Evaluating teaching effectiveness in terms of behavior change in pupils.

George Brent
University of Massachusetts Amherst

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EVALUATING TEACHING EFFECTIVENESS IN TERMS OF
BEHAVIOR CHANGE IN PUPILS

A Dissertation Presented
By
George Brent

Submitted to the Graduate School of the
University of Massachusetts
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EVALUATING TEACHING EFFECTIVENESS IN TERMS OF
BEHAVIOR CHANGE IN PUPILS

A Dissertation

By

George Brent

Approved as to style and content by:

Raymond Wyman (Chairman)

H. Todd Eachus (Member)

Robert Willoughby (Member)

William Wolf (Member)

August 1971
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The many people who have influenced my career are too numerous to mention. It is only possible to mention a few of the most significant ones.

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Finally, my work was possible only with the support of my wife, Gayle, and my immediate family and friends.
ABSTRACT

A study was conducted to demonstrate that direct measurement of behavior change in pupils can be used to evaluate teaching effectiveness. The measurement techniques used in the evaluation process were derived from operant conditioning. Effectiveness was judged in terms of the attainment by the pupils of teacher specified objectives.

The evaluation techniques were used with an adjunct teacher-training program involving twenty-two student-teachers. Both internal and external evaluation criteria were used. The internal criteria focused on the behavior change of the student-teachers within the instructional parts of the program. The student-teachers were considered pupils during the instructional part of the program and their behavior was measured to determine whether the instructional objectives were met. The external criteria focused on the behavior change of deaf pupils taught by the student-teachers during their practicum experience. The evaluation was concerned with both the immediate result of training and the product of the student-teachers, desired pupil behavior change, during actual teaching.

Four phases were included in the study: Microteaching, Adjunct-teaching, Student-teaching: Formal and Student-teaching: Informal. In all phases direct and continuous measurement of pupil behavior change was used to demonstrate the effectiveness of teaching procedures. The measurement procedures allowed the teacher to analyze the effects of
changes in teaching procedures when they introduced and as long as they remained in effect.

This study demonstrated the usefulness of operant measurement techniques in the evaluation of teaching effectiveness. The techniques allowed teaching effectiveness to be directly evaluated through pupil behavior change. Pupil behavior was directly measured and compared to terminal behaviors defined by the teachers prior to instruction. The study also demonstrates the functional relationship between teacher behavior and pupil behavior.
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In as much as we teach, we have purpose, and I think that without purpose you don't have teaching. The object, then, is for the teachers to define the evidence that they will accept as proof that this learning has taken place, and then to arrange matters so that the individual learner does demonstrate this evidence.

Herbert Hite
SECTION I
INTRODUCTION

The purpose of this study is to demonstrate that direct measurement of behavior change in pupils can be used to evaluate teaching effectiveness. The measurement techniques used are derived from the field of operant conditioning. These techniques are applied to a teacher preparatory program which is evaluated using both internal and external criteria. The internal criterion concerns behavior change of the student-teachers within the program. The external criterion focuses on the student-teachers' behavior when they are practice-teaching.

Criteria Used for the Evaluation of Teaching Effectiveness. The evaluation of teaching effectiveness is often neglected at the college level and subjectively done through observation by supervisors at the public school level. In the public schools, teachers are considered effective if they emulate other "good" teachers. This type of evaluation is not surprising when the training procedures are considered. Skinner (1968) states:

High-school and grade-school teaching is taught primarily through apprenticeships, in which students receive the advice and counsel of experienced teachers. Certain trade skills and rule of thumb are passed along, but the young teacher's own experience is to be the major source of improvement. Even this modest venture in teacher training is under attack. It is argued that a good teacher is simply one who knows his subject matter and is
interested in it. Any special knowledge of pedagogy as a basic science of teaching is felt to be unnecessary. (pp. 94-95)

Teaching effectiveness is seldom evaluated objectively and rarely evaluated in terms of behavior change in pupils.

Investigations have been conducted which demonstrate the various criteria for evaluating teaching effectiveness that are used. McClain (1968) attempted to show a relationship between scores on Cattell's Sixteen Personality Factor Questionnaire and success in student-teaching. The criteria used to judge teaching effectiveness were ratings by supervisors that classified the teachers as "excellent," "average," or "poor." It was not explained how the supervisors made their judgements. Another study (Chabassol, 1968) evaluated effectiveness in student-teaching according to the grades student-teachers received. The study attempted to relate scores on three separate measures of attitudes taken before the students received training in teaching to success in teaching. Chabassol (1968) elaborated on the grading procedure used:

At the end of the year they are given a grade in practice-teaching which is arrived at in the following manner. Approximately 85 percent of the teaching grade is based on from 15 to 20 separate evaluations submitted by both faculty and critic teachers. The marks are weighted so that grades obtained early in the year, when the student is relatively inexperienced, count less toward the overall assessment than
do grades which are based on later performances in the classroom. In addition to marks submitted for teaching actually observed, faculty members who have been in particularly close contact with the student are asked to make a subjective appraisal of the student as a potential teacher. These "suitability for teaching" estimates make up the remaining 15 percent of the final practice-teaching mark. (p. 304)

McClain (1968) and Chabassol (1968) are similar in that they do not discuss the teacher-training programs that the student-teachers were enrolled in. They use personality tests or attitude measures to predict effectiveness in teaching. Their evaluation of effectiveness in terms of subjective supervisor judgements is not surprising when their emphasis on "personality" or "attitude" measures is considered.

In contrast to the studies that focus on characteristics teachers possess before training there are those that emphasize the acquisition of skills during training. Microteaching is one type of teacher training that focuses on the acquisition of certain skills thought to be related to effective teaching. Microteaching usually involves four basic steps.

The teacher prepares a lesson that will use a specific teaching skill. The lesson is taught to a small group of pupils for about five to ten minutes. A videotape is made of the lesson and is viewed by the teacher and supervisor as they analyze the lesson. Finally, the teacher revises the lesson and teaches it again. Fortune, Cooper, & Allen (1967) state that the microteaching clinic that they conducted resulted in "... significant behavior changes in teacher education candidates (p. 342)."
Evaluation of behavior change was primarily in terms of the acquisition of certain skills by the teachers. The relationship of those teaching skills to learning in pupils was not discussed in the study. A second study on microteaching (Kallenbach & Gall, 1969) compares it with other methods of training teachers.

Contrary to expectation based on previous research findings, microteaching was not found to result in significantly higher ratings of teacher effectiveness either immediately after or a year after training. However, it was concluded that microteaching is an effective training strategy since it achieves similar results when compared with conventional training methods but in only one-fifth the time and with fewer administrative problems. An incidental finding was that pretraining ratings of teaching performance based on a brief videotaped lesson were generally good predictors of later ratings of teaching effectiveness. (p. 136)

Kallenbach & Gall (1969) assessed teaching effectiveness both in the microteaching setting and in actual classrooms. The evaluation of teaching was made in terms of the behaviors of the teachers as measured by the Stanford Teacher Competence Appraisal Guide. This guide asked raters to "... assess seventeen dimensions of teaching competence in the areas of lesson planning and presentation, use of measurement techniques to evaluate learning, and community and professional participation (Kallenbach & Gall, 1969, p. 138)."
Kallenbach & Gall (1969) also used a second measuring device, the Instrument for the Observation of Teaching Activities, to evaluate his population of student teachers. Both of the above studies evaluate teaching effectiveness primarily in terms of behaviors that student-teachers exhibit in teaching situations. Evaluation of effectiveness is not in terms of the ability of teachers to generate desired behavior changes in their students. Furthermore the studies do not attempt to correlate the behaviors that they measure with behavior changes in pupils.

The types of evaluations cited above leave unanswered the question of the ability of those evaluated to change their pupils' behavior. Teachers are judged to be effective and their training programs successful if the teachers use certain skills or display certain behaviors viewed as desirable by the individuals who judge teachers. It is not made explicit in evaluation studies whether teaching behavior is associated with desirable changes in pupils' behavior. Rather than an indirect evaluation, it may be possible to evaluate teaching effectiveness directly by measuring changes in pupils' behavior—changes that are both desirable and facilitated by the teacher. Skinner (1969) states:

Teaching is the arrangement of contingencies of reinforcement which expedite learning. A student learns without being taught, but he learns more effectively under favorable conditions. Teachers have always arranged effective contingencies when they have taught successfully, but they are more likely to do so if they understand what
they are doing. (p. 15)

Evaluations of teaching effectiveness should be addressed to the question of whether the teachers can present favorable learning conditions. The answer lies in the behavior of the child.

**Direct Measurement of Behavior Changes in Pupils.** Current research in operant conditioning illustrates that pupil behavior change can be used to evaluate teaching effectiveness. Operant procedures have been used in classrooms to modify pupils' social and academic behavior. Madsen, Becker, & Thomas (1968) found that the systematic change in the behavior of two elementary school teachers increased "appropriate behavior" for two children in one classroom and one child in the other. Before the modification was attempted, the teachers involved were given a workshop on applications of behavioral principles in the classroom. During the study, the teachers were given explicit instructions to follow. A combination of ignoring "inappropriate" behavior and reinforcing appropriate behavior was effective in achieving desired behavior change in the pupils observed. Craig & Holland (1970) modified a behavior especially important for educating deaf pupils. Visual attending was modified in three classrooms of deaf pupils. All the pupils (N=21) in these classes were involved in the study. The procedure involved the provision of "... immediate and tangible reinforcement for visual responses oriented toward the relevant teaching stimulus (p. 98)." Lights were flashed on to provide immediate reinforcement for visual attending. Non-attending behaviors were ignored during the reinforcement periods.
The behavior change was measured in terms of the frequency of appropriate observing performances. All three classes increased their average frequency by fifty percent or over. Both of the above studies succeeded in modifying behavior in classrooms. Pupil behavior changes were directly measured in terms of increases or decreases in frequencies of occurrence of the particular behavior in question. Although the studies concentrated on the modification of classroom behavior problems, they probably had an indirect effect on increasing academic performance rate. If the instructional stimuli are not received by pupils, they are prevented from learning the information presented.

It is also possible to directly modify the frequency of occurrence of academic behaviors. Lovitt & Curtiss (1969) showed that higher academic behavior frequencies occurred when a pupil arranged the contingency requirements than when the teacher specified them. The contingency manager and not the amount of reinforcement was shown to be responsible for the increase in rate. Academic performance rate was increased in the areas of mathematics, reading, spelling, and writing. Lovitt & Curtiss (1968) increased academic performance rate by manipulating the antecedent conditions rather than the consequences. Instead of reading and then answering mathematics problems, the experimenter asked the subject to read, verbalize, and then answer the problems. The procedure proved to be effective in increasing the frequency of occurrence of correct performances.
These studies used operant procedures in classrooms and show that pupil behavior change can be used to evaluate teaching effectiveness. Teaching effectiveness defined as the ability to generate desired behavior changes can be directly measured. However, the studies cited evaluated the results of situations where a few teachers (Craig & Holland, 1970; Lovitt & Curtiss, 1969; Madsen et al., 1968) or an experimenter without the aid of a teacher (Lovitt & Curtiss, 1968) were involved. When teachers were used they were given considerable help by the experimenters. This help included a workshop on the basic operant principles (Madsen et al., 1968), explicit directions to follow during the study (Madsen et al., 1968), observation by trained observers (Craig & Holland, 1970; Madsen et al., 1968), and daily feedback to the teachers concerning their behavior (Madsen et al., 1968).

In general, teacher-training programs present a different problem from those encountered in the operant studies presented above. Rather than a few teachers, the number involved may be considerable. The Stanford summer microteaching clinic involved 140 trainees (Fortune et al., 1967). Also when the teachers return to their schools, they probably will not have explicit directions to follow in their classrooms (Hall, Fox, Willard, Goldsmith, Emerson, Owen, Procía, and Davis, in press; McKenzie, Egner, Knight, Perelman, Schneider, & Garvin, 1970). Articles involving the training of groups of teachers in operant procedures differ from most articles concerning the application of operant procedures in classrooms since their goal is to train teachers
for the independent and long-term use of the procedures rather than the temporary use for the duration of a study. Hall et al. (in press) succeeded in training teachers to act as experimenters and primary observers in classroom attempts at behavior modification. This contrasts with studies (Hall, Lund, & Jackson, 1968; Thomas, Becker, & Armstrong, 1968) where the teacher was neither experimenter nor primary observer. The teachers in Hall et al. (in press) were graduate students enrolled in a class on the management of classroom behavior. Various means of recording change in pupils' behavior were used. Reliability of recordings was checked by another person or a mechanical device such as a tape recorder. The class was generally successful in using the techniques but only six out of sixty studies were reported in detail in Hall et al. (in press).

The studies reported by Hall et al. (in press) followed a similar pattern. A baseline was recorded of the frequency of occurrence of the "disruptive" behavior that each teacher chose to focus on. Reinforcement was then given for "appropriate" behavior and "inappropriate" behavior was ignored. In all cases a decrease in the frequency of occurrence of the inappropriate behavior was observed. The contingent reinforcement was reversed and then reinstated in all studies to demonstrate that teacher attention was in fact a reinforcer for appropriate behavior. The modification procedures varied in the six studies. Studies 1 and 2 combined the systematic use of teacher attention for "positive" behaviors and the ignoring of "talking-out" behaviors. The other studies used the same procedures
as studies 1 and 2 but added additional ones. In study 3 the pupil was shown a daily graph on her talking-out behavior. In study 4 another pupil, one that was emitting desired behavior, was recognized by the teacher each time the subject in question was displaying inappropriate behavior. Study 5 involved the entire class rather than a single pupil and allowed a game at the end of the day for increased frequency of hand raising. The entire class was also used in study 6. A favorite activity at the end of the day was allowed for improved behavior during the first few weeks of the study. Then another procedure was used in study 6. This involved the giving out of straws that were redeemable for "surprises" at the end of the week. These straws were taken away on days when the child talked-out.

In Hall et al. (in press), teaching effectiveness was determined by the ability of the teacher to generate desired behavior change in pupils. The behavior changes were measured by recording the frequency of the particular behavior in question. A baseline record of the behavior was recorded prior to the implementation of the experimental procedures. Changes in frequencies of the behavior being altered indicated the effect of the experimental procedures. The teachers employed procedures that they designed and received feedback from their own observations of the pupils' behavior. It is implied in Hall et al. (in press) that the ability of teachers in his course to carry out operant studies was directly related to training they had received in the course. The behavior changes that Hall et al. (in press) facilitated
in students, which allowed them to perform their operant studies, were not reported. Another training program (McKenzie et al., 1970) that used a similar method in reporting its results, differed in that the trainees did not directly modify the pupil's behavior that was reported.

McKenzie et al. (1970) reported on a training program for experienced elementary teachers. The teachers were trained to be consultants to other teachers in their districts on operant procedures. The teacher consultants acted as experimenters and observers but it was the teachers that they consulted with who actually implemented the procedures. Consultants were trained in a two-year Master of Education program which included the following features:

1. Principles of behavior modification.
2. Application of these principles to meet the needs of handicapped children in regular classrooms.
3. Precise daily measurement and monitoring of a child's progress to ensure that contingencies, methods, and materials are effective.
4. Procedures for training parents and teachers in the principles and application of behavior modification techniques.
5. Research training to increase skills in devising and evaluating education tactics.
6. Development of supplementary materials suited to the particular needs of handicapped learners.
7. Methods of advising elementary school teachers in the management and education of handicapped learners.
(McKenzie et al., 1970, p. 138)

Three case studies were given by McKenzie et al. (1970). They followed a similar pattern to those presented by Hall et al. (in press) except that no reversal of the contingencies was attempted. "Of the 50 handicapped learners served, 47 children demonstrated reliable and beneficial changes in behavior . . . The remaining children showed changes in behavior too slight to be judged."

The first case study involved three different modification attempts with a single pupil (McKenzie et al., 1970). First the teacher attempted to decrease the frequency of "interrupting" behaviors during the social studies period. The teacher ignored interruptions and within seven days the frequency of interruptions was zero. After the first procedure was successful, the teacher decided to increase "attending" behavior for the same child during social studies. The teacher increased her rate of praising the child's attending behavior and this resulted in an increased frequency of attending. During the third week of the attending study, the teacher decided to try to improve the same child's performance on math papers. She began to mark math problems at random times during the math period rather than after it. Incorrect answers were ignored. The percentage of the child's correct responses increased. The second case involved an attempt to increase a pupil's rate of accurately
completing addition problems. The use of a bar graph plus praise for days when the pupil maintained or increased his rate did not increase the rate over the baseline amount. The procedure was changed to giving the child the bar graph to color only on days when the number of correct problems was equal to or was greater than the previous day. Teacher praise accompanied the giving of the bar graph. This new procedure resulted in an increase in the frequency of occurrence of correct answers. The third case study involved the number of daily assignments a pupil completed in class. Points were given to the child for complete papers. The points were exchangeable for minutes of undivided attention by the child's mother at home. The frequency of occurrence of completed papers increased and the increase was maintained for the rest of the school year. As in Hall et al. (in press), behavior change of the teachers within the course was not reported but their effectiveness in carrying out modification procedures was reported.

If changing pupil behavior in desired directions indicates effective teaching, then the operant studies demonstrate that these behaviors can be measured and related to teaching behavior. Teachers are clearly able to demonstrate that they can facilitate learning for their pupils. It is clear that at least one method of evaluating teaching effectiveness in terms of the ability of a teacher to generate desirable behavior change in pupils is available for use.

Operant Conditioning. B. F. Skinner developed the free operant method of studying behavior during the 1930's (Skinner, 1938). The
procedures and principles continued to be expanded in the laboratory setting primarily using animals other than humans as subjects. Since 1957 much of this work has been published in the Journal of the Experimental Analysis of Behavior.

As an approach to the study of behavior, operant conditioning consists of a series of assumptions about behavior and its environment; a set of definitions which can be used in the objective, scientific description of behavior and its environment; a group of techniques and procedures for the experimental study of behavior in the laboratory; and a large body of facts and principles which have been demonstrated by experiment. (Reynolds, 1969, p. 2)

Experiments with several animal species including humans suggested that the operant principles were generally applicable to humans. Recently these principles have been used in many applied settings with humans. The Journal of Applied Behavior Analysis, first published in 1968, attests to the proliferation of applied studies.

In operant conditioning, behavior is controlled by explicitly arranging the consequences of a response. An example of operant conditioning can be seen in a student's response of raising his hand in order to answer a question. If the response is positively reinforced by the teacher's attention, the frequency of this response will increase in the future.

Much of the success in establishing lawful relationships between responses and changes in the environment has been due to an experimental
method which directly observes frequency of responding and change in those frequencies. When in a tightly controlled environment, the manipulation of an independent variable results in a change in frequency, we can be fairly certain that a lawful relationship exists. For example, a pigeon might be reinforced after every 10th peck at a disk. This results in 100 pecks per minute. If the reinforcement is changed to once every minute, the number of pecks would be seen to decrease. In laboratory situations the machine counting of frequency of responses insures accuracy but in most applied situations humans must be used to hand count or to operate counting machines.

The frequency of an operant response is used as the basic measure of operant behavior and has been widely employed in operant conditioning. It has been supported by leading theorists (Bijou, Peterson, & Ault, 1968; Skinner, 1953). Skinner (1953) gives several reasons for using this measure.

1. Frequency of response is an extremely orderly datum.

The curves which represent its relations to many types of independent variables are encouragingly simple and smooth.

2. The results are easily reproduced.

3. As a result of (2) the concepts and laws which emerge from this sort of study have an immediate reference to the behavior of the individual which is lacking in concepts or laws which are the products of statistical operations.
4. Frequency of response provides a continuous account of many basic processes.

5. We must not forget the considerable advantages of a datum which lends itself to automatic experimentation.

6. ... frequency of response is valuable datum just because it provides a substantial basis for the concept of probability of action ... (pp. 75-78)

Skinner also states that frequency of occurrence is a sensitive measure to changes brought about by the manipulation of the independent variable (Kunzalmann, 1970).

Frequency of occurrence data is used to provide a description of the relevant behavior of the subject. This description or baseline data may be used to compare with data obtained after an environmental variable is manipulated.

A steady-state baseline, obtained before instituting any experimental manipulations, also makes possible a relatively refined type of measurement of behavioral changes. It permits the effects of the manipulated variables to be evaluated with reference to the individual's own behavior. (Sidman, 1960, pp. 240-241)

Of principal concern when using a steady-state baseline is the establishment of stability criteria for the behaviors being shaped.

A stable state is a period of time during which there are relatively minor changes in the pattern of the observed behavior. There are a wide variety of stability criteria possible and "... no
rule to follow, for the criterion will depend upon the phenomenon being investigated and upon the level of experimental control that can be maintained (Sidman, 1960, p. 258)." The primary stability criteria employed in this study will be based on visual inspection of the data.

One of the basic requirements for the success of 'criterion-by-inspection' is that the experimental manipulations produce large behavioral changes. If the changes are of such a magnitude as to be easily apparent by visual inspection, then such inspection automatically assumes greater validity as a stability criterion. A more quantitative criterion might show that the behavior in question is still undergoing development, and a more precise evaluation of the independent variable's effect might require a stricter behavioral specification. But the demonstration that a variable is effective does not require the attainment of a stringently defined stable state as long as the demonstrated change is large enough to override the baseline 'noise.' (Sidman, 1960, p. 268)

If possible a procedure is usually employed to determine whether the relationship observed during the experimental phase of a study was in fact related to the experimental condition. Several procedures are possible. One commonly used procedure (Schutte & Hopkins, 1970; Whitman, Mercurio, & Caponigri, 1970) consists of reversing the
experimental operations. This procedure may not be used in the school setting if the student teacher or cooperating teacher object to reinstating the original behavior. It is also possible that reversal will not be possible if reinforcers other than those systematically manipulated maintain the modified performance when the experimental operation is stopped (Tharp & Wetzel, 1969).

A multiple baseline technique may be used as an alternative to the reversal procedure (Baer, Wolf, & Risley, 1968). In this procedure, several performances may be identified and baselines recorded. The experimental operations can be applied to one of the performances. If a change is noted, the experimental operations may then be used with one of the unchanged performances. A change in the second performance will support the contention that the experimental variable is effective. The procedure may then be applied to other performances.

A third technique involves the use of a DRO (differential reinforcement of other behavior) (Ferster & Perrott, 1968). In this technique, the experimental operations are continued. But delivery is contingent on any behavior other than the one designated for modification. A decrease in the rate of the previously modified performance would indicate that the previous contingency between the experimental manipulation and first performance resulted in the modification of that performance.

Replication by any of the above procedures is desirable in order to support the reliability of the experimental operations. But in the
applied setting, the modification of a performance is the primary goal and not the support of experimental methods. Even if none of the above procedures can be used to support reliability, changes in given pupil behaviors still indicate the effects of the experimental operations.

Educational Concern. In 1897 the results of an investigation of teaching methods were reported to an association of educators in terms of spelling test scores (Ayres, 1912). The educators reacted unfavorably to the report.

With striking unanimity they voiced the conviction that any attempt to evaluate the teaching of spelling in terms of the ability of the pupils to spell was essentially impossible and based on the profound misconception of the function of education. (Ayres, 1919, p. 300)

By 1912, the same association had changed their position and decided that "... the effectiveness of the school, the methods, and the teachers must be measured in terms of the results secured (p. 200)."

Despite the 1912 change in the association's position, arguments about why pupil performance criterion measures are supposedly unworkable continued in other educational circles until the present (Justiz, 1969).

A criterion of teaching effectiveness in terms of the ability of teachers to generate desired behavior changes in pupils is still of general concern in education and still a subject debate. The following excerpts reflect the continued interest in such a criterion.
In identifying effectiveness as a criterion dimension of teachers, we imply that the purpose of our measurement or appraisal of teachers is to estimate whether they will produce desired amounts and types of changes in pupil behaviors...

Effectiveness is the degree to which an agent produces effects... So educational objectives become the dimensions of our first major category of effect on pupils. (Committee on the Criteria of Teaching Effectiveness, 1952, p. 243).

By teacher 'effectiveness' is usually meant the teacher's effect on the realization of some value. Usually, the value takes the form of some educational objective, defined in terms of desired pupil behaviors, abilities, habits, or characteristics. Hence, the ultimate criteria of a teacher's effectiveness is usually considered to be his effect on pupil's achievement of such objectives. (Gage, 1963, p. 116)

Since the ability to generate desirable behavior change in pupils is viewed as the "ultimate" criterion of teaching effectiveness (Ackerman, 1954; Gage, 1963), it is surprising that it has been seldom used (Mitzel and Gross, 1958) or is repudiated as a usable criterion (Herbert, 1970; Justiz, 1969). Ackerman's review of the literature concerned with teaching effectiveness based on a criterion of pupil behavior change suggests some of the reasons for criticizing this type of evaluation. The articles covered in the review attempted to
determine relationships between teachers and change in pupils. Teacher variables studied included age, attitudes toward teaching, experience, intelligence, professional information, personality, social attitudes, teacher-pupil relationships, and training. The results of the studies were generally contradictory and inconsistent. Ackerman (1954) feels that the main problem in the studies was that the variables studied were not "... anchored to some sort of denotable behavior (p. 286)." He feels though that studies of this type can be improved.

The most complete picture of the teaching process would be to predict from the antecedent conditions to the classroom behavior and in turn from behavior to the effects on pupils. Usually the middle step has been omitted. The research design becomes an attempt to relate certain antecedent characteristics of the teacher to some aspects of pupil change. This procedure presents only a partial picture and can lead only to conjecture about the results. (Ackerman, 1954, p. 286)

The step that Ackerman (1954) suggests be added to evaluation studies involves directly relating teacher behavior to change in pupil behavior.

Evaluating Teaching Effectiveness in the Field of Deaf Education. There are numerous studies (Bradley, 1964, Saadeh, 1970) that evaluate teaching effectiveness but few of these concern teachers of the deaf. Rotter (1962) reports that he reviewed the literature from 1917-1959 and found a lack of evaluative studies of teacher education programs
that train teachers of the deaf. He also states that current education programs for teachers of the deaf are designed without objective bases. Thus, it appears that current programs have developed primarily on the basis of ideas, experiences and attitudes expressing the personal bias of individuals who have borne the responsibility for planning the learning experiences of prospective teachers of the deaf. There is no evidence to indicate that any portion of these programs has been planned as a result of objective information gained from studies of the actual performance of the needs of the deaf child. (Rotter, 1962, p. 481)

It is interesting that Rotter (1962), in seeking an "objective" basis for improving teacher preparation programs uses an approach that is far from objective.

In an attempt to develop an objective basis for improving a program preparing teachers of the deaf it was felt that an initial approach would be to seek information from previously trained teachers regarding their attitudes concerning the effectiveness of their training in equipping them to teach the deaf. (p. 481)

Apparently the ability of the teachers to produce changes in learners is not considered as a technique for evaluating teacher preparation.

Brill (1952) correlated teaching effectiveness and non-effectiveness with academic background. Teachers in most of the schools of the deaf in the U. S. were used in the study. They were rated by their
superintendents as the "best" three or "poorest" three in their particular schools. The following criteria assisted the superintendents in making their judgements.

1. Is the teacher interested in trying to learn all he can about each child in his class?
2. Is the teacher more interested in teaching children than subject matter?
3. Is the teacher able to appraise validly the learning in his class?
4. Does the teacher have the ability to stimulate the children's interest and curiosity?
5. Is the teacher able to provide a variety of learning experiences?
6. Is the teacher able to use his own knowledge . . .
7. Is the teacher competent in the phases of the work requiring technical knowledge? (Brill, 1952, p. 314)

The study used no objective way of measuring teacher behavior in terms of the above criteria nor does it attempt to show that the criteria are related to desired behavior changes in pupils.

With the exception of Brill (1952) a search of the literature confirmed Rotter's (1962) statement about the lack of studies that evaluate teacher education programs for teachers of the deaf. There were no studies listed under "Teacher Training" in the Bibliography on Deafness (Fellendorf, 1966) that used a research design to evaluate the teacher-training programs or teaching effectiveness.
Although education in general (Gage, 1963) is seeking to use pupil behavior change as an evaluative criteria, the sub-area of deaf education does not seem to be participating in the search.

Purpose. This study will attempt to demonstrate that teaching effectiveness can be evaluated in terms of pupil behavior change. Four parts of an adjunct teacher-preparatory program will be evaluated by observing whether pupil behavior changes during instruction in desired directions. These directions will be stated by the teachers involved in each part of the adjunct program prior to the start of instruction. Teaching effectiveness will be judged in terms of the attainment of the stated objectives.

In addition to the measurement of pupil behavior, teaching behavior will also be directly measured. An attempt will be made to demonstrate a functional relationship between teaching processes (referred to as interventions in this study) and changes in pupil behavior.

Limitations. The purpose of this study was to demonstrate that direct measurement of behavior change in pupils can be used to evaluate teaching effectiveness. The direct measurement techniques were derived from those used in operant conditioning.

An adjunct teacher-preparatory program was used as a vehicle for demonstrating the use of the direct measurement techniques. This study was not concerned with a complete evaluation of teaching effectiveness within the adjunct program nor with a complete evaluation of the effectiveness of the student-teachers prepared in the program. Rather this study was concerned with demonstrating the usefulness and availability
of the operant measurement techniques and their application to the
problem of evaluating teaching effectiveness.

The adjunct program accompanied an established teacher-training
program. Plans for data collection were built into the initial design
of the adjunct program. Because the adjunct program was part of a
structured graduate school experience, data collection procedures were
difficult to change after the initial planning had been implemented.
Precedence in the adjunct program was given to its continuation, even
when data collection procedures proved inadequate. Therefore the data
available after the completion of the program was less complete than
originally planned.

The adjunct program was not in a position of control relative to
the aims and objectives of the regular program. This resulted in the
requirements of the adjunct program being secondary in importance to
the student-teachers in comparison with other parts of their program.

Design Consideration. This study concerns the evaluation of one
aspect of an adjunct teacher-preparatory program. The data presented
includes both descriptive and experimental parts. Since this study is
an evaluation and not a research study, some of the differences
between evaluation and research are stated below. Following this
contrast is a discussion of the reasons for using the operant techniques
demonstrated in this study.

According to McIntyre (1970), "... evaluation is the basis for
decision making, and as such, includes both description and judgement,
and collection of pertinent data on which to base judgements (p. 213)."
The data basis for decision making may be either the descriptive or research type. Five characteristics are listed by McIntyre (1970) that often differentiate evaluation from research. The first involves generality. This need not be a concern in evaluation since the effectiveness of the program being evaluated is usually specific to a particular setting. "Secondly, the validity measures in evaluation are internal, not external, since we don't need to consider other populations and settings (p. 215)." Thirdly, a complete description of the event studied is needed. Fourthly, "... evaluation cannot control relevant parameters, but it can and must describe them (p. 215)." Lastly, rather than inferential statistics, often descriptive statistics, frequency counts, either-or tabulations, and chi square are used.

The type of evaluation used in this study generally involves the direct approach of defining the behaviors that the teacher wishes to develop in the pupil and measuring the extent to which the teacher is able to develop the desired behavior. In order to make the data congruent, frequency of occurrence measures were used in most parts of the study. Behaviors of interest were operationally defined, then systematically observed and recorded.

Operant measurement techniques were chosen to record pupil behavior change for several reasons. First they provide a direct measure of the behavior being modified by the teacher. Second they record individual and continuous data on each pupil. Third they provide a measure that is sensitive to environmental change.
A problem in evaluating teaching effectiveness through pupil behavior change was involved in the measure used. Herriott (1960) questions whether standardized tests or even ad hoc tests designed by the teachers themselves are valid measures of pupil behavior change. A measure is needed that will determine if a teacher's objectives are obtained. The direct measurement of operant conditioning provides such a measure. Operant measurement calls for a definition of the relevant behavior in observable terms prior to the start of measurement procedures (Bijou et al., 1968). Since operant measurement is continuous, it cannot begin until a behavior to measure has been designated. In order for direct measurement of the behavior to take place, it has to be defined in such a way that the observer knows when it has occurred.

The initial measurement or baseline provides the information whether the behavior is in fact in the repertoire of the individual and if it is, at what level. If the baseline indicates that the behavior of the pupil is already at the level specified by the teacher's objectives, then there is no need to modify the behavior of that particular child. The baseline data provides a description of the frequency of occurrence of a particular response. It is of primary importance since the effect of environmental changes (experimental manipulations) are determined in operant conditioning by comparison to the individual's own baseline.

Operant measurement provides for individual and continuous measurement. If the goal of teaching is to have every pupil in a class learn the relevant behavior, then a measure is needed that reflects individual
behavior rather than group behavior. A reason for conflicting conclusions (Herriott, 1960) of research on teacher behavior and its effects on pupils may have been the group measures employed. Operant conditioning has demonstrated that different individuals are affected in different ways by similar environmental events (Kuypers, Becker, & O'Leary, 1968). Individual data on the effects of teacher behavior may provide more consistent results than group measures.

If the individual and continuous data does show that the teacher's behavior is not having the desired effect on a pupil, then the teaching behavior may be altered. Operant measurement techniques are sensitive to changes in teaching procedures and will show the effect of those changes (Hall, Cristler, Cranston, Sharon, & Tucker, 1970; Lovitt & Esveldt, 1970). Since the measurement is continuous as well as sensitive to environmental changes, teaching procedures may be changed during the course of instruction to improve the teaching.
SECTION II

METHOD

Subjects and Setting. The subjects in this study were Master's Degree students enrolled in a program for teachers of the hearing impaired at Teachers College, Columbia University. The twenty-two students had varied academic and teaching backgrounds (see Table 1). A common core of courses and a practicum experience were provided for the students. In addition to this regular program, an adjunct program which concentrated on the subject of teaching processes was added to the practicum.

The graduate students' practicum involved two semesters of observation and teaching experiences in urban schools for the deaf. The practicum started with observation assignments and ended with two six-week periods of student-teaching.

Teachers College provided suggestions to the cooperating teachers at the student-teaching locations for the arrangement of the students' schedules. These suggestions were intended to provide a hierarchy of experiences culminating in total classroom control. The suggestions included:

First week: Observation for first two days with participation initiated no later than the third day. This might involve individual work in speech, auditory training, tutoring, etc. Assignments and planning should be initiated for the second week.
<table>
<thead>
<tr>
<th>Student-Teacher</th>
<th>Age</th>
<th>College</th>
<th>College Major</th>
<th>Years of Full-Time Teaching Experience</th>
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<td>A.B.</td>
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<td>College</td>
<td>College Major</td>
<td>Years of Full-Time Teaching Experience</td>
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<td>Emerson</td>
<td>Speech Pathology and Audiology</td>
<td>None</td>
</tr>
</tbody>
</table>
Second week: Participation daily. Group instruction in one subject.

Third week: Group instruction in three subjects or classes. Participation in all aspects of the class program. Lesson plans for the fourth week should be turned in, reviewed, and rewritten with modification where necessary.

Fourth week: Total classroom management and evaluation of teaching experience.

Fifth week: Evaluation, observation, and planning.

Sixth week: Total classroom management and evaluation of teaching experience.

The preceding schedule suggested a minimum standard. The standard was exceeded by most of the cooperating teachers.

Training Procedures. In addition to their usual program, the graduate students were involved in an adjunct teacher-preparatory program designed to teach operant principles. The focus of this adjunct program on teaching processes reflects a concern of education with improving teacher training. According to Sarason, Davidson, and Blatt (1962) improvement may take place in the content areas (liberal arts and science) or in the correct use of the principles of learning. The adjunct program attempted to improve the training of student teachers in the area of applied learning principles. The assumption is made that the teacher

... far from being a technician or imparter of knowledge, is an applier of psychological principles in a particular
kind of learning situation. One of the major implications of this point of view is that improvement of the quality of teaching is not likely to take place in any marked kind of way by merely increasing the amount and variety of information which teachers should have. Just as we must never confuse education with degree of wisdom - the educated person is not necessarily "wise" in the sense that he can utilize or apply what he knows in an appropriate, non-self-defeating way - we must not confuse what a teacher knows with how she applies such knowledge. (Sarason et al., 1962, pp. 117-118)

The adjunct program was designed to supplement existing teacher-preparation programs for teachers of the deaf. It included the basic principles of operant conditioning as a major source of training in teaching procedures. The objectives of the adjunct program were to generate a ninety-hour plan of instruction for pre-service teachers of the deaf which

a. was to consist of a seminar in operant principles, a microteaching laboratory using the mediated interaction visual response system (MIVR) and a directed practicum experience

b. was to result in verbal fluency with principles of operant conditioning

c. was to train operational skills with media available to enable the efficient application of operant principles
d. was to modify participants’ teaching behaviors through use of microteaching procedures incorporating the MIVR system
e. was to shape a repertoire of teaching behaviors through successive approximations to a full-size classroom of hearing-impaired students.

The adjunct program included a microteaching laboratory, a seminar, and involvement in the practicum experience. The microteaching laboratory was completed in the first semester and the seminar and practicum involved two consecutive semesters (one academic year). The start of microteaching followed the first seminar by several weeks.

The function of the microteaching laboratory was to provide a planned environment in which the graduate students would acquire the behavior necessary for the application of operant principles to classroom activities. The laboratory utilized the features of the MIVR system to provide environmental constraints in order to increase the likelihood that a teacher would call for active pupil responses, present materials in small steps, provide the immediate consequence of desired behavior, and provide remediation as necessary.

The microteaching laboratory planned to vary three dimensions systematically in order to shape teaching behaviors: principles of behavior, number of pupils, and duration of microteaching session.

The principles of behavior were applicable to classroom behavior and related to the textual material used in the seminar. Each
principle was to form a laboratory unit. The student-teacher would be involved in each unit for three microteaching cycles. The principles were ordered in terms of the complexity of the process involved and in the complexity of the behavior concerned. In addition, there was a progressive relationship between mastery of earlier principles and later ones.

Plans for the other dimensions included the variation of the size of the laboratory class and the length of the microteaching session to approximate a standard classroom experience.

The seminar was conducted to teach the student-teachers the basic vocabulary and principles of operant conditioning. The objective of the seminar was to have every student-teacher demonstrate verbal fluency with the material presented. It was thought that a knowledge of these principles would allow the student-teachers to analyze and apply operant techniques in their classrooms.

The major source of textual information in the seminar was Ferster and Perrott (1968). Ferster and Perrott (1968) suggest that their text is programmed in such a manner that learning of the material is facilitated. The principles and concepts of applied operant psychology are first illustrated with simple examples and then more complex forms are introduced. Chapters devoted to a single principle are divided into several parts. After a student has completed a particular part, he is administered an interview of specified format which permits demonstration of verbal fluency with the material. If verbal fluency is demonstrated, the student proceeds with the next part. If a student encounters difficulty, then remedial steps are
prescribed and another interview is scheduled.

Lectures, discussions, and films were planned to supplement the text. All material pertained to the principles of behavior modification and their application in applied settings. The films, Behavior Theory in Practice, were produced by Ellen Reese in 1965 and distributed by Appleton-Century-Crofts.

The practicum was planned so that certain skills developed in the microteaching laboratory and seminar could be tried. First the practicum was to provide opportunity to observe and record behavior using operant techniques. After proficiency in observation and recording of behavior was obtained, it was intended that the student-teachers gradually use operant principles in their teaching situations. This would include preparing lesson plans using behavioral objectives and criteria for establishing whether these objectives would be met. It was expected that operant principles would be applied to teaching especially when "normal" teaching practices were not attaining the desired objectives.

**Equipment.** Microteaching involved the use of videotape equipment and the MIVR system developed by Wyman (1968). Videotape equipment was also used to record lessons given by the student-teachers in their classrooms.

Neither microteaching nor classroom observation require the use of videotape equipment. But if the equipment is used it provides a permanent record which can be used to provide feedback to a subject immediately after a performance.
ILLUSTRATION 1. MIVR SYSTEM AT TEACHERS COLLEGE.
Two MIVR systems were used in this study—one system in each of two classrooms. Each system consisted of a set of overhead projectors for use by a microteaching class, one for each child and teacher. Illustration (1) shows the system as it was employed at Teachers College.

The MIVR system provided a favorable situation for the student-teachers to practice certain skills. Among these was calling for and consequating active pupil responses.

The individual overhead projector at each student station permits or requires visual response or behavior. The tremendous advantage of visual response is that eight students must respond every time. Verbal responses require turn-taking so that only one in eight respond each time. With visual response, every student takes a turn and provides eight times the number of responses he would otherwise have.

Every response can be observed and any correction needed can be made immediately. (Wyman, 1969, p. 4)

**Personnel.** Three experienced teachers were used as raters for this study. Each rater was chosen because of his or her teaching experience and familiarity with similar tasks.

The raters were trained for their tasks on the same videotapes they later analyzed. The use of videotapes allowed unlimited repetition of the behavior to be analyzed.
Observer reliability was analyzed by having a second observer periodically make a simultaneous observation record. Agreement of the two records was checked by comparing the total frequency count for each response. The smaller frequency count was divided by the larger and the result multiplied by 100 in order to yield a percentage of agreement figure. Agreement percentages ranged from 83% to 100%.

Procedure. The procedure is presented in subsections representing the four phases of this study. These include: Phase I—Microteaching: MITVR System, Phase II—Adjunct-teaching: Seminar, Phase III—Student-teaching: Formal, Phase IV—Student-teaching: Informal.

Most data in this study was obtained through defining behaviors in observable terms and then systematically observing and recording their frequency of occurrence. This frequency of occurrence data was used for descriptive purposes or if the situation called for it, experimental studies. The modification attempts described below were instituted when data indicated that a change in rate was desirable and the field situation permitted a modification attempt. Table (2) illustrates a model of the operant techniques used for evaluation in this study. This table was partially adapted from Reese (1968). Illustration (2) graphically presents the evaluation method.

The use of this table is illustrated in the Results section and expanded in the Discussion section of this study.

Phase I includes data obtained during a microteaching laboratory. Microteaching was used in order to provide a setting in which the
A Behavioral Model for Evaluating Teaching Effectiveness

1. Specify the final behavior that the pupil is to learn.
   a. Identify the behavior in observable terms.
   b. Determine the procedures to measure the behavior.

2. Begin teaching and determine the baseline of the relevant behavior.
   a. If the baseline indicates that the final behavior is already present, conclude teaching or move to a higher set of objectives.
   b. If the baseline indicates that the behavior is not present or is at a level lower than the desired final behavior, continue teaching procedure.

3. Use continuous data to indicate effectiveness of teaching procedures.
   a. If the behavior being measured is approximating the final behavior and at a sufficient rate, continue the same teaching procedures.
   b. If the relevant behavior is not changing or at too slow a rate, change teaching procedures.

4. Use the initial baseline in order to judge the effect of changes in teaching procedures.

(Adapted from Reese; 1968)
ILLUSTRATION 2. BEHAVIORAL MODEL OF TEACHING.
student-teachers could practice certain skills discussed in the seminar portion of the adjunct teacher-preparatory program. The skill discussed in this study was that of calling for and consequating active pupil responses.

Two technical devices were used in the laboratory. Videotape equipment allowed aural and video feedback to the graduate students as soon as the lesson was over. Videotape has been used successfully in the modification of behavior through delayed reinforcement procedures (Schwarz & Hawkins, 1970). The MIVR overhead projector system was also used in microteaching. This system made available the use of overhead projectors and transparency material for use by every pupil and teacher. The MIVR system has been successfully used in conjunction with operant principles to modify children’s behavior (Eachus, 1971).

The student-teachers were instructed to prepare a five-minute lesson for their microteaching experience. They attempted to focus upon using the skill that had been explained during a seminar session that preceded their microteaching lesson. A videotape was made of the five-minute lesson. This videotape was used to show the student-teacher his or her performance immediately after completion of the lesson. The student-teacher and a supervisor viewed the videotape and concentrated on the particular skill the student was dealing with during the lesson. The supervisor provided verbal approval after the skill in question was emitted. After this feedback session, the student retaught the lesson again focusing on the same skill.
Data presented in this phase is expressed in rates. The rates represent the average of pupil responses per minute. An active pupil response is defined as any verbal response to a relevant teaching stimulus.

The field situation from which the MIVR data was obtained involved a microteaching setting. The class size averaged three children and they were not deaf. No baseline was recorded on the behaviors of interest in the microteaching setting before the MIVR system was introduced. In order to provide a comparison between the MIVR situation and a non-MIVR situation, response rates from two other field situations were used as baselines. One situation involved the same student-teachers but in practice-teaching lessons with deaf children. The other baseline was taken from data presented by Utz (1970). Both baselines are used to compare a non-MIVR with a MIVR situation. It cannot be stated experimentally that the differences in rates of the non-MIVR and MIVR settings were due to the introduction of the MIVR system. The comparisons may not be valid because of other possible major differences in the field situations.

Phase II of this study concerns the acquisition by the student-teachers of the operant principles presented in Ferster & Parrott (1968). The frequency of occurrence of interviews was the dependent variable in this study. The first hour of every seminar session was scheduled for interviews. Initially the only individuals available as interviewers were the seminar instructor and his assistants. These were the only personnel who were familiar with the textual material and
therefore could give the first interviews. After three seminar sessions, the student-teachers began to act as interviewers in addition to the instructor and his assistants. The use of student-teachers as interviewers meant that interviewing was not restricted to the seminar period and could take place at other times and locations.

The interview method has been found superior to conventional teaching methods as measured by student achievement and student satisfaction (Keller, 1968; McMichael & Corey, 1969; Sheppard & MacDermot, 1970). It has succeeded with the same text that was used in this study (Sheppard & MacDermot, 1970). Since the interview method appeared to be superior and the text, Behavior Principles, (Ferster & Perrott, 1968) contained the necessary information, these were adapted for use in the seminar portion of the adjunct program. But one factor differed from other implementations of the interview method. Unlike Sheppard & MacDermot (1970), the student-teachers were not required to finish a specified number of units by the end of the semester in order to obtain a certain grade. The general requirement at the beginning of the seminar for the student-teachers was completion of the text by the end of the second (spring) semester by everyone in the class. A "Pass" (the only grade given in the practicum) was not said to be contingent upon completion of the text.

Near the end of the first (fall) semester, it was evident that many of the student-teachers would not complete the text by the end of the second semester. The individual rate of interview data indicated
generally low rates and a total completion of far less than half of the text. At this time Intervention I was instituted. This consisted of an announcement to the student-teachers that the first eight chapters of the text (about half of the text) must be completed by the end of the first semester in order to receive a Pass for that semester. At the beginning of the second semester, Intervention II was instituted. This consisted of negotiating contracts with each student-teacher for minimum rates per month of text units to be completed.

In addition to the interview rates, the data from Phase II includes the results of a test taken by the student-teachers. The text involved an analysis in operant terms of several filmed sequences of behavior. Any of several plausible descriptions of the behavior was accepted as correct as long as the vocabulary and principles were consistent with Ferster & Perratt (1968).

Phase III involves lessons taught by the student-teachers during their student-teaching experience. The student-teachers prepared lessons to present during a supervised session. This session included the videotaping of the lesson. Videotapes were recorded during the first six-week student-teaching experience and then approximately six weeks after during the second six-week experience.

The data presented is derived from videotapes of the lessons. Videotapes were used since direct observation in the classroom was unavailable to the observers involved in the recording of the data. Videotapes have been used in other studies for similar analyses of classroom behavior (Haring & Fargo, 1969). Data presented includes
rates of "calling for active pupil responses," "consequation of active pupil responses," and "active pupil responses."

Phase IV includes data on the pupils who were taught by the student-teachers. During their student-teaching experience, several student-teachers used operant measurement techniques and principles in their classrooms. Since there was no person trained in operant principles or recording techniques available to assist the student-teachers in the classrooms, they had to act as experimenters, observers, and reporters.
SECTION III
RESULTS

Results will be presented in subsections representing the four phases of this study. All results relate to the behavior of pupils in the particular phase. The first three phases concern the behavior changes of the student-teachers within the adjunct program. For these three phases the student-teachers will be considered the pupils. Their behavior is evaluated using behavioral objectives of the adjunct program as criteria. In Phase IV, concern will be focused on student-teaching. In this phase, the student-teachers are now considered the teachers and the pupils in their classes are evaluated in terms of behavioral objectives they established.

Phase I - Microteaching: MIVR System

Objective:

To train the student-teachers to use the MIVR system in order to set the occasion for obtaining a high rate of active pupil responses.

Results:

The data on rates of response presented in Figure 1 are based on the number of times per minute that active pupil responses were emitted during four microteaching lessons. This measure is called active pupil response rate. (The active pupil response rate is actually slightly greater than the number presented since they were only counted in the MIVR setting if the responses were emitted by the pupils and consequated by the student-teachers.) Two of the twenty-three student-teachers chose not to use the MIVR system during micro-
FIGURE 1. MEAN ACTIVE PUPIL RESPONSE RATE FOR MICROTEACHING CLASSES USING MVR

RESPONSES PER MINUTE

NON:MVR PERIOD

MVR PERIOD

SESSIONS

1  2  3  4  5  6
teaching and their data is excluded from Figure 1 (N=21.) The rates presented are compared to those obtained from sessions in which the MIVR system was not used.

The mean active pupil response rate per minute in the MIVR setting was 4.20. This compares with a mean rate of 1.55 in the non-MIVR setting with the same student-teachers and 2.51 in the non-MIVR setting described by Utz (1970). The two student-teachers who chose not to use the MIVR system had a mean rate of 1.70 responses per minute. These data are not shown in Figure 1.

Phase II - Adjunct-Teaching: Seminar

Data are presented on the acquisition of verbal fluency with the textual material by the student-teachers. The evaluation model that was presented in Table (2) is illustrated with a single subject. Then the data for the group are given. Finally the results of a test given to verify the acquisition of the verbal behavior is shown.

Results for Single Subject N. J.:

1. Final Behavior: Verbal Fluency was to be demonstrated by the completion of interviews on all of the 61 units of Ferster and Perrott (1968) by the end of the second semester.
a. Definition of Relevant Behavior: An interview was completed after the speaker had vocalized with or without notes, the main points of a textbook unit within a ten-minute period. Both the speaker and listener had to agree that verbal mastery of the unit was demonstrated.

b. Measurement Procedures: A continuous record of the textbook unit completion rate was kept.

2. Baseline Data: The Baseline Period shown in Figure 2 had a mean rate of textbook unit completion of 1.37 units per week for subject N. J. If this rate continued for the remainder of the first semester, much less than the required 29 units (half of the textbook) would be completed at the end of the first semester. Due to the slow rate of completed textbook units, the decision was made to change the teaching procedures. This involved the statement by the instructor to the student that 29 units of the text must be completed before the end of the first semester in order to receive a pass for that semester. This change in teaching procedures is referred to as Intervention I.

3. Intervention Data: Continuous data were recorded after Intervention I was instituted. Figure 2 shows that the teaching objective of having the student complete 29 units by the end of the first semester was achieved.

At the beginning of the second semester, a performance contract was drawn up that specified a minimum rate of textbook units to be completed per month. The student, N. J., had a minimum rate of 7 units per month. The Intervention II Period in Figure 2 indicates that the change in teaching procedures (i.e. the performance contract) was not
FIGURE 2. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR N.J.

TOTAL NUMBER OF TEXTBOOK UNITS

<table>
<thead>
<tr>
<th>SEMESTER I</th>
<th>SEMESTER II</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEKS</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
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<tr>
<td>10</td>
<td>12</td>
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<tr>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>26</td>
<td>28</td>
</tr>
</tbody>
</table>

HALF OF TEXT

BASELINE PERIOD
INTERVENTION I PERIOD
INTERVENTION II PERIOD
effective in achieving the objective of textbook completion.

Passing the practicum was not contingent upon unit completion during the Intervention II period. This situation was similar to the Baseline Period in that grades were not contingent upon successful textbook unit completion.

Group Results:

Figure 3 shows the mean cumulative record of completed interviews for the student-teachers during the first and second semesters. During the Baseline Period the mean rate per week of interview completion was 1.31. This rate was far from sufficient in order that the group achieve the initial objective of textbook completion by the end of the second semester.

At the end of the eighth week, Intervention I was instituted. The mean rate of interviews during the Intervention I Period was 2.17. The increased rate did not result in the group attaining the objective of twenty-nine textbook units completed by the end of the first semester.

Figures 2 and 4-25 indicate that Intervention I had two general effects. The first effect is illustrated by Figures 4-8; the student-teachers having the lowest baseline rates are shown. Intervention I had little effect on these five student-teachers. All the other student-teachers (Figures 2 and 9-25) generally had sharply increased rates during the Intervention I Period. Only two student-teachers surpassed the requirement that twenty-nine units be completed by the end of the first semester. This is shown in Figures 9 and 10.
FIGURE 3. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR GROUP

<table>
<thead>
<tr>
<th>TOTAL NUMBER OF TEXTBOOK UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEMESTER I</th>
<th>SEMESTER II</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

HALF OF TEXT
FIGURE 4. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR G.B.

<table>
<thead>
<tr>
<th>TOTAL NUMBER OF TEXTBOOK UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>35</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEMESTER I</th>
<th>WEEKS</th>
<th>SEMESTER II</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

HALF OF TEXT

BASELINE PERIOD
INTERVENTION I PERIOD
INTERVENTION II PERIOD
FIGURE 5. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR R.N.

- Baseline Period
- Intervention I Period
- Intervention II Period

Total Number of Testbooks Units

SEMESTER I
- Weeks 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

SEMESTER II
FIGURE 7. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR V.G.

<table>
<thead>
<tr>
<th>TOTAL NUMBER OF TEXTBOOK UNITS</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>20</td>
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<tr>
<td>15</td>
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<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
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<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEMESTER I</th>
<th>SEMESTER II</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
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<td>6</td>
<td>24</td>
</tr>
<tr>
<td>8</td>
<td>22</td>
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<tr>
<td>10</td>
<td>20</td>
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<tr>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>14</td>
<td>16</td>
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</table>

<table>
<thead>
<tr>
<th>WEEKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
</tr>
</tbody>
</table>

HALF OF TEXT
FIGURE 8. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR W.L.

TOTAL NUMBER OF TEXTBOOK UNITS

SEMESTER I | SEMESTER II

HALF OF TEXT
FIGURE 9. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR S.M.

BASELINE PERIOD

INTERVENTION I PERIOD

INTERVENTION II PERIOD

TOTAL NUMBER OF TEXTBOOK UNITS

SEMESTER I

SEMESTER II

WEEKS

HALLF OF TEXT
FIGURE 10. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR L.S.

<table>
<thead>
<tr>
<th>BASELINE PERIOD</th>
<th>INTERVENTION I PERIOD</th>
<th>INTERVENTION II PERIOD</th>
</tr>
</thead>
</table>

- **TOTAL NUMBER OF TEXTBOOK UNITS**
- **SEMESTER I**
  - 2 weeks: 5 units
  - 4 weeks: 15 units
  - 6 weeks: 30 units
  - 8 weeks: 45 units
- **SEMESTER II**
  - 10 weeks: 60 units
  - 12 weeks: 60 units
  - 14 weeks: 60 units
  - 16 weeks: 60 units
  - 18 weeks: 60 units
  - 20 weeks: 60 units
  - 22 weeks: 60 units
  - 24 weeks: 60 units
  - 26 weeks: 60 units
  - 28 weeks: 60 units

**HALF OF TEXT**

- **WEEKS**
  - 2 weeks
  - 4 weeks
  - 6 weeks
  - 8 weeks
  - 10 weeks
  - 12 weeks
  - 14 weeks
  - 16 weeks
  - 18 weeks
  - 20 weeks
  - 22 weeks
  - 24 weeks
  - 26 weeks
  - 28 weeks

Figure II. Cumulative record of completed interviews for B.B.

Baseline period

Intervention I period

Intervention II period

Half of text

Semester I

Semester II

Total number of textbook units

Weeks

0 5 10 15 20 25 30 35 40
FIGURE 12. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR A.B.

BASELINE PERIOD  INTERVENTION I PERIOD  INTERVENTION II PERIOD

TOTAL NUMBER OF TEXTBOOK UNITS

HALF OF TEXT

2 4 6 8 10 12 14 16 18 20 22 24 26 28
SEMESTER I WEEKS SEMESTER II
Figure 13. Cumulative record of completed interviews for A.E.

Baseline period

Intervention I period

Intervention II period

Total number of textbook units

2 4 6 8 10 12 14 16 18 20 22 24 26 28

Semester I

Weeks

Semester II

Half of text
FIGURE 14. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR B.P.

BASELINE PERIOD

INTERVENTION I PERIOD

INTERVENTION II PERIOD

TOTAL NUMBER OF TEXTBOOK UNITS

HALF OF TEXT

SEMESTER I  SEMESTER II

WEEKS

2 4 6 8 10 12 14 16 18 20 22 24 26 28
Figure 15. Cumulative record of completed interviews for C.J.

Baseline period

Intervention I period

Intervention II period

Half of text

Total number of textbook units

Semester I

Semester II

Weeks
FIGURE 16. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR C.O.

<table>
<thead>
<tr>
<th>TOTAL NUMBER OF TEXTBOOK UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMESTER I</td>
</tr>
<tr>
<td>SEMESTER II</td>
</tr>
<tr>
<td>WEEKS</td>
</tr>
</tbody>
</table>

- Baseline Period
- Intervention I Period
- Intervention II Period

HALF OF TEXT
FIGURE 17. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR D.B.

TOTAL NUMBER OF TEXTBOOK UNITS

SEMESTER I

SEMESTER II

WEEKS

2 4 6 8 10 12 14 16 18 20 22 24 26 28

INTERVENTION I PERIOD

INTERVENTION II PERIOD

BASELINE PERIOD

HALF OF TEXT

40 35 30 25 20 15 10 5

0
FIGURE 22. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR K.C.

TOTAL NUMBER OF TEXTBOOK UNITS

SEMESTER I

SEMESTER II

WEEKS

HALF OF TEXT

BASELINE PERIOD

INTERVENTION I PERIOD

INTERVENTION II PERIOD
FIGURE 24. CUMULATIVE RECORD OF COMPLETED INTERVIEWS FOR T.M.

<table>
<thead>
<tr>
<th>BASELINE PERIOD</th>
<th>INTERVENTION I PERIOD</th>
<th>INTERVENTION II PERIOD</th>
</tr>
</thead>
</table>

TOTAL NUMBER OF TEXTBOOK UNITS

SEMESTER I

SEMESTER II

WEEKS
After the first semester had been completed, performance contracts were drawn up by the seminar instructor and signed by every student-teacher. This is referred to as Intervention III. During the Intervention III Period shown in Figures 2-25, the uniform result of this intervention was that the contract stipulation of seven units per month to be completed was not met. Although the rates of the student-teachers varied during this period, no student-teacher achieved the initial objective of textbook completion.

During the first semester, the data from the Baseline Period and Intervention I Period illustrated in Figures 2-25 indicated that the group was generally attaining verbal fluency. In order to check this assumption, a written test was given at the end of the first semester. The test consisted of several film sequences of behavior that were to be analyzed in operant terms by the student-teachers. Table (3) presents the results of this test. There were nine questions in the test. The average number of answers correct was 7.5 with a range of 6 to 9 (N=22). A count was made of the incorrect use of operant terms. The count averaged 1.2 per test.

Phase III - Student-teaching: Formal Objective:

To determine whether two skills discussed in the seminar and practiced during microteaching were utilized in the student-teaching setting. The skills were calling for active pupil responses and consequating active pupil responses. An active pupil response was defined as any verbal response to teacher verbal behavior that calls for an active
### TABLE 3

**ANALYSIS OF FILM SEQUENCES OF BEHAVIOR**

<table>
<thead>
<tr>
<th>Student Teacher</th>
<th>Total of Incorrect Answers</th>
<th>No. of Operant Terms Used Incorrectly</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.B.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A.E.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>B.B.</td>
<td>1 1/2</td>
<td>1</td>
</tr>
<tr>
<td>B.P.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C.J.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C.K.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>D.B.</td>
<td>1 1/2</td>
<td>2</td>
</tr>
<tr>
<td>D.K.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>G.B.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H.H.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>H.D.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>H.N.</td>
<td>1/2</td>
<td>0</td>
</tr>
<tr>
<td>K.C.</td>
<td>1 1/2</td>
<td>1</td>
</tr>
<tr>
<td>K.P.</td>
<td>2 1/2</td>
<td>1</td>
</tr>
<tr>
<td>L.S.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>N.J.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>S.J.</td>
<td>1/2</td>
<td>0</td>
</tr>
<tr>
<td>S.D.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>T.M.</td>
<td>2 1/2</td>
<td>3</td>
</tr>
<tr>
<td>V.G.</td>
<td>4 1/2</td>
<td>4</td>
</tr>
<tr>
<td>W.J.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>W.G.</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
response to subject matter. Consequating was defined as any teacher consequtation of an active pupil response in oral or gesture form. The oral form included such words as fine, ok, good, or the repetition of an answer. The gesture form included nods or smiles.

Data:

The descriptive data presented in Figures 26-28 were obtained from videotapes of student-teaching lessons. A response was recorded if it occurred at any time within a ten-second interval. The data is presented in terms of responses per minute. All settings were small-group interactions in which the teacher and pupils were communicating.

Figure 26 shows the mean group rate of active pupil responses for two sessions. This rate averaged 02.4 responses per minute for each session. The response rate in the videotape setting is compared to an average rate of 2.5 responses per minute reported in the Utz (1970) data and of 4.2 responses per minute recorded in the micro-teaching situation using the MIVR system (Phase I).

The Utz (1970) and MIVR data were used as criteria for determining whether skills taught in Phase I and Phase II were used during the videotaped student-teaching lessons. The objective of the attainment of high rates of calling for active pupil responses was not achieved if this criterion is used.

Figure 27 shows the mean group rate of teacher consequations and active pupil responses for two sessions. The rate of teacher consequations averaged 1.55 for each session. The rate of active pupil responses consequated was not evident in the videotaped lessons.
FIGURE 26. COMPARISON OF ACTIVE PUPIL RESPONSE RATES IN THREE SETTINGS: MIVR, VIDEOTAPE, AND UTZ (1970)
FIGURE 27. COMPARISON OF TEACHER CONSEQUATION AND ACTIVE PUPIL RESPONSE DURING VIDEOTAPE SESSIONS

AVERAGE RESPONSE PER MINUTE FOR SESSIONS

ACTIVE PUPIL RESPONSE

TEACHER CONSEQUATION

SESSIONS
FIGURE 28. COMPARISON OF TEACHER CALLING FOR ACTIVE PUPIL RESPONSES & ACTIVE PUPIL RESPONSES DURING VIDEOTAPED SESSIONS

AVERAGE RESPONSES PER MINUTE FOR SESSIONS

ACTIVE PUPIL RESPONSE

TEACHER CALLING FOR
Figure 23 shows the mean group rate of active pupil responses and calling for active pupil responses by the 2.40 for each session. The rate of calling for active pupil responses averaged 2.35 for each session. The comparison suggests that each call for an active response by a student-teacher resulted in a single active response by a pupil in the class.

Phase IV - Student-teaching: Informal

Twenty-two graduate students were involved in student-teaching. Five of these student-teachers completed and handed in to this experimenter operant studies done in their classes. There was no requirement to do these studies and no formal credit was given for their completion. The studies are presented according to the evaluation model presented in Table (2).

Study #1 by C. J.

1. Final Behavior: Children were to remain lying down during rest period. (N=6)
   a. Definition of Relevant Behavior: Lying down was defined as remaining supine without talking or rolling around.
   b. Measurement Procedures: A continuous record was kept of the per cent of pupils who were lying down during each rest period. Responses were recorded at the end of every minute for each child if they were lying down at that moment.

2. Baseline Data: The Baseline Period shown in Figure 29 confirmed the student-teachers' observation that most of the children were not resting. The 54% of lying down behavior recorded during
session 1 was unusually high and thought to be caused by the presence of a reliability checker in the classroom. The student-teacher decided to attempt to reinforce lying down by giving tokens contingent upon lying down on a VI 3 schedule to the pupils. The tokens were exchangeable for an equal number of raisins after each rest period.

3. Intervention Data: The rate of lying down immediately rose after the tokens were used. The Intervention Period shown in Figure 29 demonstrates the effect of the change in teaching procedures. The teaching objective was considered to be achieved by the student-teacher.

Study #2 by S. D.

1. Final Behavior: Cooperation by the class during the social studies period (N=7).
   a. Definition of Relevant Behavior: Cooperation was defined as the pupils not talking to each other during teacher-directed lessons.
   b. Measurement Procedures: A record was kept of the percent of class cooperation during each social studies period. Responses were recorded every minute if the class cooperated for the entire interval.

2. Baseline Data: No formal baseline was recorded. The student-teacher had observed that during most of her social studies periods the class did not cooperate and desired to change the situation immediately. The student-teacher decided to give the class five free minutes at the end of each period if they cooperated during the period.
This was announced to the class without specifying the amount of cooperation.

3. Intervention Data: The rate of cooperation after the five-minute free period was employed is shown in Figure 30. The class cooperated for an average of 78% of the social studies periods recorded. The teacher considered this to be an improvement over the previous situation and decided her objective had been met.

Study #3 by A. E.

1. Final Behavior: Working while on a job placement (N=1).
   a. Definition of Relevant Behavior: Working was defined as doing the assigned task.
   b. Measurement Procedures: A record was kept of the percent of work done during each recording session. A response was recorded every 2 1/2 minutes if the pupil worked for that entire period of time.

2. Baseline Data: Figure 31 shows that during the baseline sessions 1 and 3, the pupil worked an average of 58% of the time. Session 2 of the Baseline Period indicates that the pupil worked 83% of the time during this single period but the student-teacher thought that this was due to the pupil being aware of the presence of an observer. (This was the only time that the observer was noticed.) The student-teacher decided to change the pupil's job.

3. Intervention Data: After the job change, the student-teacher recorded the pupil's behavior during two sessions. The pupil worked an average of 83% of the time during these sessions. The
FIGURE 30. COOPERATING BEHAVIOR FOR CLASS

PERCENT COOPERATIVE BEHAVIOR

BASELINE PERIOD

INTERVENTION PERIOD

SESSIONS
FIGURE 31. WORKING BEHAVIOR OF ONE PUPIL

PERCENT WORKING BEHAVIOR

100
90
80
70
60
50
40
30
20
10
1

SESSIONS

1 2 3 4 5

BASELINE PERIOD

INTERVENTION PERIOD
student-teacher considered this to be sufficient and decided that her teaching objective had been met.

\textbf{Study \#4 by S. D.}

1. Final Behavior: Children were to remain lying down during rest period. (N=6)
   a. Definition of Relevant Behavior: Lying down was defined as remaining supine without talking or rolling.
   b. Measurement Procedures: A record was kept of the per cent of pupils who were lying down during each rest period. Responses were recorded at the end of every minute for each child if he or she were lying down at that moment.

2. Baseline Data: The student-teacher attempted to use token reinforcement for lying down during rest periods. The tokens were given on a VI 3 schedule and exchangeable for raisins. The Baseline Period shown in Figure 32 indicates that the teaching procedure was ineffective as far as the objective of lying down was concerned. The student-teacher decided to eliminate the raisins and instead give stars.

3. Intervention Data: The Intervention I Period in Figure 32 indicates that the change to stars did not have the desired effect. Lying down during the rest period decreased. The student-teacher then stopped the VI 3 schedule and gave stars at the end of the period without using tokens. The Intervention II Period in Figure 32 indicates that this change in teaching procedures did not meet the student-teacher's objectives. Both interventions by the student-teacher
Figure 32. Lying Down Responses for Class 2

Baseline Period

Intervention I Period

Intervention II Period

Sessions

Percent Lying Down
failed to influence the class to lie down during rest periods.

Study #5 by K. P.

1. Final Behavior: Paying attention during class periods.
   a. Definition of Relevant Behavior: Eyes focused on the relevant teaching stimulus during class periods.
   b. Measurement Procedures: A record was kept of the responses per minute of three children. A response was recorded if a pupil paid attention for any period of time during a twenty-second interval.

2. Baseline Data: Figure 33 shows that only one session was recorded. The teacher observed three children and compared their response rates to determine if in fact pupil #1 was paying less attention than the rest of the class. Although Figure 33 indicated that pupil #1 was paying less attention, no change in teaching procedures was attempted.

Summary of Data

The four phases included in this section presented the following data concerning the objectives of each phase. Phase I indicated that the objective of having the student-teachers call for more than one active pupil response at a time was achieved when the MIVR system was used. The active pupil responses were approximately 1.75 times as great as in the non-MIVR situation. Phase II data indicated that the objective of textbook completion was met for most students during the first semester but for none of the student-teachers during the second semester. The descriptive data of Phase III indicated that two instructional
FIGURE 33. PAYING ATTENTION RESPONSES PER MINUTE FOR THREE PUPILS

- STUDENT 1
- STUDENT 2
- STUDENT 3

RESPONSES PER MINUTE

SESSIONS
objectives of the seminar and microteaching were not evident in the student-teaching setting. Active pupil response rates were averaging 1.65 per minute during the videotaped lessons and only 65% of the responses were conseqated by the student-teachers. Phase IV presented five operant studies completed by the student-teachers in their classrooms. Four studies indicated that the pupil behavior desired was attained. One study indicated that the desired behavior was not attained. Attainment of teacher objectives was considered to be effective teaching. The phases showed positive and negative results but a consistent use of pupil behavior change to determine whether the objectives were obtained.
SECTION IV
DISCUSSION

Each phase of this study will be discussed independently. Following the independent discussion, a summary of the study will be presented.

Phase I — Microteaching: MIVR System. Phase I reported data that confirmed the Utz (1970) findings on pupil response rates emitted in the MIVR setting. These rates are higher in comparable classrooms using the MIVR system than in classrooms that don't use the system.

Phase I of this study and the Utz (1970) data did not include data on pupil acquisition of subject matter in the MIVR settings. Several other studies have used the MIVR system in an attempt to modify specific academic behaviors in classroom settings.

The studies have used the MIVR system in conjunction with operant conditioning techniques. EACHUS (1969) modified the rate, accuracy, and length of sentence composition for a class of deaf pupils. Piper (1970) modified the rate and accuracy of question writing for a class of deaf pupils. Working with hearing pupils, Barrette (1971) modified the rate of learning chemistry.

The MIVR system presents considerable advantage in classrooms of the deaf. In hearing classrooms it can be assumed that vocal responses of teachers and pupils are heard by every member that is involved in a small-group interaction situation. It is possible that when a hearing pupil overtly answers a question, the other pupils do so covertly and
that the teacher's response to the answer is heard by all. In deaf classes, the best assumption in a small-group interaction situation is that the child responding overtly is having a private conversation with the teacher. One reason for this assumption is that in order to get a relatively complete message, a deaf individual usually has to face the speaker in order to lip read and/or see sign language. The HIVR system used in a classroom of the deaf insures that every pupil overtly responds and receives teacher consequation for the response.

Phase II -- Adjunct-teaching: Seminar. Phase II used a teaching method that was similar to one described by Ferster & Perrott (1968). One difference in this study and others (Ferster & Perrott, 1968; Keller, 1968) using the interview method was that grades were not contingent upon the completion of a specified number of textbook units during the Baseline Period and Intervention II Period of Phase II. Ferster & Perrott (1968) and Keller (1968) informed their classes at the beginning of the instructional periods that a specified number of textbook units completed would result in a stated grade.

The lack of grades during the Baseline Period and the Intervention II Period appeared to be the primary reason that the student-teachers were completing few interviews. Apparently the assumed reinforcement provided by the listener during the interviews was not resulting in high enough interview rates.

The adjunct program lacked control of possible reinforcers and their contingent application to the relevant responses of the student-
teachers. Control of normal college reinforcers such as grades, credits, and recommendations was lacking. In addition the social reinforcement provided by the instructors was probably limited since it was not paired with other strong reinforcers in the Teachers College setting.

Further difficulties arose because the operant approach to behavior was not integrated in the regular courses or in the student-teaching experience. In a sense, the adjunct program was overwhelmed with competing views of behavior. It seems likely that this conflict in theoretical approaches detracted from the impact of the adjunct program.

The lack of success in reaching the objective of textbook unit completion for each student-teacher can be partially explained by the lack of controls available to the adjunct program. For instance, the performance contracts used during the second semester of Phase II resulted in a complete failure to obtain the specified performances. It should be noted though that these contracts lacked a key item, no contingency of reinforcement was specified for the required performances. In fact, no reinforcer was available to the instructors of the adjunct program. In a situation where responses are not reinforced, the lack of responses was not unexpected.

The difficulties encountered in the seminar portion of the adjunct program suggest some specific areas of concern for future adjunct training programs. The programs must have control of reinforcers in the
instructional situation. Control of reinforcers may be delegated by the regular program or built into the adjunct program. For instance, the adjunct program may be presented to the students as an alternative to a regular course and then use the reinforcers available to other courses in that institution. Another possibility is that an adjunct program rely on its own reinforcers such as giving large amounts of money contingent upon specified performances.

Phase III -- Student-teaching: Formal. Phase III presented descriptive data on the student-teachers derived from videotaped lessons. These data included three response categories for the student-teachers and one for their pupils.

The videotape data were considered to be baseline data. The information sought from the data was whether the student-teachers were obtaining high rates of active pupil responses and whether they were consequating every active pupil response. Since these skills were taught in microteaching, it was hoped that they might be applied in student-teaching. It was observed in the videotape lessons that the student-teachers were calling for a single active pupil response at a time and were not consequating all responses. The skills practiced in the microteaching setting were not evident here.

The videotapes were primarily of teacher behavior. The behavior observed was considered to be baseline or descriptive data that provided information concerning the possible need for modifying the student-teachers' behavior in the classroom setting. The focus was on behaviors that reflected the within-program objectives for the student-teachers.
Teaching effectiveness of the student-teachers was not judged from these videotapes of teaching behavior.

In addition to obtaining baseline information, a possible use for videotape is for the modification of behavior outside of the setting in which the behavior normally occurs. For instance, Schwartz & Hawkins (1970) used a delayed reinforcement procedure to modify the face-touching, posture, and voice-loudness of a sixth-grade pupil. Videotapes were taken of the pupil's behavior during arithmetic and spelling periods. After a baseline was established, the experimenter and pupil started to view the videotapes after the school day was done. The experimenter would present a reinforcer to the pupil when the appropriate behavior was seen on the videotape. Viewing the videotape was not sufficient in itself to produce the behavior changes without the addition of response contingent reinforcement procedures. This delayed reinforcement technique might be adapted for training teachers.

Other uses of videotape include the training of teachers in observation skills (Haring & Fargo, 1969), self-analysis by teachers of their teaching behavior (Liberman, 1970), and for presenting models of behavior for teachers to imitate (Koran, Snow, & McDonald, 1971). Videotapes can be used in many ways since they provide a relatively simple method of permanently recording behavior and are immediately available for playback. Also videotapes can be reused as often as desired.

The use of videotape must be weighed against their disadvantages. The videotape equipment is costly, needs an operator, and must be
maintained. The presence of the equipment may disturb a subject. Videotapes cover a restricted field and are limited to what they can record. The disadvantages of videotapes should be considered and alternatives investigated before they are used.

Phase IV -- Student-teaching: Informal. Phase IV reported the results of several attempts by the student-teachers to use operant techniques in their classrooms. The student-teachers acted both as experimenters and as observers. Five of the twenty-two student-teachers completed some type of a study.

The completed studies were considered to be evidence that teaching procedures were or were not effective in those instances. Effectiveness was determined by the attainment of desired change in pupil behavior. The product of on-the-job performance by the student-teachers, desirable pupil behavior change, was directly measured and used to evaluate teaching effectiveness.

Student-teaching did not present a favorable situation for the completion of operant studies by the student-teachers. First, no formal suggestion or requirement was made in the adjunct program or practicum that operant studies be completed. Second, classroom evaluation of the student-teachers by supervisors and cooperating teachers focused on teaching behaviors. Direct measurement or pupil behavior change was not considered as an evaluation technique. Student-teachers were counseled for modeling certain teacher behavior rather than for changing their pupils' behavior. Third, preparing and completing operant studies had to compete with the heavy demands of the regular
courses and student-teaching for the time and energy of the student-
teachers. In summary, neither the occasion for the completion of 
operant studies was set nor were the few completed studies reinforced.

The lack of studies completed by the student-teachers indicates 
a major problem for teacher-training programs. The acquisition of 
a set of principles and procedures by a group of trainees does not 
necessarily mean that they will be applied in classrooms. A probable 
solution for this problem is the reinforcement of the desired behaviors 
in the classroom setting. The monitoring of behavior in the job 
setting could be done by the training program itself or by the 
administration of the school. Reinforcers might include promotions 
and salary raises.

Teacher training is limited by the degree to which its principles 
are actually applied by its trainees. The use of principles in the job 
setting can be engineered by training program. Studies such as Hall et 
al. (in press) and McKenzie et al. (1970) have successfully had nearly 
all of their trainees apply the operant principles they learned by 
requiring completed studies before credit was given in their courses.

Summary. This study has evaluated teaching effectiveness in 
terms of the attainment of specified objectives. In every case, 
objectives were decided upon prior to the start instruction. The 
prior specification of relevant objectives allowed the measurement of 
pupil progress toward these objectives throughout the instructional span.

Direct measurement of pupil behavior was used to evaluate teaching 
effectiveness in both the instructional and student-teaching parts of the
adjunct program. The frequency of occurrence measure allowed continuous records to be kept on the pupils. The records of the relevant pupil responses allowed the teacher in each situation to monitor individual learning progress. In addition the records helped the teacher measure the effects of changes in teaching procedures when they were introduced and as long as they remained in effect. Effects of teaching procedures were noted for each pupil by comparing the response rate attained after the change in teaching procedures to the baseline recorded before the change.

Directly measuring pupil behavior change allowed instructional decisions to be based on unambiguous data. The data indicated if the relevant behavior was present and if it was present, at what rate. The teacher could then continue or change teaching procedures according to the information obtained.

Training programs that adopt the evaluation procedures presented above will be faced with the problem of how to decide what pupil behavior to monitor when trainees are to be evaluated. The following two suggestions could be used. The teacher to be evaluated and the evaluators could agree before the pupils are taught what behaviors are of concern. The behaviors could then be measured during a period of time in which the trainee has control of the classroom. Another approach could start with the measurement of certain pupil behaviors in the cooperating teacher's classroom before the trainee entered it. These pupil behaviors then could be measured during the period in which the trainee has charge.
Implications for Research. The research strategy presented in this study consists of a search for ways to design teaching procedures so that each pupil can learn the specified task. The approach is different from the educational one that compares the effect of teaching methods through the comparison of achievement scores from groups of children. The strategy used in this study suggests that research should use pupil behavior change as the determinant of effective teaching.

Since pupil behavior change is available as a criterion for evaluating teaching effectiveness, there is little need for teaching effectiveness studies to infer that certain teacher behaviors will affect pupil behavior. The effect of teaching behaviors can be directly demonstrated.

The use of the pupil behavior change criterion should not be limited to the on-the-job evaluations of trainees. These external criteria of training program effectiveness should be accompanied by internal criteria of the same sort. Training programs have the responsibility of directly demonstrating that they have changed the behavior of their pupils or trainees. After behavior change has been demonstrated, the occurrence of the behaviors should be shown to exist in the work setting. Finally on-the-job effectiveness should be evaluated directly through pupil behavior changes directed by the trainees.

Other Considerations. Teachers are given the responsibility for training pupils. But their behaviors are often influenced by factors other than desired pupil behavior change. The limited influence that pupil behavior change has on teacher behavior is receiving much attention.
recently in educational literature. For instance, Lessinger (1971) is concerned with making educators "accountable" for their work by providing "proof of results." Lessinger (1971) also attacked the "... philosophy of the bell-shaped curve ... that a given number of any group of children are failures or rejects on our academic scale (p. 14)."

A focus on the direct measurement of pupil behavior change and a rejection of the notion that failure may occur should lead to an improved learning situation for the pupil. Education can adopt the position that problems in learning are not inherent in pupils but in the teaching procedures used on the pupils.

The position that pupils can learn if taught correctly has been adopted by U. S. industry. For example, Dorsett Educational Systems, Inc. has successfully completed a "performance contract" with the U. S. Office of Economic Opportunity (Lelyveld, 1970). Dorsett (Lelyveld, 1970) succeeded in showing "measurable progress for about 90% of the 400 Texarkana students who were identified as potential dropouts and enrolled in the program (p. 62)." The company was paid only for successful teaching.

The ability of teachers to specify and reach their objectives for pupil behavior change may eliminate some of the basic problems in American education today. An educational system that is based on teaching pupils reading and arithmetic cannot be considered effective when these are not taught to all students. "For example, of the 'one third of a nation' who could not pass the Armed Forces Qualification
Test (AFQT) in 1963, (a 5th - 6th grade reading and mathematics prerequisite), well over one-third of those young people had high school diplomas (Education Turnkey Systems, 1970, p. 43)."

Texarkana has demonstrated that a program to eliminate reading and arithmetic deficiencies combined with operant conditioning techniques can be effective. Effective teaching of the basics of education may allow teachers to consider the maximum education possible for their pupils rather than the minimum.
REFERENCES


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