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The hypothesis that "teachers who receive training in interaction analysis will increase their use of accepting or using ideas of students . . . and promote greater frequency of student-initiated talk" was investigated. Four teachers of mathematics and social studies were selected for interaction analysis training in the Clark High School (Las Vegas, Nevada) Interaction Analysis Inservice Teacher Training Program. Then videotapes made of their actual classroom lessons were analyzed using Ned A. Flanders' System of Interaction Analysis, and the information was transferred to a matrix. Data was analyzed empirically rather than statistically. Results confirmed the hypothesis. Additionally, results indicated (1) a decided increase in teachers' accepting, clarifying, and expanding student ideas from the first to the second semester; (2) a pronounced increase in unpredictable student statements during the second semester of the program; (3) a decrease in the number of student responses which were stimulated by the teacher (and somewhat restricted in scope) between the first and second semester; (4) a more indirect approach to motivation and control on the part of teachers during the second semester; (5) a decrease in the use of questions by teachers between the first and second semester; (6) a decrease in teacher initiation and an increase in student initiation and student response from the first to the second semester. (A 63-item bibliography is appended) (SG)

The Effects of Training in Interaction Analysis on the Verbal Behavior of Teachers

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I am most genuinely indebted to Dr. Ned A. Flanders for permission to use his newly developed ratios.

George A. Jeffs
October, 1968

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JUSTIFICATION FOR THE INSERVICE PROGRAM

Comparatively little research has been undertaken recently involving the use of interaction analysis for the inservice training of teachers. One such investigation, however, was undertaken by Wright (1967). Amidon and Flanders (1967, p. 91) point to the need for such research: "Nevertheless, there has been little research on the effects of training experienced teachers in interaction analysis since the initial Flanders study was completed." The limited number of such investigations served to prompt the Clark High School Interaction Analysis Inservice Teacher Training Program.

HYPOTHESIS

Teachers who receive training in interaction analysis will increase their use of accepting or using ideas of students (Category 3) and promote greater frequency of student-initiated talk (Category 9).

RATIONALE

The use of preservice and inservice teacher training programs focusing on the cognitive aspects of the teaching-learning process have long been in effect. It was supposed by the Principal and Director of Research at Clark High School, Las Vegas, Nevada that a more productive teacher training program might focus on the affective aspects of the teaching-learning process. This supposition led to the adoption of an inservice teacher training program employing affective objectives and the assessment of teacher progress in the use of affective skills. Flanders, et al (1965) indicated that in addition to the use of intellectual skills, teachers must develop "social skills" for dealing with feelings, just as intellectual skills are used for dealing with ideas:

> Some of the social skills that seem essential to teaching are: (a) the ability to accept, clarify, and make constructive use of ideas and feelings expressed by pupils; (b) the ability to summarize in a discussion as a method of guiding inquiry; (c) the ability to predict, or at least speculate about, both the emotional as well as intellectual consequences of various alternatives when a decision is necessary; (d) the ability to ask questions about feelings and attitudes in such a way that purely defensive responses are avoided; (e) the ability to relate feelings and attitudes to intellectual tasks so that more realistic forces of motivation are created; (f) the ability to develop a sense of timing that is involved in knowing when to digress from the intellectual aspects of a task in order to face negative feelings realistically or make fuller use of positive feelings; (g) the ability to ask broad or narrow questions and the insight to predict the consequences of using either; and similar patterns of teacher behavior which are rarely taught in teacher preparation or inservice training courses. (Flanders, et al, 1965, p. 25)

DEFINITION OF TERMS

The following definition of terms should familiarize the reader with terms possibly foreign to his vocabulary and help him to read this report with more ease and understanding.

The Flanders System

> Flanders classifies classroom verbal interaction in ten categories, seven of which identify teacher talk: Categories 1, accepting and clarifying student feeling; 2, praising or encouraging student behavior; 3, accepting and clarifying student ideas; and 4, asking questions, are considered indirect teacher talk. Categories 5, lecturing, giving information or opinion; 6, giving directions; and 7, criticizing or justifying teacher authority, are considered direct teacher talk. Student talk is classified as categories 8, response to teacher, and 9, student initiated talk. Category 10 is used to identify silence or confusion.
>
> The classroom observer or tape listener records in sequence every three seconds the appropriate category numbers. When the lesson is over, the observer enters the numbers in the form of tallies in a 10-row by 10-column grid called a matrix. The matrix reveals both a quantification of verbal interaction and patterns of verbal interaction.
>
> Data which are related to quantification include the percentage of time consumed (1) by teacher talk, (2) by student talk, and (3) in silence or confusion. Percentages dealing with the amount of time spent in each of the seven categories of teacher talk may be computed.
>
> The matrix, while summarizing the data found by the observer, also maintains some of the sequence. The teacher can see patterns regarding his reactions to student response, to silence or to student initiation. He may find answers to such questions as "Which of my verbal behaviors seem to elicit student response?" and "At what point in the interaction do I find it necessary to criticize?"
>
> The Flanders System of interaction analysis does yeild descriptive information about the teacher-pupil dialogue, but this information is in no way an evaluation of teaching. If any kind of value judgment about teaching is to be made, it is done by the teacher himself, upon studying his own interaction patterns. (Amidon, Kies, and Palisi, 1966, pp. 2-3)

Categories for Interaction Analysis

TEACHER TALK	INDIRECT INFLUENCE	1. ACCEPTS FEELING: accepts and clarifies the feeling tone of the students in a nonthreatening manner. Feelings may be positive or negative. Predicting or recalling feelings is included.
		2. PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, but not at the expense of another individual; nodding head, or saying "um hm?" or "go on" are included.
		3. ACCEPTS OR USES IDEAS OF STUDENTS: clarifying, building, or developing ideas suggested by a student. As teacher brings more of his own ideas into play, shift to Category 5.
		4. ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.
	DIRECT INFLUENCE	5. LECTURING: giving facts or opinions about content or procedures; expressing his own ideas, asking rhetorical questions.
		6. GIVING DIRECTIONS: directions, commands, or orders with which a student is expected to comply.
		7. CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from non-acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
STUDENT TALK		8. STUDENT TALK--RESPONSE: talk by students in response to teacher. Teacher initiates the contact or solits student statements.
		9. STUDENT TALK--INITIATION: talk by students, which they initiate. If "calling on" students is only to indicate who may talk next, observer must decide whether student wanted to talk. If he did, use this category.
		10. SILENCE OR CONFUSION: pauses, short periods of silence, and periods of confusion in which communication cannot be understood by the observer.

Indirect Influence

Indirect influence may be defined as actions taken by the teacher which encourage and support student participation (Flanders, 1967).

Direct Influence

Direct influence refers to actions taken by the teacher which restrict student participation (Flanders, 1967).

Feedback

Feedback is a method of supplying information to a teacher about his own behavior in a form that is organized into useful psychological concepts, and which permits the teacher and observer to discuss the teacher's patterns of influence which occurred in different periods of classroom instruction. Mechanical feedback media used in this investigation were videotape and audiotape as well as the matrix.

Interaction Analysis Matrix

The matrix is used for the tabluation of verbal statements two at a time, as pairs of events, into a table in which the first event designates the row and the second event designates the column.

Interaction Analysis Ratios*

Teacher response ratio (TRR)

The teacher response ratio is defined as an index which corresponds to the teacher's tendency to react to the ideas and feelings of the pupils.

Teacher question ratio (TQR)

The teacher question ratio is an index representing the tendency of a teacher to use questions when guiding the more content oriented part of the class discussion.

*Permission to use the interaction analysis ratios was granted by Dr. Ned A. Flanders.

Pupil initiation ratio (PIR)

The pupil initiation ratio is proposed to indicate what proportion of pupil talk was judged by the observer to be an act of initiation.

Instantaneous teacher response ratio (TRR89)

The instantaneous teacher response ratio is an index designed to indicate the tendency of the teacher to praise or integrate pupil ideas and feelings into the class discussion, at the instant the pupils stop talking.

Instantaneous teacher question ratio (TQR89)

The instantaneous teacher question ratio is an index designed to indicate the tendency of the teacher to respond to pupil talk with questions based on his own ideas, compared to his tendency to lecture.

Content cross ratio (CCR)

The content cross ratio is an index designed to indicate the degree to which the main focus of class discussion was on subject matter.

Steady state ratio (SSR)

The steady state ratio is an index designed to reflect the tendency of teacher and pupil talk to remain in the same category for periods longer than three seconds. The higher this ratio, the less rapid is the interchange between the teacher and the pupils, on the average.

Pupil steady state ratio (PSSR)

The pupil steady state ratio is an index designed to measure the rapidity of teacher-pupil interchange and especially when pupil talk is average or above average. The higher this ratio, the less rapid is the interchange between the teacher and the pupils, on the average.

Teacher talk (TT)

Teacher talk represents the percent of the total matrix during which the teacher is talking and is disclosed by totaling columns 1 through 7.

Student talk (ST)

Student talk represents the percent of the total matrix during which students are talking and is disclosed by totaling columns 8 and 9.

I/D ratio

The I/D ratio is an index which indicates the ratio of indirect to direct teacher statements.

> An I/D ratio of .5 means that for every indirect statement there was one direct statement; an I/D ratio of .67 means that for every two indirect statements there was only one direct statement, etc. (Amidon and Flanders, 1967, p. 37)

i/d ratio

> A revised I/D ratio is employed in order to find out the kind of emphasis given to motivation and control in a particular classroom...Categories 1, 2, 3, 6, and 7 are more concerned with motivation and control in the classroom and less concerned with the actual presentation of subject matter. This ratio eliminates the effects of Categories 4 and 5, lecture and asking questions, and gives information about whether the teacher is direct or indirect in his approach to motivation and control. (Amidon and Flanders, 1967, pp. 37-38)

ANALYSIS

This is a non-technical report in that data were not treated statistically but were evaluated empirically. That is, percentage distributions are presented for observational evaluation and no attempt was made to treat data statistically. Matrices, tables, and figures are presented for scrutiny by the reader. Analyses were made by comparing the percent of time each category was used during the first semester of the program with the percent of time the same category was used during the second semester of the program. The percent of time each category was in use was also compared to norms. The percent of time individual cells were in use was compared from first to second semesters. Lastly, a comparison of ratios from first to second semesters was completed.

TEACHER SELECTION

The center of the population of the Clark County School District is located in Las Vegas, Nevada. The teachers selected for the Inservice Teacher Training Project in question were assigned to Ed W. Clark High School, Las Vegas, Nevada. This particular school was selected because the Project Director is a staff member of Clark High School. Because much of the research related to interaction analysis focuses on the subject matter areas of mathematics and social science, it was decided that teachers active in these disciplines should be included in the Interaction Analysis Program. Also, Flanders (1960a) suggests that selecting teachers for interaction analysis training from the disciplines of mathematics and social studies is valuable because of the contrast these teachers present in problem solving. Willard J. Beitz, Principal, and George A. Jeffs, Director of Research, Clark High School, selected five teachers from these two subject matter areas to participate in the Program. The teachers selected were so chosen because it was believed such a program would not be threatening to them, and they would welcome the opportunity to grow professionally. Four of the five teachers accepted the invitation. The fifth teacher rejected the invitation because of a lack of teaching experience. The fifth teacher plans to join the group after gaining teaching experience. The two social studies teachers who accepted the invitation were Mr. George Mills and Mr. Joe Foss. These two teachers have an average of four years of teaching experience. The two mathematics teachers who accepted the invitation were Mr. Dennis Reese and Mr. Leon Hollingshead. These two teachers have an average of five years in the classroom.

PROCEDURE

The four teachers involved and the Project Director met once each week for a period of about 50 minutes each meeting. There were a number of weeks when not all members were in attendance because of some uncontrollable circumstances. The first meeting took place the second week of September, 1967 and the last meeting occurred during the second week of May, 1968. The first few meetings were centered on listening to and quantifying audiotapes. All audiotapes used during these sessions were prepared by Edmund J. Amidon or Ned A. Flanders. Criterion coding for each tape was offered by Amidon or Flanders so that the Clark High School Interaction Analysis Team had criterion measures against which to compare their coding practices. The criterion coding samples served to help establish reliability for Team members. For a further description of reliability, the reader should refer to page 12 of this report. The next phase of the Clark High School Interaction Analysis Teacher Training Program involved videotaping actual classroom lessons. The Project Director videotaped one lesson each week. Thus, each teacher had one of his lessons videotaped every fourth week. A lesson videotaped a particular week was presented to the group members for quantification purposes the same week. That is, the teachers viewed the videotape and quantified the verbal behavior of the teacher and students on the videotape. The Team members then gave their quantification forms (tally sheets) to the Project Director who, during the week, transferred this information to a matrix. The reader is referred to Amidon and Flanders (1967) for a

review of matrix construction. The following week the members would quantify a videotape prepared that week and review the videotape of the previous week with the help of the matrix. That is, the videotape of the previous week would be replayed and analyzed with the aid of the matrix prepared during the previous week. The Team members then had the videotape to review as they interpreted and compared the matrix to the videotape being viewed. The teachers analyzed their own teaching patterns and then attempted to adjust these patterns to best achieve their goals. The videotapes offered to the teachers feedback of their classroom behaviors. Most of the discussions of matrices and videotapes centered on Categories 3 (accepting student ideas) and 9 (student-initiated verbalization). The Project Director visited each of the four classrooms periodically and he visited these classrooms during different periods of the day for the purpose of quantifying a lesson without using the videotrainer. Each of the four teachers had the verbal interaction of some of their lessons quantified live and in the classroom by the Project Director and the verbal interaction of other lessons quantified by the Team members while viewing a videotape of a lesson taped in a classroom.

The last phase of the program focused on questioning techniques using materials developed by Taba and Hills (1965) and Minnis (1967).

RELIABILITY

Reliabilities were established by employing the percent of agreement between rater and criterion and/or percent of agreement between raters. Tables 1 and 2 show the reliability coefficients established by this practice. Table 1 reports the reliabilities when the criterion measure accompanied audiotapes. Reliability coefficients are reported for each teacher (A,B,C,D). Teacher E on Tables 1 and 2 refer to the Project Director. A reliability coefficient is reported for each teacher for each audiotape except when such information was not available. Table 2 reports reliability coefficients when videotapes were employed. Table 2 reports reliability coefficients for each teacher versus every other teacher. That is, all teachers quantified each videotape and their quantifications were compared to establish interrater reliability. Teacher A's quantification of a videotape was compared to Teacher B's quantification of the same videotape to establish percent of agreement between Teachers A and B. Teacher A's quantification of the same videotape was then compared to Teacher C's quantification of the same videotape to establish percent of agreement between Teachers A and C. This practice was continued until reliabilities were established for each comparison of teachers.

Table 1. Reliability coefficients for audiotapes

Date	Criterion	Teacher A	B	C	D	E
9-13-67	Session 1, Ex 1	.70	.95	.77	.95	
9-13-67	Session 1, Ex 2	.67	.78	.75	.89	
9-13-67	Session 1, Ex 3	.79	.78	.89	.95	
9-13-67	Session 1, Ex 4	.74	.79	.80	.65	
9-14-67	Session 2, Ex 1	.74	.85	.95	.71	
9-20-67	Session 2, Ex 2	.68	.81		.59	
9-20-67	Session 2, Ex 3	.45	.62		.61	
9-25-67	Session 2, Ex 4	.83	.65	.44	.49	
9-26-67	Session 2, Ex 5	.54	.75		.50	
9-26-67	Session 2, Ex 6	.72	.73		.67	
9-26-67	Session 2, Ex 7	.81	.71	.63	.79	
9-27-67	Session 2, Ex 10	.63	.65			
10- 5-67	Session 2, Ex 12	.63	.69	.56	.49	
10- 9-67	Session 3, Ex 1	.71	.72	.77	.56	
10-10-67	First Episode	.66	.68	.64	.65	.88
10-17-67	Second Episode	.84	.90	.81	.81	.90
11- 6-67	Third Episode	.92	.89	.86	.84	.89

Table 2. Reliability coefficients for videotapes

Date	Teachers A-E	B-E	C-E	D-E	A-B	A-C	A-D	B-C	B-D	C-D
10- 3-67	.64	.64	.31	.43	.75	.53	.74	.44	.69	.64
10-10-67	.75	.79	.65	.71	.78	.80	.91	.88	.78	.81
10-17-67	.79	.74	.68	.65	.59	.68	.51	.61	.71	.74
10-18-67	.84	.84	.87	.81	.85	.79	.71	.84	.84	.79
11- 7-67	.87	.88	.86	.84	.87	.85	.83	.85	.90	.81
11-14-67	.85	.89		.61	.90		.65		.65	
2- 1-68	.79	.82	.79	.78	.75	.80	.78	.70	.69	.88
2- 8-68	.85	.88	.88	.88	.87	.85	.85	.90	.88	.87
4-12-68	.86	.84	.88	.89	.83	.84	.85	.81	.82	.83

REVIEW OF LITERATURE

Research related to the affective aspect of the teaching-learning process

Anderson (1945,1946,1959) may be considered one of the pioneers in researching the affective environment of the classroom. One of Anderson's reports (1959) stated the following:

> The data confirmed thy hypothesis that integration in the teacher induces integrative behavior in the child. Moreover, children with the more dominating teacher showed significantly higher frequencies of nonconforming behavior directly supporting the hypothesis that domination incites resistance. The behaviors of children also supported the further hypothesis that severe domination produces not resistance but submission and atrophy. (Anderson,1959,p. 136)

Withall (1951,1952) pointed to the importance of the social and/or psychological climate of the classroom when he developed what he called the "Social-Emotional Climate Index." Withall categorized teacher statements into seven classifications: (1) learner-supportive statements or questions; (2) acceptant or clarifying statements or questions; (3) problem-structuring statements or questions; (4) neutral statements evidencing no supportive intent; (5) directive statements or questions; (6) reproving, disapproving or disparaging statements or questions; and (7) teacher-supportive statements or questions. As a result of his investigations, Withall offered several conclusions related to classroom environment: (1) dependency of the learner upon the teacher is not desirable; (2) offering opportunity for the learner to make free choices is desirable; and (3) problem solving is enhanced when the teacher offers verbal expression of understanding.

Perkins (1951), using Withall's technique, discovered that differences in the social-emotional climate of the classroom promoted significant differences in group learning. Perkins discovered that an integrative type of classroom leadership (less direct and with flexibility) produced more evidence of learning in children than the dominative (more direct and less flexible) type of classroom leadership. Medley and Mitzel (1959) reported positive correlations between the emotional climate of the classroom and student-teacher rapport, group problem solving, reading growth, and teachers' self ratings. Two investigations (Beauchamp, 1952; Burrell, 1951) showed that students exposed to teachers who were trained in group processes and emotional needs of children made greater gains in achievement than students exposed to teachers not so trained. Soar (1966) revealed that teachers with more indirect teaching styles produced greater evidence of growth in reading comprehension in elementary school pupils than did teachers with direct teaching styles. Powell (1968) found similar results in arithmetic achievement. Furst (1965) discovered a positive relationship between greater achievement and (1) indirect teacher influence, (2) amount of student talk, and (3) an average rate of teacher-pupil interaction.

Investigations by Furst and Amidon (1962, 1965) and Giammatteo (1963) showed that the teaching styles of first-, second-, third-, and fourth-grade teachers tended to be direct while the teaching styles of fifth- and sixth-grade teachers tended to be more indirect. Amidon and Giammatteo (1965) discovered that 23 elementary school teachers assessed as "superior" by their supervisors when compared to 120 teachers assessed as "average" by their supervisors: (1) talked less, (2) accepted student-initiated ideas more, (3) dominated the classroom less, (4) used criticism less, (5) used

directions less, (6) used indirect verbal behavior more, (7) asked broader questions, and (8) elicited more student-initiated verbalization.

Simon and Boyer (1968) list a number of classroom interaction systems which focus on the affective domain. The authors present each system and accompany the same with a brief description. The report offers the reader an excellent way to become quickly acquainted with a number of the interaction analysis systems developed to date. Some of the systems presented include those developed by Amidon; Amidon and Hunter; Flanders; Honigman; Hough; Hughes; Joyce; Medley; Miller; Moskowitz; Openshaw and Cyphehert; Simon and Agazarian; Spaulding; Taba; Withall; Wright; and Wright and Proctor.

Research related to the cognitive aspects of the teaching-learning process

Smith and Meux (1959) were two of the first researchers to carefully consider the logical aspects of teaching behavior. One goal of the Smith and Meux research was to develop a means of dividing verbal teacher behavior into pedagogical units for the purposes of analysis. These researchers pointed out that instruction is primarily logical in nature;therefore, the instruction may be identified, described, and evaluated. Wright and Proctor (1961) proposed that mastery of subject matter is a key to teacher effectiveness. Wright and Proctor developed a system for the classification of verbal behaviors in mathematics classes. The three categories included in the instrument were: (1) mathematical content, (2) psychological process, and (3) sociological attitude. It is obvious that the instrument was not exclusively oriented toward cognition. The authors employed the instrument

in four types of classrooms and concluded that distinctive patterns in the areas of content, process, and attitudes were established for each type of classroom.

Bellack, et al (1963) were concerned with the meanings of language used by teachers and learners in the classroom. Bellack offered descriptions of the discourse in the classroom in terms of each of the major categories of meaning established. This research pointed to possible focus on future research in terms of the question, "What kinds of classroom events are related to what kinds of learning outcomes?" Taba and her associates (1964) focused their research on the thinking processes of children. This study related the need for a four-dimensional analysis of classroom interaction which includes: (1) pedagogical functions of teacher behaviors, (2) a hierarchy of thought processes, (3) the significance of the content of these processes, and (4) the interrelationships of each to the other.

Simon and Boyer (1968) collected a number of classroom interaction systems which focus on the cognitive domain. These authors presented a copy and brief description of each system. The systems presented by Simon and Boyer included those developed by Amidon; Aschner and Gallagher; Bellack; Gallagher; Joyce; Medley; Oliver and Shaver; Openshaw and Cyphert; Simon and Agazarian; Smith; Spaulding; Taba; Withall; Wright; and Wright and Proctor.

Research related to the use of interaction analysis in pre-service teacher training

A number of investigations have centered on the use of interaction analysis with student teachers (Amidon, 1966;Amidon, Furst, Simon, Hough,

Kirk, and Zahn, 1965;Amidon and Powell, 1965;Furst, 1965;Hough and Amidon, 1964a, 1964b;Hough and Ober, 1966;Kirk, 1964;Lohman, Ober, and Hough, 1967;Moskowitz, 1966;Romoser, 1965;and Simon, 1966). Generally, the results of these investigations indicate that student teachers trained in the use of interaction analysis: (1) stimulate a greater amount of student-initiated verbalization, (2) employ criticism more infrequently, (3) offer fewer directions, (4) utilize more indirect teaching patterns, and (5) more frequently accept and use student ideas.

Research related to the use of interaction analysis in inservice teacher training

One of Flanders' (1960) first studies employing the use of interaction analysis disclosed that indirect teachers behaved more indirectly when first introducing and explaining goals in the classroom and when new material was being presented to the class. These same indirect teachers behaved more directly after this initial period of time in the classroom. The results of this investigation also revealed that students learned more from indirect than from direct teachers. This investigation was perhaps most important because it pointed up the fact that teacher flexibility rather than the dichotomies of direct versus indirect influence might well predict teaching success. Flanders, Clarke, Davies, Dawson, and Storlie (1961) used interaction analysis in a nine-week inservice training program which included 55 teachers. The 55 teachers made significant gains in the use of indirect statements. A final report of this project (Flanders, 1963) showed that some progress was made by the teachers involved in developing more flexible and indirect patterns of behavior.

Research related to the use of interaction analysis and creativity in children

Weber (1967) disclosed that pupils of indirect teachers received higher creativity scores as measured by the Torrance Creativity Tests than pupils of more direct teachers. A later report by this same author (Weber, 1968) stated the following:

> It follows that indirect teaching behaviors facilitate both verbal and figural expressions of the pupil's creative potential because both of these means of expression are kept open by the teacher who encourages their use. On the other hand, it seems that direct teaching (and then only when it is consistent from year to year) permits only figural expressions of the pupil's verbal expressions and is generally controlled by the teacher's direct behaviors. (Weber, 1968, p. 15)

Soar (1967) found that teacher indirectness of control in the classroom is significantly related in a positive direction to pupil growth in creativity.

Research related to teacher acceptance and use of student ideas (Category 3) and student-initiated talk (Category 9)

Emmer (1968) discovered that second grade teachers who increased their use of pupil ideas (Category 3) also elicited increased student initiation (Category 9). Teachers who did not increase their use of pupil ideas did not obtain more pupil-initiated talk.

Research related to the use of videotape in teacher education

One experiment (Allen, McDonald, and Orme, 1967) was conducted to compare several methods of distributing practice and feedback when the

latter employed videotaped performance of the learner. Intern teachers were assigned to one of four groups, each of which received varying amounts of practice between feedback sessions. The groups were: (1) immediate feedback--massed practice, (2) immediate feedback--distributed practice, (3) delayed feedback--distributed practice, and (4) reinstated feedback--distributed practice. Significant treatment differences were in favor of Group 1 over Group 4 in the initial acquisition of probing behaviors. McDonald, Allen, and Orme (1965) disclosed that offering discrimination training during the video-taped playbacks of intern lessons produced significantly greater increases in selected teacher behaviors than did confirmation or self-feedback procedures.

Bush (1965) pointed to the value of micro-teaching as a teacher training technique at Stanford University. Baird, Belt, and Webb (1966) offered similar sentiments from Brigham Young University. Meier (1967, p. 3) indicated that "Interaction Analysis, as developed by Ned Flanders, is quite suitable for micro-teaching analysis..." Simulation of classroom procedure involving combinations of television, videotaped film, kinescope recordings, and voice printed materials appears to be a valuable tool in teacher training (Allen and Young, 1967; Neal, 1961; Nearing, 1962; Painter, 1961; Patrick, 1958; and Schueler, et al, 1962).

Young (1968) showed the value of videotape as a feedback technique in helping teachers to analyze their behaviors:

> Videotape feedback is unique to the extent that the teacher can review his own teaching performance using the objective, audio-visual record provided by the videotape. Likewise, teacher-supervisor conferences are based on a common frame of reference rather than on the subjective record and memory of each. (Young, 1968, p. 12)

Research related to the use of audio-visual recordings and closed-circuit television

Kounin, et al (1966) used both 16 mm sound motion pictures and videotape recordings in analyzing classroom behavior. This group of researchers photographed the classroom setting by moving their equipment directly into the classroom. Biddle and Adams (1967a) employed videotape recorded in the actual classroom setting to study the classroom environment. Schueler, et al (1962) used videotapes of classroom behavior for analysis of the teaching-learning process. The Schueler group used a portable classroom setting.

Adkins (1960) and Woodward (1964) have used closed-circuit television for the purpose of training prospective teachers. Both of these researchers have pointed to the positive value of this media for pre-service training of teachers.

RESULTS AND INTERPRETATIONS

The results and interpretations section of this report will assume three approaches: (1) results and interpretations of acceptance and use of student ideas (Category 3) and student-initiated talk (Category 9), (2) results and interpretations of cells which represent 2 percent or more of the verbal interaction, and (3) results and interpretations based on formulas developed by Ned A. Flanders.

Results and interpretations, teacher acceptance and use of student ideas (Category 3)

A definite increase in teachers' acceptance and use of student ideas may be noted from the first to the second semester of the program. Table 3 and Figure 1 will show the reader that Category 3 was employed 2.88 percent of the time during the first semester and 10.85 percent of the time during the second semester. Since the "average" use of Category 3 is approximately 5.50 percent, it may be seen that the teachers involved in the Clark High School Interaction Analysis Teacher Training Program increased their use of Category 3 from "below average" to "much above average." Table 4 (first semester) reveals that there were 185 transitions to Category 3, while Table 5 (second semester) shows that there were 895 transitions to Category 3. This discovery indicates a much greater use of Category 3 during the second semester of the program. The 3-3 cell is usually about 10 percent of column 3. It may be seen from Table 4 that this percent was 46 and from Table 5 that this percent was 28. Therefore, the teachers involved in this investigation employed the 3-3 cell more frequently than might be expected. The fact that this percent

was less during the second semester might be attributed to the increased acceptance and use of student ideas (Cagetory 3) following teacher-stimulated student responses (Category 8) and student-initiated statements (Category 9). Thus, a shift from the 3-3 cell to the 8-3 and 9-3 cells may be observed. A decrease in the percent the 3-3 cell represents of the total Category 3 column may also be attributed to the fact that a greater number of transition cells were used during the second semester.

The results here obtained make it possible to accept the hypothesis.

Table 3. Percent of time categories were in use

	Categories									
	1	2	3	4	5	6	7	8	9	10
First Semester		2.00	2.88	22.72	37.94	1.68	1.95	22.19	5.05	3.59
Second Semester	.16	1.05	10.85	13.32	38.32	.84	.77	10.69	20.65	3.35
Norms*	.40	2.00	5.50	9.00	38.00	5.00	4.00	16.00	8.00	12.00

*Norms reflect a number of research reports and represent an approximation only

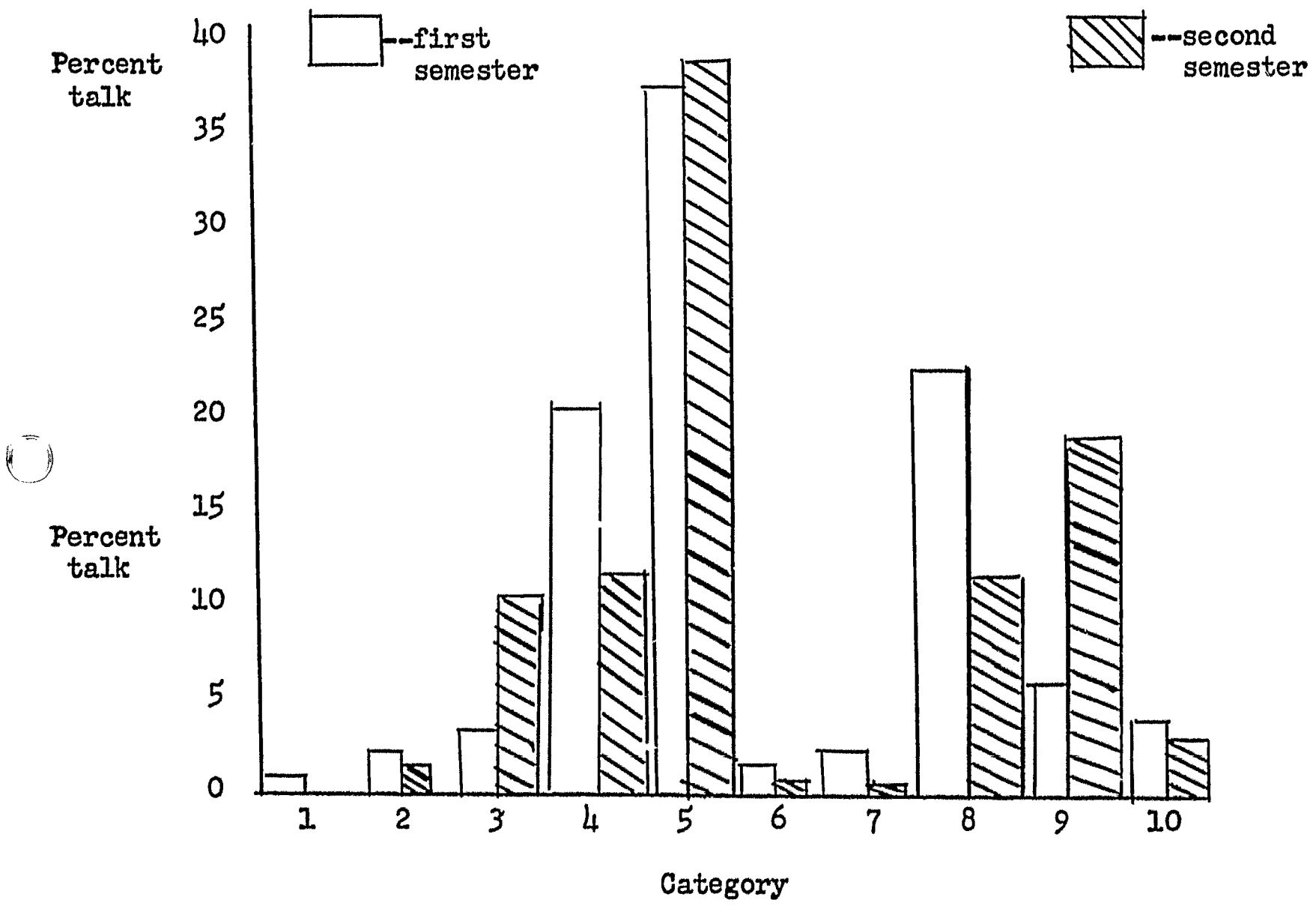

Figure 1. Percent of time categories were in use, semesters one and two

Table 4. Verbal interaction frequencies, first semester

	1	2	3	4	5	6	7	8	9	10	Row Total
1											
2		12	45	93	36			18	34		238
3		6	158	63	30	12			74		343
4				763	89	38	16	1522	112	164	2704
5				549	3838	19	11		42	56	4515
6				90		59	9	24	6	12	200
7				67	35		115	15			232
8		199	73	903	389	18	57	972		30	2641
9		17	51	149	29	6	8		305	36	601
10		4	16	27	69	48	16	90	28	129	427
Col. Total		238	343	2704	4515	200	232	2641	601	427	11901
%	0.00	2.00	2.88	22.72	37.94	1.68	1.95	22.19	5.05	3.59	

Table 5. Verbal interaction frequencies, second semester

	1	2	3	4	5	6	7	8	9	10	Row Total
1			4	4	10						18
2			29	46	14			11	9	12	121
3	12	27	352	238	194		10	10	383	21	1247
4			27	317	19	9		760	296	102	1530
5	6		48	300	3728	10		22	244	45	4403
6				4	10	44		16	19	4	97
7			7	35	14		14	5	14		89
8		64	296	203	147	18	26	364	58	52	1228
9		30	479	310	189	12	34	21	1282	16	2373
10			5	73	78	4	5	19	68	133	385
Col. Total	18	121	1247	1530	4403	97	89	1228	2373	385	11491
%	.16	1.05	10.85	13.32	38.32	.84	.77	10.69	20.65	3.35	

Results and interpretations, student-initiated talk (Category 9)

A marked increase in the frequency of student-initiated statements (Category 9) may be noted from the first to the second semester. Table 3 and Figure 1 will show the reader that student-initiated verbalization utilized 5.05 percent of the verbal interaction during the first semester and 20.65 percent of the verbal interaction during the second semester. The "average" percent inclusion of Category 9 of the total verbal interaction in a classroom is roughly 8.00. Table 3 and Figure 1 reveals that the teachers involved in the Clark High School Interaction Analysis Inservice Teacher Training Program promoted the use of student-initiated talk from "below average" to "much above average." Table 4 (first semester) reveals that there were 296 transitions to Category 9, while Table 5 (second semester) shows that there were 1091 transitions to Category 9. This finding indicates a greater frequency of student-initiated verbalization (Category 9) during the second semester. It may be seen from Tables 4 and 5 that the total percent of Column 9 represented by the 9-9 cell is 20 and 54 respectively. Thus, the 9-9 cell was used more extensively during the second semester of the in-service training program. A much greater frequency of student-initiated ideas following any teacher verbalization during the second semester indicates that more ideas were determined by students than by teachers during this period of time.

The results here obtained make it possible to accept the hypothesis.

Results and interpretations, cells representing 2 percent or more of the verbal interaction

Since this section of this paper consists of reporting results and interpreting these results from a percentage standpoint, the reader must be offered an interaction matrix on which the frequencies have been converted to percentages. Tables 6 (first semester) and 7 (second semester) represent cell frequencies converted to percentages.

3-3 cell

Use of the 3-3 cell was much above average for both first and second semesters of this investigation. The percent the 3-3 cell represents of the total of column 3 was greater the first semester than the second semester. This change may be the result of a greater dispersion of 3-3, 8-3, and 9-3 cell frequencies during the second semester. Such a frequency distribution may be interpreted to mean that the teachers in the program utilized an inquiry approach to teaching more the second semester than the first semester. Use of the 3-3 cell changed from 1.33 percent of the total verbal interaction the first semester to 3.06 percent of the total verbal interaction the second semester. This finding indicates that the teachers involved accepted student ideas more the second semester than the first semester.

3-4 cell

Greater use of the 3-4 cell occurred during the second semester of this investigation. Teachers attempted to ask questions immediately following the acceptance or clarification of student ideas more the second semester. That is, immediately following teacher acceptance of a student response, the teacher asked a question based on his, the teacher's, idea (s). This finding is not congruent with the purpose of the project.

Table 6. Verbal interaction frequencies represented as percentages, first semester

	1	2	3	4	5	6	7	8	9	10
1										
2		.10	.38	.78	.30			.15	.29	
3		.05	1.33	.53	.25	.10			.62	
4				6.41	.75	.32	.13	12.79	.94	1.38
5				4.61	32.25	.16	.09		.35	.47
6				.76		.50	.08	.20	.05	.10
7				.56	.29		.97	.13		
8		1.67	.61	7.59	3.27	.15	.48	8.17		.25
9		.14	.43	1.25	.24	.05	.07		2.56	.30
10		.03	.13	.23	.58	.40	.13	.76	.24	1.08
Total %	0.00	2.00	2.88	22.72	37.94	1.68	1.95	22.19	5.05	3.59

Table 7. Verbal interaction frequencies represented as percentages, second semester

	1	2	3	4	5	6	7	8	9	10
1			.03	.03	.09					
2			.25	.40	.12			.10	.08	.10
3	.10	.23	3.06	2.07	1.69		.09	.09	3.33	.18
4			.23	2.76	.17	.08		6.61	2.58	.89
5	.05		.42	2.61	32.44	.09		.19	2.12	.39
6				.03	.09	.38		.14	.17	.03
7			.06	.30	.12		.12	.04	.12	
8		.56	2.58	1.77	1.28	.16	.23	3.17	.50	.45
9		.26	4.17	2.70	1.64	.10	.30	.18	11.16	.14
10			.04	.64	.68	.03	.04	.17	.59	1.16
Total %	.16	1.05	10.85	13.32	38.32	.84	.77	10.69	20.65	3.35

3-9 cell

Greater use of the 3-9 cell the second semester, coupled with greater use of the 3-3, 9-3, and 9-9 cells, points to a more inquiry-oriented process of instruction during the second semester.

4-4 cell

Extended use of questions was less frequent during the second semester of the program. The use of less lengthy questions during the second semester may be the result of a limited amount of training in questioning techniques experienced by the teachers during the last phase of the training period. The goal of this phase of the program was to reduce the frequency of questions and advance the quality of the questions employed. The results here reported may be interpreted to mean that the goal was at least partially attained.

4-8 cell

Greater frequencies in the 4-8 and 8-4 cells during the first semester of the current investigation indicates a more rapid teacher-student verbal interchange characteristic of a rapid drill pattern of teaching. Support for this interpretation will be offered in the results and interpretations section of this paper focusing on ratios. The steady state ratio (SSR) and pupil steady state ratio (PSSR) will endorse the foregoing interpretation.

4-9 cell

Use of the 4-9 cell advanced considerably from first to second semesters. Greater use of the 4-9 cell may indicate several possibilities: (1) the questions posed were of such a nature that they tended to promote

expansion of students' responses; (2) the questions were not directly reacted to by students, but the students tended to introduce their own ideas either related or unrelated to the teacher's query; and (3) students requested more information about teacher questions. These interpretations might be considered positive in light of the objectives of the program. The 4-9 cell might also be considered a motivation-promoting cell because motivation usually requires student freedom to react to a teacher question without fear of teacher rejection.

5-4 cell

Use of the 5-4 cell became less during the second semester of this investigation. The important issue at this point is that the teachers appeared to be using fewer 5-4 sequences and replacing these with 5-9 sequences. In other words, rather than ask questions related to lecture, the lecture was more thought-provoking and promoted more student-initiated responses. Student responses to teacher questions (4-8, 4-9) which might follow a 5-4 sequence indicated that more student-initiated responses (4-9) occurred during the second semester, while fewer teacher-initiated student responses (4-8) occurred during this same period of time. That is, not only did the use of the 5-4 cell become less frequent during the second semester, but when it did occur, the student response was more likely to be expanding.

5-5 cell

Use of the 5-5 cell remained approximately the same for both semesters of this investigation. As was previously mentioned, however, an increase in the use of the 5-9 cell and a decrease in the use of the 5-4 cell during

the second semester might lead one to believe that teacher lecture was more frequently interrupted with student-initiated thought during this period of time.

5-9 cell

An increase in the use of the 5-9 cell during the second semester signifies an advancement in student initiation in response to teacher lecture. This finding may be interpreted to mean that lecture during the second semester was more stimulating and thought-provoking. It should be recalled by the reader that such an increase was an objective of this program.

8-3 cell

A large increase in the use of the 8-3 cell during the second semester of the program points to increased teacher acceptance and use of ideas expressed by students. This result may be interpreted to mean that the teachers during the second semester of the program encouraged more student participation and expressed more genuine interest in what students were saying. The reader should also recall that an increase in the use of teacher acceptance of students' ideas was a major objective of this project.

8-4 cell

A decided decrease in the use of the 8-4 cell was noted from first to second semester. When this result is coupled with fewer frequencies in the 4-8 cell during the second semester, one might interpret this result to mean that the short question-short answer sequence was less in effect during the second semester. One of the objectives of the program

was to promote more student-initiated responses and consequently reduce the quick drill or 4-8-4-8 pattern. It would appear that such was accomplished. Observation of Tables 6 and 7 will show that a decrease in 8-4 cell frequencies may have led to an increase in 8-3 cell frequencies. It was the desire of the personnel involved in this program to reduce teacher questions which reflected the teacher's own ideas as in the 8-4 cell and promote acceptance by the teachers of student verbalization stimulated originally by the teachers as in the 8-3 cell.

8-5 cell

Use of the 8-5 cell, which involved narrow student response followed by teacher lecture, was reduced considerably from first to second semester. An increase in the 8-3 cell may indicate that some of the first semester teacher responses to students restricted comments changed from lecture to acceptance of what students were saying or to comments incorporating students' ideas (8-5 to 8-3).

8-8 cell

Use of the 8-8 cell, extended student response initiated by the teacher, was reduced measurably from first to second semester. Some attempt was made during the course of this program to promote more 8-9 sequences. Such was attained to a very limited degree and may, in part, explain a reduction in the use of the 8-8 cell during the second semester. That is, rather than continue with narrow responses as in the 8-8 cell, the students expanded their comments and advanced to the 8-9 cell. Most of the reduction in frequency of the 8-8 cell from the first to the second semester, however, was absorbed by the 8-3 cell.

9-3 cell

Use of the 9-3 cell increased greatly from the first to the second semester. Increased use of the 9-3 cell coupled with an increase in the use of the 3-3, 3-9, and 9-9 cells points to the employment of the inquiry pattern in the teaching style and is congruent with the objectives of the program. More student ideas were clarified or developed by the teacher during the second semester than were clarified or developed during the first semester.

9-4 cell

Use of the 9-4 cell increased perceptibly from the first to the second semester. This finding indicates that the teacher introduced his own ideas through questions following student-initiated talk more during the second semester than during the first semester. When the choice to be made by the teacher following a 9-9 sequence was to select a 9-3 or a 9-4, however, he most frequently elected to clarify ideas expressed by students (9-3) rather than introduce new questions based on his own ideas (9-4). Tables 6 and 7 will show this behavior during the first and second semesters respectively.

9-9 cell

A definite increase in the use of sustained student-initiated verbalization occurred between the first and second semesters. The reader will recall that this objective was most certainly one of the major objectives of the program. An increase in the use of the 9-9 cell in conjunction with advanced use of the 9-3, 3-3, and 3-9 cells, as previously discussed, describes a pattern most closely resembling the inquiry approach to teaching.

Results and interpretations, ratios

The following section of this paper bases the interpretations of results on ratios developed by Ned A. Flanders. The reader should refer to the definition of terms section of this paper for a review of the meanings of the ratios which follow. The term "average" as used in this section of the report refers to a mythical national average established by Flanders.

Teacher Response Ratio (TRR)

It may be noted on Table 8 that teacher response ratios for the teachers involved were much above the mythical national average both the first and second semesters. The teacher response ratios for both semesters were inflated because of the low incidence in Categories 6 and 7. Nonetheless, this result points to the fact that the teachers frequently reacted to students' ideas and feelings. A great increase in the teacher response ratio from the first semester (57) to the second semester (88) verifies a decided growth in teacher sensitivity to students' ideas and feelings following the Inservice Training Program. The teacher response ratios also indicate that the teachers involved exhibited simultaneously strong motivational forces and control in the classroom. An advance in this ratio from first to second semester indicates that the teachers progressed from being slightly indirect to very indirect in approach to motivation and control. The i/d ratio gives the same results.

Teacher Question Ratio (TQR)

A reduction in the teacher question ratio the second semester suggests a decreased use of questions in directing the content of a lesson. Two

of the objectives of the Clark High School Interaction Analysis Inservice Teacher Training Program were to employ fewer but more effective questions. It appears that the former objective was attained to some degree since fewer questions were used during the second semester. The latter objective may or may not have been achieved. It is hoped that the results show that the teachers learned to lead a class discussion by asking fewer but more highly developed questions.

Table 8. Interaction ratios, first and second semester

	RATIOS											
	TRR	TQR	PIR	TRR89	TQR89	CCR	SSR	PSSR	TT	ST	SC	I/D
First Semester	57	37	19	79	72	61	53	39	69	27	4	.40
Second Semester	88	26	66	91	60	52	61	46	65	31	3	.39
Norms (average)	42	26	34	60	44	55	50	38	68	20	12	

Pupil Initiation Ratio (PIR)

Table 8 will show the reader that the pupil initiation ratio for the first semester (19) was much below average (34). This result may be attributed in part to the facts that half of the interaction team consisted of mathematics teachers, and mathematics is a discipline which perhaps lends itself to greater content orientation than most disciplines and thus somewhat limits student initiation. The great increase in the pupil

initiation ratio the second semester, from 19 to 66, is a result of a greater use of Category 9 and a lesser use of Category 8 during that time period. A high PIR supposes that pupil response is not determined by questions posed by the teacher. This supposition lends support to the reduced teacher question ratio during the second semester of this investigation. The reader will recall that the hypothesis of this investigation predicted greater use of Category 9 following interaction analysis training.

Instantaneous Teacher Response Ratio (TRR89)

The instantaneous teacher response ratio followed the same pattern as was noted for the teacher response ratio (TRR). Such a pattern is understandable because the TRR89 is highly related to the TRR. The instantaneous teacher response ratios for both semesters were much above the average. An advance of this ratio from 79 the first semester to 91 the second semester, however, may be interpreted as meaning that the teachers during the second semester were more prone to offer encouragement or react to students' ideas immediately after the student terminated his talk than was true during the first semester.

Instantaneous Teacher Question Ratio (TQR89)

Table 8 will show the reader that the instantaneous teacher question ratio from first to second semester followed the same pattern as the teacher question ratio. The instantaneous teacher question ratio during both semesters was higher than the average, but this ratio lessened during the second semester. This finding may be interpreted to mean that during both semesters the teachers were prone to move to a question rather

than lecture, but such a move was less likely to occur during the second semester. This finding may also be interpreted to indicate that teacher-student interchange was high during both semesters of this investigation but higher the first semester. A reduction in the use of questions during the second semester may be a result of teachers attempting to use fewer but more effective questions. The use of fewer teacher questions may result in less rapid teacher-student interchange.

Content Cross Ratio (CCR)

The reader will note on Table 8 that the content cross ratios did not differ greatly from the average during either the first or second semester of this investigation. The content cross ratio for the first semester (61) was slightly above the mythical national average (55) while the same ratio for the second semester (52) was slightly below the average. The percent of verbalization which fell into columns and rows four (4) and five (5) was 60.66 during the first semester and 51.64 the second semester. The reduction in use of the content cross area during the second semester of this investigation is largely the result of the employment of fewer questions during this period of time. The reader should realize that this finding supports an objective of this investigation. The results related to the content cross ratio may be interpreted to mean that the teachers focused slightly less on subject matter the second semester of the program and assumed a less active role in discussions during this period of time.

Steady State Ratio (SSR)

Table 8 reveals that the tempo of interchange between teachers and students is slower than the national average. The reader should know that this ratio is inversely related to verbal interchange. That is, the higher the ratio the slower the rate of interchange between teachers and students. Interchange during the first semester (53) was slightly below the average (50) and even less rapid during the second semester (61). The results here disclosed may be attributed to a greater use of the 9-9 cell during the second semester. This finding may be interpreted to mean that lessons during the second semester were less likely to follow a rapid drill pattern or extended teacher-initiated student response sequence and more likely to follow an inquiry or student-initiation pattern.

Pupil Steady State Ratio (PSSR)

The pupil steady state ratio (PSSR) is an index similar to the steady state ratio (SSR) but is more sensitive to the tempo of teacher-student interchange. A first semester pupil steady state ratio of 39 approaches the mythical national average (38). This same ratio reached a reading of 61 during the second semester. The reader should know that this ratio, like the steady state ratio, is inversely related to teacher-student verbal interchange. The findings here reported may again be the result of greater frequencies in the 9-9 cell during the second semester. Reduction of the pupil steady state ratio during the second semester may be interpreted to mean that, like the SSR, the teacher-student interchange was less rapid due to the absence of a drill pattern of instruction.

Also, reduction in the use of the 8-8 cell during the second semester was more than offset by an increase in the use of the 9-9 cell. Thus, the prolonged use of the 9-9 cell would limit teacher-student interchange, but it would show an increase in student initiation. Furst (1965) found a positive correlation between moderate interchange and student achievement. The results of this investigation show that the teacher-student verbal interchange may be considered moderate.

Percent of Teacher Talk (TT)

Table 8 shows that the percent of teacher talk (69) during the first semester of the Clark High School Interaction Analysis Inservice Teacher Training Program was very slightly above the average (68) while, during the second semester, this percent (65) was slightly below the mythical national average. One objective of the program was to reduce teacher talk while increasing student-initiated verbalization. It appears that this goal was achieved to some degree.

Percent of Student Talk (ST)

Table 8 reveals that student talk advanced from 27 percent of the total verbal interaction during the first semester to 31 percent of the total verbal interaction during the second semester of the program. Although the advance in student participation is not great, it is nonetheless in the desired direction. The increase in student participation is more significant when one realizes that such participation was much more student-initiated during the second semester of the program.

Silence or Confusion (SC)

The average silence or confusion approaches 12 percent. The percent of silence or confusion recorded during the first semester of the Clark High School Interaction Analysis Inservice Teacher Training Program was only 4 and this percent was reduced to 3 during the second semester of the program.

Additional results and interpretations, teacher response, teacher initiation, student initiation

It may be noted on Tables 6 and 7 that teacher response during the first semester reached 4.88 percent of the total verbal interaction. This percent advanced to 12.06 during the second semester of the program. Teacher initiation was reduced from 62.34 percent the first semester to 52.48 percent the second semester. Student initiation advanced from 5.05 percent the first semester to 20.65 percent the second semester. These findings are in accord with the goals of the program. That is, it was the desire of the personnel involved in the program to limit teacher initiation while increasing teacher response to greater student initiation.

A NOTE OF CAUTION

On the basis of the results herein reported, the hypothesis must be accepted. However, Emmer (1968) listed several limitations to such findings:

> First, there is still the possibility that some other unobserved variable, varying concommitantly with teacher use of student ideas, may have been responsible for the changes in student initiation. Also, this category called use or acceptance of a student's ideas is in fact made up of a number of behaviors: clarification, expansion, comparison, and asking questions based upon a student's ideas are coded into this category. It may be that certain of the behaviors are more effective elicitors of student initation than others, or that certain students are more responsive to one than to others, in different instructional settings. (Emmer, 1968, pp. 6-7)

In addition, the reader should realize that the first semester of this project was actually shorter chronologically than the second semester. It was November before the teachers had learned the Flanders system of interaction analysis well enough to attempt an adjustment of teaching styles. Therefore, the teachers involved had a longer period of time and more tools with which to work during the second semester of this project.

SUMMARY

Only the most prominent of the results shall be reported in this section of the paper. The reader is referred to the results and interpretations section of this report for a more detailed analysis.

1. A decided increase in the use by teachers of accepting, clarifying and expanding student ideas (Category 3) was noted from the first to the second semester. This finding is supported by the teacher response ratio (TRR) and the instantaneous teacher response ratio (TRR89).

2. A very pronounced increase in student statements which were not predictable, not teacher-elictited, and not restricted in scope (Category 9) was noted during the second semester of the program.

3. A marked decrease in the number of student responses which were stimulated by the teacher and somewhat restricted in scope (Category 8) was discovered between the first and second semester.

4. Teachers became more indirect in approach to motivation and control during the second semester of the program.

5. A prominent decrease in the use of questions by teachers (Category 4) was noted between the first and second semester. This finding is supported by the teacher question ratio (TQR) and the instantaneous teacher question ratio (TQR89).

6. Teacher initiation decreased from the first to the second semester while teacher response and student initiation increased during this same period of time.

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