal behavior categories. An alternative approach is to use two different instruments to gather data, one focusing on verbal interaction and the other, on the nonverbal behavior. More discussion of multiple systems will be presented when recommendations relative to methodology are discussed.

A seventh recommendation relates to research studies which seemingly should be discouraged rather than encouraged. Investigations in which the researcher attempted to identify relationships between personal. factors, attitudes, or beliefs and teacher behavior appeared to provide i... positive results in terms of significant findings. The majority of researchers were unable to identify any variables that were significantly related to teacher behaviors or to teacher effectiveness, depending on the focus of the study. At present there appear to be few possible explanations for this situation. Sample size may be a factor. It is also possible that the instrumentation involved was faulty or inappropriate for the problem investigated. It may also be possible that personality and attitude factors are so complex as to make studies using presently available approaches unsuccessful.

The eighth recommendation is really in the form of a question: has the nature of teaching been adequately researched? Has the need to know what actually goes on in the classroom been satisfied? Despite the large number of studies reviewed in this section in the monograph as well as those reviewed in science education sections one and two, the answer to both of the preceding questions seems to be "No." More descriptive research studies need to be developed and undertaken. This does not necessarily mean more studies that only repeat what has already been investigated, although confirmation or denial of previous findings would be important. In addition, there are areas such as classroom climate that appear to deserve more descriptive investigation.

Recommendation nine is that more ecological research such as that done by Gump and others needs to be done to provide a more comprehensive picture of events taking place in classrooms.

Recommendation ten is that more on-going research projects should be developed at institutions in which faculties are actively involved in pre-service and in-service education programs. This would enable the permanent faculty to provide continuity and to direct the overall research project while allowing doctoral students to temporarily become a part of the project as they work on specific subproblems for their dissertation requirement. It would also mean that some of the other factors mentioned by Ornstein (money, equipment, staff) might be available so that the research could be more adequately carried out. It would also permit more longitudinal research studies.

An additional recommendation, number eleven, is that more cooperative research studies involving several institutions should be carried out. Field testing of the minicourses developed by the Far West Laboratory does involve colleges and universities in different locations. It should also be possible for colleagues within a discipline or from related disciplines to map out research which could be done at their respective institutions. This could involve separate studies at the various institutions or the duplication of a particular problem at different institutions where different populations are available so that results obtained by using the same techniques on different groups could be compared.

The twelfth and final recommendation relative to the problems investigated is as much a note of caution as it is a recommendation. Increasing emphasis is being placed, both by local boards of education as well as by state supervisory personnel, on making teachers "accountable." Accountability can easily become translated as "effective." The research studies aimed at the problem of identifying effective teachers have produced mixed results. It is therefore recommended that the definition of effectiveness or accountability be clearly spelled out before any research is begun.

Knowledge of teaching effectiveness is usually thought to consist of knowledge of relationships between what a teacher does while teaching and the effect of these actions on pupil growth and development. If effectiveness is assessed by measuring learning outcomes, this assessment is usually in the form of a test. Nationally standardized tests are commonly used. Items on these tests may measure knowledge which the teacher did not consider in formulating objectives for the year or unit of study. Frequently teachers strive to develop, in their students, skills, attitudes or self-perceptions for which no nationally standardized instrument is available. These are only a few of the problems involved in conducting research on teaching effectiveness. A more detailed description of the problems and possible approaches is to be found in Chapter 12 of Flanders' book, Analyzing Teaching Behavior (102).

The Methodology Used

Balzer and Evans have each included several recommendations relative to instrumentation and methodology. Some of the recommendations included in this section reflect concerns in fields other than science education that are similar to those expressed when only research in science education is considered. There are no recommendations which they make to science educators which could not be applied to other content areas.

One of the recommendations concerning methodology that needs to be made has been mentioned in connection with recommendations about problems to be investigated. That recommendation is that multiple observation systems should be used in teacher behavior research. Rather than attempting to develop a new instrument which will enable, or force, the observer to code all of the different aspects in which the investigator is interested, researchers should consider the use of more than one instrument. Studies have been cited, earlier in this section of the monograph, in which multiple systems have been used. This trend should be continued and should spread from colleges and institutions in Florida, where it is reported, to other institutions where teacher behavior research is being conducted.

Two, more attention needs to be paid to the problems of assessing reliability and validity of instruments and of observers. Is the widely-used Scott's coefficient the most desirable technique for assessing inter- and intra-observer reliability? There are other, and possibly better, measures for estimating reliability. Regardless of the procedures used, they should be described and the results presented. Statements such as "a high degree of inter-observer reliability was attained" are less than satisfactory in terms of the information provided.

Three, more attention needs to be given to the problems created by the presence of an observer in the classroom. One of the studies reviewed earlier (Samph) resulted in the finding that the presence of an observer, whether this observer was anticipated or unexpected, did make a difference in the teacher's behavior.

Studies in which the investigator used principals or other administrative personnel as observers and/or raters merit careful examination before the results are accepted. If an observer who is not expected to provide any evaluative comments or to make any judgments about the teacher's behavior does influence this behavior, what effects must be caused by having the principal or supervisor in the observer role?

Four, more research needs to be done to determine how many observations, and of what length, need to be made before a representative sample of teacher behavior is obtained. Evans, in his recommendation section, cites Rosenshine to the effect that one or two observations appear sufficient for obtaining a representative sample of a teacher's affective classroom behavior but that more observations are needed in order to obtain a representative sample of the teacher's cognitive behavior. How many observations are necessary? What is the optimum length for these observations?

Jackson, in Life in Classrooms (478:17), said that four unpublicized features of school life are delay, denial, interruption, and social distraction. He was speaking from a student's perspective. These features are not totally divorced from teacher behavior. Are they considered in most observational systems and in most short (five minutes or less) observations?

Five, additional research needs to be done relative to the method(s) used for recording data. If equipment is used either in addition to, or in place of, live observation in the classroom, what influence does the necessity of having recording equipment in the classroom have on both teacher and pupil behavior?

Balzer suggested that videotaping procedures be more widely used. Videotape does enable an investigator to capture both nonverbal and verbal behavior. However, if Mortensen's assumption that many researchers use improper instrumentation and techniques to gather data is correct, the problems which he identified in making researchers proficient in the manipulation of technical variables need to be recognized and solutions need to be provided.

Six, researchers should be more aware of factors which influence classroom interaction but which may not be identifiable via their observation instruments. Komulainen, in one of his papers on teacher behavior, made a point which deserves to be re-emphasized: just as the presence of some vocally active students influences a teacher's behavior so does the absence of certain students affect what transpires in a classroom. Observers need to know how many pupils were absent when a specific observation was made, as well as making a sufficient number of observations so they can identify changes which occur when the student population changes.

Seven, just as investigators need to make certain that the observational instruments measure what the investigators set out to study, they also need to make certain their statistical analysis techniques are proper and adequate.

Yamamoto and his colleagues pointed out the fact that conclusions to be drawn from the observational record are circumscribed by the selected mode of data reduction. The design of a study specifies much of the treatment and measurement details and the nature of the resultant information suggests exclusion of certain means of analysis. Therefore, the rationale for the selected mode of data reduction needs to be made clear to the reader of the study.

Maxey spoke to this same point (that of the data collection process determining the analysis) in his paper when he criticized the sampling unit used in his simulated study. Other researchers have voiced similar criticism. Yet these errors persist.

Eight, more consideration needs to be given to the subjects involved in a specific research study. Many of the investigators reported that the participants volunteered to participate but did not provide detailed information concerning how the project was presented, who requested the "voluntary"

participation, etc. If, as occurred in many studies, no significant find-
ings resulted when volunteers were used, is it correct to assume that the
situation would have been unchanged if teachers had been randomly and arbi-
trarily selected to participate?

Nine, how generalizable are findings which result from one study carried
out with a small sample of teachers working in one or two school districts
(or school buildings in the same district)? In some studies, the investi-
gators were able to select teachers working in two or more different socio-
economic settings. Even with this added information, how much assurance
does a reader have in considering that what was true for some third, fourth
and fifth grade teachers in Illinois would also hold true for teachers of
these same grade levels in Oklahoma, Oregon, Louisana or elsewhere?

Ten, when the methodology involved in a particular research project is
reported, the author(s) of the report need to provide adequate detail con-
cerning their techniques, procedures, treatments, statistical analyses, etc.
Perhaps there would be more duplication of research thrusts at different
institutions and replication of research studies if the researchers could be
certain that they knew what had been done, step by step, in the original
investigation. Sufficient information should be provided in tables and
appendices as well as in the body of the report to make replication possible.

All of these cautions and recommendations are intended to make future
research more adequate and to improve research efforts. However, the impact
(or lack of impact) of research findings is also important. The last series
of recommendations is related to this aspect.

The Findings Which Result

Perhaps the most important question which should have been asked, even
before this monograph and review of research was undertaken, is "Why conduct
research on teacher behavior?" What are, or should be, the major objectives
for this work?

If the primary purpose of conducting teacher behavior research is to
help define the nature of teaching and to provide more information, on a
scientific and objective basis, concerning what takes place in the classroom,
this objective has not yet been completely achieved. Teaching has often
been considered to be both an art and a science. Teacher behavior research
cannot yet be said to have adequately described the art or comprehensively
illustrated the science. Therefore, research about teacher behavior should
continue.

Sometimes it appeared, when reviewing studies, that research on teacher
behavior was conducted because the behaviors, like Mt. Everest, "were there."
Research conducted because of such motivation should be discouraged. Teachers
and their pupils should be involved only in studies which are undertaken with
some prospect of benefit in mind other than the completion of a dissertation
or the writing of a final report to fulfill the commitments of receiving a
grant.

Hopefully, research in teacher behavior is carried out so that the state of the art of teaching-learning can be improved. Research findings should cause, directly or indirectly, changes in teacher behavior so that teachers become more effective in producing pupil gains and growth considered desirable.

For this to occur, teachers need to receive feedback concerning the research findings. Frequently teachers do receive, as compensation for being part of a research project, an abstract of the study. In most instances this abstract is written as a report to the profession and is couched in terminology which is familiar to the teacher educator and to the researcher but not necessarily to the classroom teacher. (This monograph itself is an example of this situation.) The classroom teacher may read and forget or not even read the abstract. Seldom does the information in the abstract cause the teacher to think about his or her teaching behavior in an attempt to analyze it and to make changes. In some studies, teachers received feedback as a part of the treatment and some change did result (depending upon the study under consideration). Whether this change persisted once the study was completed and the experimental condition removed is questionable.

One of the major recommendations of this section on use of the findings from teacher behavior research is that these findings be written in at least two different formats: one in the acceptable style and terminology of the researcher and teacher educator and a second report in a style in which the important findings are couched in terminology that clearly identifies the importance of these findings and their implications for changes in practices. All of the individuals closely involved in teacher education programs in colleges and universities are not equally expert in statistical analysis techniques. This second form of the research report would be of benefit to them as well as to classroom teachers in public and private schools.

An additional and necessary recommendation is that some forum must be made available for the dissemination of this second type of research report. Significant findings need to be published in professional journals which are read by classroom teachers. Periodically the National Education Association issues small pamphlets in a series entitled "What Research Says to the Teacher." This is a step in the right direction but it is possible that more frequent reporting of the results and implications of research would be more effective than an occasional publication in which many studies were digested and synthesized.

If findings which could make an impact on the classroom teaching-learning situation are to do so, they must be communicated to classroom teachers as well as to other teacher behavior researchers. In addition, specific suggestions for change and possible methods of implementing change strategies in classroom situations need to be provided. Describing what exists and publicizing these findings is only the first step in producing changes in teacher behavior.

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