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ABSTRACT

The stated null hypothesis of this study is that "there will be no significant difference in criterion instrument scores which measure the numbers of types of questions (basic, leading, probing) which teachers ask their students among the following groups of inservice elementary teachers who purposefully self-evaluate their teaching by (1) self videotapes, (2) self audiotapes, (3) a combination of self videotapes and model videotapes, and (4) reflective evaluation only (i.e., without mechanical or electronic equipment)." Based on a modified version of the pre-post-test control group design, the experiment involved 78 experienced elementary school teachers randomly assigned to one of the four evaluation-treatment groups and one of the two time-treatment groups (either a single, concentrated evaluative procedure or one extended over a 3-week period of time). Included in the design of the study was systematic instruction in questioning skills techniques and in the use of the portable videotape recorder and the self-evaluation instrument. Findings of the study (based on statistical analysis of data provided by 188 videotapes rated by three trained raters and suggesting a variety of areas in need of further research) are presented and analyzed in terms of differences in questioning behavior which resulted from the various treatment combinations. Appended to the extensive report are such materials as a 96-item bibliography, evaluative and criterion instruments, and self-evaluation forms. (JES)

FINAL REPORT

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THE USE OF THE PORTABLE VIDEOTAPE RECORDER IN HELPING TEACHERS SELF-EVALUATE THEIR TEACHING BEHAVIOR

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U. S. DEPARTMENT OF
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CHAPTER I

INTRODUCTION

Many authorities have recognized that the American culture is involved in fast changing, increasingly technological development, in which man now finds economic and mental security difficult to achieve. Up to now, knowledge has been relatively static, and provided man with a relatively lasting security. But the state of knowledge is not static, rather it is dynamic; thus it brings problems to man, such as, affluence to some men, increased leisure to others; automation has replaced some men, and in some instances, segments of society, forming ghettos. These conditions are due in part to the tremendous increase in knowledge. Man is beginning to recognize that he cannot learn all there is to learn. Learning is not amassing factual knowledge; rather, it is developing broad thinking skills, such as problem solving, inductive and deductive reasoning, questioning, inquiry skills, and creative cognition. In short, knowledge is still essential, but it appears that it is best accomplished in a "learning to learn" scheme (21).

The fact that we are entering the last quarter of the twentieth century deluged with increasing masses of technological advances

places a tremendous burden on public school educators. Never before has education faced such a challenge--that of disseminating, screening, and teaching this profusity of data to the youth of this generation.

It is evident that those charged with leadership for instruction in the public schools must assume a significant responsibility in facilitating maximum use of the best learning resources now available to education. Teaching quality must be improved, and learning time must be economized if today's children--tomorrow's citizens--are to be equipped with the knowledge and skills demanded of them to solve the problems of their own generation as well as the problems still unsolved at the present time.

Max Rafferty, Superintendent of Public Instruction for the State of California, points out that the needs for education today are so pressing that "they can be filled only by the utilization of every possible tool that can be placed in the hands of competent and creative teachers" (22:iii). This premise is echoed by others. Harold Wigren, in noting the fusion of technology and education, states:

> Innovation practices which employ with considerable sophistication the use of television and other technologies are to be found in increasing numbers at all levels of education. These practices indicate the growing willingness--and determination--on the part of educational leaders to make creative application of technology in the solution of instructional problems (19:v).

If teachers are going to be subjected to new media by which they can creatively teach, it is necessary that investigative practices in these technological areas be intensified. According to Harris, what is needed is "precise, painstaking research in teacher effectiveness oriented toward a variety of educational goals in a variety of educational situations." "Most of all," says Harris, "we need a comprehensive theory of teacher behavior and learning . . ." (47: 1485).

It is becoming increasingly clear that the focus of attention should be upon the central role of the teacher and his behavior as a result of exposure to and training with new media. The Educational Policies Commission recognizes this and in 1960 stated, "The teacher, more than any other factor, determines the quality of elementary education" (29:25).

Bruner is acutely aware of the importance of the teacher, but recognizes that teachers are not sufficiently well trained to teach their subject, and strongly recommends work-research on how to train teachers (21).

The introduction of new types of recording equipment has made it possible to now offer in-service courses which stress change in teacher behavior, rather than an accumulation of content which is presented in hopes of change. One such new device is the videotape recorder.

It is with the above thoughts in mind that this study focuses on one use of the portable videotape recorder in an in-service program for experienced teachers.

STATEMENT OF THE PROBLEM

Although scattered literature references can be found with respect to the videotape recorder as early as 1959, systematic usage of the device appears to be a comparatively recent development. Only recently has the videotape recorder been introduced into educational circles for the purpose of training teachers (5). Stanford University is a forerunner in the use of the videotape recorder for the training of intern teachers and has been followed by other teacher training institutions. However, little or no empirical studies have been made concerning the effect of the machine with experienced teachers. Current emphasis on in-service utilization of the portable videotape recorder emanates from such agencies as the Far West Laboratory for Educational Research and Development in Berkeley, and from individual school districts utilizing Title I funds for implementing studies at the local level.

This study seeks to answer the following questions:

1. Can the teaching behavior of in-service teachers be changed through the use of the portable videotape recorder? If so, what are the "residual" effects of its use?

2. Can teachers who evaluate themselves with the portable videotape recorder improve or modify their teaching behavior to the same extent as those who use an audio-tape recorder?
3. To what extent does the viewing of a model tape in combination with one's own videotape affect the teaching behavior of a classroom teacher?
4. Does the technique of combining a teacher's own videotape with that of a videotape model for self-evaluation purposes show a more significant change in teacher behavior than that of the evaluation of one's self-videotape only?
5. Is it more effective to provide training and self-evaluation using the portable videotape recorder on a one-shot time basis or does evidence indicate that training over a period of time seems better?

DELIMITATION OF THE STUDY

This investigation is limited to the study of the effect of the portable videotape recorder on the teaching behavior of elementary teachers in grades one through six. No attempt has been made to introduce variables other than those procedures of evaluation as specified in the hypothesis.

The specific intent of this study is to determine whether or not change in questioning-skill ability in experienced elementary

classroom teachers is possible through the use of the portable videotape recorder and four different means of self-evaluation.

The use of basic, leading, and probing-type questions in the teaching-learning process comprised a portion of the training program for subjects. It is important to note that the training sessions did not attempt to specifically emphasize the use of one type of questions more than another as far as the videotaped lessons were concerned. Each of these three types of questions were identified, studied, and discussed via the Far West Laboratory for Educational Research and Development training tapes and in the discussion that followed. However, because probing-type questions stimulate and develop the higher cognitive processes (93:133), their importance was stressed. Therefore, a second purpose of this study was to determine whether or not teachers, through the process of self-evaluation, as outlined in the hypothesis of this study, and a knowledge of the value of these three types of questions, would significantly change their questioning-skill behavior in the direction of an increase of probing questions asked between pre-taped and post-taped lessons.

JUSTIFICATION OF THE STUDY

The marriage of the portable videotape recorder concept and the process of television is one which is both natural and educationally

sound. The PVTR contributes to television by providing videotapes for delayed viewing or "instant replay." There is now considerable evidence to document that television can be used with great effectiveness for a wide variety of instructional tasks, ranging from classroom instruction, pre-school instruction for young children, out-of-school instruction for youth, the fundamental and basic education of adults, the training of industrial workers for new jobs in an age of automation, and the pre-service and in-service education of teachers. In the judgment of many educational leaders, however, the greatest promise for instructional television lies in the latter category, i.e., its ability to offer professional growth opportunities for teachers.

Assessing teacher effectiveness is an educational and administrative frustration. It is a pressing problem in education today. Multitudinous studies have been directed towards its solution (79). Few have been successful in establishing specific criteria for self-evaluative purposes. Many theories exist, but none have provided the key to objective evaluation of meritorious teaching. Until a program of evaluation is developed that is acceptable to teachers and administrators alike, success in identifying satisfactory evaluatory practices will continue to be evasive.

The components of this study are closely allied with this problem. This study is an investigation into objective procedures for evaluating the teaching process. The theory of self-evaluation and

its correlation to teacher behavioral change appears to be positive, but in desperate need of verification.

DEFINITION OF TERMS

The following definitions are presented because of their technological nature and/or specialized meaning as pertains to this study:

1. Portable Videotape Recorder (PVTR): an electronic system whereby a television camera receives both visual and auditory images which are transmitted to the recording system, a system which retains images and sounds on tape. The tape recorder can play back on its own monitor, through any standard television set nearby, or through television studio channels.

2. Micro-teaching: short, videotaped lessons or lesson segments of 5-10 minutes duration taught to small groups of from four to six pupils.

3. Purposeful self-evaluation: the process of self-evaluating with specific intent and evaluative instrumentation.

4. Feedback: The process of receiving immediate, recognized correction or reinforcement from a videotape or audiotape.

5. Questioning-skill: the number of types of questions asked by a teacher in a given lesson, i.e., basic questions (p. 62); leading questions (p. 64); or probing questions (p. 65).

6. Teacher behavior: "The behavior, or activities, of persons as they go about doing whatever is required of teachers, particularly those activities which are concerned with the guidance or direction of the learning of others" (79:15).

7. Reinforcement: an event that follows the action of a person and which leads to the modification of the person's behavior (58:399-404).

8. Set: an explanation to the teacher of lesson objectives or teaching techniques to obtain these objectives; this precedes the teaching act.

9. Self-view: designated by "SV," and meaning the viewing of one's own videotape.

10. Model-view: designated by "MV," and meaning the viewing of a videotape teaching model.

11. Audio-tape: designated by "AT," and meaning that the teacher listens only to the audio portion of the videotaped lesson.

12. Experienced teacher: a teacher with in-service experience of at least one year.

13. Teach: designated by "T," and meaning the act of teaching for videotaping.

14. Playback: an immediate showing of a videotape.

15. Videotape: a visual reproduction of a teaching act on magnetic tape.

16. Reflective evaluation: that process by which a teacher re-thinks (reflects upon) the lesson taught without the aid of mechanical or electronic equipment.

ASSUMPTIONS AND THE STATED HYPOTHESIS

The following assumptions have been formulated after a review of the literature. They serve to generate the hypothesis for this study:

1. The ego of a teacher is deeply involved in determining the direction of change in her teaching behavior. One's self percepts will be enhanced by the opportunity to view himself in the teaching act; teacher behavior is observable (79:16).
2. In-service education programs are in desperate need of new and effective modes of training teachers to improve the teaching act.
3. There is value in the process of purposeful self-evaluation; teachers are not always conscious of their needs.
4. The ability to ask purposeful questions is a technical skill; it can be developed through training and practice.

The Stated Hypothesis: There will be no significant difference in criterion instrument scores which measure the numbers of types of questions (basic, leading, probing) which teachers ask their

students among the following groups of in-service elementary teachers who purposefully self-evaluate:

a. Self videotapes

b. Self audiotapes

c. A combination of self videotapes and model videotapes

d. Their teaching by reflective evaluation only.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The demand for fast communications is one of the facts of modern life. We all share in the vast explosion of information that was ushered in with the technological breakthroughs in electronics, in computers, and in television. The fields of research, industry and education develop new discoveries, new data, and new information every day. We are bombarded with information from the time we get up until we turn in. Some of it is absorbed by us. Some of it is not. In spite of this, we do have a need for knowledge and, in fact, we have come to expect it to be available instantly.

Information is useless unless it can be retrieved when it is needed most. We forget easily. The printed word alone is not strong enough to impress the mind as forcibly as the combination of seeing and hearing. Just reading about a particular event is futile unless we can see it. Only then is it hard to forget.

The need for sight and sound communications is very pressing. New surgical techniques that can save lives must be shared among doctors. A revolutionary product innovation must be seized upon

quickly before competition can develop and exploit it. It must be explained to the sales force and to prospects. This same need exists for teachers, athletes, students . . . just to name a few.

THE DEVELOPMENT AND USE OF THE VIDEOTAPE RECORDER

In 1944 videotape was still in the realm of science fiction. The business at hand was developing and producing advanced electric motors and generators for airborne radar systems. When the war ended in 1945 electronic companies began pioneering work in a whole new field . . . magnetic recording. By 1947, this early research resulted in a product that revolutionized radio broadcasting. It was the first professional quality magnetic tape recorder. High-fidelity music became a reality. Since that time, professional tape recorders have been used for making master recordings, and are used in the majority of radio stations throughout the free world.

In 1956, the first commercial videotape recorder was introduced to the television industry. This was followed two years later by the introduction of the first color videotape recorder.

Currently, recorders are used by National Aeronautics and Space Agency to preserve the vital data transmitted by manned and unmanned space flights. Instrumentation recorders have also been used to record the data that provided the first close-up pictures of Mars and also those from the Lunar Orbiter series of space probes.

This wide base of usage has established the videotape recorder as a pacesetter for communications and training.

A portable videotape machine works on much the same principle as an audio-tape machine; that is, it records and plays back, or simply plays back, images and sound on magnetic tape. These devices offer advantages to educational programs in terms of (1) economy and quality of production, (2) economy of distribution, and (3) convenience in program use. In addition to the programs which can be produced locally with videotape, hundreds of high quality ITV courses on all grade levels and on a wide variety of subjects are available from the large regional and national libraries. These taped courses can be rented and played back over a district recorder-distribution-display system.

The development of the videotape recorder has added a major new dimension to the methodology of teaching. For the first time, teachers can see immediately how they have performed. They cannot only see results at once but can practice a given skill repeatedly until it is perfected.

The potentiality of the machine lies in its use as a device for recording and analyzing complex human behavior. With the advent of instructional television the videotape recorder has become a prime factor in the establishment of equipment whereby educational programs, past and present, may be videotaped for release at a

later time. The relationship and compatibility of the VTR and television is so closely linked that any school district contemplating the utilization of instructional television will find a videotape recorder to be an essential component of the system.

The California State Department of Education states that when distribution and display systems are contemplated by school districts, "the addition of a videotape machine as an originating source is highly desirable" (22:26). Moreover, the Department states, "When local production facilities are contemplated, the inclusion of a videotape facility is mandatory if true quality and efficiency are to be achieved" (22:26).

Advantages of the portable videotape recorder in the training of experienced teachers are many. The sight-sound medium can fulfill an eavesdropping function without the intrusive presence of the physical observer. It can multiply to the capacity of a viewing room the number of observers that may watch without being in the physical presence of the subjects being observed. The eye of the observers may be extended to the extent that the videotape camera may roam at will, provide close-up views of student and teacher's faces and activities to an extent quite impossible in in-person viewing. "If properly directed with a knowledgable professional determining the selection of multiple camera views, the views shown can be selected with the optimum educational effect in mind" (81:2).

Personnel at Hunter College find additional advantages (81). Videotape is not time-bound; it captures for the life of the recording what in the in-person or live view happens but once and is forever lost except in highly fallible human recall. For example, a particular recording of a happening in the first grade science lesson is available for replay whenever it is needed (as in an in-service program for the faculty), or it is available for individual teachers tomorrow, the next day, or next year . . . long after the event has actually taken place. Finally, it can be discarded, erased, or at least not used in a particular instructional situation because of its lack of pertinence to the matter at hand. It also has the additional advantage of being editable and generally independent of its final application from the medium that originally produced it.

Hunter College recognizes that there is a seriously restrictive limit on how much can be learned about children and teachers without seeing and experiencing them in actual behavior. States Hunter personnel, "The recorded sight-sound media, particularly portable video-recordings on tape . . . provide intriguing means of extending these necessary observation and demonstration functions to hitherto unknown levels of efficiency and pertinence" (81:2).

Considerable emphasis is being directed toward school districts with a view toward improving their in-service educational programs. The following statement serves as an example (22:30):

> Under the impetus of grant monies now being made available to schools, the purchase of television equipment is now within the reach of many school organizations, and the possibilities of their use is indeed exciting . . . . The portable videotape recorder is an example. The capability of such a recorder to record, to store for future use, or to instantly play back information in both picture and sound, and then to erase this information and record and play, has applications which are challenging to many teachers and other school people.

The California State Department of Education felt that the use of the portable videotape recorder in schools was so important that a special study was conducted in June, 1967, of the current makes of portable videotape recorders with the purpose of developing guidelines for their economical purchase in the light of instruction-justified need. This study was funded by an ESEA, Title V grant, and was headed by Dr. Jacob H. Wiens of the College of San Mateo.

There is a sparsity of information regarding the use of the portable videotape recorder in in-service education programs. An exhaustive search of current research periodicals, as of this writing, indicates that empirical research in using the PVTR with experienced classroom teachers is rare. The only available information emanates from an in-service program initiated by the Far West Laboratory for Educational Research and Development in Berkeley, California. This agency has actively initiated and developed a series of in-service programs which has been actively employed by cooperating school districts. As stated in PROGRAM PLANS (34:13) the mission of the FWL has been "to improve the

effectiveness of classroom teachers by developing, evaluating and implementing programs of in-service education based upon models and/or simulations of teacher behavior and aimed at essential skills and knowledge related to basic teaching performance, teaching non typical pupil groups, teaching in new educational programs, and teaching new curricula."

In February, 1968, Walter R. Borg of the FWL reported preliminary findings of the program (18:6-7). Although the focus of the FWL program is considerably different from that of this investigation, it is important to note the following results based upon the utilization of the PVTR, micro-teaching, and teachers with classroom experience:

> Previous studies have shown that teachers talk as much as 70 per-cent of the time during class discussions . . . . Analysis of the videotapes of the 48 teachers who took Minicourse 1 during the field test revealed that on the pre-course tapes the average teacher talked nearly 52 per-cent of the time, while on the post-tapes the average teacher talked 28 per-cent of the time. This indicates a major change in the teachers' behavior in conducting discussion lessons.

One segment of the FWL program closely parallels the variable of teacher questioning-skill in this investigation, the training of teachers to ask questions that require pupils to use higher cognitive processes. FWL results indicated that 63 per cent of teacher questions on the pre-tapes called for specific facts and 37 per cent called for higher cognitive processes. In the post tapes, fact questions were

reduced to 48 per cent, and higher cognitive questions increased to 52 per cent. "From the data analysed to date," says Borg, "we may conclude that the miniccurse shows considerable promise as an instructional model to develop teaching skills and bring about changes in the teacher's classroom behavior" (18:8).

Some authentic studies having to do with component practices of PVTR use are available. Acheson's study (2), was undertaken using teacher interns at Stanford University. Subjects chosen at random presented ten minute lessons three times per week for six weeks. The technique of micro-teaching was used in this study. Half of the experimental group viewed television recordings of their performance following each lesson. Interns who received feedback from student evaluations and also from television made even greater gains over those in the control group (beyond the .01 level).

The value of substituting portable videotape recordings for live observations in training intern teachers was studied by Olivero. Although this study, too, was conducted with inexperienced teachers, results demonstrated that there was a significant difference (to the .05 level) favoring the use of video recordings (71:5769). This finding offers reinforcement to the present investigation.

Popham tested 124 college students at UCLA in 1965 to determine the value of four different videotaped instructional sequences in bringing about behavior changes in prospective teachers.

The chief target behavior sought was the subject's ability to identify the presence of certain instructional principles in videotaped situations. Popham inferred that instructional programs can be devised which significantly increase the probability that the student will acquire this ability. He notes, however, "that the brief printed or audio taped instructional materials were not sufficient in themselves, to produce the level of terminal behavior secured through the use of videotaped programs" (76:5).

The portable videotape recorder is experiencing wide use in numerous teacher training institutions. Robert C. Jones of the University of Massachusetts has utilized the PVTR with students majoring in elementary education (50:3-4). Similar uses and programs have been initiated elsewhere.

MICRO-TEACHING

Stanford University was among the first to systematically investigate the use of the portable videotape recorder with teacher interns. The technique was dubbed "micro-teaching" (40). Gage indicates that the term evolved from a term coined "micro-criteria" by him in 1962. At that time he was advocating a specific approach to the analysis of classroom instruction and maintained that "if variables at one level of phenomena do not exhibit lawfulness, break them down" (40:602). The rationale involved suggests that

technical skills are specified instructional techniques and procedures that a teacher may use in the classroom. They represent an analysis of the teaching process into relatively discrete components, and, according to Gage, "these can be used in different combinations in the continuous flow of the teacher's performance" (40:602).

Gage explains that micro-teaching is simply a "scaled-down" teaching exercise. The exercise is short, usually between five to ten minutes. The teacher teaches a group of between four to six students. In terms of the lesson, since the teacher attempts to perform only one of the technical skills in any single micro-teaching session, specific concentration can be devoted to the teaching skill involved in the lesson. The sessions are recorded on videotape, and the teacher then gets to see and hear himself, then reteach the same lesson to a new small group of pupils in an attempt to improve on his first performance.

Micro-teaching as a teaching methodology is endorsed by Dr. Warren Kallenbach, Project Director for the FWL. According to Kallenbach, "micro-teaching offers the considerable advantages of immediate knowledge of results and opportunity to practice a given skill at once and until satisfactory performance is obtained and without disservice to classroom groups" (51:5).

Borg (18:4-5) also emphasizes specific advantages of micro-teaching:

1. Since the teacher is working with a short lesson and few students, she can try out new methods and ideas in a less difficult situation than that found in the regular classroom. This reduces the threat implicit in trying new approaches and thus encourages teachers to change and improve.
2. Micro-teaching gives the teacher a chance to learn teaching skills through direct experience. Many teacher education programs fail to develop classroom skills because the teacher is told about the skills, but does not practice them in a controlled situation.
3. The teacher gets immediate reinforcement from viewing, revising, and reteaching the lesson; and noting changes in pupil behavior.
4. The teacher gets immediate feedback from the videotape replays of her teaching. Thus, she can promptly evaluate her progress, eliminate bad habits and more firmly establish the new methods she is learning.
5. Micro-teaching focuses on specific skills rather than generalities.

Bush and Allen also acclaim the virtues of the technique (5) as providing "an opportunity for those who are preparing to teach to obtain a liberal amount of practice immediately upon their entrance

into training, under optimum conditions for the trainee without endangering the learning of pupils."

Authorities feel that micro-teaching has direct implication for enhancing in-service programs. Allen (4:Sec. 4, p2) maintains that "While micro-teaching was first developed for preliminary experience and practice in teaching and as a research vehicle to explore training effects under controlled conditions, the concept can be of service to experienced teachers as a means of gaining new information about their teaching in a relatively short time, and as a means of changing teachers' perceptions of their own teaching behavior."

Experienced teachers may gain new insights through adaptation of the micro-teaching model. Under the present framework, if a teacher wishes to try a new approach in a particular lesson, he must wait until the following year to test alternatives to that lesson. In micro-teaching, the teacher can experiment with several alternatives with a limited number of students each time, with the opportunity for immediate evaluation and additional trials. Following this limited application, the plan can then be presented to an entire class. In this way, teachers may experiment with new methods and new content without the risk of defeating student learning and with much more satisfactory timing.

The micro-teaching is an effective stimulus for the improvement of teacher performance after a plateau is reached in

early tenure. "The most effective teachers attain a high level of performance early in their careers," states Allen. "Unfortunately, they rarely have the stimulus to further increase their competence. Providing them with an opportunity to try new ideas easily and without risk to student learning can be an important asset to professional development" (4:2).

A number of recent studies have utilized the technique of micro-teaching. A 1966 study at Stanford University indicated that the results of micro-teaching in teacher training showed that candidates trained over an eight week period performed at a significantly higher level of competence than a similar group of candidates receiving separate instruction and theory with an associated teacher aid experience. Specific skills were also found to produce a higher level of competency during instruction in micro-teaching.

Gage, Fortune, and Shutes utilized the concept of micro-teaching in an investigation in 1965 (40:601-606). In this study an attempt was made to determine the generality of explaining ability, and the degree to which the ability to explain a topic to one group of pupils on one occasion was correlated with the ability to explain the same topic to another group of pupils on another occasion. The same consisted of forty social studies interns at Stanford University. Results showed that the interns were moderately consistent in their ability to explain the same topic to different groups on different

occasions, but they were not consistent in their ability to explain different topics.

One segment of Gage's study is particularly relevant to the present study. Gage was concerned as to whether or not there was variance in the interns' lectures that would be manifested in something about the lecture that was visible or audible. Results showed that teacher effectiveness in explaining was reflected in something that could be seen or heard in the lecture. This finding lends emphasis to the possibility that there may be some credence to the variable of self-evaluation utilizing the PVTR in the present experiment.

IN-SERVICE TRAINING

The value of profitable in-service education as a technique to further the education of teachers is hardly open to question. Reno, in a recent article (78:2) states:

> To anyone familiar with American education, it is quite evident that our most urgent educational problem is not the education of the un-educated--the education of school children or the functionally illiterate or the disadvantaged or the so-called "ineducable." It is the education of the educated.

In the past, in-service training courses for teachers have generally not been successful in significantly improving teacher effectiveness. Miles reported in 1964 that on the elementary level, almost fifty per cent of schools in California were having extreme

difficulty with their in-service programs. "The large number of teachers to be trained, and the inability of administrators and supervisory staff to provide effective leadership in the substantive content of new programs made formal in-service work relatively ineffective" (64:171).

It is generally recognized that in-service programs specifically designed to promote teacher effectiveness have been extremely poor. Harris points out that the reason for this is due to research and administrative practice proceeding on the premise that teaching competence is a unitary trait. "Many educators," states Harris, "still act on the assumption that the teacher who stimulates the greatest student growth in one basic skill will stimulate the greatest growth in other skills, as well as in problem solving, social adjustment, and other educational objectives. Perhaps most of all we need a comprehensive theory of teacher behavior" (47:1485).

If in-service training is to change teachers in the ways that seem necessary, it must break free of the present educational model. In the past, in-service training courses for teachers have been generally not successful in improving teacher effectiveness. This has been due in part to the fact that certification requirements have usually required teachers to take added course work, with the inducers based on the accumulation of a specific number of credits,

rather than any defined change in behavior. The result is teacher apathy.

American education is faced with a dilemma--not only must teachers be trained to screen which of the deluge of knowledge increasing daily should be taught, but they must be sufficiently well trained to teach it. Bruner expresses great concern regarding this problem. He maintains that "such teaching requires special training, and it is not clear what the most effective form of training is" (21: 88-89). He endorses work-research on how to train teachers along with research on the actual teaching of younger children.

Denemark (27) joins Bruner and Harris in referring to the teacher as a communicator of knowledge and emphasizes the ever-increasing need for continuous and effectual training of teachers. Emphasis has come from other sources, as well. The FWL has aligned itself with the major mission of improving in-service education (34). The Federal Government, under Title III, recognizes the need for "catalytic" action to spur hesitant school districts toward more emphatic and effective on-the-job training programs. Additional emphases have come from programs at Stanford, San Jose State College (51), and various individuals (94, 91, 90, and 61).

SELF-APPRAISAL AND OBSERVATIONAL LEARNING

Appell points out that the quest for self-improvement was given voice by Socrates about 2,000 years ago when he advised, "Know thyself" (11). A basic problem in developing skills based on human interaction with others is that it is extremely difficult for the individual to get close to himself as others see, hear, and experience him. In recognition of this physiological impossibility of being able to experience oneself as one affects others, training programs have provided the intermediary of the trained supervisory observer, whose function it is to interpret to the individual his effect on others and to provide guidance for his self-improvement as a communicator and influencer of the behavior of others. The effect of the mentor, however, in assisting the development of the teacher has always been inhibited by two major limitations: (1) the inability for the observee to see and hear himself as others do, except vicariously through the report of others, and (2) the inability to recapture except through verbal vicarious recall what the subject actually did and said and looked like when it actually happened.

The basic premise underlying self-evaluation involves self-concept. In their text, The Psychology of Ego-Involvement, Sherif and Cantril (84) point out that one's ego consists of many attitudes which are related to the self. These attitudes comprise the character of one's personality. When situations call for an

expression of these attitudes, one becomes personally involved. At that time cognitive and affective senses are stimulated and explicit behavior is accordingly exhibited and subjected to modification. Kaufmann's theory (52) is that a person who values an attribute highly, but possesses very little of it will persist until he succeeds in attaining the attribute, or lowers the value he attributes to it. This premise is also compatible with Festinger's (36) theory of "cognitive dissonance" and has direct implication for this study.

The ability of the PVTR to record both visual and auditory messages provides hitherto unattainable resource for research in the learning and teaching process. For example, the resources for analysis of what constitutes the elements of teaching behavior are largely vicarious--descriptions of live observations; narrowly limited--products of one-time ratings and descriptions of what was observed and statistical analyses of ratings largely unsupported and unchecked by repeated checking of the observation of the same event; and essentially philosophical, consisting largely of what was hoped for, without the evidence to support the demonstration of its actual attainment. Video recording of many selected examples of teaching and learning behavior provide, for the first time, repeatedly observable events that may be analyzed and checked by as many and as often as is deemed desirable, unlimited by the fallibility of human recall of remembered observation or the limitation in numbers restricted by

the logistics of live observation. At Hunter College, one of the endorsers of the use of the PVTR, "there is hardly an area of human behavior observable within the confines of a school that does not lend itself to the possibilities of videotaped observation" (81:5).

Although the value of self-assessment was an early realization, studies dealing with the subject are few. Gage (41) gives only incidental recognition to the practice. Some published studies are available, but the results are inconclusive. Brandt (2) experimented with sixth and eleventh grade students in an effort to assess the accuracy of self-estimate. He found that one-third of the subjects were highly consistent in accuracy of self-estimate while the lower one-third was inconsistent. Poor reporting tends to make his study difficult to interpret. In 1925, Shen (3) used college-age subjects in an effort to establish data regarding self-comparison with group assessment. He concluded that even though an individual is likely to know and recognize his strengths and weaknesses, he is less likely to rank himself lower than his associates.

Interest in modeling and reinforcement in imitation learning has been generated since 1960. Mowrer's work on feedback led to his distinguishing two types of imitation learning, direct observer reinforcement and vicarious reinforcement. According to Mowrer, "The fundamental thing about an imitative response is that it is similar to the stimulus which produces it" (69). McBreaty, Marston,

and Kaufer (67) showed that the behavior of the observer may match the behavior of the model in some cases, even though no direct reinforcement is administered.

The effects of modeling and feedback variables and consequent affect on teaching behavior was studied by Orme in 1966 (72). Hypothesis 1 was that perceptual modeling will produce significantly greater changes in response rate of desired probing responses than will symbolic modeling. Results were significant and generally supported the hypothesis. The contrast for adjusted means on clarification led to similar results with higher levels of significance. Hypothesis 2 stated that perceptual and symbolic modeling would be more effective than either procedure alone. This hypothesis was partially confirmed since it was better than both symbolic modeling treatments, but not significantly different from either minimal or maximal perceptual modeling alone. The third hypothesis was that combined prompting and conformation feedback would be more effective than prompting, conformation, or self feedback alone. This hypothesis was generally not supported, although in one instance prompting and conformation was better than conformation alone.

One study compared several methods of distributing practice and immediacy of feedback when the latter employed videotape performance of the learner (7). Intern teachers were videotaped on four separate occasions during the first twenty minues of regular

classroom lessons. The amount of practice and the delay in feedback was manipulated as the experimental variable. The dependent variable involved techniques for improving the quality of pupil participation in the classroom. This study did not show consistent differences traceable to combinations or immediate feedback, delayed feedback, mass practice and distributed practice. There is some doubt whether delayed feedback concept is appropriate with videotaping since feedback was always given during the videotape playback, and in this sense the feedback was immediate even though a delay may have occurred between taping and replay.

There have been some experiments dealing with imitative behavior. One study measured the imitative aggressive behavior of children. Children observed a film in which adult models demonstrated the behavior under one of three conditions. After the children had seen the film, they were required to match the model's behavior. The children who observed the model in the rewarded condition imitated more of the model's behavior. The no-reward group produced fewer model responses, and the model-punished group produced the least (14). A second study by Bandura (15) concerned itself with the imitation of symbolic responses. Children observed a film in which an adult demonstrated a large number of relatively novel responses. The results favored the active symbolic symbolizers.

Baer and Sherman (13) were also interested in the principle of imitation in young children. They taught children to imitate three responses produced by means of a puppet. The puppet encouraged the children to match his behavior and praised them for doing so. They found positive results and concluded that the generalization of reinforcement in imitating situations was applicable in three different response situations.

Although these studies may not agree as to the nature of the contingencies underlying imitation, they do agree that imitation depends on whether or not the behavior pays off. Likewise, it appears that imitation is facilitated when the individual has emitted the imitative behavior before, even if infrequently (65).

Krumboltz (56, 57) has conducted some investigations concerned with the effects of modeling and reinforcement in the area of counseling and guidance. One tested the degree of model counselor attentiveness and prestige in increasing later information seeking behavior. The PVTR was utilized in this study to record the interviews where the counselor was or was not attentive. Results showed that reinforcement and model reinforcement counseling procedures are effective in changing certain behaviors. A second study by the same investigator (57:324) randomly assigned 192 eleventh grade pupils to individual and group counseling settings. Model reinforcement and reinforcement counseling produced more information seeking behavior than control procedures.

Kaufmann attempted to give added insight into the self-concept in a study of 96 male college students. The subjects were led to believe that they had a high level of the ability in question and first were allowed to succeed, and then subjected to failure. Decree of relevance was found to be positively related to estimated probability of success, amount wagered, and performance speed, and was negatively related to self-rating of the ability after failure. The theory on which this investigation is based asserts that the behavior of individuals in a task situation can be interpreted, at least in part, as resulting from tendencies to seek cognitive balance and to avoid cognitive imbalance (52).

QUESTIONING

The ability to ask questions is an area of teacher education which shows neglect, both in classroom teaching and empirical investigation. Studies regarding questioning are rare. Those that are in evidence show that teachers tend to utilize those questions which seem to be aimed at the lower levels of knowledge as described by Bloom (17). One study (3) of secondary school teachers showed that the majority of questions asked were designed to elicit only memory of factual information. Another study by Floyd (35:53, 54) recorded teacher questions on tape. Analysis of these questions showed that the pupil activity ratio as measured by the number of

words spoken by students during the taped sessions was 29 per cent as compared to 71 per cent for the teachers. A sample of 1,347 questions were evaluated on a point system in this same study. Fewer than 100 questions were judged capable of stimulating reflection, and about 6 per cent of the questions were judged worthy of thinking about and answering. Classification of question types indicated 42 per cent were concerned with memory of specific facts and 23 per cent information on specific facts, 9 per cent direction giving request or demand, 8 per cent criticism or evaluation, and 3 per cent comparison. The broad classification of memory questions contained 53 1/2 per cent of the total questions. When this is combined with 23 per cent information, it comprises more than three-fourths of the total questions. Gusack obtained similar results in his study regarding reading comprehension (45). He found that teachers tend to concentrate more on recall and recognition questions than on any other types.

Taba (88) and Sanders (80) acknowledge the importance of questioning and offer suggestions for improving the skill. Bruner (21:40) lends emphasis to questioning skill by quoting David Page:

> Given particular subject matter or a particular concept, it is easy to ask trivial questions or to lead the child to ask trivial questions. The trick is to find the medium questions that can be answered and that take you somewhere.

Bruner postscripts these remarks by emphasizing the study of the art of asking questions.

An early investigation into the role of questions in education (87) led Stevens to note a dominant emphasis on memory questions. This study was one of the first to demonstrate that teachers talk too much and generally ask questions not geared to developing pupil's higher cognitive functions.

Houston (48) devised a plan for improving the quality of teacher questions involving group conferences, observation of teacher use of questioning, analysis of stenographic reports of teachers' questions and conferences designed to evaluate quality of questions and suggest techniques for improving questions. He tried out this course in two schools. Although the number of cases was small (11 teachers) the results indicate that the approach was promising in that the questioning became increasingly directed toward the teachers' avowed purposes. There is indication that a careful program directed at a specific questioning behavior can result in significant changes in teacher questioning.

There is little doubt that there is an art, or skill, in question formulation and execution. It is a technique that has been grossly under-developed and unused in classrooms of the nation. It needs attention and practical application by classroom teachers. It offers

a promising challenge and practical mode for a study attempting to develop in teachers a particular teaching skill or strategy.

There is an increasing quantity of research which indicates that more objective means of self-evaluation are possible. Potential improvements in the teaching and learning act have evolved since the introduction of the portable videotape recorder in 1956. Teaching methods, or the system of interactions which occur between a teacher and students, have been the subject of many investigations in the last decade. The concept of micro-teaching promises to generate much research and development on instructional methods. In this approach, the teacher and student rather than the content, hardware, or program are central in the educative process. Instructional television research renews confidence in the value of careful observation in the natural environment by an interested, objective scholar. The opportunity to utilize the concept of imitative behavior and observational training has been enhanced by the introduction of sophisticated electronic devices. Additional emphasis on the art of asking meaningful questions seems forthcoming in view of the fact that higher cognitive processes are stimulated by specific type questions. Coupled with the fact that the charting of thought processes is now better understood as a result of Piaget's methods and refined variants thereof, it appears that further investigations which utilize these recent concepts are in order.

In a new field, models are required as guides to operations. It is hoped that the utilization of the portable videotape recorder with experienced classroom teachers will furnish valuable information on whether or not teacher behavior may be changed or modified, and if so, to what extent this is possible. There is a scarcity of investigations of this kind. This study may serve to guide school districts or investigators in future explorations involving the use of the PVTR in an in-service program for teachers.

CHAPTER III

PROCEDURE

THE SAMPLE

The subjects for this study consisted of seventy-eight teachers in grades one through six. All possessed State of California teaching credentials. Fifty-one teachers in eleven schools were from the Union School District in San Jose, California; twenty-one in four schools were from the Saratoga Union School District in Saratoga, California. All subjects were volunteers.

SUBJECT ORIENTATION, TRAINING, AND LESSON PROCEDURE

Each subject was randomly assigned to one of two time-treatment groups and within these groups, to one of four evaluation sub-groups. Because the FWL in Berkeley has utilized an in-service program involving the PVTR and questioning skill technique in certain California school districts and San Jose State College has followed a similar plan with its student teachers, subjects with previous participation in this type of program were screened out in order to control the variable of previous participation.

The time-treatment groups consisted of a "one-shot" treatment group and a "distributed-time" treatment group. Subjects in the "one-shot" treatment groups (AA, BB, CC, DD) taught the same lesson four times, including the pre-test lesson. Different students were used for each lesson. The total time allotted to each subject in the one-shot treatment group was three hours. The three lessons, including the time used for the evaluation process by the subjects, were executed in the three hour period. The paradigm for this treatment group is explained in detail under the "Research Design" section of this chapter (p. 47).

The "distributed-time" treatment group procedure (AAA, BBB, CCC, DDD) differed from the one-shot treatment group only in that the amount of time allocated each teacher was extended over a three week period following the pre-test.

The total time involved per teacher was equal to that of the one-shot treatment group, i.e., each "distributed-time" teacher taught and evaluated for a total of one hour per week. Subjects in this group taught the same lesson to different students over a four week period, including the pre-taping session. This provided a means for measuring possible significant differences, between the teaching-and-evaluating-at-one-time variable and the variable of teaching and evaluating over a distributed time period. The paradigm for this

treatment group is explained in detail under the "Research Design" section of this chapter (p. 47).

All subjects attended a total of three meetings. The first meeting was a general orientation meeting. The portable videotape recorder was introduced and the subjects informed of the general purpose of the study. This meeting was held before the pre-test lesson. Subjects were told to develop a ten-minute discussion-type science lesson of their choice. Specific guidelines were distributed to them outlining the general procedure for the lesson. They were also given a time schedule indicating the time that the videotaping would take place in their school. No attempt was made to indicate that the questioning process was to be evaluated; however, the importance of planning for verbal interaction between students and teacher was emphasized.

Science was chosen as the lesson content for two reasons: (1) It is a motivating subject for elementary school children and lends itself effectively to verbal discussion; (2) It allows the teacher to provide visual aids through which discussion and thinking might easily be stimulated. Subjects were told that the lesson should include information familiar to the children. An evaluation of the program developed by the Far West Laboratory for Educational Research and Development discloses that cognitive concepts are more easily

verbally expressed when there is opportunity to reflect upon familiar material (34:1).

The first lesson was then videotaped and became the "pre-test" for statistical measurement. Teachers taught their own students. These students were randomly assigned to the teacher for each "teach," via an order of random numbers arranged by the investigator. The teacher also assigned each child a number; she was then instructed to bring certain numbers from the random number list to the videotape lesson. The teacher kept a list of participating children in order that no child would participate twice.

A procedure known as "micro-teaching" was utilized throughout the study. This procedure was appropriate for this study for three reasons: (1) It provided an opportunity for teachers to videotape themselves, thereby eliminating the need for a second adult in the room; (2) It permitted the subject to teach different students at each teaching session; (3) The same lesson was utilized throughout the entire treatment sessions. Stanford University was among the first to systematically investigate the use of the portable videotape recorder with teacher interns. The technique was dubbed "micro-teaching." The procedure called for the teacher to prepare a short lesson (ten minutes) with four to six pupils. The lesson was given and simultaneously videotaped. Shortly thereafter, the teacher replayed the tape and critiqued the behaviors. A revised version of the short lesson

was prepared, videotaped, and critiqued again. This teach-reteach method is designed to help teachers increase their classroom effectiveness through observation and practice. Although evaluations of micro-teaching are still tentative, it would appear that the results obtained are at least equal to, and achieved in less time, than the usual practice teaching approach for training intern teachers (51).

The first session consisted of a thirty minute period for all subjects. Twenty minutes of this time was used to orient the teacher and students to the portable videotape recorder and its function. The investigator remained with the teacher and students to explain the operation of the equipment. Time was allowed for informal discussion and questions between teacher, students, and investigator. To reduce the "cosmetic" effect of initial exposure to the portable videotape recorder, both teacher and students were allowed to view informal playbacks of themselves. The last ten minutes were devoted to the actual videotaping of the lesson. The ten minute time limit was controlled by a mechanical timer. The investigator started the recorder, set the timer, and left the micro-teaching situation. The teacher was alone with her students during the lesson. At the end of the ten minute time limit, the teacher turned off the recorder.

A total of fifteen schools participated in this study. Because it was not possible for each school to supply a micro-teaching facility, it was necessary to provide a "mobile" micro-teaching unit for eight

of the schools. This was done by equipping a sixteen foot house trailer with a portable videotape recorder unit. This facility was transported from school to school. Because teachers and students in all participating schools were videotaped in a facility other than their own classrooms the trailer posed no serious threat to the validity of this study. To further remove the uniqueness of the mobile facility, pre-testing for all subjects and students was done in the trailer.

The second training session for all subjects followed the pre-test videotape. At this session the self-evaluation instrument was introduced and explained. Through the courtesty of the Far West Laboratory for Educational Research and Development, a series of training videotapes was secured. These were evaluated by each subject. This procedure provided practice for teachers to use the instrument. Types of questions were also identified and discussed. The basis for this training conformed closely with the program instigated by the Far West Laboratory entitled "Effective Questioning in a Classroom Discussion" (32). The control groups (DD, DDD) were also encouraged to attend this second training meeting even though they were not involved in self-evaluation with the portable videotape recorder. It was felt that the same type of evaluation procedure should be used by all subjects.

Following the second training session, the micro-teaching and self-evaluation procedure began. The procedure closely resembled the pre-testing procedure, except that each teacher participated in the evaluation procedure assigned to her group. Substitute teachers were hired to take the participating teacher's class while she was involved in the micro-teaching and self-evaluation process.

During the third week of the study, a third meeting was held with each of the eight groups individually to insure that procedures were clear. Questions were clarified at this time.

The subjects in the seven schools which provided a micro-teaching facility were trained by the investigator to operate the portable videotape recorder. This enabled the investigator to transport the mobile facility to the other schools while trained portable videotape recorder subjects were teaching their lesson.

FOLLOW-UP

In order to ascertain the "residual" effects of the use of the portable videotape recorder, four subjects were randomly selected from each of the eight treatment groups one month after the termination of the formal study. A total of thirty-two teachers again taught their same lesson a fifth time and these were videotaped. These tapes supplied the data for the follow-up portion of this study. The procedure for the follow-up closely paralleled that of the pre-testing procedure.

LENGTH OF STUDY

This study began on March 11, 1968, and terminated on June 16, 1968, a total of 69 days.

EQUIPMENT AND ITS USE

Two Ampex PVTR 7000's and one Sony 7010 were utilized in this study. One PVTR 7000 was supplied by the Union School District, the other by Ward-Davis Associates in Palo Alto, California. The Sony was used through the courtesy of the IBM Corporation in San Jose, California.

Videotapes to conduct this study were supplied by the Ampex Corporation, Redwood City, California, and the Memorex Corporation in Santa Clara, California. Model tapes were loaned through the courtesy of the Far West Laboratory for Educational Research and Development in Berkeley, California. These were used for: (1) training raters to identify questions and question categories, and (2) training subjects in the use of the evaluation instrument.

In order to become familiar with the operation and maintenance of the portable videotape recorder, the investigator participated in an eight hour training session at Ward-Davis Associates in Palo Alto designed to prepare individuals to use the PVTR. A number of visits were also made by the investigator for additional training purposes to the Far West Laboratory in Berkeley, and to the elementary

education department at San Jose State College. The investigator also attended a two day conference on micro-teaching in the winter of 1968 at Stanford University.

THE RESEARCH DESIGN

A modified version of Campbell and Stanley's pre-post-test control group design (40:183-194) was used for this study.

Group AA, AAA:	R O_1 $X_{a,b}$ O_2	(view own videotape)
Group BB, BBB:	R O_3 $X_{c,d}$ O_4	(audio tape only)
Group CC, CCC:	R O_5 $X_{e,f}$ O_6	(own videotape plus model videotape)
Group DD, DDD:	R O_7 O_8	(control - no PVTR)

Two time-treatment groups were established. These were designated as a "one-shot" treatment group and a "distributed-time" treatment group. The one-shot treatment subjects (designated by double letters) taught the lessons, evaluated, retaught, and post-tested in one time block of three hours. Their participation in the study was then completed.

The treatment paradigms for both groups are outlined below:

One-shot treatment group:

	AA	BB	CC	DD
Before training:	Pre-test	Pre-test	Pre-test	Pre-test
	T_1, SV_1	T_1, AT_1	T_1, SV_1-MV_1	T_1
After training: (one three-hour period)	T_2, SV_2	T_2, AT_2	T_2, SV_2-MV_2	T_2
	Post-test	Post-test	Post-test	Post-test

The pre-test and post-test lessons were not evaluated by the subjects.

Distributed-time treatment group:

Week	AAA	BBB	CCC	DDD
1 (before training)	Pre-test	Pre-test	Pre-test	Pre-test
2	T_1, SV_1	T_1, AT_1	T_1, MV_1-SV_1	T_1
3 (after training)	T_2, SV_2	T_2, AT_2	T_2, SV_2-MV_2	T_2
4	Post-test	Post-test	Post-test	Post-test

This time-treatment group taught one lesson, then evaluated that lesson, both in a period of one hour per week for three weeks. The overall time allotment was constant for both time-treatment groups, i.e., three hours.

SOURCES OF DATA

THE SELF-EVALUATION INSTRUMENT

The self-evaluation instrument, including its objectives and its rationale, adhere closely to a plan developed by Dr. Theodore Parsons

of the School of Education in Berkeley, California. Permission was granted to the investigator to utilize the basic plan. Provision is made in the instrument for the viewer to categorically record types of questions asked in the videotape or audiotape playback. Simple arithmetical computation allows subjects to evaluate differences between playbacks. (See appendix A.)

Self-evaluation Instrument Objectives. The self-evaluation instrument is based upon the following objectives:

A. To structure the teacher's observation of his questioning-skill ability as demonstrated by a videotape or audiotape recording of his teaching performance, by focusing his attention on specific types of teacher behaviors which are intended to stimulate specific types of cognitive activities and pupil responses.

B. To provide an instrument which will enable the teacher to identify, code, record, and count the number of each type of teacher-posed question asked and also the resulting student response.

C. To direct the teacher's computation of the proportion of each type of question and pupil response in the total performance and consequently, provide him with a basis for a quantitative analysis of the observed data.

D. To indicate possible interpretations which the teacher can put upon the outcomes of his quantitative analysis, by viewing them in relation to his stated educational objectives and his knowledge of his pupil's interests, abilities, and achievements, and so to provide him with a basis for a qualitative analysis of the observed data.

E. To lead the teacher to make a judgment about the appropriateness and effectiveness of his questioning-skill behavior for achieving his stated educational objectives--the learning outcomes he intends and expects to result from his instructional efforts.

F. To make the teacher aware of any incongruities between his aims and his achievements, his intentions and their effects, and so to induce in him that degree of cognitive dissonance (36) which will motivate him to consider critically the appropriateness and effectiveness of his questioning-skill and to ponder seriously the desirability of making certain changes therein.

G. To prescribe, by defining terms and question categories, the direction which the teacher might take in making modifications in his questioning-skill in order to reduce the cognitive dissonance which he has experienced as the result of his self-analysis and self-evaluation.

Rationale. This instrument is a stimulus-response model wherein the stimuli are teacher behaviors and the responses are pupils' cognitive activities. The stimuli are teaching acts which create and control certain features of the affective medium in which the teaching-learning process takes place; which induce and manipulate certain "pre-cognitive" sets of pupils in the teaching-learning situation; and which initiate, mediate, integrate, and terminate the pupils' individual and group orientations and operations, such as paying attention, receiving, reacting, judging, organizing, and characterizing (17) their attainments of knowledge and understandings, such as specific terms and facts, procedures for dealing with these specifics, and inferences, abstractions, generalizations, principles, theories, and universal laws; and their demonstrations of intellectual abilities and skills, such as comprehension, analysis, synthesis, application, and evaluation (17).

In this instrument, the stimuli are instructional techniques which can be viewed as strategies and tactics, and which can be ordered and valued by such theoretical constructs as are variously termed the "inductive," "inquiry," "discovery," or "heuristic" method. The responses are cognitive acts which can also be viewed as strategies and tactics, and which can be ordered and valued by such theoretical constructs as are variously termed "critical thinking," "problem solving," "cognitive mapping," "hypothesis testing,"

or "speculating, conjecturing, theorizing, and tentatively explaining." Some recent attempts to formulate these theoretical constructs for educators include those of Jerome Bruner in The Process of Education (21).

The quantitative analysis of observed data is based first upon tallies or counting the number of each type of question asked and student response, and then by computing the proportion (percentage) of each type of question and response in the total performance. The qualitative analysis, however, leading to the interpretation and evaluation of the self-viewed videotape or audiotape, must be based upon clear guidelines which reconstruct in general form the logic of drawing inferences about the quality of student responses resulting from teacher-posed questions. It is important to note, however, that this study focuses upon teacher behavior only and therefore the tabulation and quality or quantity of student responses are deleted in the final statistical tabulation.

This instrument requires the teacher to state in operational or behavioral terms her lesson objectives. These serve as working definitions and descriptions of the learning outcomes toward which the subject's instructional techniques are directed. The principles of formulating operational statements of educational objectives are exemplified in Bloom and are explained and demonstrated in Robert Mager's Preparing Instructional Objectives (60). Subjects in this

study were encouraged to utilize the behavioral objective approach and were referred to Mager's text. By stating their educational objectives in operational terms and by arranging them in hierarchies, such as those exemplified by Bloom's Taxonomy, teachers can gain some measure of the effectiveness of their observed teaching behavior.

Criteria for Categories. The development of the category system used in both the self-evaluation and criterion instruments was based upon the following criteria:

A. "An assessment device is closely related to the designation of significant criterion components. Regardless of the particular device employed, its effectiveness will depend to a large extent on how clearly the behaviors involved are defined--how well general and abstract names are explained in terms of observable behaviors requiring a minimum amount of interference" (77:74).

B. Tallies should be based on "natural" units (each tally represents an occurrence).

C. Making the behavioral clues on which discriminations are made easy for the observers to identify is important. "The categories should be defined clearly enough so that new observers, of comparable sophistication, could learn to use the system merely by practicing it" (41:300).

D. Coding the behaviors into categories should be limited to less than ten. "It seems desirable to define the categories so that their average frequencies are roughly equal" (41:300).

E. It is helpful to institute a category with a name such as "neutral," "other," or "unclassified." "The frequency of this category should be low" (41:300).

The selection of questioning-skill as an independent variable for this study was based upon the premise that a primary concern of teachers should be to teach children to think as opposed to merely remember. This is a basic assumption underlying the development of the self-evaluation instrument. The characteristics of the three categories of questions, i.e., Basic, Leading, and Probing, have important bearing on the nature and level of thinking demanded of students. The rationale for each question category is listed below:

Basic Questions. Basic questions require only memory or simple association.

a) Characteristics of basic questions:

1. They are narrow in that they ask for a specific, correct answer.
2. Their narrowness calls for sharp convergence in thinking (a specific answer) and generally does not facilitate the use of supposition, intuition, and imagination.

3. Basic questions, due to their fragmentary nature, tend not to provide a sound basis for concepts formation or hypothesizing.
4. Attempts by students to develop relationships, synthesize, or to provide convergence from information seems more likely to lead to better skills with these tasks than does answering basic questions in which most of the relationships are either supplied or implied by the teacher.

Basic questions can be a tool for directing attention to information, or to provide hints to students attempting to build concepts or establish relations. They also can be used to facilitate and sustain concepts, the framework of which has already been established.

For purposes of this study, and in the self-evaluation instrument, the specific definition of a basic question is a teacher-posed question which asks for a "correct" answer by expecting a yes-no, memory-recall, or factual type of answer.

Leading Questions. Leading questions may be questions which imply directions either to sources of information, to a desired approach, or to the desired answer.

Leading questions should serve to further cognitive efforts by students rather than supplant them.

a) Characteristics of leading questions:

1. Leading questions are often an unnecessary crutch to the correct answer.

2. When many leading questions are consistently used, students may learn that if they stall the teacher will provide clues.
3. If leading questions are to serve a useful purpose in promoting thinking, they must also lead to additional cognitive efforts, not just an answer.
4. Leading questions which tend to only point in diverse directions or to isolated bits of information may lead students to assume that only "a" answer is required.
5. Leading questions imply that background information is available to students. They serve to sustain probing attempts by students in that they lead to information or approaches which facilitate the student continuing his probe. In addition, they serve to support students who lack self confidence or ability in cognitive tasks.

Based upon the above information, and for purposes of this study, a leading question is defined simply as a question in which the specific answer expected is stated by the teacher when the question is asked.

Probing Questions. Probing questions are open-ended questions which broaden the field of consideration. They provide a framework or structure for the inquiry without indicating the nature or an approach to an answer. Probing questions require a higher level of

thinking and invite students to go beyond the specific and factual level. They require students to infer, compare, contrast, explore, imagine, organize, analyze, judge, evaluate, hypothesize, or generalize.

a) Characteristics of probing questions:

1. Probing questions imply that there is no one answer. They challenge the able and provide an opportunity for the less able to contribute at their level and to improve.
2. Answers to probing questions should be treated as hypotheses to be evaluated and tested. Divergent views and attempts which go astray should be evaluated objectively to facilitate learning.
3. One student's answer should be supplemented by other students. A cooperative and supportive attempt to explore answers should be used.
4. An extension of a probing question should be some reflection as to the quality of an answer.
5. Students need to understand that some probing questions have no answers.
6. Students need sufficient time to formulate answers to probing questions before there is teacher intervention.
7. Probing questions will often need support from basic or leading questions or by lower order probing questions to assist student insight and to prevent discouragement and collapse of the probe.

8. Probing questions may vary from simple searches for relations or meaning between specific information on common things or events to speculation as to the nature of the cosmos.

For purposes of this study, a probing question is defined as a teacher-posed question necessitating original thinking on the part of the student, exemplified by using opinion, comparison, evaluation, how, why, what if, explain, or inference.

An Interpretative Guide. A guide to the interpretation of the self-evaluation instrument appears in the Appendix A of this study. This guide was developed to help the subjects interpret their raw data. It is not intended to set forth an ideal model; rather, it is intended merely to suggest several interpretations that might be drawn from the various patterns of raw data.

The Criterion Instrument. This instrument was designed by the investigator and is similar to the self-evaluation instrument in that provision is made for a tabulation of numbers of types of questions asked. Since the focus of this investigation is on teacher behavior, no provision is made in this instrument to tally types of student responses.

a) Criterion instrument objective: To provide an instrument which will enable a trained rater to identify, record, and count the number of each type of teacher-posed questions asked in the ten

minute micro-teaching lesson. From this tabulation, the pre- and post-tape tally of questions asked is recorded for later statistical analysis.

b) Rationale: This instrument is a recording device which tabulates the numbers of types of questions asked by the teacher during the ten-minute micro-teaching lesson.

In much the same way as the evaluation instrument serves to record questions asked, this instrument provides a record resulting from particular teaching strategies manifested by the verbalization of specific types of teacher-posed questions.

The quantitative analysis of observed data is based solely upon the tallies or counting of the numbers of each type of question asked by the teacher. The totals of each type of question tallied are then totalled to show: (1) numbers of basic questions asked, (2) numbers of leading questions asked, and (3) numbers of probing questions asked. Provision is also made for recording the total number of all types of questions asked. This procedure enables (1) an establishment of an inter-rater reliability coefficient in all three question-type categories plus a total question category and (2) a computation of data via statistical analysis for before and after-treatment differences.

Participant Evaluation Questionnaire. At the termination of the post taping each subject was asked to complete an evaluation

questionnaire. The purpose of the questionnaire was to provide the investigator with information which he felt would be helpful in providing additional information regarding the feelings and attitudes of experienced teachers who had been subjected to an investigation of this sort.

a) The raters: Three educators from school systems other than the participating districts rated the videotapes. These included two classroom teachers and one assistant professor from the elementary education department at San Jose State College. The raters were trained to identify types of questions asked in the videotaped lessons by practicing with model videotapes furnished by the Far West Laboratory of Educational Research and Development in Berkeley. Approximately sixteen hours per rater were necessary for training purposes. The desired coefficient of reliability of .80 between raters was exceeded after the above training and after each of the raters evaluated the same thirty randomly selected videotapes from the total of one hundred eighty-eight in this study.

b) Coding of videotapes: All of the one hundred eighty-eight videotapes were coded according to the following pattern:

Pre-tape: School number, teacher number, first letter of teacher's last name

Post-tape: School number, teacher number, second letter of teacher's last name

Follow-up tape: School number, teacher number, third letter of teacher's last name.

c) Analysis procedures: Kendall's coefficient of concordance was utilized to establish the inter-rater reliability coefficient (54: 267-8). This measure indicates the degree of association between the rankings of the three raters. The coefficient of concordance "W" expresses the average agreement on a scale from .00 to 1.00, between the ranks. "W" is therefore expressed as the ratio between the between-groups (or ranks) sum of squares and the total sum of squares of a complete analysis of variance of the ranks. Where there are "K" rankings of "n" individuals, Kendall's coefficient of concordance is defined by: $W = \frac{12\,S}{K^2\,(n^3-n)}$.

"S" is the sum of the deviations squared of the totals of the "n" ranks from their mean. It is a between-groups sum of squares for ranks.

In cases of ties in rankings, the median (or mean) of the ties is used.

The comparisons between frequency of types of questions asked in the pre and post tapes were treated in terms of difference scores and analyzed by means of chi-square (χ^2).

The organization for the presentation of the statistical analysis of obtained data includes: (1) treatment analyses, including a

description and analysis of histograms; (2) time factor analyses; and (3) follow-up analyses.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE FINDINGS

INTRODUCTION

There were a total of one hundred eighty-eight videotapes analyzed in this study. One hundred fifty-six were the pre tapes and post tapes of the seventy-eight subjects in the two time-treatment groups. The additional thirty-two videotapes were follow-up tapes to determine the residual effects in each follow-up treatment group one month after their last videotaped lesson.

CRITERION INSTRUMENT SCORES AND TESTS OF STATISTICAL SIGNIFICANCE

Inter-rater reliability was established using Kendall's coefficient of concordance formula. Raters recorded numbers of types of questions asked on the criterion instrument (see Appendix B) on each of thirty randomly selected videotapes from the total of one hundred eighty-eight. The number of questions were then ranked from one to thirty, from the highest number of questions asked to the lowest.

The coefficient of concordance, W, expresses the average agreement, on a scale from .00 to 1.00, between the ranks.

ANALYSIS OF INTER-RATER RELIABILITY

Tables I, II, III, and IV on the following pages show the results of these rankings in terms of numbers of basic, probing, leading, and total questions asked in the ten-minute micro-teaching lesson. The rankings assigned by each of the three raters, X, Y, and Z, to each of the thirty videotapes, also appear in the tables. The coefficient of concordance, or inter-rater agreement, appears under each table.

In analyzing the number of the three types of questions asked in the thirty videotapes, basic questions asked ranged from a low of four to a high of sixty-three, a difference of fifty-nine basic questions asked between the highest and the lowest ranked videotapes. The number of probing questions asked ranged from a low of six to a high of fifty-three, or a difference of forty-seven probing questions asked between the highest number of probing questions asked and the lowest. The range of leading type questions asked was narrow, ranging from zero to ten, and possibly indicates that teachers did not feel a need to utilize this type of question.

ANALYSIS OF TREATMENT EFFECT

In Table V, each of the four classifications of treatment in the one-shot experiment is shown. These include the use of the PVTR (AA), evaluation by using the audio portion of the PVTR (BB), evaluation through the use of the PVTR plus a videotape model (CC),

TABLE I

*Rank Order of Basic Questions Asked in Thirty Randomly Selected Tapes

TAPE NO.	RATER X		RATER Y		RATER Z		Σ	$\Sigma\chi^2$
	BASIC QUESTIONS	RANK	BASIC QUESTIONS	RANK	BASIC QUESTIONS	RANK		
1	34	11	30	10	24	14	35	132.25
2	38	9.5	44	5	39	7.5	22	600.25
3	28	13.5	24	15	22	16	44.5	4.00
4	9	27.5	4	29.5	8	29	86	1560.25
5	24	16	22	17	19	19.5	52.5	36.00
6	5	30	4	29.5	11	27	86.5	1600.00
7	11	25	11	24.5	12	25	74.5	784.00
8	14	22.5	15	22.5	15	22	67	420.25
9	21	18	20	18	21	17	53	42.25
10	48	3.5	51	3	48	4	10.5	1296.00
11	52	2	58	2	51	2.5	6.5	1600.00
12	40	6.5	25	14	26	13	33.5	169.00
13	11	25	10	26	12	25	76	870.25
14	20	19	19	19.5	20	18	56.5	100.00
15	48	3.5	46	4	51	2.5	10	1332.25
16	39	8	34	9	35	9	26	420.25
17	27	15	27	13	27	12	40	42.25
18	9	27.5	9	27	10	28	82.5	1296.00
19	29	12	28	11.5	29	10	33.5	169.00
20	63	1	63	1	63	1	3	1892.25
21	16	21	16	21	16	21	63	272.25
22	14	22.5	15	22.5	14	23	68	462.25
23	38	9.5	38	8	39	7.5	25	462.25
24	40	6.5	40	7	40	6	19.5	729.00
25	22	17	23	16	23	15	48	2.25
26	28	13.5	28	11.5	28	11	36	110.25
27	19	20	19	19.5	19	19.5	59	156.25
28	6	29	7	28	7	30	87	1640.25
29	42	5	42	6	41	5	16	930.25
30	11	25	11	24.5	12	25	74.5	784.00

*Inter-rater reliability obtained by using Kendall's Coefficient of Concordance W =.985

TABLE II

*Rank Order of Probing Questions Asked in Thirty Randomly Selected Tapes

TAPE NO.	RATER X		RATER Y		RATER Z		Σ	Σ χ^2
	PROBING QUESTIONS	RANK	PROBING QUESTIONS	RANK	PROBING QUESTIONS	RANK		
1	12	20	16	13.5	17	13	46.5	0.00
2	16	13.5	10	23	13	18.5	55	72.25
3	17	12	24	8	26	5.5	25.5	441.00
4	28	5	33	3	29	4	12	1190.25
5	10	23.5	12	21	11	22	66.5	400.00
6	18	11	22	9.5	15	15.5	36	110.25
7	20	9	19	11	19	11.5	31.5	225.00
8	6	28.5	6	29.5	6	29.5	87.5	1681.00
9	10	23.5	8	26	8	27	76.5	900.00
10	13	17	12	21	15	15.5	53.5	49.00
11	29	3.5	28	4.5	31	3	11	1260.25
12	12	20	14	15.5	23	9	44.5	4.00
13	26	6.5	28	4.5	24	7.5	18.5	784.00
14	6	28.5	6	29.5	6	29.5	87.5	1681.00
15	10	23.5	8	26	10	24	73.5	729.00
16	3	30	8	26	7	28	84	1406.25
17	13	17	13	18	13	18.5	53.5	49.00
18	26	6.5	26	6	26	5.5	18	812.25
19	52	1	53	1	53	1	3	1892.25
20	24	8	22	9.5	22	10	27.5	361.00
21	14	15	14	15.5	14	17	47.5	1.00
22	8	27	7	28	9	26	81	1190.25
23	16	13.5	16	13.5	16	14	41	30.25
24	10	23.5	12	21	10	24	68.5	484.00
25	12	21	13	18	12	20.5	58.5	144.00
26	52	2	52	2	52	2	6	1640.25
27	19	10	18	12	19	11.5	33.5	169.00
28	29	3.5	25	7	24	7.5	18	812.25
29	9	26	9	24	10	24	74	756.25
30	13	17	13	18	12	20.5	55.5	81.00

*Inter-rater reliability obtained by using Kendall's Coefficient of Concordance W = .957

TABLE III

*Rank Order of Leading Questions Asked in Thirty Randomly Selected Tapes

TAPE NO.	RATER X		RATER Y		RATER Z		Σ	$\Sigma \chi^2$
	LEADING QUESTIONS	RANK	LEADING QUESTIONS	RANK	LEADING QUESTIONS	RANK		
1	0	23	0	23.5	0	23.5	70	552.25
2	1	11.5	1	14	3	6	31.5	225.00
3	1	11.5	1	14	1	15	40.5	36.00
4	0	23	0	23.5	0	23.5	70	552.25
5	1	11.5	1	14	2	11	36.5	100.00
6	1	11.5	1	14	1	15	40.5	36.00
7	0	23	0	23.5	0	23.5	70	552.25
8	0	23	0	23.5	0	23.5	70	552.25
9	1	11.5	4	4.5	3	6	22	600.25
10	2	7	2	9.5	2	11	27.5	361.00
11	0	23	0	23.5	0	23.5	70	552.25
12	1	11.5	4	4.5	2	11	27	380.25
13	1	11.5	2	9.5	3	6	27	380.25
14	7	3	9	2.5	8	3	8.5	1444.00
15	3	5	3	6.5	3	6	17.5	841.00
16	0	23	0	23.5	0	23.5	70	552.25
17	0	23	0	23.5	0	23.5	70	552.25
18	0	23	0	23.5	0	23.5	70	552.25
19	0	23	0	23.5	0	23.5	70	552.25
20	1	11.5	2	9.5	2	11	32	210.25
21	0	23	0	23.5	0	23.5	70	552.25
22	10	1	10	1	9	2	4	1806.25
23	3	5	3	6.5	2	11	22.5	576.00
24	3	5	2	9.5	3	6	20.5	676.00
25	8	2	9	2.5	10	1	5.5	1681.00
26	0	23	0	23.5	0	23.5	70	552.25
27	0	23	0	23.5	0	23.5	70	552.25
28	0	23	1	14	1	15	52	30.25
29	0	23	0	23.5	0	23.5	70	552.25
30	0	23	0	23.5	0	23.5	70	552.25

*Inter-rater reliability obtained by using Kendall's Coefficient of Concordance W = .957

TABLE IV

*Rank Order of Total Questions Asked in Thirty Randomly Selected Tapes

TAPE NO.	RATER X		RATER Y		RATER Z		Σ	Σ χ^2
	TOTAL QUESTIONS	RANK	TOTAL QUESTIONS	RANK	TOTAL QUESTIONS	RANK		
1	46	12.5	46	12	41	15	39.5	49.00
2	55	8	55	8	55	8	24	506.25
3	46	12.5	49	11	49	12	35.5	121.00
4	37	19	37	18.5	37	19	56.5	100.00
5	35	21	35	20.5	32	23.5	65	342.25
6	24	28.5	27	28	27	28	84.5	1444.00
7	31	26	30	26.5	31	26	78.5	1024.00
8	20	30	21	30	21	30	90	1892.25
9	32	24.5	32	24.5	32	23.5	72.5	676.00
10	63	5	65	5	65	5	15	992.25
11	81	2.5	86	2	82	2.5	7	1560.25
12	53	9.5	43	14	51	10.5	34	156.25
13	38	17.5	40	16.5	39	17	51	20.25
14	33	23	34	22	34	21	66	380.25
15	61	6	57	6.5	64	6	18.5	784.00
16	42	14.5	42	15	42	14	43.5	9.00
17	40	16	40	16.5	40	16	48.5	4.00
18	35	21	35	20.5	36	20	61.5	225.00
19	81	2.5	81	3	82	2.5	8	1482.25
20	88	1	87	1	87	1	3	1892.25
21	30	27	30	26.5	30	27	80.5	1156.00
22	32	24.5	32	24.5	32	23.5	72.5	676.00
23	57	7	57	6.5	57	7	20	676.00
24	53	9.5	54	9	53	9	27.5	361.00
25	42	14.5	45	13	45	13	40.5	36.00
26	80	4	80	4.0	80	4	12	1190.25
27	38	17.5	37	18.5	38	18	54	56.25
28	35	21	33	23	32	23.5	67.5	441.00
29	51	11	51	10	51	10.5	31.2	225.00
30	24	28.5	24	29	24	29.0	86.5	1600.00

* Inter-rater reliability obtained by using Kendall's Coefficient of Concordance W = .993

TABLE V

Significance of Difference Between Observed and Expected Numbers of Probing and Basic Questions Asked in the Pre-Post Lessons in the One-Shot Experiment

	AA	BB	CC	DD	TOTAL χ^2
BASIC					
Obs.	-5.0	-5.9	7.0	7.7	
Exp.	-5.5	-2.4	6.3	4.3	
χ^2	.023	1.15	.02	.59	1.783
PROBING					
Obs.	-4.8	1.3	6.1	1.2	
Exp.	-4.3	-2.2	6.8	4.6	
χ^2	.023	.95	.02	.58	1.573
					3.356*

* Not significant

and the control groups which utilized none of the above evaluation procedures (DD). Data listed include both observed and expected scores of difference between the two tapings and a chi-square value calculated for the difference scores.

An analysis of Table V revealed that there was no significant difference between the four evaluation groups in either basic or probing questions.* The PVTR subjects decreased their number of basic and probing questions asked from pre- to post-tapes. The audio-tape group (BB) also showed a decrease in numbers of basic questions asked from pre to post tapes, but increased the number of probing questions asked. Groups CC and DD showed increases in both basic and probing questions from pre to post tapes.

In Table VI, each of the four evaluation treatments in the distributed-time experiment was analyzed. The groups were identified as AAA (PVTR), BBB (audio-tape), CCC (PVTR plus model), and DDD (control). Data listed included both observed and expected scores of difference between the two tapings and a chi-square value calculated on the difference scores.

Table VI revealed that the groups differed significantly from each other in the distributed-time experiment ($p. < .01$). The PVTR

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*Leading questions have been omitted in this statistical analysis due to the negligible number (.82 of 1 per cent) used in the pre and post taped lessons.

TABLE VI

Significance of Difference Between Observed and Expected Numbers of Probing and Basic Questions Asked in the Pre-Post Lessons in the Distributed-Time Experiment

	AA	BB	CC	DD	TOTAL χ^2
BASIC					
Obs.	-12.9	-5.6	10.5	7.0	
Exp.	- 7.7	- .4	4.1	3.0	
χ^2	3.7	1.8	.02	.88	6.45
PROBING					
Obs.	1.3	12.4	7.8	8.3	
Exp.	- 3.9	7.2	14.2	12.3	
χ^2	2.4	1.2	1.4	.58	5.58
					12.03*

* Significant at the .02 level

group and the audio-tape group decreased from pre to post tapes in basic questions, but increased in numbers of probing questions asked. Groups CCC and DDD increased in both areas of basic and probing questions from pre to post tapes. Pairs of treatment groups were then analyzed. These calculations appear in Table XII (Appendix E p. 145). Significant differences were found between the following groups: AAA and CCC ($p. < .01$); AAA and DDD ($p. < .01$); BBB and CCC ($p. < .05$); and BBB and DDD ($p. < .05$).

A comparison of the one-shot and distributed-time analyses indicated that the distributed-time factor was more conducive to changing the questioning skill of teachers than the one-shot sequence, with the exception of the PVTR group in which decreases were evidenced in both time treatments.

Because of the wide range in the number of types of questions asked between pre and post taped lessons and between subjects and groups, a comparison of mean percentage differences between pre and post tapes was calculated in Table VII. Percentages based upon the number of probing questions asked were chosen because the ability to ask probing questions was considered to be more desirable than the ability to ask basic questions. These values were rounded to the nearest five per cent, and histograms were plotted for each of the eight groups (Appendix F, p. 147). Examination of the median percentage differences for each histogram (also included in Figures

TABLE VII

Significance of Frequencies of Percentage Differences in Number of Probing Questions Asked Between Pre and Post Tapes

(percentage frequencies collapsed as indicated)

Combined Groups	(-5) – (-60)	0	5 - 60	TOTAL χ^2
AA, AAA				
Obs.	5	6	9	
Exp.	4	3	13	
χ^2	.25	3	.01	3.26
BB, BBB				
CC, CCC				
DD, DDD				
Obs.	10	5	43	
Exp.	11	8	39	
χ^2	.09	.01	.41	.51
				3.77*

* Not significant

1 and 2, p. 75) indicated that the median values for groups BB-BBB, CC-CCC, and DD-DDD appeared to differ from the median values for group AA-AAA. Therefore, histograms which combined the BB-BBB, CC-CCC, and the DD-DDD groups were plotted and subsequently compared by means of a chi-square analysis. These combined histograms appear in Figures 1 and 2 and the chi-square analysis in Table VII. Because of the low frequencies in the AA-AAA histograms, the collapsing of the percentage intervals into a contingency table resulted in three categories. Hence, the resulting analysis yielded a gross measure for comparison of the groups.

Examination of Table VII indicated that the pooled groupings did not differ significantly from each other. A comparison of the medians of the two groups, however, showed that the median of groups AA-AAA lay near zero, while the median in the other groupings fell near 15. Thus, it would seem that the PVTR groupings in both time treatments increased their frequency of probing questions between pre and post tapes.

A comparison of the histogram results with the initial analysis using the difference scores showed that the PVTR groups in both analyses did not increase their frequency of probing questions from pre to post tapes.* Thus, the PVTR experience in this investigation

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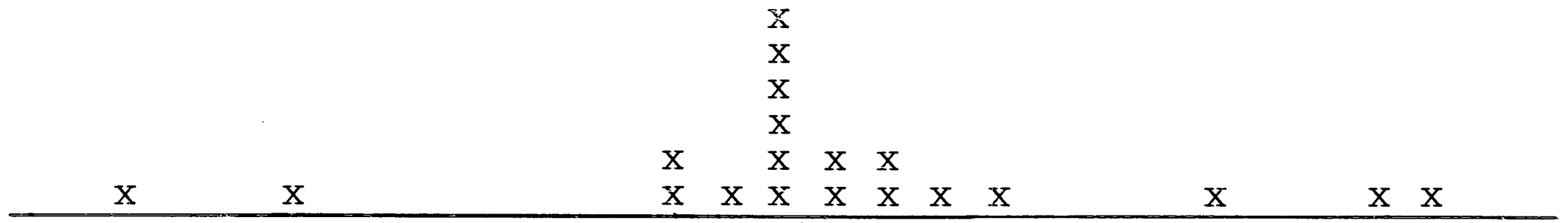
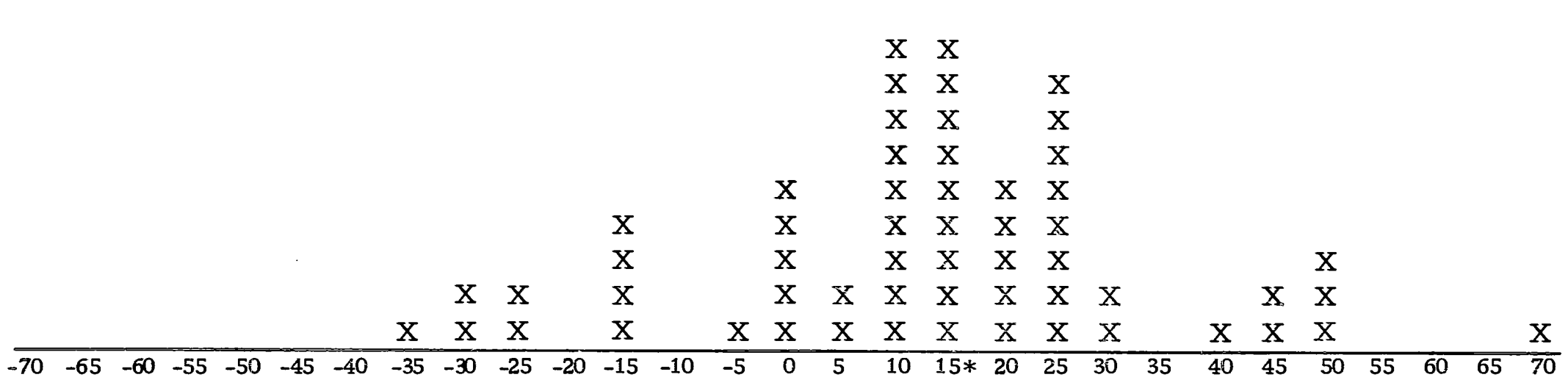
*Any comparison of histogram analyses with other data should



*Median, 0

FIGURE 1

Percentage Differences of Probing Questions Asked for Treatment Groups AA, AAA (to closest five percent)



*Median, 15

FIGURE 2

Percentage of Differences of Probing Questions Asked for Treatment Groups BB, BBB, CC, CCC, DD, DDD (to closest five percent)

did not alter the questioning skills of the teachers involved. Although the initial difference score analysis showed no consistent relationship between the three remaining groups, the histogram analysis suggested that the audio-tape groups showed the greatest increase in frequency of questions asked between pre and post tapes. This finding supported the use of this technique over that of the PVTR in changing the questioning skill behavior of teachers.

ANALYSIS OF TIME EFFECT

The comparison of the one-shot and distributed-time groups was analyzed in terms of mean difference scores between pre and post tapes on basic and probing questions. Table VIII shows the results of a chi-square analysis for each of the four treatment conditions. This table compared the effect of time on each of the four evaluation treatment groups. Observed and expected frequencies were recorded and computed, together with a chi-square value for each treatment group.

The results indicated that of the four groups, only one (AA-AAA) differed significantly between time conditions on basic and probing questions ($p. < .02$). The area of greatest change was in number of

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take into consideration the fact that the histogram was generated by means of several transformations of the data and may therefore not accurately reflect actual differences in scores between groups.

TABLE VIII

A Comparison of Time Factor Effects on the Mean Difference of Basic and Probing Questions Asked in the Eight Treatment Groups

TREATMENT GROUP	BASIC	PROBING	TOTAL χ^2
AA			
Obs.	- 5	- 4.8	
Exp.	- 8.7	- 1.2	
χ^2	2.1	.93	
AAA			
Obs.	-12.9	1.3	
Exp.	- 9.2	- 2.3	
χ^2	2.3	1.0	6.33*
BB			
Obs.	- 5.9	1.3	
Exp.	- 7.5	2.8	
χ^2	.34	.12	
BBB			
Obs.	- 5.6	12.4	
Exp.	- 4.0	10.9	
χ^2	.23	.08	.77
CC			
Obs.	7	6.1	
Exp.	7.3	5.7	
χ^2	.004	.007	
CCC			
Obs.	10.5	7.8	
Exp.	10.2	8.2	
χ^2	.003	.006	.020
DD			
Obs.	7.7	1.2	
Exp.	5.6	3.2	
χ^2	.21	.21	
DDD			
Obs.	7	8.3	
Exp.	9.1	6.3	
χ^2	.18	.18	.78

* Significant at the .02 level

basic questions asked. Both groups showed a decrease in numbers of basic questions asked from pre to post tapes, with group AAA reflecting the greatest difference. Group AA also showed a decrease in probing questions asked, but AAA increased its number of probing questions.

In three of the four analyses (BB, CC, and DD) the time factor made no difference in the difference scores for each type of question.

ANALYSIS OF FOLLOW-UP

The follow-up tapes for the one-shot groups were analyzed in Table IX. The findings are shown by both observed and expected frequencies of questions asked. This analysis indicated that there were no significant differences in this experiment. The greatest difference scores were posted in both basic and probing questions by the control group (DD). The PVTR group (AA) reflected no difference change in numbers of basic questions asked from pre to post tapes, but showed a slight positive change in number of probing questions asked. The audio-tape group decreased its number of basic questions and increased the number of probing questions asked. Group CC (PVTR plus model) reflected a decrease in both areas of basic and probing questions.

Table X reflects the follow-up analysis of the distributed-time groups with observed and expected frequencies evidenced in this

TABLE IX

Significance of Difference Between Observed and Expected Numbers of Probing and Basic Questions Asked in the Follow-Up Lessons in the One-Shot Experiment

	AA	BB	CC	DD	TOTAL χ^2
BASIC					
Obs.	0	-6.25	-1	9.5	
Exp.	-2.8	-3.3	-4.7	4.0	
χ^2	.64	.74	1.32	1.59	4.29
PROBING					
Obs.	.50	5.5	-3.25	8.0	
Exp.	3.30	2.5	.40	13.5	
χ^2	.42	.05	.86	1.06	2.39
					6.68*

* Not significant

TABLE X

Significance of Difference Between Observed and Expected Numbers of Probing and Basic Questions Asked in the Follow-Up Lessons in the Distributed-Time Experiment

	AAA	BBB	CCC	DDD	TOTAL χ^2
BASIC					
Obs.	4	-9.75	.25	-2	
Exp.	3	-6.1	-1.1	-4	
χ^2	.05	1.5	.95	.36	2.86
PROBING					
Obs.	5	-1.75	-1.5	-5	
Exp.	6	-5.4	- .2	-3	
χ^2	.04	1.4	.11	.33	1.88
					4.74*

*Not significant

comparison. The PVTR group (AAA) showed an increase in both basic and probing questions while the other three groups showed decreases in both of these areas. The exception was group CCC (PVTR model) which showed a slight increase in numbers of basic questions asked.

ANALYSIS OF PARTICIPANT EVALUATION QUESTIONNAIRE

The "Participant Evaluation Questionnaire" presented to the subjects involved in this study yielded the following information:

Seventy-five out of the 78 subjects had never been directly involved in any study involving a control group investigation since leaving college. Three teachers indicated a casual acquaintance with some studies emanating at the school district level.

Seventy-six of the subjects had never before used the technique of micro-teaching. The remaining two were acquainted with the procedure through their knowledge of the technique being used at Stanford University.

Sixty-five teachers felt that their participation in this study enhanced their questioning-skill ability and awareness of the questioning process. Fifteen teachers expressed the feeling that they received little or no benefit from it. Of these, 8 were control group subjects and expressed disappointment at not being able to utilize some phase of the PVTR for self-evaluation. (The investigator had

hoped that subjecting all experimental groups to the videotaping process during the teaching of all lessons plus an introduction to the portable videotape recorder previous to actual micro-teaching lessons would offset this feeling.)

Regarding whether subjects had ever received previous training in questioning skill before participation in this study, 76 out of the 78 subjects indicated no formal contact with this phase of teaching.

All participants felt that the utilization of the PVTR in a carefully planned and structured in-service program would be beneficial to them and to their students.

ADDITIONAL VARIABLES TO BE CONSIDERED

The investigator feels that certain additional factors may have influenced the results that were obtained in this study.

The use of a housetrailer as a micro-teaching videotaping facility was unlike a permanent school facility. Unfortunately, there was no other possibility at the time this study was conducted. Some of the subjects suggested that while the facility did suffice, they were placed in a rather unnatural setting. It was small, rather crowded, and too "different" for the children. In spite of a splendid degree of cooperation from teachers and students alike, it is possible that the uniqueness of the trailer influenced the findings.

Another variable which was impossible to control was that of subjects discussing the various techniques utilized before the termination of the study. Although the idea of discussing types of various questions to be asked in the micro-teaching lesson was not a disadvantage, the interchange of outcomes on the teacher evaluation instrument could have influenced subjects toward asking more of one type of question than another.

A third factor to be considered is that of the Hawthorne effect. A number of subjects expressed disappointment in not being able to utilize the PVTR equipment for evaluation purposes. Conversely, those who were randomly assigned to the PVTR and its components appeared pleased. Did the control group subjects execute a greater effort to affect a change in questioning skill than they otherwise might have done?

An analysis of the numbers of male and female participants in this investigation shows a total of 17 males and 61 females. If an exact balance of male-female ratio could have been established together with the pairing of equal years of teaching experience, the results may have proved to be considerably different than those recorded here.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE STUDIES

SUMMARY OF PROCEDURES

THE PROBLEM

The development of the portable videotape recorder, an electronic device capable of reproducing simultaneously audio and visual signals, has opened new vistas in the field of business, industry, and education. Within the last five years it has been responsible for innovations in the television industry, sales and management areas, various athletic promotions, law enforcement programs, and educational and teacher-training areas. The usefulness of the PVTR should continue to be utilized in additional endeavors with the accompanying virtue of enhancing those programs and individuals utilizing its capabilities.

Supervisors, principals, and master teachers have been the observers and evaluators of the classroom teacher. The typical teacher evaluation results from numerous observations or visitations by superiors with suggestions for improvement and constructive ideas for the betterment of one's teaching efficiency. Only recently with

the introduction of the PVTR, has the opportunity been provided for the teacher to see and hear herself in an actual classroom situation.

Whether or not providing the classroom teacher with this opportunity significantly changes the teaching behavior of that teacher has yet to be proven. There appears to be some evidence that the behavior of student teachers can be affected. However, there is a sparsity of evidence citing the effect of the PVTR on the teaching behavior of experienced classroom teachers. Is it possible that experienced teachers of two, five, ten, or twenty years can be influenced with the PVTR in such a way that their teaching behavior is significantly changed or modified? To what extent does the opportunity to evaluate by seeing and hearing oneself compare to merely hearing one's self? Is it possible that the viewing of a model utilizing the same technique as the teacher can influence the teacher's behavior? Is there any significant carry-over in particular self-evaluative technique? These are questions which this investigation has attempted to answer and which give impetus to the various approaches which were used in an attempt to determine the practicality of the PVTR in influencing the behavior of experienced classroom teachers.

DESIGN OF THE EXPERIMENT

A modified version of Campbell and Stanley's pre-post-test control group design was used in this study.

The Experimental Groups. The subjects in this investigation consisted of 78 experienced elementary school teachers, each of whom was randomly assigned to one of eight evaluation groups. Six of the eight groups utilized the PVTR and/or components thereof to evaluate their questioning skill. The two control groups evaluated their questioning skill by reflective evaluation, a procedure of re-thinking the lesson taught without the aid of mechanical or electronic equipment. Subjects in these groups did not use the PVTR or its components, but evaluated the types of questions asked by merely re-thinking the lesson.

To assess whether length of time spent in self-evaluation and micro-teaching was a crucial factor in using the different evaluation procedures, a "one-shot" time treatment group and a "distributed-time" treatment group were established. The one-shot time treatment groups taught and evaluated their lessons in one 3 hour period. The distributed-time treatment groups taught once and evaluated once for a one-hour period for three weeks. Hence, the total amount of time spent in teaching and evaluating by each of the time-treatment groups was equal. Each of the time-treatment groups consisted of four sub-groups or evaluation groups.

Subject Training. Subjects were trained in the use of the PVTR and the evaluation instrument so that the presence of the investigator

was unnecessary during the actual teaching and evaluation of the lesson. Control group subjects were encouraged to use the evaluation instrument if they so desired. Its use was also included in the training program for control group subjects. All subjects were involved in equal time and training periods.

Training films from the Far West Laboratory for Educational Research and Development in Berkeley were utilized to instruct the subjects in the use of the PVTR and to identify specific types of questions to be identified. Specific question types were utilized by the subjects in teaching a ten-minute discussion-type science oriented lesson. The question-types were basic, leading, and probing questions.

A procedure known as "micro-teaching" was utilized by all subjects to teach each lesson.

The Pre-experimental and Post-experimental Methods. Each subject taught a ten-minute lesson preceding any training or orientation as to the operation of the self-evaluation instrument, or before any knowledge of question categories was presented. The post tape lesson was taught after all subjects had been exposed to training films regarding questioning skill techniques, the place of question types in a lesson, the use of the PVTR, and instructions and practice

in using the self-evaluation instrument. Control group subjects received identical training as did the experimental groups.

Statistical Analysis. A total of 188 videotapes were rated by three trained raters. These videotapes consisted of 78 pre tapes, 78 post tapes, and 32 follow-up tapes. Four subjects were randomly selected from each of the eight evaluation groups. The follow-up tapes were made approximately one month after the post taped lessons.

Inter-rater reliability was obtained by first training raters to correctly identify question types to be measured in this study. Training tapes from the Far West Laboratory were utilized for this purpose. Following this intense training, 30 videotapes were randomly selected from the 188 tapes in the study. Using Kendall's coefficient of concordance formula, an inter-rater reliability coefficient of .985 for basic questions, .957 for probing questions, and .993 for total number of questions asked per subject was established. A coefficient of .846 was also established for leading questions, but because the total number used was negligible, a statistical analysis was felt by the investigator to be unwarranted. These exceeded the target reliability coefficient of .80 specified in the research proposal. Each rater then rated one-third of the remaining 158 videotapes independently.

Differences in numbers of types of questions asked between pre tape and post tape lessons, and between post tape and follow-up tape lessons were computed by comparing the pre and post test frequencies of numbers of types of questions asked and computing a chi-square value on the mean differences.

This investigation hypothesized that there would be no significant difference in criterion instrument scores which measured numbers of types of questions teachers ask their students among four groups of teachers who purposefully self-evaluate self videotapes, self audio-tapes, a combination of self videotapes and model videotapes, and their teaching by reflective evaluation only.

The decision rule established for the analysis was to reject a null hypothesis whenever the probability of committing a Type I error was equal to or less than .05.

SUMMARY OF THE FINDINGS

TREATMENT EFFECT

No significant differences were found in the treatment effects in the one-shot time experiment. The PVTR subjects decreased in numbers of basic and probing questions asked between pre and post tapes. The audio-tape, PVTR plus model, and control groups all increased in both basic and probing questions with the exception of

the audio-tape group which decreased in numbers of basic questions asked between pre and post tapes.

Significant differences were found in the distributed-time experiment between the following groups: AA and CCC ($p. < .01$); AAA and DDD ($p. < .01$); BBB and CCC ($p. < .05$); and BBB and DDD ($p. < .05$). The distributed-time factor was found to be more conducive to changing the questioning skill of teachers than the one-shot sequence with the exception of the PVTR group in which decreases were evidenced in both time treatments.

A histogram analysis of mean percentage differences between probing questions asked in the pre and post tapes was calculated for each of the eight groups. No significant differences were found between the combined time-treatment PVTR groups, and the combined audio-tape, PVTR plus model, and control groups. Examination of the median values of the two histograms further substantiated that the PVTR groups did not increase their frequency of probing questions asked between pre and post tapes. Moreover, the histogram analysis suggested that the audio-tape groups showed the greatest increase in frequency of questions asked between pre and post tapes.

TIME EFFECT

Only one group (AA - AAA) differed significantly between time conditions on basic and probing questions ($p. < .02$).

Basic questions were more effected than probing questions in both time experiments.

The time factor made no difference in the difference scores for each type of question in the remaining groups.

FOLLOW-UP

No significant differences were found in the follow-up analysis, the difference appearing in numbers of basic and probing questions asked by the one-shot experiment control group. Both AA and BB groups increased in the number of probing questions asked, but decreased in number of basic questions asked. Group CC decreased in both areas of basic and probing questions.

No significant differences were found in the follow-up analysis of the distributed-time groups.

CONCLUSIONS AND RECOMMENDATIONS

THE PROBLEM

This study set about to determine whether or not the videotape recorder could be used in affecting change in the teaching behavior of experienced elementary school teachers, viz., is it possible for teachers to change or modify their questioning-skill ability through the process of self-evaluation with the use of the portable videotape recorder and/or components related to it? The investigator also attempted to determine through empirical validation whether

teachers profited most from a single, but concentrated evaluative procedure or a procedure extended over a period of time, i.e., three weeks. A third objective of the study was to determine whether, by training and self-evaluation procedures outlined above, a carry-over or "residual" effect was possible.

THE DATA

Although not statistically significant in some instances, the results of this investigation indicated that differences existed between evaluative treatment groups and that the effectiveness of the treatment depended upon the amount of time in which subjects utilized the evaluative procedures.

In the one-shot experiment, no significant differences were evidenced among the four evaluative treatment groups. However, the audio-tape group was the only one of the four groups showing a decrease in basic questions and an increase in probing questions. While this finding is not statistically significant, the investigator wishes to call attention to the fact that this is an important trend because it indicates the direction of change desired as outlined elsewhere in this study.

The evaluative treatments produced varying results in the distributed-time experiment. Both the PVTR and the audio-tape groups were successful in decreasing numbers of basic questions

asked between pre and post tapes and in increasing the number of probing questions asked. Although the mean difference increase in number of probing questions asked by the PVTR group was slight and statistically not significant, there appeared to be specific reasons for this result. The fact that the subjects were able to see themselves where they were (PVTR), were able to decide where they would like to be (self-evaluation instrument), and strive to reach this goal (re-evaluation with the PVTR) reflects Kaufmann's theory (52), i.e., a person who values an attribute highly, but possesses very little of it will persist until he succeeds. Second, the idea of immediate feedback to practice a given skill (51) and the opportunity to replay specific portions of the videotape for reviewing may have provided learning stimuli of sufficient strength to modify behavior with consistent use and purposeful guides. A third possibility stems from the fact that these subjects were competing against themselves and greater effort may have been exerted to affect difference scores.

The largest mean difference in numbers of probing questions asked between pre and post tapes was reflected by the audio-tape group. This finding leads the investigator to conclude that it is possible to utilize audio-tape recorders in the self-evaluative process to produce change in teaching behavior. Apparently the necessity to listen intently without visual concentration provides

stimulation sufficient to significantly affect the questioning-skill ability of teachers. It is possible that audio-tape recorders are grossly underrated and it is suggested that, based upon the findings of this study, school districts re-evaluate ways in which this device may be used to enhance teacher effectiveness.

Self-evaluation by utilizing a model videotape in conjunction with one's own videotape, and self-evaluation by reflective thinking with purposeful direction, when utilized in a distributed-time procedure, both appear to positively affect teaching behavior. The results of this study indicated that teacher behavior was affected when a model videotape was utilized following the criteria of evaluation pursued in this investigation. As previously cited, the use of videotape models have produced significant and positive results when used in different circumstances. In recognizing the work of Mowrer (69), Orme (72), Allen (7), and Bandura (14), conditions of model-behavior acceptance by subjects depended upon variables different from those present in this investigation. It is therefore recommended that further experimentation utilizing videotape models with the self-evaluation procedure be carried out incorporating the concept of reinforcement, peer and supervisorial evaluation, and videotape model critiqing by participating subjects.

The creditable showing of the control group in its ability to increase both probing and basic questions between pre and post tapes

indicates that the value of continuous reflective evaluation over a period of time was valuable in contributing to changing the questioning skill ability of teachers. It should be noted, however, that because all subjects were trained and encouraged to use the self-evaluation instrument, the showing of the control group might be attributed to the guidance and direction furnished them through the use of this instrument.

It is important that the value of reflective evaluation as defined in this study be given some credence as a useful evaluative technique. It is possible that the reflective process, when used with purposeful supplementary guides, may be useful in contributing more to the improvement of teaching than has been recognized to date. On the basis of the decidedly strong showing of this technique in the distributed-time experiment in this study, further study involving this technique is warranted.

This study also sought to determine the most effective use of time in the training of experienced teachers, i.e., does self-evaluation lend itself to a one-shot time training period or to a distributed-time period of training? Significant differences were found between time periods in only one of the four treatment groups. The positive mean difference in numbers of probing questions asked by the PVTR distributed-time group, while slight, was significant at the .02 level when compared with the negative mean difference in both basic and

probing questions of the PVTR one-shot group. Apparently, the additional time between self-evaluations and re-teaching allowed the subjects to concentrate on the formulation of more probing-type questions appropriate to the given lesson. It was evident, therefore, that the distributed-time experiment proved superior to the one-shot experiment for subjects utilizing the PVTR.

A final area of investigation in this study explored the residual effect resulting from self-evaluation with the PVTR and its components. Results showed no significant residual effect in the one-shot treatment groups. The most consistent showing was made by the control group which reflected positive mean differences for both basic and probing questions. It is possible that the practice of self-evaluation without the aid of any electronic equipment (reflective thinking only) afforded the control group a more natural and lasting ability to retain specific questioning skills.

Leading questions, as identified and planned in this study, prove unsatisfactory. Further study by interested parties should be given to the value of leading questions and their purpose and function in a discussion-type lesson. The writer feels that leading questions can be conducive to stimulating higher cognitive processes and teachers should be made aware of their value.

Finally, the investigator directs special attention to the following variables which potentially had some effect on the outcome of this study:

1. The micro-teaching classes may have varied in the ability to express themselves verbally. A highly verbal group could evolve different results than a non-verbal group. Likewise, a cognitive-level variance in the students could influence the types of teacher-posed questions asked and thereby control the number of types of questions asked between the pre and post tapes. Future investigations should consider this factor and provide for this variable in the research design.
2. The final results of this study could have been influenced by limiting the lessons to a specific time period (in this study, ten minutes). A time period longer than ten minutes should be considered in another study of this kind.

ADDITIONAL INFORMATION FROM PARTICIPANT QUESTIONNAIRE

1. The technique of micro-teaching is worthy of more consideration by faculties and should be given credence by educators responsible for improving in-service programs.
2. Faculty involvement in a research study appears to be motivational in nature and school districts should consider this factor as a means to keep participants motivated, informed, and aware of basic research procedures and techniques.

3. The majority of teachers participating in this investigation had no previous training in the art of asking meaningful questions. It is possible that many teachers share this weakness. Attention should be given to this neglected area of teacher pre-service and in-service training.
4. It is possible that the results of this investigation were influenced by the restricted subject matter area of science because of the negative attitude held by some of the subjects regarding their ability to teach science-related concepts. Perhaps the negative attitude can be avoided in another study in which the subject matter of social studies is used.

RECOMMENDATIONS FOR FUTURE STUDIES

1. More empirical data are needed to ascertain the residual effects of the evaluative techniques used in this study. It is recommended that a follow-up study be conducted with periods of six and twelve months to furnish additional information to collaborate or nullify the findings in this study.
2. It is possible that other segments of the teaching act where less verbal and more demonstrative-type teaching is done with self-evaluation by the PVTR may provide different results than this study produced. For example, the introduction of mathematical concepts by the teacher via physical manipulation of

materials followed by a close evaluation of pupil learning may provide additional insights regarding the self-evaluative function of the PVTR.

3. A replication of this study utilizing a specifically designated micro-teaching videotape facility within each school is strongly recommended. The use of the "portable classroom" (house-trailer) introduced difficult-to-control variables and possibly influenced the results of this study.

4. A high peer-interest evolved during this investigation. Many subjects expressed the desire to view videotapes of fellow teachers. It is conceivable that a combination of peer-evaluation and self-evaluative techniques could provide additional support toward PVTR evaluative procedures.

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APPENDIX A

VIDEOTAPE RECORDER STUDY EVALUATION INSTRUMENT*

Introduction

This instrument is designed to guide your viewing of your taped micro-teaching lesson. It asks you to complete a sequence of tasks which have been planned to help you observe, analyze, interpret, and evaluate the questions you have used in teaching the lesson.

There are two schedules, A and B. Schedule A is to be used for your first evaluation, schedule B for the second. They are self-explanatory.

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* Courtesy of Dr. Theodore Parsons, U. C.

SCHEDULE A

VIDEOTAPE SELF-EVALUATION INSTRUMENT

FIRST VIEW

SCHEDULE A - FIRST SELF-EVALUATION OF MICRO-TEACHING LESSON

This is the first of two schedules to aid you self-evaluate and analyze your videotaped lesson. You are requested to complete a series of tasks (seven in Schedule A) which will enable you to focus your attention on your questioning procedures as they apply to stated instructional objectives.

Please complete these tasks in the sequence in which they are presented.

Although this study is primarily concerned with the types of questions you ask your students, you will be asked (in Task III) to identify student responses to your questions. This information will guide you in evaluating and replanning your microteaching lesson.

TASK I

You are asked to develop, in the space below, a brief written outline of your instructional objectives for the lesson to be recorded on videotape. Insofar as you possibly can, state your objectives in behavioral terms. That is, you should describe what it is you expect your pupils to be able to do better after the lesson than they could before, using such terms as "to identify, list, compare, contrast, explain," etc.

INSTRUCTIONAL OBJECTIVES FOR THE VIDEOTAPE LESSON

TASK II

In this task, you are asked to consider only one technique of instruction: QUESTIONING. The QUESTIONS which teachers ask can be classified according to the function they are intended to serve in stimulating the cognitive acts of pupils; that is, according to the ways in which the teacher uses them to structure and direct the conduct of inquiry into the subject matter of a lesson. For the purposes of the procedure required in the next task your questions can be classified by using the following defining terms and categories:

1. BASIC QUESTIONS: ask for "correct" answers; that is, for facts which are verifiable, for terminology which is accurate, or for inferences which are valid. Basic questions are posed in order to lay the basis for further inquiry and exploration on more abstract, general, universal, and complex levels of knowledge.

Examples:

A. In what part of the United States do the Hopi Indians live?

B. From what materials do they make their clothes?

C. Judging from the scale of this map, what is the area of the camp site shown here?

2. LEADING QUESTIONS: ask for a "correct" answer also. The answer is incorporated into the question through a term, a specific fact, a general inference, a procedure, and specify either what the "correct" answer is or what a "proper" approach to developing the answer would be. Leading questions are posed in order to lead inquiry from basic matters of fact and judgment to successively higher levels of abstraction, generality, universality, and complexity.

Examples:

A. Leather rots quickly in moist ground. What do you conclude about soil conditions in this area from the fact that many remains of leather footwear have been uncovered in excavations of this site?

B. There appears to be water in this balloon as a result of condensation. If this balloon were to suddenly burst leaving a residue of water, how would the water have been formed?

3. PROBING QUESTIONS: are those which, although they do not ask for a "correct" answer or prescribe a "proper" approach to developing an adequate one, nevertheless imply what the conceptual structure of an adequate answer might be: a generalization, an explanation, an interpretation, etc. Probing questions are posed in order to probe abstract relationships among facts and judgements, to investigate logical procedures for processing such information, and to explore ideas of order and discover degress of probity and integrity among forms of knowledge on the highest levels of abstraction, generality, universality, and complexity.

Examples:

A. Why do you suppose these Indians built their hearths so close to and directly in front of the entrance to their dwellings?

B. On what evidence and with what arguments would you conclude that these Indians were hunters rather than farmers, and to what expectations about their religious beliefs would you be led by such a conclusion?

C. By what line of reasoning might one conclude that the hearth shown in the center of the circular area near the lower left corner of your map was used for animal sacrifices, ritual dances, or worship ceremonies rather than for cooking?

TASK II, CONTINUED

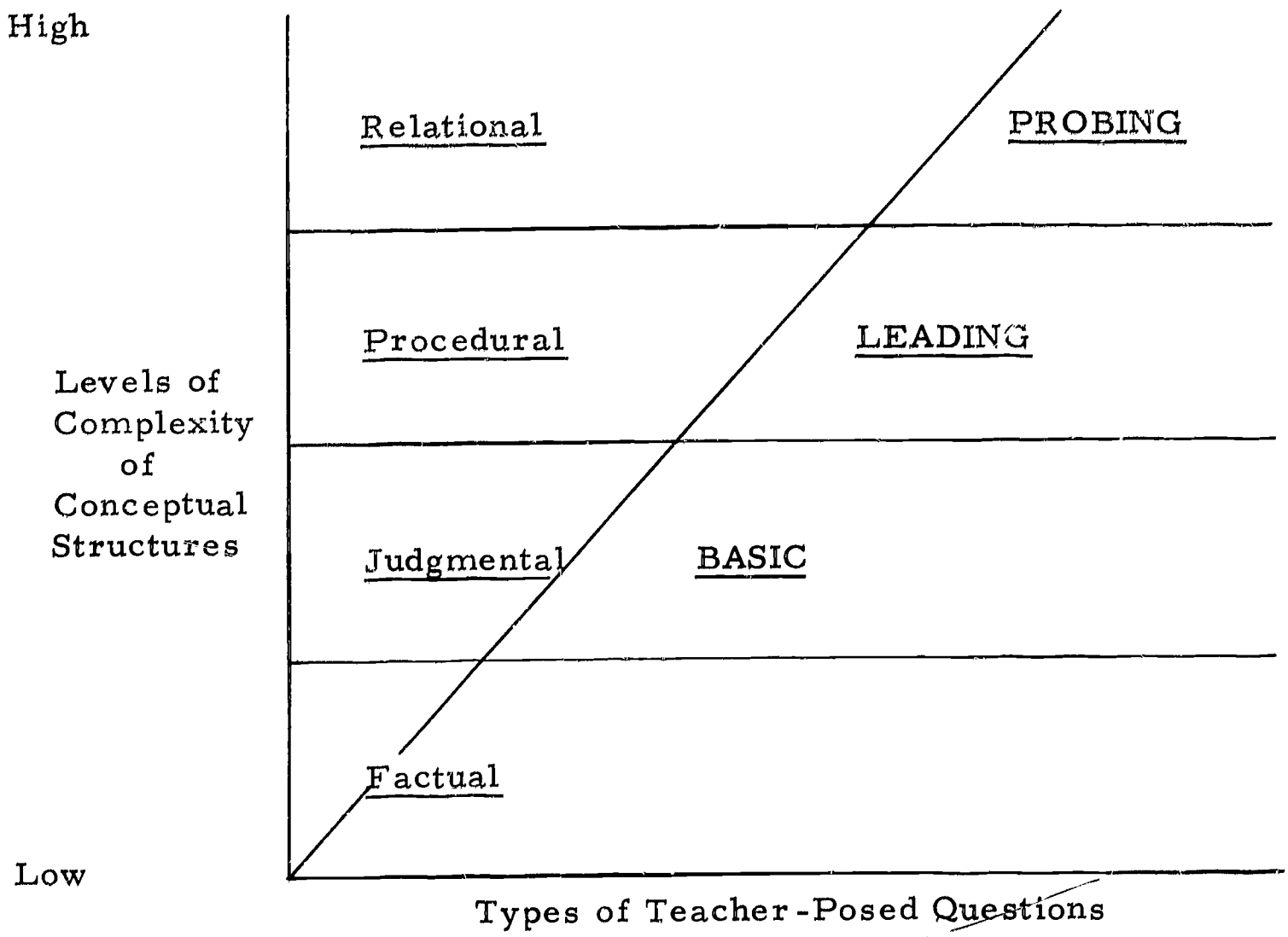

FIGURE 1

Relation Between Types of Teacher-Posed Questions and Levels of Abstraction, Generality, Universality, and Complexity in the Inquiry Which They Structure

The figure above represents graphically the complexity of thinking about the subject matter under inquiry which is associated with each type of question that the teacher poses in order to stimulate such thinking and elicit responses from pupils.

TASK III

Task III requires you to view and analyze your videotaped or audio-taped lesson for the first time. When you view the tape, be sure to concentrate on two specific areas:

1. Identification of each teacher-posed question asked during the lesson

2. Identification of each pupil response to each question.

PROCEDURE:

1. Tallying teacher-posed questions: Decide which of the three categories (basic, leading, probing) categories best fits the question. Make a tally mark in the appropriate box of the frequency chart in Table II. If you are unable to classify a question, make a tally mark in the "non-identifiable" column.

2. Tallying pupil response: Listen for pupil response to each teacher-posed question. Then tally the response in Table II according to the key below. If you have time, you may replay the videotape a second time to tally student responses.

0 if no verbal response is invited or expected

? if the pupil response is a request for clarification or repetition of the question

\+ if the teacher-posed question has elicited a satisfactory answer

— if the teacher-posed question has elicited an unsatisfactory or inadequate answer.

(Turn to the following page for Tables I and II.)

TASK III, CONTINUED

TABLE I

Relative Percentages of Questions

Type of Questions	Observed Frequency of Incidence Tally Marks	Totals
1. BASIC		
2. LEADING		
3. PROBING		
4. NON-IDENTIFIABLE		
	Total questions	

TABLE II

Relative Percentages of Pupil-Responses

Types of Response	Observed Frequency of Incidence Tally Marks	Totals
1. 0		
2. ?		
3. +		
4. –		
	Total responses	

TASK IV

As a basis for understanding the significance of the frequency chart in Table I, express the total frequency tally for each type of question as a percentage of the total number of questions asked. Read the following example and then complete columns A and B of Table III.

$$\frac{\text{No of Basic Questions}}{\text{Total No. of Questions}} = \%\ \text{Basic Questions asked}$$

TABLE III

Relative Percentages of Questions

	A	B	C
Question type	Observed Number of Questions	% Questions Observed	% Questions Desired
1. BASIC			
2. LEADING			
3. PROBING			
4. NON-IDEN-TIFIABLE			
TOTALS		100%	100%

GUIDE TO INTERPRETATION OF THE EVALUATION COMPUTATIONS IN SCHEDULE A

INTERPRETATION GUIDE

The following guide is provided to help you interpret your raw data. The guide is not intended to set forth an ideal model that you should strive to imitate; rather, it is intended merely to suggest several interpretations that might be drawn from various patterns of raw data. It is up to you to decide if a particular interpretation applies to you in any given instance.

Interpretation of Question Percentages: The proportion of each type of question you ask is relevant only to the objectives you have set up, the type of class you are teaching, and the activity you are pursuing at a specific time. With these important reservations in mind, however, you may be able to draw some gross interpretations from these figures. For instance:

1. If the percentage of your basic questions is very high (i.e., over 75%), you may be spending more time than you need to at a lower order of thinking. Such an interpretation would probably not be true if your class was one that needed a great deal of basic preparation before it could advance to more complex orders of thinking or if the majority of your basic questions served primarily to support or enhance higher-order questions.

2. If the percentage of your leading questions is very high (i.e., over 75%), you may be:

   a. Asking too many leading questions before you have established a sufficient basis. (You might give this interpretation special consideration if many of the student responses were 0's.)

   b. Asking too many leading questions when you might be advancing to higher order thinking. (Of course, you may be dealing with a class that is incapable of proceeding higher; or your leading questions may be primarily supporting or enhancing the probing questions you are considering.)

3. If the percentage of your probing questions is much above 30%, you may be:

a. Misclassifying lower order questions as probing ones

b. Not allowing sufficient time for real, in-depth probing to take place. (You cannot have probing going on unless you have enough time. Of course, it is possible that you have asked only a few total questions during the lesson and that a large percentage of these few are true probing questions.)

Interpretation of Pupil-Response Percentages: The interpretation of these symbols is also very subjective. Nevertheless, here in broad outline are the kinds of things you should consider in interpreting your data:

1. If you have a large proportion of 0's (over 40%), you may be spending more time talking (giving directions, keeping order, etc.) than you might want to.

2. If you have a large proportion of -'s (over 60%), you may be demanding too high a level of response from your students before they are ready for it. Or you may be keeping your students involved by asking them difficult questions which require a great deal of cogitation.

3. If you have an extremely high proportion of +'s (over 90%), you may be asking your class too many easy questions which they can answer without doing much thinking.

4. A ? is, of course, a sign that the student does not understand what kind of response you want from him. If you have several ?'s, perhaps:

a. You are not speaking loudly enough or enunciating carefully enough

b. You are not phrasing your questions in such a way that your students can grasp what you want

c. You do not have the sufficient attention of the class or at least of the student you were questioning.

d. You have more than your share of non-verbal students.

TASK V

As a basis for understanding the significance of the frequency chart for pupil response, express the total frequency tally for each type of pupil response as a percentage of the total number of pupil responses given. Read the following example and then complete columns A and B of Table IV.

$$\frac{\text{No. of ? Responses}}{\text{Total No. of Responses}} = \text{\% of ? Responses}$$

TABLE IV

Relative Percentages of Pupil Responses

	A	B
Type of Response	Observed Number of Responses	% Responses Observed
0		
?		
+		
–		
TOTALS		100%

TASK VI

Look at column B of Table III. Note the relative percentages of types of teacher-posed questions observed from the videotape.

Refer again to Figure 1. Note again the type of thinking which each type of question requires.

Write a short statement (for your own clarification) summarizing the kinds of thinking demanded of your students in the micro-teaching lesson on videotape or audiotape. What kind of thinking was most heavily emphasized during the lesson?

TASK VII

Refer to your outline of the instructional objectives which you have in mind for this lesson (Task I).

Look again at Figure 1.

Think again about the kinds of thinking you asked students to do in the first micro-teaching taped lesson.

Now --- consider the kinds of questions (i.e., the kind of thinking) that you should be asking your students in order to achieve more effectively your stated instructional objectives.

Express the results of your consideration by filling in column C of Table III (Task IV). Enter the relative percentages of questions that you think you should be attaining in order to develop more complex thinking in your students.

Keep these desired percentage figures in mind when preparing and teaching your next micro-teaching lesson. Remember the relationship between the kinds of questions asked by you and the kind of thinking demanded of students.

SCHEDULE B

VIDEOTAPE SELF-EVALUATION INSTRUMENT

SECOND (LAST) VIEW

SCHEDULE B - SECOND (LAST) SELF-EVALUATION OF MICRO-TEACHING LESSON

This schedule and procedure, like the previous one, is concerned with questioning. The purpose of the first procedure was to help you understand the differences in the nature of the three kinds of questions identified, the kinds of student thinking demanded by the different questions, the nature of student responses, and the character of your own teaching as rated by you in terms of the kinds of questions you asked in the videotaped or audio-taped lesson.

The purposes of this second procedure, Schedule B, are a) to help you further develop your understanding of the different types of questions and your use of them, and b) to help you further develop your skill in the phrasing of probing questions.

This schedule consists of three tasks. Please complete each task before going on to the next one.

TASK I

For Task I of this procedure you are asked to view the second videotaped lesson and try to identify the types of questions which you asked during the lesson. For each question which you identify, make a tally mark in the appropriate box of the frequency table (Table V) below. Do this for student responses also (Table VI below). When you have finished viewing the lesson, add up the tally marks in each box and complete both tables.

TABLE V

Teacher-Posed Questions

Type of Question	Observed Frequency Tally	Totals
1. BASIC		
2. LEADING		
3. PROBING		
4. NON-IDENT.		
	Total Questions	

TABLE VI

Pupil Responses

Type of Response	Observed Frequency Tally	Totals
1. 0		
2. ?		
3. +		
4. –		
	Total Responses	

TASK II

TABLE VII

Relative Percentages of Questions Asked for Both Videotaped Lessons

	A	B	C
Types of Questions	Desired %	Observed % (1st view)	Observed % (2nd view)
1. BASIC			
2. LEADING			
3. PROBING			
4. NON-IDENT.			
TOTALS	100%	100%	100%

Columns A and B have been completed using information which you developed in the first videotaped or audiotaped lesson. Complete Table VII by computing the percentage of each type of question and entering the percentages in the appropriate box in column C. Recall: (example)

$$\frac{\text{No. of leading questions}}{\text{Total No. of all questions}} = \%\text{ of leading questions}$$

Note the desired % of each question in column A. Recall the criteria used to determine these percentages.

Note column B. These are the percentages of each question you asked in the first lesson.

Examine columns A and B. Note the differences between the desired percentage distribution of question types and the distribution observed in the first lesson.

TASK III, CONTINUED

Examine Columns A and C. The figures give you the relationship of desired percentages and actual percentages of each category of question in the second taping.

Examine Columns B and C. This gives you the difference in percentages in each category between the first and second taping.

What changes have occurred in each category of questions between the first taping (col. B) and the second taping (col. C)?

Do the percentages in Column C show a closer relationship to the percentages in Column A?

Briefly outline the conclusions you can make about your questioning procedures based upon your examination of Table VIII.

TASK III

TABLE VIII

Relative Percentages of Pupil Responses for Both Videotaped Lessons

Types of Responses	A Observed % (1st view)	B Observed % (2nd view)
1. 0		
2. ?		
3. +		
4. –		
TOTALS	100%	100%

Column A was completed using information which you developed in the first evaluation (view). Complete Table VIII by computing the percentage of each type of pupil response and entering the percentages in the appropriate box in column B. Compute in exactly the same manner as before.

Examine columns A and B. Note the differences between the percentage distribution of pupil responses between the two tapings.

APPENDIX B

VIDEOTAPE RATING SHEET - (CRITERION INSTRUMENT)

Rater_____ Tape Code_____Date_____

TEACHER QUESTION CATEGORY KEY:

"B" - BASIC (Yes-No, Recall, Memory, Factual)

"L" - LEADING (Answer stated in question)

"P" - PROBING (Opinion, Comparison, Evaluation, How, Why, What If, Explain. Original thinking involved.)

"U" - QUESTION DOES NOT APPLY TO ABOVE CATEGORIES

TEACHER Q	TEACHER Q	TEACHER Q
1.	26.	51.
2.	27.	52.
3.	28.	53.
4.	29.	54.
5.	30.	55.
6.	31.	56.
7.	32.	57.
8.	33.	58.
9.	34.	59.
10.	35.	60.
11.	36.	61.
12.	37.	62.
13.	38.	63.
14.	39.	64.
15.	40.	65.
16.	41.	66.
17.	42.	67.
18.	43.	68.
19.	44.	69.
20.	45.	70.
21.	46.	71.
22.	47.	72.
23.	48.	73.
24.	49.	74.
25.	50.	75.

TOTAL QUESTION TYPES

NO. OF B's: ____
NO. OF L's: ____
NO. OF P's: ____
NO. OF U's: ____

TOTAL ALL: ____

APPENDIX C

PARTICIPANT EVALUATION QUESTIONNAIRE - VTR SELF-EVALUATION STUDY

1. Have you participated in any other study similar to this one since leaving college? If so, where and when?

2. Have you ever used the micro-teaching technique before?

3. Do you feel that your participation in this study helped you with your questioning-skill technique? With any other phase of your teaching?

4. Have you ever received any training in questioning technique previous to your participation in this study?

5. Was the study individually worthwhile for you as a classroom teacher?

6. In what ways could the study have been improved?

7. Would you be interested in an in-service program which utilized the videotape recorder?

8. What are specific areas of teaching and/or learning which you feel would be enhanced through the use of the VTR?

APPENDIX D

TABLE XI

Pre-Post Tape Differences in Numbers and Percentages of Probing Questions Asked by Subjects

			Pre-Tape			Post Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
1	F	AA	4	42	9.53	12	72	16.67	7.14	Mineral Identification
2	F	AA	20	42	47.62	16	46	34.79	-12.83	Magnets
3	F	AA	14	76	18.43	34	44	77.28	58.85	Pulleys
4	F	AA	50	106	47.17	2	56	3.58	-43.59	Weight of Water
5	F	AA	14	40	35.00	40	44	90.91	55.91	Cells
6	F	AA	36	66	64.55	26	50	52.00	- 2.55	Tree Identification
7	F	AA	10	62	14.13	12	40	30.00	13.97	Leaves
8	F	AA	18	62	29.04	16	46	34.79	5.75	Electricity
9	F	AA	40	52	76.93	10	70	14.28	-62.65	Water Power
10	M	AA	40	52	76.93	30	40	75.00	- 1.93	Water Purification
11	F	BB	30	72	41.66	12	66	18.18	-23.48	Yeast Cells
12	F	BB	10	74	13.55	20	52	38.46	24.95	Butterflies

TABLE XI (continued)

			Pre-Tape			Post-Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
13	F	BB	18	94	19.15	24	76	31.58	12.43	Flowers
14	F	BB	24	86	27.91	22	64	34.37	6.46	Insect Identification
15	F	BB	14	62	22.58	32	34	94.11	71.53	Feathers
16	M	BB	16	62	25.80	19	38	50.00	24.20	Aquariums
17	M	BB	6	54	11.11	14	44	31.81	20.20	Tadpoles
18	M	BB	12	50	24.00	18	36	50.00	26.00	Animal Coloration
19	M	BB	30	90	33.33	4	70	5.71	-27.62	Gases
20	M	BB	6	46	13.04	14	52	26.92	13.88	Liquid Measure
21	F	CC	18	66	27.27	22	87	25.29	- 1.96	Matter
22	F	CC	24	66	36.36	24	46	52.17	15.81	Air Pressure
23	F	CC	26	60	43.33	53	81	65.43	22.10	Friction
24	F	CC	14	48	29.16	30	72	41.66	12.50	Block and Tackle

TABLE XI (continued)

			Pre-Tape			Post-Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
25	F	CC	16	66	28.57	22	48	45.83	17.26	Evaporation
26	F	CC	18	64	28.12	10	68	14.70	-13.43	Speed of Light
27	F	CC	10	86	11.63	20	66	30.30	18.67	Gravitation
28	F	CC	18	52	34.61	18	44	40.90	6.29	Mirage
29	M	CC	14	50	38.00	14	30	46.66	18.66	Light Meter Principle
30	F	DD	20	84	23.81	13	24	54.16	30.35	Magnifying Glass
31	F	DD	18	70	25.71	20	76	26.31	.60	How Sound Travels
32	F	DD	9	51	17.64	20	66	26.31	8.67	Rocket Principle
33	F	DD	10	53	18.86	16	57	28.07	9.21	Useful Plants
34	F	DD	30	54	55.55	36	56	64.28	8.73	Plant Structure
35	F	DD	26	44	59.09	16	50	32.00	27.09	Harmful Plants
36	M	DD	8	32	25.00	4	38	10.62	-14.48	Grafting Fruit Trees

TABLE XI (continued)

			Pre-Tape			Post-Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
37	M	DD	22	54	40.74	30	30	100.00	50.26	Household Pests
38	M	DD	18	68	26.47	14	28	50.00	23.53	Body Germs
39	M	DD	24	48	50.00	16	46	34.78	-15.22	House Fly
40	F	AAA	52	80	65.00	60	90	66.67	1.67	Anatomy of Frog
41	F	AAA	32	74	43.24	18	40	45.00	1.76	Water Power
42	F	AAA	18	52	34.61	30	40	75.00	40.39	Jet Propulsion Principle
43	F	AAA	16	98	16.33	6	76	7.89	- 8.44	Aerodynamics
44	F	AAA	12	54	22.22	12	54	22.22	0	Gas Engine
45	F	AAA	20	52	38.46	22	44	50.00	11.54	Simple Electricity Experiments
46	F	AAA	13	45	28.88	18	62	29.03	.15	Glass Blowing
47	F	AAA	24	66	36.36	26	54	48.14	11.78	Pulleys
48	F	AAA	12	96	12.50	20	58	34.48	21.98	Seasons

TABLE XI (continued)

			Pre-Tape			Post-Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
49	F	AAA	2	80	2.50	2	62	3.22	- .72	Weather Forecasting
50	F	BBB	20	56	35.71	32	92	34.78	- .93	Seashore Animals
51	F	BBB	11	34	32.35	28	37	75.67	43.32	Body Care
52	F	BBB	24	49	48.97	34	46	73.91	24.94	Birds
53	F	BBB	2	38	5.26	25	56	46.42	41.16	Ocean Life
54	F	BBB	8	32	25.00	14	38	36.84	11.84	Plant Study
55	M	BBB	6	54	11.11	34	54	62.96	51.85	Clouds and Weather
56	F	BBB	18	24	75.00	20	48	41.66	-33.34	How to Experiment
57	F	BBB	12	66	18.18	25	33	75.75	57.57	Convex Lenses
58	F	BBB	22	46	47.82	22	44	50.00	2.18	Inclined Plane
59	F	CCC	18	76	23.68	24	60	40.000	16.32	Seed Growth
60	F	CCC	20	68	29.41	10	61	16.39	-13.02	Body Development

TABLE XI (continued)

			Pre-Tape			Post-Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
61	F	CCC	6	34	17.64	24	39	61.53	43.89	Liquid Measure
62	F	CCC	13	63	20.63	29	81	35.80	15.17	Water Pressure
63	F	CCC	12	62	19.35	18	44	40.90	21.65	Uses of Fire
64	F	CCC	8	58	13.79	24	54	44.44	30.65	Forest Conservation
65	M	CCC	48	70	68.57	38	46	82.60	14.03	Effect of Drugs
66	F	CCC	22	70	31.42	7	42	16.66	14.76	Chlorophyll
67	M	CCC	32	68	47.05	38	54	70.37	23.32	Digestive System
68	M	CCC	22	50	44.00	10	50	20.00	-24.00	Magnets
69	F	DDD	36	52	69.23	44	56	78.57	9.34	Electricity
70	F	DDD	8	60	13.33	10	72	13.89	.56	Pulleys
71	F	DDD	12	48	25.00	4	28	14.28	10.72	Rock Identification
72	F	DDD	10	40	25.00	28	66	42.42	17.42	Cell Structure

TABLE XI (continued)

			Pre-Tape			Post-Tape				
Subj.	Sex	Treat. Group	No. Prob.	Total	Percent Probing	No. Prob.	Total	Percent Probing	Percent Difference	Lesson Focus
73	F	DDD	2	20	10.00	30	50	60.00	50.00	Water Pressure
74	F	DDD	28	58	48.27	12	66	18.18	-30.09	Fossil Study
75	F	DDD	5	19	26.31	18	48	37.50	10.19	Air Pressure
76	F	DDD	26	50	52.00	18	50	36.00	-16.00	Paint Pigment
77	M	DDD	20	40	50.00	20	34	58.82	8.82	Algae
78	F	DDD	12	50	24.00	26	50	52.00	28.00	Steam Engine Principle

APPENDIX E

TABLE XII

Mean Difference Comparison of Numbers of Basic and Probing Questions Asked Between Distributed-Time Treatment Groups

TREATMENT GROUPS	BASIC	PROBING	TOTAL χ^2
AAA			
Obs.	-12.9	1.3	
Exp.	-11.2	- .5	
χ^2	.76	.22	
BBB			
Obs.	- 5.6	12.4	
Exp.	- 7.3	14.2	
χ^2	.37	2.9	1.46
AAA			
Obs.	-12.9	1.3	
Exp.	- 7.8	- 3.8	
χ^2	3.9	2.9	
CCC			
Obs.	10.5	7.8	
Exp.	4.1	14.2	
χ^2	1.5	1.1	*9.4
AAA			
Obs.	-12.9	1.3	
Exp.	7	- 3.6	
χ^2	1.8	2.1	
DDD			
Obs.	7	8.3	
Exp.	2.9	13.2	
χ^2	1.3	.85	**7.5
BBB			
Obs.	- 5.6	12.4	
Exp.	0	6.7	
χ^2	2.0	1.4	
CCC			
Obs.	10.5	7.8	
Exp.	4.9	13.8	
χ^2	1.5	.12	***5.0

TABLE XII (continued)

TREATMENT GROUPS	BASIC	PROBING	TOTAL χ^2
BBB			
Obs.	- 5.6	12.4	
Exp.	- 1	7.7	
χ^2	1.5	.97	
DDD			
Obs.	7	8.3	
Exp.	2.4	13	
χ^2	1.2	.78	****4.4
CCC			
Obs.	10.5	7.8	
Exp.	9.5	8.7	
χ^2	.04	.03	
DDD			
Obs.	7	8.3	
Exp.	8	7.4	
χ^2	.04	.03	.14

* Significant at the .001 level

** Significant at the .01 level

*** Significant at the .05 level

**** Significant at the .05 level

APPENDIX F

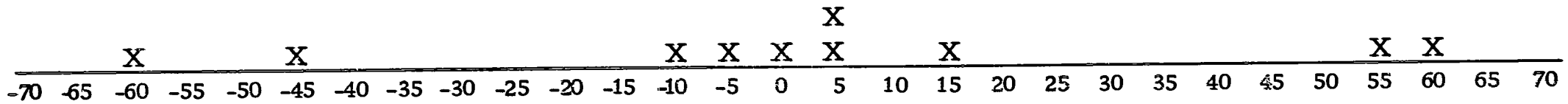

FIGURE 3

Percentage Differences of Probing Questions Asked for Treatment Group AA

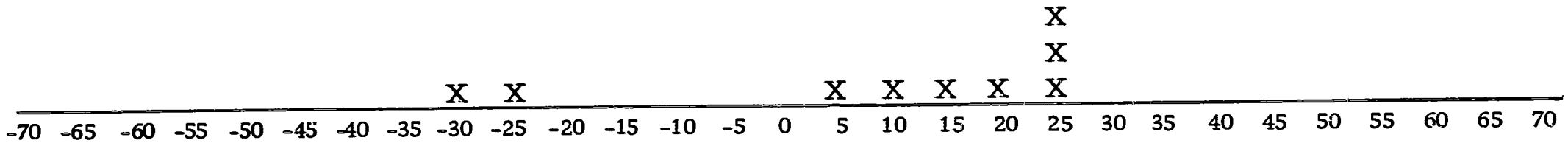

FIGURE 4

Percentage Differences of Probing Questions Asked for Treatment Group BB

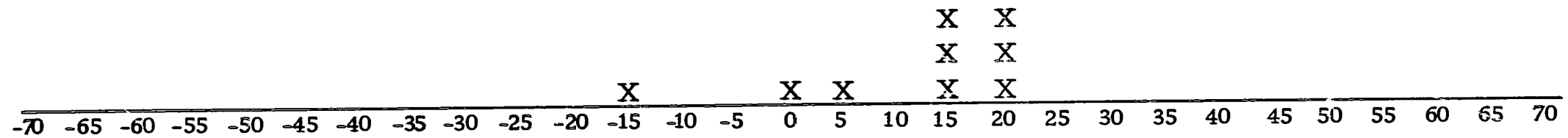

FIGURE 5

Percentage Differences of Probing Questions Asked for Treatment Group CC

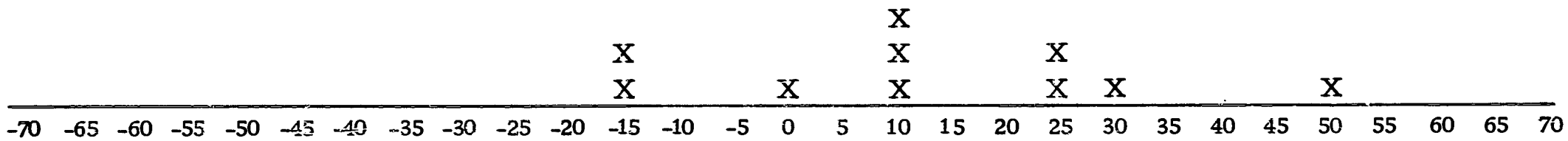

FIGURE 6

Percentage Differences of Probing Questions Asked for Treatment Group DD

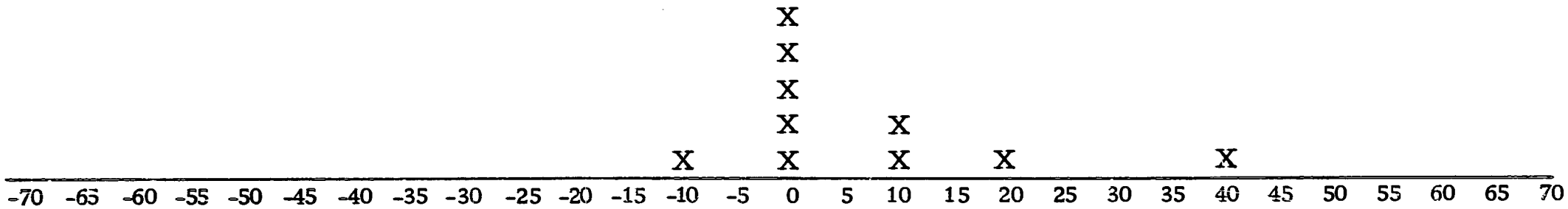

FIGURE 7

Percentage Differences of Probing Questions Asked for Treatment Group AAA

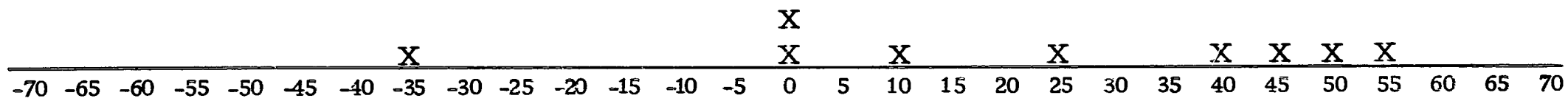

FIGURE 8

Percentage Differences of Probing Questions Asked for Treatment Group BBB

FIGURE 9

Percentage Differences of Probing Questions Asked for Treatment Group CCC

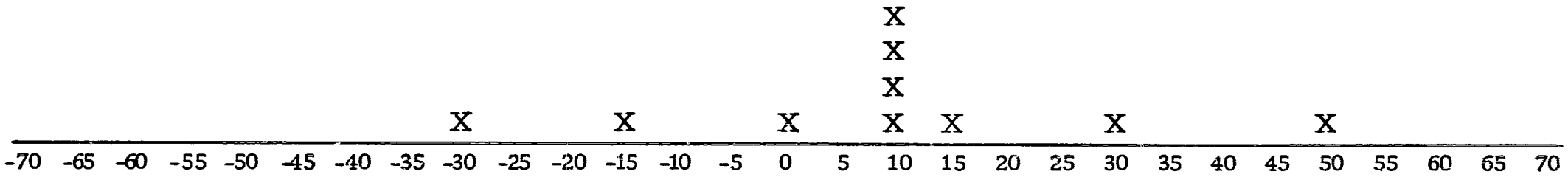

FIGURE 10

Percentage Differences of Probing Questions Asked for Treatment Group DDD