AN ABSTRACT OF THE THESIS OF

Anne Dawley Raymond (Name) for the Doctor of Philosophy (Degree)

in Science Education (Major) presented on August 4, 1971 (Date)

Title: THE ACQUISITION OF NONVERBAL BEHAVIORS BY PRE-SERVICE SCIENCE TEACHERS AND THEIR APPLICATION DURING STUDENT TEACHING

Abstract approved: Thomas P. Evans

This investigation was designed to determine the effectiveness of microteaching as a technique to acquire a teaching skill in the use of nonverbal cues during a preservice methods course, and the inculcation of that skill into a repertoire of behaviors during student teaching. Two aspects of nonverbal cues were considered; they were, as a method to increase student participation in the science classroom, and as a means of communicating positive affectivity.

Participants in the study were: (a) ten prospective science teachers randomly assigned to the control group who taught four microlessons focusing upon two separate teaching skills, and (b) ten prospective science teachers randomly assigned to an experimental group who taught six microlessons focusing upon three separate teaching skills. All prospective teachers taught microlessons to acquire

the skill of set induction and probing questioning; in addition, each prospective teacher in the experimental group taught two additional microlessons to acquire the teaching skill of nonverbal cues.

The skill of set induction was practiced at the University with members of the peer group serving as microclass members. Facilities and students at a junior high school in Corvallis, Oregon were used for practice in the teaching skill of probing questioning and nonverbal cues. Each microlesson was videotaped with supervisory feedback provided by the researcher.

Criterion measures included: (a) the amount of time devoted to nonverbal and congruent expressions of behavior as determined through an analysis of one videotaped class session using the Biology Teacher Behavior Inventory, (b) the number of positive nonverbal interactions initiated by the teacher, and (c) a measure of teacher effectiveness obtained from secondary science students completing the Teacher Demonstration Rating Form. Categories with the Biology Teacher Behavior Inventory were analyzed using the Mann-Whitney U test to obtain a measure of between group differences.

The Findings

The following conclusions were drawn from data obtained and analyzed in this study:

1. There was a significant difference at the .10 level in the percent of time devoted to nonverbal behaviors between prospective teachers practicing the skill of nonverbal cues during the preservice methods course and prospective teachers not practicing this skill.

2. There was no significant difference in the percent of time devoted to congruent behaviors between prospective teachers practicing the skill of nonverbal cues during the preservice methods course and prospective teachers not practicing this skill.

3. There was a significant difference at the .05 level in the number of positive nonverbal interactions initiated by prospective teachers practicing the skill of nonverbal cues during the preservice methods course and prospective teachers not practicing this skill.

4. There was no significant difference in the rating of teacher effectiveness as perceived by secondary students in the science classes of prospective teachers practicing the skill of nonverbal cues during the preservice methods course and prospective teachers not practicing this skill.

5. There was a significant difference in the amount of time devoted to the category "States Knowledge" as a verbal behavior at the .10 level and "States Knowledge" and "Shows Knowledge" as a congruent behavior at the .025 level between prospective

teachers not practicing the skill of nonverbal cues and prospective teachers practicing this skill.

6. There was a significant difference at the .10 level in the amount of time devoted to the category "Positive Affectivity" as a nonverbal behavior between prospective teachers practicing the skill of nonverbal cues during the preservice methods course and prospective teachers not practicing this skill.

The Acquisition of Nonverbal Behaviors by Preservice Science Teachers and Their Application During Student Teaching

by

Anne Dawley Raymond

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

June 1972

APPROVED:

Redacted for Privacy

Associate Professor of Science Education
in charge of major

Redacted for Privacy

Chairman of Department of Science Education

Redacted for Privacy

Dean of Graduate School

Date thesis is presented August 4, 1971

Typed by Cheryl E. Curb for Anne Dawley Raymond

ACKNOWLEDGEMENTS

Sincere appreciation is extended to the many people who contributed to this study by giving freely of their time, effort, and encouragement. The researcher wishes to express her grateful appreciation to the administrators in the school systems participating in this study, the members of the Audio-Visual Department at Oregon State University and to those students who participated in the study.

Special thanks is also due to the following persons:

To Dr. Thomas Evans who maintained a cheerful disposition and contagious enthusiasm throughout the formation and completion of the study, and provided inspiration and encouragement to the researcher;

To Dr. Stanley Williamson for his support of the study and confidence in the researcher as a student in science education;

To Dr. Norbert Hartmann for his assistance in the statistical treatment of the data;

To Dr. Denis Baron, Dr. Daniel Jones and Dr. Robert Storm for serving as members of the doctoral committee;

To Joseph Kelly, Paul Eggen and Ted Ozawa for their cheerful assistance to the researcher during times of need;

To my three children, Jeffrey, Mark and Martha for making it all worthwhile.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF FIGURES

THE ACQUISITION OF NONVERBAL BEHAVIORS BY PRESERVICE SCIENCE TEACHERS AND THEIR APPLICATION DURING STUDENT TEACHING

INTRODUCTION

Educational researchers have recently been giving attention to the percent of time devoted by teachers to verbal and nonverbal interactions with their students, and they have found that a large percentage of class time has been consumed by "Teacher-talk" during which the teacher exerts a direct influence upon the students. A teacher employing methods which emphasize this influence may not be meeting the objectives of the science curriculum because these curricula are based upon the concept of science as inquiry; namely, the laboratory, and a student-centered classroom employing methods of inquiry. In such a classroom, the teacher provides for learning activities which encourage the active participation of each student. Consequently, there is a discrepancy between the rationale upon which the science curricula are based and actual classroom practice.

The discrepancy may exist because of the emphasis on verbal behavior in the improvement of the act of teaching. Classroom teachers concerned about their teaching effectiveness often equate "teaching" with "telling". For these teachers, an improvement in the teaching act focuses upon utilizing those methods by which more information may be imparted to the students in that classroom. Until

recently, with the accessibility of the videotape recorder to provide feedback on teacher nonverbal behavior, the only convenient means of recording classroom teacher behavior was with audiotapes. Analysis of videotaped classroom behaviors of teachers has revealed that nonverbal cues provide an important source of communication between teachers and students. Further studies of teacher nonverbal behavior will hopefully reveal the nature of this communication.

Traditionally, the role of the methods course has been designed to introduce preservice teachers to various teaching techniques. However, science methods courses emphasizing the acquisition of verbal behaviors often do not provide opportunities to develop the inquiry techniques necessary for the science teacher attempting to meet the goals of the newer science curricula. Critics of the traditional methods class have stated that the teaching act is too complex to be studied in its entirety but should rather be divided into specific strategies referred to as "teaching skills." Each identified skill defines behaviors exhibited by a teacher in reaching a predetermined educational goal. In this study, the acquisition and effect of one of these teaching skills, i.e., nonverbal cues, by preservice science teachers will be investigated.

To undertake this study, the following assumptions will be made:

1. Teacher verbal and nonverbal behaviors are observable and identifiable.

2. An observer in the classroom will not significantly affect teacher behavior.
3. A representative sample of classroom behavior may be obtained from one classroom session designated as representative by the teacher.
4. Teacher classroom behavior is composed of both verbal and nonverbal behaviors.
5. The Teacher Demonstration Rating Form is a valid and reliable measure of teacher effectiveness.

The Problem

The traditional methods class has not offered the opportunity to preservice teachers to practice and analyze specific teaching behaviors. Although advocates of the microteaching format have indicated success in sensitizing teachers to use specific teaching skills, research has contributed little to the overall knowledge concerning teacher behavior or the effect of independent variables such as a methods course upon teacher behavior. Further, research in teacher behavior has largely ignored the nonverbal component. Nonverbal communication is especially important where a contradiction is manifested between verbal and nonverbal components of teacher behavior. This study is designed to analyze the role of the methods class in the development of a specific teaching skill in the use of nonverbal cues

cues and the inculcation of that skill within a repertoire of skills used during the student teaching experience. The hypotheses to be tested are as follows:

1. Teachers who have identified and practiced the skill of nonverbal cues during a methods class will devote significantly more time to nonverbal behaviors during their student teaching experience.
2. Teachers who have identified and practiced the skill of nonverbal cues during a methods class will devote significantly more time to congruent behaviors with students during their student teaching experience.
3. Teachers who have identified and practiced the skill of nonverbal cues during a methods course will demonstrate significantly more positive nonverbal interactions with their students during their student teaching experience.
4. Teachers who have identified and practiced the skill of nonverbal cues will be perceived as more effective teachers by their students.

Definition of Terms

1. Biology Teacher Behavior Inventory (BTBI) - An instrument designed to categorize teacher verbal and nonverbal behavior through a systematic analysis of video-taped class sessions.

2. Congruent behavior - Simultaneous verbal and nonverbal teacher behavior manifesting agreement between the two expressions of teacher behavior in which one stresses or reinforces the other.

3. Microlesson - A scaled-down sample of teaching. Essentially, a brief (4-10 minute) single concept lesson with a small group of pupils (3-5) during which the teacher concentrates on one teaching skill.

4. Nonverbal cues - A specific teacher behavior designed to influence learners in a pre-determined direction without verbal communication. This may include the use of silence.

5. Probing questioning - A questioning skill which requires students to formulate hypotheses, justify answers, draw conclusions and relate concepts.

6. Science methods course - A university course offered to preservice secondary science teachers for the purpose of developing skills in the methods of teaching science.

7. Set induction - A teaching skill focusing upon an ability to prepare students for a subsequent learning situation with a dramatic introduction.

8. A Teacher Demonstration Rating Form - An instrument developed for the purpose of measuring teacher effectiveness as perceived by students within that classroom.

9. Teaching skill - A specific teaching behavior which emphasizes one aspect of the total complex teaching act. Examples may include the skills of set induction, attending behavior, or stimulus variation in addition to 15 other identified skills.

10. % All - An instrument designed to classify teacher-student interactions into positive or negative verbal and nonverbal interactions. A % All measure indicates the number of interactions the teacher had with a particular student divided by the total number of interactions with all students in the class.

Limitations of the Study

1. The study will be limited to the total number of students electing to participate in the methods class, student teaching sequence.

2. The study will be limited by the assignment of the preservice teachers enrolled in the methods class to complete student teaching during a term other than one which successively follows the methods class experience.

3. The study will be limited by the use of instruments for the analysis of secondary science teacher behavior which have not been used previously in this same capacity.

4. The study is intended to evaluate the effectiveness of teacher behavior solely as perceived by students.

Delimitations of the Study

1. The study does not intend to evaluate inquiry teaching as a method of teaching science.
2. The study does not intend to measure student achievement.

Needs for the Study

One of the major problems in science education today is the preparation and training of science teachers. New concepts regarding the nature and purposes of training science teachers are evolving from the re-examination of existing programs. Issues are continually being raised regarding improvement in the existing programs. These issues will not be resolved until more is known concerning the nature of science teacher behavior. While information on teacher behavior is beginning to accrue, the vast majority of the studies have dealt with verbal behavior. This study is designed to yield added information regarding the acquisition and application of nonverbal teacher behavior.

This study will attempt to identify an effect of an independent variable within a science methods class upon student teacher behavior. Results of this study may yield information of value regarding the future role of experiences such as microteaching in the preservice training of teachers. Few research studies have been directed to studying the effect of independent variables within the teacher training program upon subsequent teacher behavior. Consequently, this study

will provide information which may be used for the development of new concepts in teacher training programs.

Design of the Study

Preservice secondary science teachers registered in Education 407, a one-credit seminar to be taken concurrently with the methods course, will be randomly assigned to two groups during the Fall and Winter terms, 1970-1971. One group will be designated as the control (C) and the other experimental (E). Both groups will develop the skill of set induction during the regularly scheduled class time at the University, using peers as members of their microclass. Both groups will then develop the skill of probing questioning at a local secondary school using students as their class members. The experimental group will, in addition, continue to teach an additional microlesson sequence utilizing the skill of nonverbal cues. Each group will be exposed to the following sequence in the development of the skill:

1. Discussion of the skill to be developed in a large group situation utilizing handout sheets and student discussion;
2. Viewing a model lesson emphasizing the particular skill;
3. Practice in the development of the skill through teaching a microlesson;

4. Analysis of the microlesson through videotape recording and supervisor feedback; and

5. Reteaching the same lesson to a different group of students.

The design of the experiment is presented in Figure 1.

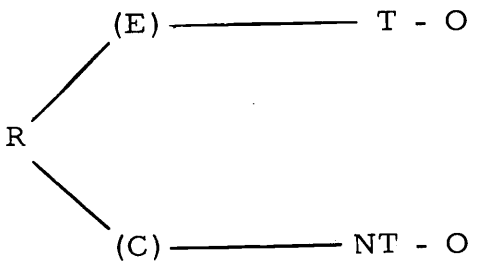

Figure 1. Where R is the random assignment to groups; E is the experimental group; T designates treatment; C is the control group; NT designates no treatment and O is the criterion measure of T and NT.

During the student teaching assignment following the methods course, each of the students will be videotaped in his assigned classroom. The student teacher will designate the class period which is perceived as his best class. The videotape recording will be analyzed for the percent of time devoted to verbal, nonverbal, congruent and contradictory behaviors using the Biology Teacher Behavior Inventory (BTBI) which is found in Appendix A. In addition, analysis of the verbal and nonverbal interactions will be noted using the % All.

Differences between the two groups will be analyzed using a statistical test of significance. Criterion variables will be the total percent of nonverbal and congruent behavior as measured by the BTBI and the number of positive nonverbal interactions as measured by the % All. Students in all classes will be asked to complete A Teacher Demonstration Rating Form (Appendix B), with differences between the two groups subjected to a statistical test of significance. Specific categories within the BTBI will be further subjected to tests of significance for between group differences.

Organization of the Remainder of the Study

The study is composed of four major sections. In Chapter II, a review of the literature upon which the formulated hypotheses are based is presented. The procedures by which the hypotheses are tested are found in Chapter III, and the findings of the study are located in Chapter IV. Conclusions drawn from results of this study and recommendations for further study are presented in Chapter V. A series of appendices include supplemental information concerning the procedures and criterion measures in this study.

II. REVIEW OF LITERATURE

Microteaching

During the past decade, many new science curriculum projects have emerged. It is probable that a classroom methods course designed to prepare teachers for these new curricula results in knowledge concerning the nature of the curriculum, but is not beneficial in the acquisition of behaviors necessary for the achievement of the curriculum objectives.

A recent report concerning the status of teacher education programs in the sciences suggests widely divergent practices by instructors to meet the objectives of the methods course. Regardless of these divergent practices, the authors identified the lecture or modified lecture technique as being the dominant methodology utilized in science methods courses during classroom visitations (Newton and Watson, 1968, p. 75).

Hurd (1969) has stated that it is time for science educators to develop new kinds of science methods courses for beginning teachers. He further stated that this need has been recognized but not supported (Hurd, 1969, p. 123). Thus, science educators are still faced with the problem of developing new methods courses for training teachers to utilize methodology conducive to the achievement of the objectives of the newer curricula.

One of the most recent attempts to meet this need is a training technique called microteaching. Microteaching, defined most succintly, is a short lesson presented to a small group of students. Defined and described originally at Stanford University in 1963, the term has taken on a variety of meanings and uses. As defined by its originators, a microlesson is an authentic learning experience lasting from 4 to 20 minutes involving 3 to 10 students. The purpose of microteaching is to reduce some of the complexities of the teaching act to allow the teacher to focus upon and practice a selected teaching skill (Allen and Ryan, 1969, pp. 1-2).

Teaching skills refer to specific teacher behaviors designed to influence the teaching-learning experience. This requires that the behaviors be predetermined, and as such, operationally defined (Johnson, 1967, p. 87). The teaching skills approach in microteaching is based upon the assumption that by breaking down the complex teaching act into more easily trained skills, the teacher can acquire a repertoire of teaching skills for use in the classroom. In addition to preparing teachers with a repertoire of teaching skills, microteaching has been used to focus attention upon the acquisition and effect of a specific skill. Nathan Gage (1963) directed comments to this possibility in suggesting that researchers investigate "micro-criteria" of teaching effectiveness. Rather than seek criteria for the over-all effectiveness of teaching ability, the teaching act should be divided

into identifiable roles with criteria of effectiveness defined for these small specific roles (Gage, 1963, p. 120).

The concept of focusing upon one skill at a time emerged from the doctoral research of Horace Aubertine during the summer of 1963 at Stanford University. During this summer, pre-intern teachers were enrolled in a special program designed to prepare graduates of a liberal arts curriculum for subsequent assignment as intern teachers during the Fall term. Initial attempts at having pre-intern teachers prepare short lessons seemed to lack direction (Cooper and Allen, 1969, p. 3). Elimination of this problem seemed apparent when the pre-intern teachers were taught the skill "How to Begin a Lesson" developed by Aubertine. The decision to investigate the possibility of developing other teaching skills led to an informal task analysis of teacher classroom behavior. Since 1963, the list of identified teaching skills has been modified as a result of research and added information. The teaching skills were subsequently identified and defined in terms of desirable teacher behaviors. A recent list of teaching skills include:

1. Stimulus variation
2. Set induction
3. Closure
4. Silence and nonverbal cues
5. Reinforcement of student participation

6. Fluency in asking questions

7. Probing questioning

8. Higher-order questions

9. Divergent questions

10. Recognizing attending behavior

11. Illustrating and use of examples

12. Lecturing

13. Planned repetition

14. Completeness of communication (Allen and Ryan, 1969, p. 15).

Concurrent with the identification of specific teaching skills has been the development of training protocols. Initially, instruction in the teaching skills was given to the trainees through a combination of oral instruction, written directions, demonstrations or a combination of these techniques. With the availability of video-tape recorders and research findings concerning the effects of models in changing behavior, the component skills approach emerged (Allen and Ryan, 1969, p. 26). Essentially, the research indicated that complex behavior may be acquired almost entirely by imitation (Bandura and Walters, 1963) and the provision of live or video-taped models illustrating these behaviors serves to accelerate the learning process (Bandura, Ross and Ross, 1963). The task presented to the Stanford Teacher Education Program was then one of establishing a clear definition of the skill and to develop a model film to illustrate and emphasize that skill.

Koran (1969a) tested the effect of presenting preservice elementary science teachers with a videotaped model of a teacher demonstrating the use of observation and classification questions. Utilizing kits prepared by the University of Texas Science Education Center to accompany specific lessons within Science - A Process Approach, he investigated the assumption that one may instruct teachers in classroom methodology through lecture. He assigned 33 undergraduate elementary education majors enrolled in an elementary science methods course to one control and two treatment groups. The control group received only general instructions in the basic topics and materials that would be included in a science methods class including the role of observation and classification in concept formation. Both treatment groups received specific instructions concerning objectives and teaching strategies of the Observation I and Classification I kits. Treatment I group viewed a videotaped model lesson illustrating the questioning behaviors to be acquired. The criterion measure for the three groups was the assignment to write as many observation and classification questions as they could ask given the kit materials associated with the lesson. The results in this study indicated that additional experiences beyond specific classroom instruction were necessary in producing the desired behavior modification utilizing this skill.

Modeling forms an integral part of the suggested training protocol in the acquisition of teaching skills developed at Stanford. Berliner

(1969) states:

> In fact, the use of model tapes, i.e., short video recordings of a master teacher performing a lesson to illustrate uses of a specific skill has become the most frequently used means to promote skill acquisition in trainees (Berliner, 1969, p. 10).

While the use of model films has not been questioned by researchers, a discrepancy exists between theory and practice. Ward (1970) surveyed 442 colleges and universities accredited by the National Council for Accreditation of Teacher Education for the use of microteaching in their training program. Of the 176 institutions indicating using the microteaching technique, less than a third of the institutions had rationales for or videotaped models of any of the technical skills of teaching.

Allen and Ryan (1969) suggest a training protocol which includes having the trainee:

1. Read the description of the skill;
2. Read a typescript of the model film (if available);
3. Watch a demonstration film or tape;
4. Prepare and teach a microlesson to practice the skill;
5. Read comments written on evaluation sheets by students participating in the microlesson;
6. Participate in a critique of the lesson with a supervisor;
7. Watch a replay of the videotaped lesson (if available); and,
8. Prepare to reteach the same lesson to a different group of

students (Allen and Ryan, 1969, p. 39).

Berliner (1969) has suggested the need to investigate several aspects of the training protocols including:

1. The type of model and whether modeling procedures should be used for all skills.
2. The teach-reteach cycle, especially the number of times a lesson is retaught.
3. The length of the teaching lesson.
4. The number of students in a lesson.
5. The length of time between teaching lessons.
6. The delay between teaching session and feedback.
7. The mode of feedback.
8. The feasibility of multiple skill training.
9. Retention of skill acquisition.
10. Transfer of skills to classroom teaching.

Several researchers have investigated various aspects of the microteaching format including the microteaching process and training protocols. Amidon (1969) systematically evaluated the effects of skill development in microteaching between 1964-1967. The results of his study indicated that student teachers participating in microteaching sessions differed from student teachers in the control group. Amidon used as his criterion of effectiveness specific categories of teacher behavior in terms of the Interaction Analysis model. This

model was expanded in 1968 in order to define more clearly the behaviors which fell into each category. The expanded interactional analysis system provides for specific skills to be developed through microteaching called the Skill Development in Teaching Model (SKIT). The expanded interaction analysis model is as follows:

CATEGORY 1 - Accepts Student Feelings

1a - Acknowledges feelings
1b - Clarifies feelings
1r - Refers to similar feelings of others

CATEGORY 2 - Praises

2w - Praises with no criteria
2P - Praises with public criteria
2p - Praises with private criteria

CATEGORY 3 - Accepts Student Ideas

3a - Acknowledges ideas
3c - Clarifies ideas
3s - Summarizes ideas

CATEGORY 4 - Asks Questions

4f - Asks factual questions
4c - Asks convergent questions
4d - Asks divergent questions
4e - Asks evaluative questions

CATEGORY 5 - Lectures

5f - Factual lecture
5m - Motivational lecture
5o - Orientation lecture
5p - Personal opinion lecture

CATEGORY 6 - Gives Directions

6c - Gives cognitive directions
6m - Gives managerial directions

CATEGORY 7 - Criticizes

7w - Criticizes with no criteria
7P - Criticizes with public criteria
7p - Criticizes with private criteria

CATEGORY 8 - Predictable Student Talk

8f - Factual student talk
8c - Convergent student talk

CATEGORY 9 - Unpredictable Student Talk

9d - Divergent student response
9e - Evaluative student response
9i - Student initiated talk

CATEGORY 10 - Silence or Confusion

10s - Silence
10c - Confusion

The method employed in the SKIT Model for achieving specific teaching skills is based upon the assumption that a teacher, in developing a skill, cannot be overloaded with a multiplicity of behaviors to consider. Thus, the requisite behaviors to be acquired are in terms of specific categories of teacher behavior found in each subcategory of the expanded interactional analysis, categories of other observational systems available, or new categories developed with the trainee. Further, objectives are stated in very specific terms, and only those objectives stated for a specific skill session are considered in

evaluating that microlesson (Amidon, 1968, pp. 12-13).

Aubertine (1968) showed that interns trained in the skill of set induction at the Stanford Microteaching Clinic were perceived as significantly more effective teachers when rated by their students and compared to a similar group of intern teachers. Schuck (1970) also studied the effect of acquiring a skill in set induction. He studied student achievement and student perception of teaching effectiveness when taught by teachers trained in this skill. Subjects for his study included 18 pre-service biology teachers who had volunteered for the study. The teachers were randomly assigned to an experimental or control group. Each was then randomly assigned to a group of ten ninth grade students who had likewise volunteered for the study from junior high schools located in Mesa, Arizona. A unit on respiration included in each of the three versions of the BSCS curriculum was selected as the subject of the two week instructional program. Criterion measures included an achievement test constructed at Arizona State University for the study and the Teacher Demonstration Rating Form for student perception of teacher effectiveness developed at Stanford University for use with the Microteaching Clinic. Data collected in this study indicated that teachers trained in the skill of set induction were perceived to be more effective teachers ($p > .01$) and pupils of these teachers achieved significantly higher scores ($p > .01$) on the achievement test employed.

Goldwaite (1968) investigated the effectiveness of teaching pre-service science teachers the skill of presenting demonstrations. The microlesson format was adopted with peer group members serving as pupils in the microclasses. Goldwaite found that those student teachers who had participated as pupils in the microlessons received the highest ratings on the effectiveness of their demonstrations by their students during student teaching. His data suggested that those student teachers who had participated in the microclasses learned from the experience. Further, the evidence would suggest a transfer of learning from a microclass experience to the classroom environment.

Morse and Davis (1970) investigated the training procedure for skill acquisition. Their data indicated that the training protocol was instrumental in producing differential results in acquisition of questioning strategies. For their study, two sections of an introductory teaching course at the University of Texas were assigned to an experimental group. Two other sections of the same course were taught by a second instructor and assigned to the control group. Students in all sections were given instruction in questioning strategy concepts and were required to participate in a microteaching sequence. The two classes participating in the control group participated in an educational game called "Questionize" based upon Bloom's taxonomy, while the two remaining classes were subjected to a Teaching Laboratory task including protocols for specific teacher behaviors related to

questioning. The Teaching Laboratory includes procedures for developing specific behaviors similar to the training protocols developed by the Stanford University Microteaching Clinic. Audio tapes of all final microlessons were subjected to analysis utilizing the Questioning Strategies Observation System (Morse and Davis, 1970) and statistically analyzed by the multiple linear regression procedure. Data indicated that the experimental group utilized more cognitive questions and showed more behaviors which were supportive of pupil responses while control group teachers asked more procedural and affective questions.

Shively (1970) reported that the mode of feedback to the teacher upon completing the first microlesson produced differential changes in teacher behavior during the reteach lesson. He indicated that the greatest change in behavior between the two microlessons occurred in the treatment group which received supervisory feedback based upon an audiotape of the lesson. The Treatment group also perceived this feedback as very valuable. Written responses to the Stanford Teacher Competence Appraisal Guide by peer group members serving as microlessons occurred in the treatment group which received supervisory feedback based upon an audiotape of the lesson. The Treatment group also perceived this feedback as very valuable. Written responses to the Stanford Teacher Competence Appraisal Guide by peer group members serving as microteaching students also effectively

produced change in teaching performance, but the responses were not perceived as valuable feedback by the microlesson teacher. The opposite was true of the group subjected to videotape feedback. While the teachers perceived this type of feedback to be valuable, little change in behavior was recorded. Of least value in terms of change in behavior or microlesson teacher attitude was the supervisor feedback based upon the live lesson. Data to measure changes in teacher behavior were obtained from scores on the Stanford Teacher Competence Appraisal Guide and an attitude scale measuring the attitudes toward various aspects of the microteaching experience. Subjects in this study included 37 undergraduates enrolled in an educational psychology course, randomly assigned to the four treatment groups. Ratings on the first microlesson were used as covariates in the statistical analysis of the data.

Allen et al. (1966) indicated that data which they had collected in the microteaching clinics clearly indicated the importance of supervisor feedback based upon one component task of teaching at a time. They stated that the teaching behavior of microlesson teachers is modified most effectively when the supervisor and microlesson teacher have in mind a specific behavior to be acquired, and their discussions center around means by which this behavior will be performed more frequently and more effectively in future lessons.

The focus upon one teaching skill at a time may be extremely important regarding the consequences of the skill acquisition. Waimon and Ramseyer (1970) studied the effect of video feedback to preservice teachers upon completion of a short lesson. Those microlesson teachers who had received videotape feedback could not be distinguished from another group of microlesson teachers who received no feedback. Waimon and Ramseyer concluded that video feedback did not produce significant differences in the overall rating of student teacher teaching ability. In another study by Brashear and Davis (1970), verbal teaching behaviors of beginning teacher candidates were modified by microteaching. However, they found that these general behaviors did not persist into student teaching.

Chavers et al. (1970) investigated the interaction of the microlesson teacher's characteristics with the training method employed upon terminal tests of teaching ability. Several training methods were utilized by the authors including skill acquisition in microteaching; microteaching coupled with the Stanford lectures which accompany the skill; microteaching accompanied with the Stanford lectures and sensitivity training; and, no prior training. Significant differences were found between those teachers who had microteaching and those who had no training. Teachers who were included in the treatment of microteaching, coupled with the Stanford lectures and sensitivity training, performed better than any other treatment group. In general, students

who were high on flexibility as an indicator of personality performed better across treatments.

Nonverbal Behavior in the Classroom

Nonverbal communication in the classroom has been neglected by educational researchers. Few studies in teacher behavior have included nonverbal communication. Evans (1968) and Balzer (1968) reviewed the literature in teacher behavior and were concerned with the focus and emphasis upon verbal behaviors in the analysis of teacher behavior. Together, they developed a category system for systematic observation of the verbal and nonverbal behaviors of high school biology teachers. The instrument was developed inductively through the analysis of 13 videotaped class sessions. By recording discrete behaviors upon three-by-five cards and subsequently sorting the cards into related piles, individual categories and subcategories were identified and defined. A complete list of these categories will be found in Appendix A.

Subsequent analysis of individual teacher behavior yielded data which indicated the importance of teacher nonverbal behavior. Biology teachers in their study utilized nonverbal behavior 39 percent of the time and congruent behaviors 26 percent of the time. Contradictory behaviors occupied less than one percent of the total class time (Evans, 1968, p. 185; Balzer, 1968, p. 120).

Galloway (1966, 1968, 1970) was one of the first educators to purport the influence of nonverbal communication in the classroom. Nonverbal language refers to the communication which occurs without words. As such, it refers to messages which are communicated through facial expressions, gestures, body position and movement, and vocal intonation. Galloway (1970) has concerned himself with the analysis of the influence and consequence of a teacher's nonverbal behavior with pupils. He found it useful to view the influence of a teacher's nonverbal behavior on a continuum from encouraging to restricting communication. He developed a category system of teacher behaviors which exemplified the teacher's nonverbal communication. The seven categories of nonverbal teacher behavior included the following:

Encouraging Communication

1. Enthusiastic support
2. Helping
3. Receptivity
4. Pro Forma

Inhibiting Communication

5. Inattentive
6. Unresponsive
7. Disapproval (Galloway, 1970, pp. 11-12)

Included in each category of nonverbal communication are specific examples of teacher behavior which would be placed in that category. They would include:

1. Enthusiastic support: would include behaviors as enthusiastic approval, unusual warmth, emotional support, or strong encouragement. A smile, a nod, a pat on the back, a warm greeting of praise, vocal intonation or inflection of approval.
2. Helping: would include a spontaneous reaction to meet a pupil's request, help a pupil, a look of understanding followed by appropriate action, a supportive voice or a laugh to break the tension.
3. Receptivity: includes a willingness to listen with patience and interest to pupil talk by maintaining eye contact, assuming a body position communicating a willingness to listen, or a gesture that encourages the pupil to continue.
4. Pro Forma: includes routine acts which neither encourages nor inhibits communication.
5. Inattentive: includes behaviors such as avoiding eye contact, assuming a slouchy position or gestures to terminate pupil talk.
6. Unresponsive: would include a failure to respond when a response was expected, threatening, condescending behaviors, or gestures suggesting tension or nervousness.
7. Disapproval: includes frowning, scowling, sarcasm, a pointed finger which pokes fun, belittles, or threatens pupils, and vocal

tone that is hostile, irritated or antagonistic (Galloway, 1970, pp. 11-12).

In order to have a complete picture of the nature of the communication in the classroom, both the verbal and nonverbal components must be analyzed. Galloway suggested using an observation system for combining the Flanders system of Interaction Analysis with his category system of nonverbal behavior (Galloway, 1970, pp. 14-16). The system would be designed to enable the coder to use the categories, time intervals and ground rules of the original Flanders system while recording the nonverbal dimensions as well. The observer would mark a slash (encouraging) or dash (restricting) to the right of the recorded tally. In addition, a nonverbal teacher behavior would be indicated by circling the category number indicative of that behavior.

Lail (1968) reported combining Flanders System of Interaction Analysis and Galloway's Analysis of Nonverbal Communication to evaluate student's performance in the Teacher Corps and Prospective Teacher Fellowship Program at the University of Kentucky. Using the Flander's category system for coding behaviors every three seconds, the coder placed a "1" in front of the category number to indicate a restrictive behavior. Thus, a "2" indicating verbal praise might be coded as a "12" if the nonverbal teacher behavior is incongruent with the verbal message. Acceptance, or the use of a student's

idea, Category "3" would become a "13" if the teacher statement is perfunctory. Through this system, the teacher would receive feedback on the type, and percent of inconsistent or restrictive behaviors utilized during the class period.

Amidon (1969) reported utilizing a Nonverbal Interactional Analysis for the clarification of discrepancies which occurred in the development of a skill using the SKIT model (see pp. 18-19). The Nonverbal Interactional Analysis utilized by Amidon is believed to be the same type of category system employed by Galloway. He reported an example of the use of the Nonverbal Interactional Analysis in a demonstration of the SKIT model to a group of teacher educators. The teacher was practicing the skill of category "3", acceptance, or use of a student's idea, in the microteaching format. The Verbal Interactional Analysis indicated that the teacher had achieved the objective for the microlesson. Amidon reports:

> The data collected from the students indicated that several students were uncertain about whether student ideas were being accepted. Further, a Nonverbal Interaction Analysis indicated that the teacher was not completely congruent while accepting ideas verbally. Certain non-verbal behaviors that the teacher used while using verbal acceptance were not accepting. Some of these such as a hesitancy in tone of voice, turning away as a student is speaking, and lack of eye contact were observed by a student acting as non-verbal observer. The audio and videotape replay offered further evidence that the teacher needed further practice in the use of this category (Amidon, 1969, p. 22).

The use of silence and nonverbal cues was identified early in the task analysis of teacher behavior at the Stanford Teacher Education Program. The identification of this skill is credited to David Berliner who states in a recent report:

> Analyses of the interpersonal effects of such stimuli as a raised eyebrow, a frown, a cocked head, a nod, a smile, and other gestures with shared understandings was judged as relevant to the training of good teachers (Berliner, 1969, p. 37).

The teaching skill of silence and nonverbal cues has been described by Cooper and Allen as:

> . . . this skill is designed to allow the teacher to control and direct classroom discussions without talking. Nonverbal communication is one of the most neglected means of teacher-student communication, but one of the most powerful. The skill focuses on the controlled use of teacher silence to get students to speak, and on techniques of non-verbal communication (Cooper and Allen, 1969, p. 30).

The premise that a teacher's use of silence and nonverbal communication is effective in producing an increase in student participation formed the basis upon which the training protocol was developed in acquiring this skill. In behavioral terms, acquiring a skill in the use of silence and nonverbal cues means increasing the amount of student participation by decreasing the amount of teacher talk. Possible methods of reaching this goal would include using silence as follows:

1. After an introductory statement;
2. After a question from a student;
3. After asking a student a question; and,

4. After a student response (Allen and Ryan, 1969, pp. 139-140).

However, because silence by itself is ambiguous, the teacher should be alert to accompanying nonverbal behaviors including as follows:

1. Facial cues

   a. smiles directed to a student to encourage him to continue;

   b. frowns may either halt the student's response or stimulate him to justify or clarify his response;

   c. looking thoughtful indicates the teacher is considering the response;

   d. maintaining eye contact while a student is responding usually encourages him to continue talking; and

   e. looking quizzically at the student may stimulate him to reword his answer.

2. Head movement

   a. a nod will encourage a student to continue;

   b. a shake of the head will indicate that the student is on the wrong track and may cause the student to change his response; and

   c. a cocked ear and tilted head may communicate listening to the student.

3. Body movement

   a. by moving toward the student when he is responding will indicate that the teacher wants to hear what the student is saying.

4. Gestures - are combinations of separate, discrete actions which compose a patterned behavior such as:

   a. pointing to a student;

   b. "Continue" cue;

   c. "Anything else?" cue;

   d. "Stop" cue; and

   e. referring one student comment to a second student

   (Allen and Ryan, 1969, pp. 139-141).

Karasar (1970) studied the impact of video feedback on teachers' eye-contact mannerisms in microteaching. The study utilized video recordings from the data bank generated by previous studies conducted at the Ohio State University's Center for Vocational and Technical Education. Two panel members used stop watches to measure the time spent in eye-contact during the microlessons. The initial microlesson served as a pretest and the second microlesson served as a posttest. The researcher concluded that there was no significant difference at the .05 level between teachers who received video feedback and those who received no video feedback in their eye-contact mannerisms. Thus, it was concluded that the video feedback may not

have any significant effect on eye-contact mannerisms.

Meichenbaum, Bowers and Ross (1969) investigated teacher verbal and nonverbal behavior as a mediator of the teacher expectancy effect. The results of an earlier study by Rosenthal and Jacobson (1968) revealed data indicating that randomly selected elementary school students often show significant intellectual gains as compared to the remainder of students in the same class. Teachers of these students were told that the identified students would show "unusual intellectual gains during the academic year." The change in student behavior resulting from the teacher's expectations has been referred to as the teacher expectancy effect.

The study of Meichenbaum, Bowers and Ross (1969) was designed to investigate the nature of the behaviors exhibited by teachers which mediate the teacher expectancy effect by analyzing teacher-pupil interactions. The subjects were 14 adolescent female offenders institutionalized in a training school complex. They comprised two classes taught by four teachers. Six girls comprised the experimental "late bloomer" group and eight girls were assigned to the control group. The researcher asked the teachers to rate the academic potential of the girls early in the study. Data concerning the nature of teacher-pupil interaction was collected using the % All. The % All measure was obtained by training observers to record every verbal and nonverbal interaction which occurred between the teacher and pupils.

The interactions were coded as positive, neutral or negative. The number of interactions the teacher had with an individual student divided by the total number of interactions she had with all girls in the class was the % All. Thus, the % All measure reflected the amount of attention the teacher paid to an individual student. The % All is composed of three subcategories, namely, percentages of positive, negative, and neutral teacher-student interactions.

% All data were collected on each teacher for six days prior to indicating to the teacher the ficticious results of a premeasure on academic potential. The six girls identified as "late bloomers" on the ficticious premeasure included three girls who had been identified by the teachers and three girls who had not been identified. For eight days after giving the teachers these results, % All data were collected.

Analysis of variance scores indicated there were no significant changes in the teacher's level of attention. However, the researchers noted that while the four teachers as a group did not indicate changes in interaction patterns, differential patterns of behavior were evident. Two teachers responded to the expectancy instructions by increasing the % Positive interactions and one teacher by decreasing the % Positive contacts toward the expectancy group. The fourth teacher manifested a significant decrease in % Negative interactions for the expectancy subjects.

Analysis of variance of change scores in pupil behavior and academic performance indicated significant results. The girls in the expectancy group significantly improved their classroom behavior and academic performance on objectively scored exams, regardless of the teachers' prior expectancy.

The authors suggested that the expectancy effect was not mediated by teachers' increasing attention to the expectancy subjects, but was more likely to have been due to the changes in quality of interaction with subjects in the expectancy group (Meichenbaum, Bowers and Ross, 1969, p. 315).

Dalton (1969) investigated the relationship between classroom interaction and teacher ratings of pupils in order to explore the means by which teachers may communicate their expectancies. Dalton proposed that the pattern of interaction that a teacher has with each pupil will be significantly related to the teacher ratings of that pupil. Differences in both the verbal and nonverbal content in interactions produced a salient relationship between differential expectancies and patterns of pupil-teacher interaction.

The teacher was asked to describe her concepts of a typical "worst student" and a typical "best student" without referring to any real pupil. Using these concepts as the lower and upper points, respectively, of a ten step scale (Kilpatrick and Cantril's self-anchoring ladder rating scale), she was asked to assign all the pupils in her

room a number from 1 to 10. The pupils were fourth grade students in one classroom.

Interaction Analysis data was totaled over the period of ten days, yielding frequency of occurrence totals for each of the pupils for each Flanders category. On the basis of their Ladder scale ratings, the pupils were assigned to one of three groups. The data were analyzed to determine the existing relationship between the interaction frequencies and the ladder ratings.

Examination of the differences between the means of the totals and subtotals for each of the rating groups utilizing the Newman Keul Test showed in each case the low group differed significantly from the other two groups. The teacher interacted significantly more often with those students rated low, especially in the categories of asking questions, giving directions and using criticism.

Victoria (1970) developed an instrument for the systematic observation of nonverbal behavior. He utilized videotapes of student teachers in art to develop a typology of seven categories of nonverbal behavior and seven terms descriptive of affective qualities. Further, he developed an instrument to measure the relationship between the student teachers' general behavior and classroom affective qualities.

The seven categories of nonverbal behavior included the following:

1. Eye Contact

2. Facial Motion

3. Head Motion

4. Body Posture

5. Body Motion

6. Arm-Hand-Finger Motion

7. Directed Arm-Hand-Finger Motion

The seven categories of terms descriptive of qualities of nonverbal behavior were classified on a continuum ranging from supportive to unsupportive. They included the following:

1. Enthusiastic

   Nonverbal behaviors which evoke qualities of unusual enthusiasm, warmth, encouragement, or emotional support for students or topic.

2. Receptive - Helpful

   Nonverbal behaviors that evoke qualities of attentiveness, patience, willingness to listen, acceptance or approval; a responsiveness to students or situations implying receptiveness to students or situations implying receptiveness of expressed feelings, needs or problems.

3. Clarifying - Directive

   Nonverbal behaviors that evoke qualities of clarification, elaboration, direction or guidance.

4. Neutral

Nonverbal behaviors that evoke qualities of little or no supportive or unsupportive significance within contextual situations; routine acts.

5. Avoidance - Insecurity

Nonverbal behaviors that evoke qualities of avoidance, insecurity, insensitivity, impatience, ignorance, or disruption to students, topic or situations.

6. Inattentive

Nonverbal behaviors that evoke qualities of inattentiveness, preoccupation, apparent disinterest; an unwillingness or inability to engage students, topic or situations.

7. Disapproval

Nonverbal behaviors that evoke qualities of disapproval, dissatisfaction, disparagement or negative overtones to students, topic or situations.

He concluded, based upon the agreement reached with independent judges, that nonverbal behaviors may be systematically measured and described by means of the categorization of both nonverbal gestural behaviors and affective qualities observed in video recordings of student teachers in art.

Summary of Related Literature

Experimental data indicate that microteaching was an effective method for modifying teacher behavior. While many questions remain unanswered concerning the most effective training protocol to employ, the literature suggested that focusing upon one teaching skill at a time during any one microteaching session was important. Using microteaching to teach a general lesson did not seem to be consistent with the premise upon which microteaching was conceived; namely, to break the complex art of teaching down into small, identifiable skills.

Microteaching was not a panacea for the ills of the science methods course. It remains for individuals like John Koran (1969b) to suggest and implement new paradigms for the preservice education of science teachers. The program in which he utilized microteaching as a method to interpret the aims and objectives of science curricula in terms of teacher behavior suggested a new dimension to the future role of the methods class.

The appearance of the video tape recorder in the early 1960's opened the door of research into teacher nonverbal behavior. Early workers in the area of nonverbal behavior were often patronized as to the importance of their work. Meanwhile, researchers in psychology amassed a wealth of data which has generally remained untapped by

educators, indicating that nonverbal behaviors may be the most important mode of communication. The ramifications of research evidence which has quantified nonverbal behavior are many. One of import to science educators concerned with methodology is clear: improvement in the teaching act includes the identification of and practice in the acquisition of nonverbal behaviors consonant with verbal behaviors, curriculum objectives and teacher personality.

III. THE METHOD

The Sample

Participants in this research were preservice secondary science teachers enrolled in Education 407 B, a one-credit seminar to be taken concurrently with a selected methods course. The methods course options during the Fall term included methods in physical science, biological science, and junior high school science. During the Winter term, only the methods course in biological science was offered. All students registered in this seminar during the Fall (18) and Winter (13) terms, 1970-1971, participated in the microteaching experience; however, only those students who completed their student teaching requirement during the Winter or Spring terms, 1971, were included in this study. Thus, from an original sample of 31 preservice secondary science teachers completing the microteaching sequence, 20 student teachers were subsequently identified in included in the study. Of these 20, 10 had been randomly assigned to the experimental group and 10 to the control group.

Randomization of the Sample

Prior to the first seminar meeting, 18 numbers representing the students who had pre-registered for the class were randomly assigned to two groups. A schedule for the presentation of the

microlessons was prepared and included in an instructional hand-out sheet which was distributed to the students during the first seminar meeting. In order to assure the random assignment to groups, the instructional hand-out sheets were likewise numbered, shuffled and randomly distributed to the members of the class. Students were informed that scheduling difficulties and lack of time did not permit the entire group to participate in developing a third skill which was not identified to the group during this meeting.

In addition to random assignment to groups, random order of lesson presentation within groups was achieved. By checking his assigned number on the instructional hand-out sheet with an accompanying schedule (Appendix C) each student was able to identify his responsibilities for class presentation, for participation as a member of a microclass during the development of the initial skill, and day and time for presenting lessons at a local secondary school. Conflicts in schedules could be identified and corrected at this meeting in order to assure minimal difficulties encountered during videotaping. No conflicts in scheduling occurred during the Fall term. Six minor adjustments were made to the schedule during the Winter term in order that students not miss class meetings in other courses.

Description of the Seminar

The aim of the seminar is to provide students enrolled in a methods course with a practical experience in the preparation and execution of lessons. The lessons, which are taught to their peers, are videotaped in order to provide the students with additional feedback pertinent to their lesson presentation. Permission to diverge from this model was granted by the Department of Science Education for the purpose of this research. In the experiment, lessons were taught to focus upon specific teaching skills, utilizing microteaching as a training procedure. In addition, some microlessons were scheduled at a local secondary school where junior high school students participated as students in the microclass. All microlessons were videotaped with the researcher serving as the supervisor.

Teaching Skills

The experiment was designed to test the effect, during student teaching, of the acquisition of a teaching skill in the use of nonverbal cues during a preservice methods course. In the design of this experiment, the investigator considered two variables which could interfere with this effect; namely, the presence of videotape equipment in the classroom, and the influence of a University supervisor during student teaching. In addition, the problem concerning the transfer of

learning from a University methods course to a secondary science classroom was considered. To reduce the effect of these variables, the design of the experiment included the use of videotape equipment and the utilization of facilities and students at a local secondary school during the training period. In addition, the investigator was to serve as the supervisor of the microlesson sequences and student teaching experience. Thus, two additional microlesson sequences were scheduled: one to eliminate the "cosmetic effect" of viewing oneself upon videotape, and the second to provide University students with a realistic experience in acquiring a teaching skill to promote the transfer of learning to student teaching.

The two teaching skills, set induction and probing questioning, were chosen for the first two microlesson sequences. Essentially, set induction is based upon techniques to increase student motivation, and probing questions require students to justify or clarify their initial response.

Set induction was chosen because this skill was shown to be a teaching skill which contributed to greater achievement by secondary biology students who also perceived their teachers to be more highly effective (Schuck, 1970). Questioning, as a teaching skill, is considered to be an essential component in teaching the newer science curricula based upon inquiry techniques. In addition, both skills focused upon verbal cues during the training protocol, reducing the

possibility that nonverbal behaviors would be acquired during these microteaching sessions.

Selection of Students for the Microlessons

Early in the Fall term, 1970, Dr. Thomas Evans contacted the Superintendent of the Corvallis schools regarding the use of facilities and students within a local secondary school for the microteaching sequence. The superintendent referred the request to the Director of Curriculum in order that he secure permission from the principal in charge of the school included in the study. A request by the curriculum director to the principal of Highland View Junior High School to use the facilities at that school for this research was extended and permission granted. The investigator made an appointment to talk with the principal during which time schedules were ascertained, a room adequate for videotaping the microlessons was located and permission was obtained from the classroom teachers in charge of the study halls from which the students would be drawn.

From this initial meeting it was learned that study halls were in session the last two periods of the school day. This allowed for one group of students to participate as members of the initial lesson and a second group of students to participate as members of the reteach lesson. The periods were of sufficient duration to allow four microlessons to be presented during each class interval.

Selection of students to participate in the microlessons was on a volunteer basis. Ten students volunteered from the first study hall and 13 from the second group. All students who volunteered were given the opportunity to participate. Four students from each study room were selected for each day of videotaping. A schedule was planned, and a copy was given to the classroom teacher.

Training Procedure

During the first seminar meeting the concept of microteaching was explained by the researcher to the entire group of methods students by lecture and discussion techniques. In addition, the teaching skill, set induction, was introduced. Again, the skill was identified and clarified by lecture and discussion utilizing a hand-out sheet (Appendix D) describing the skill. Key ideas were emphasized and the students were told to look for the development of these points in the model lesson.

The model lesson shown was developed at the Stanford Microteaching Clinic and distributed by the Educational Learning Corporation. The entire set of model lessons demonstrating the teaching skills developed at Stanford University had been purchased by Eastern Oregon College. The model films demonstrating the skill of set induction, probing questions and the use of silence and nonverbal cues were borrowed from Eastern Oregon College for the purpose of this

research.

Following the presentation of the model film additional questions were answered. Students were then asked to prepare a lesson on a science topic of their choice in which they were to focus upon the skill of set induction, to be presented according to the prepared schedule.

Presentation of Microlessons

The first hour of the seminar was divided into four 15-minute segments. Each student was allotted five minutes for presentation of a microlesson, five minutes for the critique of the acquisition of the teaching skill, and five minutes for reviewing the videotape recording. During the critique the student was allowed to make a personal assessment of the microlesson as well as receiving feedback from microclass members and the supervisor. The critique focused only upon the behavior to be acquired. Suggestions for changes to be made in the reteach session were offered during this time. Because it was imperative to stay within the time period allotted for each student, rigid adherence to the schedule was maintained.

Members of the microclass for the first presentation of "teach" session consisted of the other students presenting lessons and one additional person. Usually, the fourth student was an observer. For the reteach cycle which occurred during the second hour of the seminar, four other students from the seminar were responsible for

participating as members of the microclass. Thus, each student was responsible for serving as a member of a microclass for seven class members in addition to presenting two lessons.

For this research, the purpose of acquiring the skill in set induction was twofold: instruction in the acquisition of a teaching skill to partially fulfill the goal of the seminar, and to acquaint the students with the operation of the videotape recording equipment in the microteaching format. The decision to develop the skill at the University using peers as microclass students was made in view of the desired goals and scheduling difficulties.

The whole class again met for instruction for attaining skill in probing questioning. An instructional handout sheet (Appendix E) informed the students of behaviors which a teacher would illustrate using this skill. These behaviors were clarified for the group by the researcher, and questions were answered prior to viewing the model film. During this class meeting specific instructions for the procedure to be followed at the junior high school were delineated. These instructions included a time and place to meet for transportation to the school, the procedure for reporting to the school office, the use of audio-visual aids and an overview of the school setting.

Microteaching at the Junior High School

The room allocated for the microlessons was used primarily by the guidance department for small group training classes one day a week. During the Fall term, the school administration arranged to have this class meet in another location which permitted the storage of the videotape equipment at the school for the duration of the training period. This equipment included a remote control camera, a stationary camera, the videotape recorder and console unit to monitor the image. A lavalier microphone which hung around the neck of the teacher was used for audio transmission.

The room was adequate in size to accommodate a portable chalk board and five persons in a microteaching situation. One camera was placed inside the room and one in the doorway. The console unit and videotape recorder were conveniently located in an alcove off the hallway and out of the way from the main stream of traffic. Two graduate students responsible for the instruction of two of the methods classes alternated as videotape recorder operators.

During the Winter term, additional demands upon the use of the videotape equipment and the use of the facilities at the junior high school necessitated the daily transfer of the equipment. A one-camera system was adopted which meant that videotape feedback was not available until return to the University. In addition, the researcher operated the videotape recording equipment.

Procedure

The class periods were 50 minutes in length. Each student teaching a microlesson was allowed approximately 12 minutes. Upon completion of a five-minute microlesson, evaluation sheets were distributed to the junior high school students. While the students were recording their comments, the researcher and the microlesson teacher critiqued the lesson, focusing upon the types of questions which were asked and techniques which could be used for improvement. The teacher was then free to read the comments and plan his reteach lesson.

The reteach lessons were taught to a different group of students in the period which immediately followed the teach sessions. The same procedure was followed, often with the microlesson teacher noting differential responses to the two lessons from the two groups of students.

Skill of Nonverbal Cues

The students designated to develop a third skill met with the researcher upon completion of the probing questioning sequence. The group was given a handout sheet explaining the skill of nonverbal cues (Appendix F). An informal discussion was held during which the researcher explained the use of nonverbal communication to increase

the amount and quality of student participation and teacher-student interaction. Specific behaviors were emphasized to achieve these goals including eye contact, smiling, body position, body movement and gestures. Additional techniques to increase student participation were explained including problem-solving, inquiry and the use of silence during a small group discussion. Students were encouraged to choose from among the alternative methods a technique which they felt was consonant with their personality to achieve the desired teacher behavior. The model tape was viewed as illustrative of one technique of increasing student participation through nonverbal cues.

Again, the students were assigned to be microlesson teachers at the junior high school following the same procedure as that of probing questions. The lessons were taught to one group of junior high school students, critiqued by the supervisor and retaught to a second group of students.

Assignment to Student Teaching

Eight students were assigned to student teaching during the Winter term who had completed the microteaching sequence. An additional 14 students completed their student teaching during the Spring term. One student teacher elected to student teach in Alaska and was subsequently eliminated from the study. Three students were assigned to the Portland school system: one during the Winter

term and two during the Spring term. During the Winter term, due to the distance involved, there was not adequate time to include that student in the study. However, during the Spring term with the co-operation of the University supervisor, the other two student teachers assigned in the Portland schools were included. The researcher served as the supervisor of student teaching for the other 18 student teachers included in the study. These students were assigned to a total of 13 schools in seven school districts. A summary of student teacher assignments during student teaching is presented in Table 1.

Table 1. Classification of student teachers according to student teaching assignment.

Location of Student Teaching Assignment	Junior High		Senior High		
	Gen. Sci.	Biology	Biology	Chem.	Physics
Albany	1				
Central Linn			1		
Corvallis	4	1	1		
Lebanon			1		1
Philomath	1		1	1	1
Portland			1	1	
Salem	1			2	1

Supervision of the Student Teaching Experience

A similar pattern of supervision was followed for each student teacher. The first visitation occurred within the first two weeks of the term. The purpose of this visit was to be introduced to the co-operating teacher and the school principal and to talk with the student

teacher concerning possible scheduling difficulties or assignments. Discussion pertinent to the supervisor's expectations focused upon lesson planning. The student teacher was told that during the second visitation the supervisor would expect to see a lesson in which the objectives were clearly delineated and thought had been given to utilize the best method for the achievement of these objectives. During this visit, student teachers were asked to designate the class which they preferred to be videotaped, and a date was set for the second visitation.

During the second visitation, the supervisor made notes concerning the seating arrangement within the room and coded the sex of each pupil for future reference. A supervisory conference was always held following the classroom presentation in order to discuss the achievement of the desired goal with the student teacher and cooperating teacher when feasible. Student teachers were asked to identify their objectives for the class presentation and to indicate the alternative methods which they had considered to achieve the objectives. If the supervisor was not satisfied with the teacher's performance, additional instruction in planning was given and another visitation scheduled with the same designated goal. Usually satisfactory performance was indicated, in which case the supervisor identified an aspect of the teaching act which needed improvement. Stimulus variation and reinforcement were the two most common skills identified.

This behavior was indicated to the student teacher and methods by which this behavior could be acquired was suggested. Those behaviors associated with increasing the use of nonverbal cues were not identified for the teacher until data indicating the number of positive nonverbal interactions had been collected.

The supervisory conference following the third observation focused upon the acquisition of the skill to be developed. Often during this conference, the student teacher would identify a particular skill or methodology for which he requested assistance, and the remainder of the conference would be devoted to this goal. During this visitation a date for videotaping would be scheduled, and a continuous record of student teacher interactions was obtained.

The record of student-teacher interaction was obtained by recording each individual observed interaction upon a data record sheet (Appendix G). A student raising his hand in order to ask a question or for recognition would be coded as a student-initiated nonverbal interaction. The result of the initiation would determine the affective code. If the student was chastized, ridiculed or embarrassed by the teacher for the question or remark, the interaction was coded as a student-initiated nonverbal, negative interaction for the particular student as coded on the seating plan.

In order for an interaction to be coded as positive, an analogous situation must occur; i.e., the resulting interaction must affectively

reinforce or reward the student. A teacher walking around the room, stopping to look at the work of student "C" and patting him on the shoulder or smiling at him would be coded as a teacher-initiated, non-verbal, positive interaction. Interactions which could not be interpreted as positive or negative were designated neutral. A list of representative behaviors coded in this study is found in Appendix I.

Classroom Videotaping

During the first visitation to the school, permission was obtained from the principal to videotape the student teacher. The cooperating teacher was informed of the intent to videotape the student teacher but was not informed of the exact nature of the research.

In order to prevent interruption of normal school functioning, the videotape equipment was assembled in the location and at a time when it least inconvenienced school officials. Most often this time occurred during the transfer of classes or before school.

The equipment consisted of one camera with tripod on wheels, a videotape recorder and a lavalier microphone. The camera was usually located in the back of the room behind the last row of students. In some large classrooms, the length of the lavalier cord was not sufficient to allow placement of the equipment in the back of the room. In these instances, the equipment was placed to one side. All of the classes were videotaped by the researcher and reviewed with the

student teacher at the University.

The student teacher was informed of the exact day and time of videotaping. The only instruction issued to the student teacher was to avoid including a test or film during the class presentation. Further, each teacher should proceed in the same manner to which he was accustomed. Most of the student teachers were aware that they had participated in a research study, but were not able to identify the exact nature of the research problem. A few student teachers seemed oblivious to the fact that they were participating in a research project.

Each student teacher was observed during at least two class periods following the videotaping session. The goals for the supervisory visit were individualized to focus upon an array of classroom behaviors including: use of audio-visual aids, pacing a lesson, stimulus variation, reinforcement, higher-order questioning, small group discussions, and others. The researcher was utilized by the student teachers primarily as a resource person during the final weeks of the student teaching experience.

Administration of Teacher Demonstration Rating Form

The Teacher Demonstration Rating Form (Appendix B) was prepared by Horace Aubertine and Dwight Allen during the development of the Microteaching Clinic at Stanford University. The instrument asks secondary students to rate the teacher on a five-point, forced-choice

scale in the areas of lesson objectives, content, method and evaluation. In developing the instrument, the assumption was made that one of the more reliable estimates of teacher effectiveness would be given by the pupils themselves. Subsequent research by Aubertine (1964) tested the reliability, the stability and predictive validity of the instrument. Aubertine reported that the TDRF had value as an indicator of performance during student teaching (Aubertine, 1964, p. 29).

In this study, the researcher relied upon a measure of teacher effectiveness as perceived by secondary students. The TDRF had been shown to reveal differences among student teachers who had been subjected to microteaching as perceived by students in each classroom.

The Teacher Demonstration Rating Form was administered to the secondary students within two weeks following the videotaping. The secondary students were told that student teachers from Oregon State University had participated in a special teacher preparation program. In order to evaluate the effectiveness of this program, the University needed to review evaluations from students of these teachers. In addition, the students were informed that the teachers would be allowed to review these evaluations, but would not be informed of the identity of the students. The researcher was familiar to the students as a representative of the University.

The evaluation forms were numbered to correspond to the coded classroom seating plan and distributed by the researcher to assure

the correct pattern of distribution. The six items were explained, and the students were given instructions to mark that response which best indicated their evaluations of the teacher. Upon completion, the students were instructed to turn their papers face down upon the desk, and they would be collected all at one time.

During the time the students were engaged in completing the forms, the researcher checked the seating plan for incorrect notations and absentees. Incongruities were checked with the student teacher and corrected.

Data Collection

For this study, the investigator utilized three sources of data: (1) a record of student teacher interaction as measured by the % All; (2) student perception of teacher effectiveness as measured by the Teacher Demonstration Rating Form; and (3) an analysis of the teacher behavior manifested in the videotaped class session using the Biology Teacher Behavior Inventory. Two of the sources of data, student-teacher interaction and teacher behavior, necessitated the establishment of inter-observer agreement prior to the collection of data.

During the Winter term, three cooperating teachers were asked to establish inter-observer agreement for the nature of student-teacher interaction in the classroom. The basis for selection of these three cooperating teachers was subjective. In the opinion of the

investigator, these three cooperating teachers would not have viewed this request as an imposition.

Each cooperating teacher was instructed in the coding procedure and given a list of examples of interactions which would be coded as student-initiated or teacher-initiated, verbal or nonverbal and whether they were positive, negative, or neutral. Preliminary coding by the researcher resulted in the modification of the % All to include the distinguishing of student-initiated or teacher-initiated interactions.

The researcher and cooperating teacher simultaneously observed one class period. Each observed interaction which occurred between the teacher and a student was recorded upon a Data Record Form (Appendix G). A measure of observer agreement was achieved by use of the Scott Index of Inter-coder Agreement (Scott, 1955). The Scott Index of Inter-coder Agreement corrects for the number of categories of the instrument and the frequency of usage of each category (1955, pp. 321-323).

The Scott coefficient (π) was determined as follows:

$$\pi = \frac{P_o - P_e}{1 - P_e}$$

P_o is the percentage of judgments on which the two observers agree and was obtained by subtracting the percentage of disagreements from 100 percent. For example, if two observers disagreed on five

tallies out of a total of 20, the percent of disagreement would be 25 percent. P_o would then be .75.

P_e is a correction factor and is the percent agreement to be expected on the basis of chance. P_e was computed by squaring the percent agreement between the observers for each category and then summing these squared proportions over all categories. The number of categories in the instrument is represented by k, and P_i is the proportion of all behaviors in the sample which fall in the i category.

$$P_e = \sum_{i=1}^{k} P_i^2$$

A value of .79 was computed for the % All between the researcher and the three cooperating teachers.

Inter-observer agreement for the analysis of teacher behaviors as coded in the Biology Teacher Behavior Inventory was achieved during the last week of March. Ten five-minute random samples of the seven student teachers videotaped during the Winter term were analyzed. The two observers viewed the tapes separately and coded the behaviors second by second on a Data Record (Appendix H). Each category and subcategory was treated separately, as was the form of expression. That is, control Category 2 was treated separately if it was verbal, nonverbal, congruent or contradictory.

One of the sample tapes included a two minute segment in which the teacher was not visible, and thus, this sample was discarded.

Initial agreement on two tapes was too low to establish reliability. Re-examination of the behaviors manifested led the researcher to recode one tape and having the other observer recode the second tape. A value of .81 was achieved between the researcher and the observer.

Encoding of Data from BTBI

Upon establishment of inter-observer agreement, the videotapes were subsequently encoded, second by second. The first time the videotape was played, a dot was placed in the appropriate verbal, congruent, nonverbal or contradictory column of the Data Record sheet indicating the form of expression of the teacher behavior. A metronome was set to beat with a rhythm of 60 beats per minute and was used as the basis for encoding the second by second marks. The Data Record sheet was divided into ten second intervals to facilitate the encoding procedure. Key phrases or words were frequently noted on the page to guide the researcher in subsequent analysis. In addition, a numeral corresponding to the tabulated counter on the recorder was placed at the end of each page.

The videotape would then be replayed as many times as necessary to record the symbol of the behavior next to the dot indicating the time at which the behavior was recorded. Using this method, only one decision at a time; i.e., the mode of communication or

example of the behavior, need be made. Coding time was significantly reduced from the original method of encoding a ten second interval at a time. The total time for encoding one videotape varied according to the researcher's familiarity with the instrument and the spectrum of behaviors elicited by the student teacher. One videotape required only two and one-half hours to encode; another required close to six hours.

The total number of seconds devoted by the teacher to each individual category of behavior was computed. The totals were recorded for each teacher upon a master data sheet for keypunching. The total amount of time in seconds was subsequently converted by the computer to the percent of time devoted by the teacher to that category. Means were computed for the two groups of teachers and subjected to a Mann-Whitney U test for differences between the two groups. This test was chosen because it is an alternative to the parametric t test when the assumptions underlying the t test cannot be made (Siegel, 1956, p. 116).

The total number of teacher-initiated, positive, nonverbal interactions was calculated for each of the two groups. A mean value of teacher effectiveness as measured by the Teacher Demonstration Rating Form was calculated for each teacher. A correlation between the number of teacher-initiated positive nonverbal interactions and the mean value of teacher effectiveness was calculated by the Spearman

Rank Correlation Coefficient. Between group differences testing the significance of the mean values for teacher effectiveness and teacher-initiated, positive, nonverbal interactions were obtained using the parametric t test.

Summary

In this chapter the procedure by which this study was undertaken was presented. The sample of student teachers completing the microteaching experience during the preservice methods course was described and the training procedures followed for skill acquisition through microteaching discussed. The pattern of supervision and collection of data during student teaching was described. A discussion concerning the calculation of inter-coder agreement prior to the encoding of data was presented.

IV. THE RESULTS

In this study, the hypotheses to be tested were as follows:

1. Teachers who have identified and practiced the skill of nonverbal cues during a methods class will devote significantly more time to nonverbal behaviors during their student teaching experience.
2. Teachers who have identified and practiced the skill of nonverbal cues during a methods class will devote significantly more time to congruent behaviors with students during their student teaching experience.
3. Teachers who have identified and practiced the skill of nonverbal cues during a methods course will demonstrate significantly more positive nonverbal interactions with their students during their student teaching experience.
4. Teachers who have identified and practiced the skill of nonverbal cues will be perceived as more effective teachers by their students.

To test the first and second hypotheses, each of the teachers in the control and experimental group were videotaped one class period during his student teaching experience. The recorded teacher verbal and nonverbal behaviors were categorized second by second using the BTBI. The total number of seconds devoted by the teacher

to each of the categories was computed. Subsequently, the total number of seconds was converted to percent of time allocated to each of the categories and subcategories in order to compare classes of unequal time periods.

Prior to the encoding of the recorded teacher behaviors, inter-observer agreement was established. From seven original videotaped class sessions, ten five-minute segments were re-recorded upon a separate videotape. Each observer independently coded nine of the segments upon a Data Record Form (Appendix G). A tenth segment was eliminated because the teacher was not visible for half of the five minute period. The Scott coefficient of inter-coder agreement (π) was calculated for each segment. The π values ranged from a low value of 0.67 to a high value of 0.87. The results are presented in Table 2.

Table 2. Observer agreement based on the Scott coefficient of inter-coder agreement.

1. 0.78	4. 0.87	7. 0.67
2. 0.72	5. 0.84	8. 0.87
3. 0.87	6. 0.78	9. 0.85

Use of the Instrument

In this study, the BTBI was used to encode teacher behaviors exhibited by science student teachers during a representative class session. The data were examined for information concerning transfer

of specific teaching skills practiced during the preservice methods course. In addition, the data were examined for similarities and differences which occurred between one group of student teachers subjected to the teaching skill of silence and the use of nonverbal cues and another similar group of student teachers designated as control teachers.

This instrument had previously been used only to encode experienced biology teacher behavior. In this study, student teachers in junior high school general science, and high school teachers in biology, chemistry and physics were videotaped. Based upon an overall Scott coefficient of inter-coder agreement ($\pi = .81$) and infrequent use of Category 7 (Undecided) in the encoding process, the investigator found this instrument appropriate to use in this study.

Differences Between the Two Groups of Teachers

The BTBI consists of seven categories of teacher behavior including: (1) Management, (2) Control, (3) Release, (4) Goal Setting, (5) Content Development, (6) Affectivity, and (7) Undecided. The percent of time devoted to each category by the experimental and control group is presented in Table 3.

Table 3. Percentage of time devoted to each category of the biology teacher behavior inventory.

	Category						
Teachers	1	2	3	4	5	6	7
Experimental	20.85	2.95	9.14	.84	62.91	3.09	.21
Control	20.50	1.84	9.62	1.07	64.43	2.33	.22

More than half of the class time was devoted to the development of content by both groups of science student teachers. Category 1, "Management" also consumed a large proportion of the teachers' time.

In Table 4, the percentage of time devoted to each subcategory and category by both groups of teachers is presented. The subcategories included: (1A) Routine Management, (1B) Laboratory Management, (1C) Study Management, (5A) Teacher-Centered Content Development, (5B) Student-Centered Content Development, (6A) Positive Affectivity, and (6B) Negative Affectivity.

Table 4. Percentage of time devoted to each category or subcategory of the biology teacher behavior inventory.

	Category or Subcategory									
Teachers	1A	1B	1C	2	3	4	5A	5B	6A	6B
Experimental	6.53	7.64	6.73	2.96	9.16	.84	49.60	13.45	2.83	.27
Control	6.11	6.84	7.57	1.84	9.64	1.07	63.84	.73	1.97	.37

The percent of time devoted to Category 1, "Management" is evenly distributed between the three subcategories with the experimental group devoting slightly more time to laboratory management,

and the control group spending more time in study management. A difference is exhibited between the two groups of student teachers also in Category 5, "Content Development". Some of the experimental student teachers devoted a substantial proportion of class time to student-centered classroom activities (5B) which accounted for the difference between the two groups.

Category 5, "Content Development", is further divided into seven subdivisions as follows: (1) Procedures, (2) Knowledge, (3) Scientific Process, (4) Tentativeness of Knowledge, (5) Generalizations, (6) Articulation of Content, (7) Facilitates Communication. Within the subdivisions of Content Development are five acts of communication which are identical within the seven subdivisions. The acts of communication are: (A) States, (B) Asks, (C) Shows, (D) Acknowledges, (E) Clarifies. Within Category 5, the encoder must decide first whether the classroom is teacher-centered or student-centered. A second decision regards the nature of the content being developed from among the seven subdivisions. In each case, the act of communication is encoded. An example would include as follows: a teacher who exhibits a behavior by asking a question about a scientific procedure would be encoded 5A1B or, clarification of a scientific process would be encoded as 5A3E, etc. The percentage of time devoted to each subdivision by the two groups of teachers in this study is presented in Table 5.

Table 5. Percentage of time devoted to each subdivision of Category 5, content development.

	Subdivisions						
Teachers	5-1	5-2	5-3	5-4	5-5	5-6	5-7
Exper.	23.01	35.69	27.77	.84	.59	4.76	7.34
Control	21.06	55.04	10.13	.38	.83	5.35	7.21

For each of the two groups of teachers, behaviors classified in the subdivisions pertaining to "Tentativeness of Knowledge" (5-4) and "Generalizations" (5-5) was very low when compared to "Procedures" (5-1), "Knowledge" (5-2) and "Scientific Process" (5-3). Differences between the two groups of teachers was evidenced in the subdivisions of "Knowledge" (5-2) and "Scientific Process" (5-3). Some teachers in the experimental group spent less time developing content at the "Knowledge" level and more time at the "Scientific Process" level which accounted for the differences between the two groups.

In Table 6 the percentage of "Content Development" behaviors comprised of the various communication acts by each of the two groups of teachers is presented.

Table 6. Percentage of time devoted to the various acts of communication in developing content.

	Communication Acts				
Teachers	States (A)	Asks (B)	Shows (C)	Acknowledges (D)	Clarifies (E)
Experimental	22.14	15.97	17.59	35.13	9.16
Control	39.33	11.52	19.06	19.71	10.38

Both groups of teachers in this study devoted similar percentages of time to "Asks", "Shows" and "Clarifies" as communication acts in developing content. The two groups differed in the communication acts "States" and "Acknowledges". "States " comprised a greater proportion of "Content Development" behaviors by teachers in the control group while "Acknowledges" was the dominant communication act exhibited by the experimental group of teachers.

All behaviors encoded for each teacher were encoded according to the various forms of expression including: "Verbal", "Congruent", "Nonverbal" and "Contradictory." Because the number of seconds devoted by the teachers in this study to contradictory behavior was negligible, these data were eliminated for statistical purposes. Table 7 shows the percentage of behaviors by teachers in this study in the various forms of expression.

Table 7. Percentage of behaviors by teachers in the various forms of expression.

	Forms of Expression		
Teachers	Verbal	Congruent	Nonverbal
Experimental	15.95	39.98	44.07
Control	20.59	45.14	34.27

From an inspection of Table 7, differences in behaviors between the two groups of teachers are observed concerning the various forms of expression. Both groups of teachers exhibited nonverbal behaviors

a substantial proportion of the class time, with the experimental group devoting the most time to nonverbal behaviors. The control group devoted more time than the experimental group to behaviors expressed in verbal and congruent expressions.

Hypotheses 1 and 2

By means of the Mann-Whitney U test, it was possible to test whether two independent groups have been drawn from the same population (Siegel, 1956, p. 116). It was possible to measure the probability of differences between the two groups of teachers on the basis of the congruent and nonverbal forms of expression.

The procedure was to convert the total number of seconds devoted to verbal and congruent behaviors to percentages for each teacher within the two groups. The teachers were ranked across both groups on the basis of these scores and the ranks used to compute the value of U.

The procedure for computing the value of U is as follows:

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1$$

or,

$$U = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2$$

where:

n_1 = size of one sample,

n_2 = size of the other sample,

R_1 = sum of the ranks assigned to the sample whose size is n_1,

R_2 = sum of the ranks assigned to the sample whose size is n_2.

The formulas presented above yield different values for U. The smaller value of the two is the one used with the significance ascertained by reference to an appropriate table of probabilities (Siegel, pp. 119-120).

In Table 8 the U values for the total percentage of congruent and nonverbal behaviors expressed by both groups of teachers are presented.

Table 8. U values for the congruent and nonverbal behaviors based upon experimental and control teachers.

Expression	U Value	Significance
Congruent	47	N.S.
Nonverbal	31	.10

The hypotheses, as stated, were concerned with the experimental group manifesting more time devoted to nonverbal and congruent expressions of behavior. The probabilities of differences were based upon directional tests of significance. Reference to an appropriate table of probabilities revealed that the U value as presented in

Table 8 was not significant for the percent of congruent behaviors expressed by the experimental group. The U value for the total percent of nonverbal behavior exhibited by the experimental group of student teachers was significant at the .10 level. Thus, Hypothesis 1 was accepted at the .10 level and Hypothesis 2 was rejected.

Hypotheses 3 and 4

In this study, the % All was used to encode teacher-student interactions which occurred between student teachers in science and individual students within their classes. The interactions were examined for information concerning the nature of the interactions which occur between the student teachers and their students and the relationship between these interactions and the effectiveness of the student teacher as perceived by these students.

Use of the Instrument

Originally, the % All encoded verbal and nonverbal interactions which occurred between the teacher and student as positive, negative, neutral in affectivity. In this study, the investigator expanded the % All to differentiate between interactions initiated by the teacher or the student, and whether these interactions were verbal or nonverbal in communication. Encoding student-teacher interactions in this manner was perceived to be more appropriate for this study.

Prior to classroom encoding, inter-observer agreement was established. Three cooperating teachers were asked to simultaneously encode classroom interactions during one class period. Interactions were coded upon a Master Record Form (Appendix H) as teacher-initiated, or student-initiated verbal or nonverbal interactions. Further, each interaction was coded positive, negative or neutral in affectivity. At the end of the class period, a continuous record of individual student-teacher interactions was obtained. The Scott coefficient of inter-coder agreement (π) was calculated for each class period, with an overall agreement of 0.79 achieved. The results of the three class sessions used for the establishment of inter-coder agreement are presented in Table 9.

Table 9. Observer agreement based on the Scott coefficient of inter-observer agreement for the % All.

1. 0.74	2. 0.79	3. 0.83

During this study there were three classes during which student-teacher interactions could not be encoded: a class devoted to a debate, a portion of a class during which the students engaged in small group discussions and one laboratory session. In each case, the lack of means to encode interactions resulted from the researcher's inability to identify the students when they were not located according to their identified seating arrangement. An observer familiar with the identity

of the students would not be encumbered with this disadvantage. Further, in most classrooms, individual interactions increased during activities encouraging student participation which emphasizes the importance of maintaining student identity under all learning situations.

Classroom Interaction Patterns

A summary of student-teacher interaction patterns is presented in Table 10. Inspection of this summary reveals a variety of patterns identifiable with different teachers in this study. Some teachers exhibited behaviors which evidenced a dominant number of student-initiated interactions. In these classrooms, some interactions were initiated by nonverbal cues as raising a hand, while in others a verbal student behavior initiated the interaction. Further differential patterns were evidenced in these classrooms. Some teachers as "I" and "L" reinforced student initiated verbal interactions while others as "B" and "C" treated these interactions with an absence of either positive or negative affectivity. Teachers "E" and "F" initiated interactions with their students through verbal behaviors. Although the number of positive verbal interactions were nearly identical for these two teachers, teacher "E" evidenced an equal number of interactions encoded as neutral in affectivity. Verbal-positive, verbal-neutral, and nonverbal-neutral interactions formed the dominant interaction patterns in the classrooms of the teachers in this study. A glossary of

Table 10. A summary of student-teacher interaction patterns.

	Positive Nonverbal		Positive Verbal		Negative Nonverbal		Negative Verbal		Neutral Nonverbal		Neutral Verbal	
Teacher	TI	SI	TI	SI	TI	SI	TI	SI	TI	SI	TI	SI
A	5	3	7	5	0	0	2	1	5	6	11	14
B	0	0	0	3	0	0	1	0	17	4	2	10
C	0	0	3	0	2	6	5	3	1	13	2	17
D	2	1	0	0	0	0	0	4	18	2	1	28
E	0	1	15	6	2	1	4	0	0	0	15	5
F	4	0	14	4	0	0	3	2	3	4	4	5
G	7	0	0	7	0	1	0	1	2	0	8	7
H	2	0	2	7	0	0	0	0	0	0	0	6
I	2	0	4	9	0	1	0	0	18	3	8	22
J	0	1	1	3	0	1	1	0	4	9	1	32
K	5	2	10	2	0	0	0	0	7	6	5	6
L	9	0	8	16	0	0	0	1	8	4	5	12
M	0	0	6	1	5	5	8	2	2	2	29	20
N	4	1	10	2	1	1	4	0	2	5	22	35
O	7	2	1	0	0	0	0	0	0	9	4	26
P	7	0	7	0	1	0	2	0	2	3	25	15
Q	6	0	15	8	2	0	5	0	5	0	7	31
R	2	0	0	1	2	0	2	2	0	2	2	17
S	2	0	0	1	2	1	0	0	16	4	3	51
T	7	0	6	1	0		1	1	4	16	27	7

representative coded interactions is presented in Appendix I.

In Table 11 a summary of the percent of students with whom the teacher interacted (% All) is presented. The coefficients represent the number of students with whom the teacher interacted divided by the total number of students in the class.

Table 11. Percent of students interacting with teacher (% All).

Teacher*	% All
A	.75
B	.85
C	.80
D	.80
E	.65
F	.58
G	.60
H	.38
I	.56
J	.52
K	.47
L	.77
M	.72
N	.87
O	.81
P	.95
Q	.60
R	.47
S	.72
T	1.00

*Teachers A-J represent the control group and K-T represent the experimental group.

Teacher "H" interacted with the smallest percentage of students in the class. Thirty-eight percent of the class interacted with this teacher. Teacher "T" made an effort to interact with all students in

that classroom. As a result, a high value of 100 percent was typical behavior for this teacher. In this study, teachers "A" through "J" included control group teachers while the remainder represented the experimental group.

To test Hypothesis 3, the average number of teacher-initiated, positive, nonverbal interactions was calculated for each group of eachers. The means were subjected to a t test of significance. The results of this test are presented in Table 12.

Table 12. A comparison of group means for teacher-initiated positive nonverbal interactions.

Group	Number	Variance	Mean Score	t
Control	10	9.07	2.2	
Experimental	10	5.75	4.9	2.25[a]

[a]Significant beyond the .05 level.

The calculated t was significant at the .05 level of probability. Thus, Hypothesis 3 was accepted. Teachers in the experimental group exhibited significantly more positive nonverbal interactions with students in their classrooms.

Hypothesis 4 states that teachers in the experimental group will be perceived as more effective teachers by their students as measured by the Teacher Demonstration Rating Form. The TDRF consisted of a five-point, forced choice rating scale on six items. The students were to evaluate the teachers presentation of lesson

objectives, organization of content, classroom method and personal achievement. Each item was assigned a value from minus 2 to plus 2 and summed for a total score for each student. An average value was obtained by summing the scores for the entire class and dividing the calculated sum by the number of students in the class. A comparison between the experimental and control group of teachers for teaching effectiveness is presented in Table 13.

Table 13. A comparison between the experimental and control group of teachers for teaching effectiveness as measured by the Teacher Demonstration Rating Form (TDRF).

Teacher Effectiveness			
Teacher*	Score	Teacher	Score
A	9.08	K	5.10
B	8.49	L	8.78
C	1.46	M	1.88
D	5.00	N	4.27
E	8.06	O	9.90
F	2.52	P	9.47
G	7.19	Q	6.45
H	5.87	R	7.11
I	6.36	S	7.35
J	4.15	T	8.50

* Teachers A-J include teachers in the control group and teachers K-T represent the experimental group.

The lowest score for teacher effectiveness was achieved by teacher "C", while teacher "O" indicated the highest score by the students in that classroom. A mean value for teacher effectiveness was calculated for each group of teachers and subjected to a t test of significance for differences between two groups. The results of this test are presented in Table 14.

Table 14. A comparison of group means for teacher effectiveness between the two groups of teachers.

Group	Number	Variance	Mean Score	t
Control	10	6.46	5.82	
Experimental	10	6.37	6.93	1.0 (N.S.)

N.S. - not significant

Because the calculated t was not significant at the .05 level, the fourth hypothesis was rejected. In this study, the teachers in the experimental group were not perceived as more effective teachers by their students.

In Table 15 a correlation between the student perception of teacher effectiveness and the number of teacher-initiated positive nonverbal interactions as measured by the Spearman Rank Correlation Coefficient is presented.

The results of findings presented in Table 15 indicate that a positive relationship exists between the number of teacher-initiated, positive nonverbal interactions and teacher effectiveness as perceived by students of teachers in this study. The correlation between the number of positive nonverbal interactions initiated by the teacher is significantly related to the rating on teacher effectiveness as perceived by students in their classrooms.

Table 15. Correlation between student perception of teacher effectiveness and number of teacher-initiated nonverbal positive interactions as measured by the Spearman Rank Correlation Coefficient.

Teacher	Rank for Teacher Effectiveness	Rank for Teacher-Initiated Nonverbal Positive Interactions R_2
A	3	6.5
B	5	13.5
C	20	16.0
D	15	10.0
E	16	18.5
F	18	10.0
G	9	3.0
H	13	13.5
I	12	13.5
J	17	18.5
K	14	6.5
L	7	11.0
M	19	18.5
N	16	10.0
O	1	3.0
P	2	3.0
Q	11	16.5
R	10	13.5
S	8	13.5
T	4	6.5

$N = 20$
$d^2 = 776.00$
$r_s = .42$
$t = 1.77^a$

[a]Significant at the .05 level

In addition to the statistical tests of significance calculated for testing the hypotheses of the study, differences between the two groups of student teachers in classroom behaviors as measured by the BTBI were analyzed. For each group, a mean value for percentage of time

devoted to each category, subcategory and subdivision of the BTBI was calculated. Using the Mann-Whitney U test, differences between the two groups were tested. In the Mann-Whitney U test, a rank is computed for each teacher based upon the percentage of time devoted to each behavior. Differences in ranks across the two groups were calculated in order to obtain a value for U which was compared to a table of probabilities. All teachers in this study did not exhibit all behaviors, and many teachers manifested the same percentage of time to other behaviors; hence, the computation of significant U values was hampered by the fact that "tied data" interfered with the assignment of meaningful ranks to the teacher.

The Mann-Whitney U test revealed that significant differences between the two groups existed within four categories of behavior. These categories were: (1) "States Knowledge" - Verbal (5A2A); (2) "States Knowledge" - Congruent (5A2A); (3) "Shows Knowledge" - Congruent (5A2C); and "Positive Affectivity" - Nonverbal (6A). Inspection of the data revealed that the control group devoted significantly more time to the first three categories and the experimental group of teachers spent more time in the category of nonverbal positive affectivity. The percentage of time devoted by each teacher to each of these categories is presented in Table 16.

Table 16. The percentage of time devoted by each teacher to categories designating between group differences.

Teacher	Category			
	5A2A-V	5A2A-Ct	5A2C-Ct	6A-NV
A	1.09	8.50	12.48	1.34
B	9.87	9.42	4.44	.76
C	2.20	3.84	3.71	.09
D	11.56	24.51	13.11	.00
E	1.44	3.23	2.03	.40
F	2.17	2.69	.26	.21
G	3.52	12.55	6.02	1.44
H	13.53	6.41	4.68	.42
I	9.98	14.45	13.48	.23
J	7.03	4.72	2.74	.00
K	1.23	3.34	.13	1.15
L	2.80	1.84	1.54	1.63
M	1.44	2.95	2.05	.72
N	2.72	.41	.09	.36
O	.00	0	.00	2.74
P	4.37	4.94	.00	3.42
Q	00	.15	.00	.53
R	2.09	2.56	5.91	.14
S	7.71	17.48	15.37	.00
T	5.86	9.16	.67	1.21

Each teacher was ranked according to the percentage of time which was spent in the categories 5A2A - Verbal; 5A2A - Congruent; 5A2C - Congruent; and 6A - Nonverbal. The differences in ranks between the two groups of teachers revealed that calculated U values for these categories were significant. In Table 17 the U values and significance level for each U value is presented.

Table 17. U values for categories designating differences between two groups of student teachers.

Category	U Value	Significance Level
5A2A - Verbal	28.5	.10
5A2A - Congruent	20.0	.025
5A2C - Congruent	20.0	.025
6A - Nonverbal	31.0	.10

Inspection of the data revealed that the control group devoted more time to: (1) "States Knowledge" - Verbal (5A2A); (2) "States Knowledge" - Congruent (5A2A); and (3) "Shows Knowledge" - Congruent (5A2C). The experimental group devoted more time to "Positive Affectivity" - Nonverbal (6A) which accounted for the significant difference between the two groups of teachers.

Findings not Related to the Hypotheses

Teacher nonverbal behavior comprised a significant portion of the classroom behavior of teachers in this study. A mean value of 44% of class time was devoted by the experimental teachers to nonverbal behaviors, while the control group spent 34% of their time in nonverbal activities. These figures support findings of Evans (1968) and Balzer (1968) who reported an average value of 38% of class time devoted to nonverbal behaviors exhibited by biology teachers in their study, and

questions the argument that verbal behaviors provide an adequate sample of teacher classroom behavior.

In Table 18 a summary of the results reported by Evans (1968) and Balzer (1968) concerning the percentage of behaviors by teachers in the various forms of expression and the results in this study is presented.

Table 18. A comparison of the percentage of time devoted to behaviors by two samples of teachers in the various forms of expression.

Teachers	Forms of Expression			
	Verbal	Congruent	Nonverbal	Contradictory
Biology teachers (Evans & Balzer, 1968)	34.76	26.18	38.94	00.10
Student teachers in science	18.27	45.56	39.17	--

Student teachers in this study devoted more time to congruent behaviors than reported for biology teachers studied by Evans and Balzer (1968). In both studies, behaviors expressed as nonverbal communicative acts comprised a large proportion of the total classroom behaviors expressed by teachers in science.

Further comparison between the two samples of teachers reveals that student teachers in this study and biology teachers in the studies of Evans and Balzer (1968) devoted a majority of their time to "Classroom Management", Category 1 and "Content Development",

Category 5. In Table 19, a comparison between the two samples of teachers is presented.

Table 19. A comparison between two samples of teachers in the major categories of the BTBI.

Teachers	Category 1	2	3	4	5	6
Biology Teachers (Evans & Balzer, 1968)	44.31	1.95	1.95	.81	49.83	1.37
Student teachers in science	20.68	2.39	9.32	.95	63.66	2.69

Student teachers in this study appear to spend less time devoted to "Classroom Management", Category 1 than the biology teachers in the studies of Evans and Balzer (1968). However, results in this study indicate that they devote a higher percentage of time to "Release", Category 3 and "Content Development", Category 5. Percentages of time devoted to "Control", Category 2, "Goal Setting", Category 4 and "Affectivity", Category 6 are evenly distributed between the two groups' and occupy less of the total percentage of behaviors exhibited by both groups of teachers.

Within each subdivision of Category 5, "Content Development", wide variations between groups of teachers are evident. Upon inspection of Table 20 which presents the percentage of content development behaviors for a group of BSCS teachers and non-BSCS teachers studied

by Balzer (1968) and the two groups of student teachers in science, differences become evident in the subdivisions "Knowledge" (5-2), "Scientific Process" (5-3) and "Facilitates Communication" (5-7).

Table 20. Percentage of content development behaviors in each subdivision of content development by two samples of teachers.

	Subdivisions						
Teachers	5-1	5-2	5-3	5-4	5-5	5-6	5-7
Non-BSCS	22.97	39.57	7.22	0.20	1.23	9.00	19.78
BSCS	17.76	26.94	17.21	0.93	1.26	4.17	31.70
Experimental	23.01	35.69	27.77	0.84	0.59	4.76	7.34
Control	21.06	55.04	10.13	0.38	0.83	5.35	7.21

Three categories within the subdivision of Category 5, "Content Development," were found to be statistically significant when the two groups of teachers in this study were compared. The three categories were within the subdivision "Knowledge" (5-2). In this study, the control teachers devoted more time to the behaviors manifesting the expressive acts of "Stating Knowledge", Category 5A2A in both the verbal and congruent communicative acts, and "Showing Knowledge", Category 5A2C in the congruent communicative act.

The experimental group of teachers in this study and the BSCS teachers in the study of Balzer (1968) devoted more time to "Scientific Process" (5-3) than the other two groups of teachers in the studies. Balzer (1968) reported a U value approaching a significant difference

at the .05 level between the two groups of biology teachers in his study for that category. In this study, most, but not all, of the teachers in the experimental group exhibited behaviors in the category "Scientific Process". Rather, some of the teachers exhibited a high percentage of behaviors in that category in their classrooms which accounts for the mean differences between the two groups of teachers in this study. Within the classrooms of these teachers behaviors were manifested in a variety of methodologies employing scientific process including: small group discussions focusing upon hypothesis formation; debates; and, short laboratory sessions incorporated into a regularly scheduled class period.

Findings Related to Microteaching

The literature revealed some discrepancy concerning the effectiveness of microteaching in the preparation of teaching, especially with respect to the transfer of teaching skills to actual classroom practice. Data in this study provide evidence that teaching skills attained during the microteaching sessions were inculcated within a repertoire of behaviors exhibited by secondary science student teachers.

Skill acquisition within the group of preservice teachers was not consistent for all teaching skills. Some preservice teachers found the microlesson sequences difficult, but showed evidence that

the skill had been acquired during student teaching. Other preservice teachers exhibited model behaviors in developing a teaching skill during the microlesson sequence, but showed the least transfer from the methods course experience to student teaching. This pattern varied for the teacher under study, as would be expected.

Most student teachers in this study expressed the opinion that the microteaching experience was of considerable value to them. They suggested that opportunities to develop additional teaching skills be extended to subsequent preservice teachers.

In this study, the researcher was not able to predict the level of performance for each student teacher during a second microlesson sequence, nor the level of success during student teaching as perceived by the students in their classes.

Summary

Hypotheses 1 and 2 stated that teachers in the experimental group would devote more time to nonverbal and congruent behaviors than the control group. U values obtained utilizing the Mann-Whitney test indicated that the experimental group exhibited more nonverbal behaviors than the control group at the .10 significance level. The U value for the percentage of congruent behaviors manifested by the experimental group did not approach significance. Thus, the differences between the two groups of student teachers were attributed to chance, and the

second hypothesis was rejected.

The mean value for each group of teachers indicative of the number of teacher-initiated, positive nonverbal interactions was subjected to a t test of significance. The hypothesis that the experimental group of teachers would devote more time to this behavior was accepted.

Hypothesis 4 was rejected on the basis that the mean value for teacher effectiveness of the experimental group was not significantly different from that of the control group. However, the correlation between teacher rank on effectiveness and rank on the number of teacher-initiated, positive nonverbal interactions was found to be significant at the .05 level.

U values for each of the categories, subcategories and subdivisions of the BTBI to measure between group differences revealed four values of significance. The student teachers in the control group devoted significantly more time to the categories "States Knowledge" - verbal, "States Knowledge" - congruent and "Shows Knowledge" - congruent. The experimental group of student teachers spent more time in "Positive Affectivity" - nonverbal, than the control teachers.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter comprises three major sections. The first incorporates a summary of the design and conclusions concerning the hypotheses in this study. The second section is devoted to conclusions not related to the hypotheses, and the third section deals with recommendations for further study.

Summary

Preservice science teachers enrolled in a science methods course were randomly assigned to an experimental and control group. The experimental group developed the teaching skill in the use of nonverbal cues, including silence. The classroom behaviors of these teachers during student teaching were analyzed using the BTBI in order to measure differences in behavior between two groups of student teachers. Additional data were collected concerning the number and nature of teacher-student interactions and a measure of teacher effectiveness as perceived by the secondary school students. The study was designed to determine the effectiveness of the preservice methods course in preparing science teachers with a specific teaching skill, and the application of this skill during student teaching. Skill acquisition was achieved by videotaping microlessons at a local secondary school utilizing junior high school students as members of the microlessons.

Both groups of teachers developed the skill of set induction at the University where peers served as members of the microclass. During the development of this skill, the preservice science teachers had an opportunity to become accustomed to the operation of the videotape recording equipment.

The skill of probing questioning was practiced at a local secondary school where junior high school students participated as microclass students. Both groups of teachers participated in this microlesson sequence which provided a more realistic teaching experience to promote skill acquisition. All of the microlessons were videotaped with the investigator serving as the supervisor.

The training protocol for each of the three teaching skills was identical. Teachers were assembled at the University for a discussion of the skill to be developed. A handout sheet explaining the skill was distributed, and a model film demonstrating the skill was shown to the group of teachers. Practice in developing the skill included: (1) teaching a five minute microlesson to one group of students, (2) critiqueing the microlesson with the supervisor, and (3) re-teaching the lesson to a second group of students.

The sample of student teachers in this study included 20 preservice science teachers who had completed student teaching following the microteaching experience during the academic year 1970-1971. These student teachers were assigned to general science, biology,

chemistry, and physics classrooms during student teaching in 13 secondary schools, located in seven school districts in Oregon. Each student teacher was videotaped by the investigator during one class period of his choice. Individual student-teacher interactions were encoded during two class sessions and averaged for a measure of classroom interaction patterns. Each student in the videotaped class was asked to complete a Teacher Demonstration Rating Form for a measure of teaching effectiveness as perceived by the secondary students.

The reliability of the coding systems was checked by calculating Scott's index of inter-coder agreement. Nine five-minute segments were randomly selected from seven videotaped lessons and independently coded using the BTBI by the investigator and a second observer using the same instrument for another study. The overall Scott index of inter-coder agreement was calculated to be .81. Interactions in three classrooms were simultaneously encoded by the investigator and each cooperating teacher to whom the student teacher was assigned. An overall index of .79 was calculated for encoding teacher-student interactions by the three cooperating teachers and the investigator.

Encoding the classroom behavior of student teachers was accomplished by writing down symbols representing the appropriate category, subcategory, and subdivision in the appropriate columns of the Data Record sheet based on whether the behaviors were verbal,

congruent, nonverbal or contradictory. As long as a given behavior continued, pencil dots indicating one-second time intervals were continued under the appropriate symbol. The total number of seconds devoted to each behavior in the various forms of expression were totaled and entered upon a Master Data Record for keypunching. The total number of seconds devoted to each category, subcategory and subdivision were subsequently converted to percentage of time in order to compare classes of different time periods.

For each group, a mean value for percentage of time devoted to each category, subcategory and subdivision of the BTBI was calculated. The Mann-Whitney U test was employed to test for between group differences for each category, subcategory and subdivision of the BTBI in addition to the total percent of time devoted to congruent and nonverbal behaviors.

Teacher-student interactions were identified as teacher-initiated or student-initiated, verbal or nonverbal communicative acts. The resulting interaction was encoded as positive, negative or neutral in affectivity. Each student was assigned a number according to a seating chart in that classroom in order to facilitate identification of the student involved in the interaction. Those interactions involving any one student were coded beside the student number on the Data Record. The total number of students with whom the teacher interacted was divided by the number of students in that classroom in order to obtain

a measure of the percent of students with whom the teacher interacted. In addition, the total number of teacher-initiated, positive nonverbal interactions was calculated for each teacher and a mean value obtained for each group.

A measure of teacher effectiveness was obtained for each teacher by asking each student in the videotaped class to complete the Teacher Demonstration Rating Form. A five-point, forced-choice scale indicating the student's evaluation of the teaching ability of the student teacher was utilized. Each of the six items was rated from a negative two to a positive two and summed for an individual score. A mean value was obtained for each teacher from the class which was videotaped and used as a measure of teaching effectiveness.

The mean value for teacher-initiated, positive non-verbal interactions, and teacher effectiveness was calculated for each group of teachers and tested for significance using the Student's t-test. In addition, a Spearman Rank Correlation was computed for the relationship between teacher-initiated, positive nonverbal interactions and the measure of teacher effectiveness.

Conclusions

It is concluded on the basis of the analyses carried out that the experimental group of student teachers differed significantly in their classroom behavior from the control group. The teachers in that

group devoted more time to nonverbal behavior, including the number of teacher-initiated, positive nonverbal interactions with students in their classrooms, and the total amount of time spent in nonverbal positive affectivity. On the basis of this difference, it is concluded that the treatment during the preservice methods course accounts for the difference in classroom behaviors between the two groups. Thus, it may be concluded that for the teachers in this study, the behavior of initiating interactions with students through nonverbal communication which may be inferred to be positive in affectivity may be acquired during a preservice methods course and inculcated within a repertoire of behaviors during student teaching.

It is concluded that the number of positive, nonverbal teacher-initiated interactions correlates significantly with the student's perception of teacher effectiveness for student teachers in this study. That is, a comparison between the ranks for the two groups of student teachers on the number of teacher-initiated, positive nonverbal interactions, and teacher effectiveness as perceived by students in their classrooms revealed that a positive relationship existed between the two measures. It may be concluded on the basis of these data that a causal relationship exists between the number of positive, nonverbal interactions which a student teacher initiates and the measure of teacher effectiveness. Thus, a student teacher who initiates positive, nonverbal interactions with students in the classroom may be perceived

as a more effective teacher as measured by the Teacher Demonstration Rating Form.

Statistical analysis of the difference between the two groups of teachers failed to support the hypothesis that the experimental group of teachers would be perceived as more effective teachers. Thus, it is concluded that the experimental group of student teachers in this study did not differ significantly from the control group of teachers, and that differences between the two groups may be accounted for by chance. Analysis of the differences between the two groups of teachers in the study revealed that one teacher in the control group was rated very high by students in the classroom (Teacher "A"), and one teacher in the experimental group was rated very low by students in that classroom (Teacher "M"). As a result, between group differences did not exceed those obtained by chance.

The hypothesis that the experimental teachers would exhibit significantly more congruent behaviors than the control teachers was rejected. As a result, it is concluded that obtaining a skill in nonverbal cues did not cause an increase in the congruent behaviors manifested by the student teachers in this study. Each teacher in the study manifested congruent behaviors. It is concluded that congruent behaviors occupy a large proportion of the classroom behaviors of teachers which accounts for a lack of difference between the two groups. Such nonverbal cues emphasize and reinforce teacher verbal behavior.

Thus, it may be further concluded that nonverbal cues associated with verbal teacher behaviors are an important source of communication within a science classroom.

Conclusions not Related to the Hypotheses

Teacher nonverbal behavior comprised a significant proportion of classroom behaviors of teachers in this study. These data supported findings of Evans and Balzer (1968) who reported similar findings. On the basis of these data, it may be concluded that the study of teacher nonverbal behavior is an essential component of teacher behavior and should be incorporated into future studies of teacher classroom behavior. Further, instruments used for the analysis of science teacher verbal behavior as an adequate sample of classroom science teacher behaviors are based upon false assumptions. Studies employing such instruments should be considered inadequate.

Analysis of differences between the two groups of science student teachers in this study revealed that the control teachers devoted more time to Category 5A2A, "Stating Knowledge", in both the verbal and congruent communicative acts and Category 5A2C, "Showing Knowledge", in the congruent communicative act. On the basis of these data, it may be concluded that the student teachers in the control group in this study devoted significantly more time to this behavior than the experimental group. Because this difference may not be

accounted for by chance, it is concluded that the treatment during the preservice methods course encouraged the teachers in the experimental group to use behaviors other than "Stating Knowledge" or "Showing Knowledge".

The categories "Showing Knowledge" and "Stating Knowledge" incorporates those behaviors of the teacher which pertain to giving information at low cognitive levels and includes the presentation of scientific content as facts, definitions and terminology. As a result, it may be inferred that the student teachers in the control group exhibited classroom behaviors which were not consonant with the goals of an inquiry or discovery classroom in science.

The experimental group of teachers in this study and the BSCS teachers in the study of Balzer (1968) devoted more time to "Scientific Process", Category 3, than the other two groups of teachers in the studies. It may be concluded that the treatment during the preservice methods course encouraged some of the teachers to incorporate methods of teaching employing scientific process. Those behaviors were consonant with the objectives of the classroom devoted to the teaching of science. Thus, for some student teachers in science, the methods course offers opportunities for the acquisition of teaching skills in scientific processes, and the inculcation of those behaviors into a repertoire of behaviors manifested during student teaching.

Recommendations for Further Study

1. Individual teacher behaviors are discernible with the BTBI. To assess the effectiveness of specific skill acquisition, a pre-test, post-test design would identify changes in teacher behavior which resulted from the treatment. Statistically, changes in behaviors would be more readily identified, and thus, more likely to yield meaningful information concerning the modification of teacher behavior.
2. In this study, the BTBI was shown to be a reliable instrument in assessing the classroom behavior of student teachers in science. To what extent the cooperating teacher influences the pattern of teaching behavior is not known. In the future, a comparison of the teaching behavior manifested by the cooperating teacher and student teacher as measured by the BTBI would yield information concerning this influence.
3. In the opinion of the writer, many student teachers in this study were capable of identifying teaching skills which they assessed to be indicative of their strengths and/or weaknesses. At this point during the student teaching experience of these teachers, behaviors were most amenable. In the future, more attention should be given to personal selection and acquisition of teaching skills during the student teaching experience of these teachers,

and identification of variables responsible for this characteristic.

4. Different teaching strategies are needed to reach the variety of goals in the science curriculum. Preservice science methods courses should incorporate opportunities for acquisition of specific teaching skills consonant with the philosophy upon which the goals of the science curriculum are founded.

5. Modeling has been shown to be an effective technique in developing teaching skills (Orme, 1966). The isolation of teaching skills unique to the science classroom and the development of model films illustrating these skills would be useful in the preservice as well as the inservice education of the science teacher.

6. Probably one of the most important criterion of teacher effectiveness is the evaluation of the teacher by the students within that classroom. In the opinion of the writer, research in the area of classroom behavior of teachers should include student feedback. Additional attention should be given to the development of instruments to measure student perception of teacher effectiveness.

7. The percent of contradictory behaviors encoded in this study was very small, and non-existent in most of the teachers in this study. However, in those few classrooms accounting for

the presence of contradictory behaviors, pupils perceived the teacher's effectiveness as very low. A study of contradictory behavior may yield information concerning teacher variables which account for low ratings by students.

8. Many teacher-student interaction patterns were encoded in this study. Dalton (1970) indicated that the nature of these interactions in one fourth grade classroom related to the teacher perception of the student. In that classroom, the teacher initiated verbal interactions with students she had identified as "low" students. A similar pattern existed in some classrooms in this study; however, the opposite pattern was also evidenced. Why teachers initiate interactions with some students is not known. In addition, while interactions in this study were encoded as positive, negative or neutral by the observer, the perception of the student is not known. Data concerning the nature of teacher-student interactions would yield information of value to teacher educators.

9. In this study, a posttest only design was utilized. Because of this design, it was not possible to detect differences between the two groups of teachers prior to treatment. A similar study implementing a pretest-posttest design with the treatment occurring during student teaching would measure a change in behavior.

BIBLIOGRAPHY

1. Allen, Dwight and Richard Clark. Microteaching: it's rationale. The High School Journal 51:75-79. 1967.

2. Allen, Dwight, F. McDonald and M. Orme. The effects of feedback and practice conditions on the acquisition of a teaching skill. Paper presented at AERA meeting, Chicago, Illinois, 1966, 12 numb. leaves.

3. Allen, Dwight, Kevin Ryan, Robert Bush and James Cooper. Teaching skills for elementary and secondary school teachers. Manhattan, New York. General Learning Corporation, 1969, p. 1-62.

4. Allen, Dwight and Kevin Ryan. Microteaching. Reading, Massachusetts, Addison-Wesley, 1969. 151 p.

5. Amidon, Edmund. Interaction analysis and microteaching skill development in teaching. Paper presented at the annual meeting of the American Psychological Association, Washington, D. C., 1969. 26 p. (Microfiche)

6. Ashlock, Robert. Microteaching in an elementary science methods course. School Science and Mathematics 68:52-56. 1968.

7. Aubertine, Horace. An experiment in the set induction process and its applications to teaching. Ph. D. thesis, Stanford, Stanford University, 1964. 148 numb. leaves.

8. Balzer, A. LeVon. An exploratory investigation of verbal and nonverbal behaviors of BSCS teachers and non-BSCS teachers. Ph. D. thesis, Columbus, The Ohio State University, 1968. 233 numb. leaves.

9. Bandura, Albert, D. Ross, and S. Ross. Imitation of film mediated aggressive models. Journal of Abnormal and Social Psychology 66:3-11. 1963.

10. Bandura, Albert and R. Walters. Social learning and personality development. Chicago, Holt. 1963. 329 p.

11. Berliner, David. Microteaching and the technical skills approach to teacher training. Washington, D.C., 1969. 62 p. (U.S. Office of Education, Bureau of Research) (Microfiche)

12. Brashear, Robert and O. L. Davis, Jr. The persistence of teaching laboratory effects into student teaching: a comparative study of teaching behaviors and attitudes. Paper presented at Annual meeting, AERA, Minneapolis, March 1970. 13 p. (Microfiche)

13. Chavers, Katherine, Adrian Van Mondfrans, and John Feldhusen. Analysis of the interaction of student characteristics with method in microteaching. Paper presented at Annual meeting, AERA, Minneapolis, March, 1970. 18 p. (Microfiche)

14. Cooper, James. Developing specific teaching skills through microteaching. The High School Journal 51:80-86. 1967.

15. Cooper, James and Dwight Allen. Microteaching: history and present status. Microteaching Workshop, School of Education, University of Massachusetts, Summer, 1970. 53 numb. leaves.

16. Dalton, William. The relations between classroom interactions and teacher ratings of pupils: an exploration of one means by which a teacher may communicate her expectancies. Peabody Papers in Human Development. Nashville, Tennessee, 1969. 14 p. (Microfiche)

17. Drumheller, S. and J. Paris. An effective approach for incorporating teaching experiences in methods courses. The Journal of Teacher Education 17:290-295. 1966.

18. Evans, Thomas P. An exploratory study of the verbal and nonverbal behaviors of biology teachers and their relationship to selected personality traits. Ph. D. thesis, Columbus, The Ohio State University, 1968. 276 numb. leaves.

19. Fast, Julius. Body language. New York, M. Evans. 1970. 192 p.

20. Galloway, Charles. Teacher nonverbal communication. Educational Leadership 24:55-63. 1970.

21. _____. Non-verbal communication. Theory into Practice. 7:172-175. 1968.

22. Galloway, Charles. Teaching is communicating: nonverbal language in the classroom. The Association for Student Teaching, National Education Association, Washington, D. C. 1970. 24 p.

23. Gage, Nathan. An analytical approach to research on instructional methods. Phi Delta Kappa 49:601-606. 1968.

24. _____. Paradigms for research on teaching. In: Handbook of research on teaching, ed. by Nathan Gage. Chicago, Rand McNally, 1963. pp. 94-141.

25. Gardner, Marjorie and Rolland Bartholomew. Microteaching: a medium for modifying teacher behavior. The Science Teacher 36:45-47. 1969.

26. Goldwaite, Daniel T. A study of micro-teaching in the preservice education of science teachers. Ph. D. thesis, Columbus, The Ohio State University, 1968. 142 numb. leaves. (Abstracted in ERIC no. 027 184. 1969)

27. Hurd, Paul DeH. New directions in teaching secondary school science. New Trends in Curriculum and Instruction, John Michaelis, Series Editor. Chicago, Rand McNally, 1969. 239 p.

28. Johnson, William D. Microteaching: a medium in which to study teaching. The High School Journal 51:86-92. 1967.

29. Karasar, Niyazi. Impact of video feedback on teacher's eye-contact mannerisms in microteaching. Ph. D. thesis, Columbus, The Ohio State University, 1970. 94 numb. leaves. (Abstracted in ERIC no. 038 528. 1970)

30. Koran, John, Jr. The relative effects of classroom instruction and subsequent observational learning on the acquisition of questioning behavior by preservice elementary science teachers. Journal of Research in Science Teaching 6:217-223. 1969a.

31. _____. A design for pre-service science teacher education. Science Education 53:47-52. 1969b.

32. _____. Two paradigms for the training of science teachers using videotape technology and simulated conditions. Journal of Research in Science Teaching 6:22-28. 1969c.

33. Lail, Sue S. The model in use (nonverbal communication). Theory into Practice 7:176-180. 1968.

34. Meichenbaum, Donald, Kenneth Bowers and Robert Ross. A behavioral analysis of teacher expectancy effect. Journal of Personality and Social Psychology 13:306-216. 1969.

35. Meier, John. Rationale for and application of micro-training to improve teaching. The Journal of Teacher Education 19:145-157. 1968.

36. Morse, Kevin and O. L. Davis, Jr. The effectiveness of teaching laboratory instruction on the questioning behaviors of beginning teacher candidates. University of Texas, Austin, 1970. 16 p. (U.S. Office of Education. Bureau of Research.) (Microfiche)

37. _____. The Questioning Strategies Observation System (QSOS). University of Texas, Austin, 1970. 20 p. (U.S. Office of Education, Bureau of Research) (Microfiche)

38. Newton, David and Fletcher Watson. The research on science education survey (ROSES). Cambridge, Harvard Graduate School of Education. 1968. 120 p.

39. Orme, Michael E. J. The effects of modeling and feedback variables on the acquisition of a complex teaching strategy. Ph. D. thesis, Stanford, Stanford University, 1966. 149 numb. leaves. (Abstracted in Dissertation Abstracts 27:3320)

40. Rosenthal, Robert and Lenore Jacobson. Teacher expectations for the disadvantages. Scientific American 218:19-23. 1968.

41. Schuck, Robert. The influence of set induction upon student achievement and perception of effective teaching. Journal of Research in Science Teaching 7:35-40. 1970.

42. Scott, W. A. Reliability of content analysis: the case of nominal scale coding. Public Opinion Quarterly. 19:321-325. 1955.

43. Siegel, Sidney. Nonparametric statistics for the behavioral sciences. New York, McGraw-Hill. 1956. 312 p.

44. Shively, Joe. The effect of mode of feedback in microteaching. Paper presented at annual meeting of American Educational Research Association, Minneapolis. 1970. 13 p. (Microfiche)

45. Victoria, J. James. An investigation of nonverbal behavior of student teachers. University Park, Pennsylvania State University, 1970. 106 p. (U.S. Office of Education, Bureau of Research) (Microfiche)

46. Waimon, Morton and Gary Ramseyer. Effects of video feedback on the ability to evaluate teaching. The Journal of Teacher Education 21:92-95. 1970.

47. Ward, Blaine. A survey of microteaching in NCATE-accredited secondary education programs. Stanford University, Stanford Center for Research and Development in Teaching, 1970. 63 p. (U.S. Office of Education, Bureau of Research) (Microfiche)

48. Young, David. The modification of teacher behavior using audio video-taped models in a micro-teaching sequence. Educational Leadership 26:394-403. 1969.

APPENDICES

APPENDIX A

Categories of Teacher Classroom Behavior

1. Management
   - a. Routine Management
   - b. Laboratory Management
   - c. Study Management
2. Control
3. Release
4. Goal Setting
5. Content Development
   - a. Teacher Centered
     - 1) Procedures
       - a) states
       - b) asks
       - c) shows
       - d) acknowledges
       - e) clarifies
     - 2) Knowledge
       - a) states
       - b) asks
       - c) shows
       - d) acknowledges
       - e) clarifies
     - 3) Scientific Process
       - a) states
       - b) asks
       - c) shows

d) acknowledges
e) clarifies

4) Tentativeness of Knowledge

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

5) Generalizations

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

6) Articulation of Content

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

7) Facilitates Communication

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

b. Student Centered

1) Procedures

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

2) Knowledge

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

3) Scientific Process

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

4) Tentativeness of Knowledge

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

5) Generalizations

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

6) Articulation of Content

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

7) Facilitates Communication

a) states
b) asks
c) shows
d) acknowledges
e) clarifies

6. Effectivity

a. Positive Affectivity

b. Negative Affectivity

7. Undecided

TEACHER DEMONSTRATION RATING FORM

Name of Teacher: _____ Date: _____

Objectives of the class	Fully developed Clearly understood	Developed Generally understood	Some developed Partly understood	Incompletely developed Little understanding	No apparent development
Content	Well organized Meaningful throughout	Good organization Most content meaningful	Fair organization Some content not meaningful	Weak organization Little meaning in content	Very weak organization No meaningful content
Method	Teacher actively stimulates student response throughout lessons	Teacher seeks student response sometime during lesson	Teacher seeks little response during lesson	Teacher tends to ignore or overlook student during lesson	Teacher discourages student response during lesson
	Students often actively engaged in classroom discussions	Students sometimes engaged in classroom discussion	Students seldom participate in discussions	Student's comments ignored during lesson	Student comments discouraged
Evaluation	Strong feeling of accomplishment	Some feeling of accomplishment	Mixed feeling of accomplishment	Some doubt of accomplishment	Some feeling of a lack of accomplishment
	Strong feeling of like for the teacher	Some feeling of like for the teacher	Mixed feeling of like for the teacher	Some doubt of like for teacher	Feeling of dislike for the teacher

APPENDIX C

Course Description

Science Education 407 B
Fall Term, 1970

Science Education 407 B is a two-hour, one-credit seminar intended to allow each student technological assistance in the videotape recording of an actual teaching session. The seminar this term has been designed to provide each student with an opportunity to develop specific teaching skills in preparation for student teaching. These skills will be practiced in a short lesson (5-10 minutes) taught to a small group (4-5 students) called a "microlesson". Each lesson will be videotaped and evaluated by members of the microclass and supervisor for the skill which is under observation. Utilizing the suggestions of the supervisor and members of the microclass, the microlesson will be retaught to a different group of students. This procedure is referred to as a teach-critique-reteach cycle. The first lesson will be taught by members of the seminar class; however, it is expected that secondary school students will serve as microclass students in the development of the second skill.

What are Teaching Skills?

Teaching skills are specific, identifiable behaviors comprising the complex teaching act. By focusing upon and developing an ability to utilize each skill through microteaching, prospective teachers should be better prepared for the complex teaching act. Some of the skills which have been identified are:

1. Recognizing Attending Behavior - a skill designed to sensitize and alert the teacher to what is going on in his classroom by observing cues his students present.
2. Silence and Non-verbal Cues - This skill is designed to allow the teacher to control and direct classroom discussions without talking.
3. Cueing - This skill is designed to give the teacher more control over the success a student has in answering questions or in making a comment.
4. Set Induction - This skill is concerned with properly preparing students for some upcoming activity.
5. Stimulus Variation - This skill deals with verbal and non-verbal techniques designed to reduce boredom and apathy.
6. Reinforcement - An incentive skill used by the teacher to reward students for proper behavior.
7. Probing Questions - A questioning skill that requires pupils to go beyond superficial "first-answer" questions.

8. Divergent Questions - A questioning skill characterized by the fact that there are no "correct" answers and helps students to make hypotheses and reorganize concepts.

At present, 18 teaching skills have been identified. The list above represents a variety of such skills which may be developed in a microteaching format. Due to time limitations each student will be asked to focus upon (1) Set Induction and (2) Probing Questioning. In addition, some students will be asked to develop an additional skill. A schedule for teaching the microlessons will be found on the following pages.

Schedule for microlessons developing a skill in Set Induction.

Student	Group	10/15	10/22	10/29	11/5
1		X	O		
2		X	O		
3	1	X	O		
4		X	O		
5		X	O		
6		O	X		
7		O	X		
8	2	O	X		
9		O	X		
10		O	X		
11				X	O
12				X	O
13	3			X	O
14				X	O
15				O	X
16				O	X
17	4			O	X
18				O	X

Note: X - denotes responsibility for presentation of a lesson.
O - denotes responsibility as a member of a microlesson.

Schedule for microlessons developing a skill in Probing Questions

11/15	11/16	11/17	11/18	11/19
	17	7	4	6
Whole group	3	2	15	8
discussion	10	5	18	12
2-3 PM	13	1	11	12
	16	14		

Schedule for developing an additional skill

12/3	12/9	12/10
	14	12
Whole group discussion	9	5
for designated	4	17
students	13	2

APPENDIX D

Set Induction

Discussion:*

This skill is concerned with properly preparing students for some upcoming activity. It includes an interesting and/or novel way of introducing the activity, and establishing common frames of reference between the teacher and students in order to facilitate communication. It is basically an initiating activity by the teacher to stimulate and motivate students.

Guidelines for Development

In planning for a lesson to practice this skill the teacher must ask the following questions?

1. Will the introduction be interesting?
2. Will the introduction inspire the students to study the main part of the lesson?
3. Is the relationship between the introduction and the main part of the lesson clear to the student?

---

* James Cooper and Dwight Allen. "Microteaching: History and Present Status". Mimeographed material. University of Mass.

4. Are there guides or cues in the introduction to help the students understand the main part of the lesson?

5. Will the introduction be likely to help the student remember the material covered in the main part of the lesson?

Evaluation

Evaluation of a lesson designed to practice the skill of set induction will proceed only in reference to the guidelines for the development of such a lesson. While an occasional comment may be made regarding the development of the lesson, evaluation of the skill under practice will be limited to analysis of the above questions.

EVALUATION SHEET: SET INDUCTION

Teacher_____ Date_____

Observer_____

Teach_____ Reteach_____

STUDENTS: (Optional for Supervisors and Teachers)

1. How interesting was the teacher's introduction?

2. To what extent did the introduction inspire you to study the main part of the lesson?

3. Would the teacher's introduction be likely to help you remember the material covered in the main part of the lesson?

SUPERVISORS AND TEACHERS ONLY:

1. How clear was the relationship between the introduction and the main part of the lesson?

2. To what extent did the teacher provide guides or cues in the introduction to help the students understand the main part of the lesson?

   Give some examples:

COMMENTS:

APPENDIX E

Probing Questioning

Discussion

This skill is concerned with the teacher's ability to keep discussions going by asking questions that require more than superficial answers. The approach is based on techniques that may be used after a student has given a superficial response. The teacher's cue is the student's response. Once it has occurred, the teacher, instead of advancing to another question, probes the student's response by means of one of the following techniques:

1. The teacher seeks clarification. He may ask the student for more information, or clarification, by saying:
   a. "What, exactly, do you mean?"
   b. "Please rephrase that statement."
   c. "Could you elaborate on that point?"
   d. "What do you mean by the term. . . ?"
2. The teacher seeks to increase the student's critical awareness. He wants the student to justify his response. Examples of appropriate probing questions are:
   a. "What are you assuming?"
   b. "What are your reasons for thinking that is so?"

c. "Is that all there is to it?"

d. "How would an opponent of this point of view respond?"

3. The teacher refocuses the response. If a student has given a satisfactory response, it might seem unnecessary to probe it. However, the teacher could use this opportunity to refocus on a related issue. Examples might be:

a. "If this is true, what are the implications for... ?"

b. "How does John's answer relate to... ?"

c. "Can you relate this to... ?"

d. "Let's analyze that answer."

4. The teacher prompts the student. The teacher gives the student a hint to help him answer the question.

5. The student redirects the question. This is not a probing technique per se, but it does help bring other students into the discussion quickly, while still using probing technique. Examples would include statements as:

a. "Mary, do you agree?"

b. "Ron, do you think it's that simple?"

c. "Mark, can you elaborate on Jim's answer?"

These techniques have two main characteristics in common:

1. They are initiated by the teacher immediately after the student has responded; and

2. They require the student to think beyond his initial response.

Evaluation

Students in your class will be asked to respond to your presentation by answering the following two questions:

1. Did the teacher seem to accept most of the answers to his question? If not, why?
2. Did you feel the teacher's questions were different from most teachers' questions? If so, in what way were they different?

Your supervisor will evaluate the microlesson according to the use of questions indicating the skill as outlined in the five examples.

APPENDIX F

Nonverbal Cues and the Use of Silence

The first task of the classroom teacher is communication. How a teacher is perceived by the student will depend upon the nature of the verbal and nonverbal messages which are communicated. The interactions between the teacher and learner will be determined to a great extent by how these communications are perceived by the student. Thus, while you may become sensitive to your nonverbal communications, you may never be able to evaluate the effect of these behaviors upon all students. In this skill we will attempt to:

1. increase student participation by decreasing teacher talk; and
2. isolate and practice some of the most obvious nonverbal cues.

Decreasing teacher talk will necessitate a decline in giving instructions, lecture, and the use of examples. Several possible techniques to accomplish this might include:

1. Presenting a problem to the students in the form of a slide, photograph, demonstration, news item or data to analyze.
2. Small group discussion.
3. Experiments are generally agreed to be problem solving activities.
4. Using certain nonverbal cues which will encourage students to ask questions, respond, and to continue discussion.

a. maintain silence after a student has spoken either as a question or response,

b. hand movements may indicate "keep talking",

c. indicate a second student to respond to the first student.

5. Interact nonverbally with as many students as possible.

EVALUATION SHEET: SILENCE AND NONVERBAL CUES

Teacher_____ Date:_____

Observer_____

Teach_____ Reteach_____

STUDENTS, SUPERVISORS, AND TEACHERS:

1. Did the teacher allow the students to do most of the talking?

2. Did the teacher remain quiet after asking a question, thus allowing the student time to think about his answer?

3. Did the teacher communicate with facial expressions, gestures, and body movements?

4. Was the teacher able to direct and control the discussion without speaking very often?

5. Was the teacher attentive? Did the teacher seem interested in what the students had to say?

6. Did the teacher make an effort to include as many students as possible in the discussion?

COMMENTS:

APPENDIX G

Data Record Form - BTBI

Verbal	Congruent	Nonverbal	Contradictory

APPENDIX H

Analysis of Teacher-Student Interaction

Teacher _____ Date _____ Period _____

	Student Initiated		Teacher Initiated	
	Verbal	Nonverbal	Verbal	Nonverbal
Student				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Interactions will be coded as:

- for negative interactions
+ for positive interactions
0 for neutral interactions

APPENDIX I

A Glossary of Representative Interactions

Student Initiated - Verbal

These interactions were initiated by students speaking out ino class without raising their hand, being formally recognized or called upon by their teachers.

Positive

1. The student speaks out saying: "What about the graph on page 121?" The teacher responds: "That's a good example to use."
2. The students are completing worksheets at their desks. One student calls out: "Is this a submerged valley?" The teacher responds by telling the class, "Debbie has figured it out."
3. The teacher is doing a representative problem at the board. A student speaks out: "I can do that for you, Miss _____." The teacher responds: "O. K. Bob, why don't you come up to the board and finish it for me."
4. The teacher misspelled a word on the blackboard. A student called it to his attention. The teacher responded with a joke at his own expense.

Neutral

1. A student asked: "What page do we start our reading?" The teacher responded: "Page 156."
2. The student asked: "Are the laboratory reports due today?" The teacher responded: "They are due Friday with the rest of the homework.
3. During a class discussion a student voluntarily contributes an idea such as: "Maybe they developed legs." The teacher responds by probing the student contribution by asking, "O.K., can you elaborate on that?"

Negative

1. A student asked the teacher for help to solve a problem. The teacher responded: "Did you read the chapter? Go back to your seat and read the book."
2. A student asked where she could find the petri dishes. The teacher responded: "If you had been listening you would have heard me tell the class that they were on the front table."
3. The teacher was giving instructions to the class concerning the procedure for making a model. A student speaks out: "I ain't going to do that." The teacher responds: "You are going to do the same things that the rest of the class do, or you will no longer be a member of this class."

Student Initiated - Nonverbal

A communication was coded as a student-initiated, nonverbal interaction when the student voluntarily initiated an interaction through a nonverbal message to the teacher. Most often, these messages were received when the student raised his hand or moved toward the teacher and stood silently near to the teacher.

Positive

1. The student raised his hand to answer a question or contribute to a class discussion. The student answer was responded to with "Good.", "That's right.", "That's the answer I was looking for.", "I knew you had the answer all along.", etc.
2. A student tossed a model of a crystal at a designated container. The teacher said: "You missed." and smiled at the student.
3. During a demonstration one student walked up to the demonstration desk for a better view while the remainder of the class remained seated. The teacher then incorporated the student's help by asking him to weigh several objects.

Neutral

1. A student raised his hand to respond to a question. The teacher responded to the answer by saying: "Yes, can you think of anything else?"

2. The student raises his hand indicating a need for assistance during a supervised study session. The teacher walks over to the student's desk and indicates the procedure to follow by pointing to a page or paragraph.

3. During a laboratory, a student raises his hand for assistance in removing a band from the leg of a chicken. The teacher responds by having the student hold the chicken while she removes the band from the leg.

Negative

1. A student wraps a venetian blind cord around the radiator. The teacher stops the class and looks at the student until he removes the cord from the radiator.

2. A student turns around in his seat and hits the desk in back of him with a ruler. The teacher responds with, "That's enough of that. Turn around."

3. A student tugs at the lavalier microphone cord which a teacher wears around the neck during videotape recording. The teacher frowns at the student.

4. A student is drumming on a cardboard box while simultaneously dancing around it. The teacher responds with, "Stop that and take your seat."

Teacher Initiated - Verbal

An interaction was coded as teacher-initiated whenever a teacher independently decided to interact with a student. As with the other interactions, nonverbal cues were important in order to determine affectivity.

Positive

1. The teacher initiated the interaction by saying: "Bill, would you tell the class what you told me yesterday during resource period about the article you read?"
2. During a review session, the teacher said: "Joe is going to do this one for us. OK, Joe, come on."
3. A student is called upon to answer a question. The teacher said in response to the answer: "You've got it, you're on the right track."
4. A teacher prefaces a question directed to a particular student with: "I have a question especially for Terry. What is zooplankton?"

Neutral

1. The teacher initiates the interaction by saying: "Sally, will you hand me that culture medium?"
2. A teacher asks a student when they can make up a test, a laboratory assignment or project.

3. The teacher calls a student to the front of the room to distribute materials.

Negative

1. The teacher stated: "Put that baseball mitt away."; "Knock it off."; "Don't you ever listen?"
2. A student is called upon to answer a question. In response to the student answer the teacher says, "No, that's not right."
3. "Why did you girls take that good graph paper? You shouldn't take things without asking first."
4. The teacher walks toward a student and says, "Keep your voice down, Debbie."

Teacher Initiated - Nonverbal

Positive

1. A teacher is walking around a laboratory, approaches one student and nods approval to the student procedure.
2. A teacher pauses during a lecture, after a question, or after putting a drawing on the board, looks around the room, focuses upon one student and smiles.
3. During a question and answer period, the teacher walks around the room among the students. After asking a question such as, "Why are fossils found in the arid parts of the world?" the student who he is standing beside responds with an answer to which

the teacher says, "Good. Did anyone else get that answer?"

4. After asking a question, the teacher pointed to a student who responded. The response is reinforced by the teacher.

Neutral

1. A teacher walking around a laboratory stands near to a student. The student asks, "Is this the right sample to use?" The teacher responds, "Yes. Try the quartz next."
2. The class is divided into small groups. The teacher moves from group to group to listen to the discussions. He sits next to a student who asks,"How long are these animals supposed to stay there?" The teacher responds, "As long as you think it is necessary for the characteristics to develop."
3. A teacher motions for a student to "come here". The student is asked to take a message to the school office.

Negative

1. A student is presenting a report to the class. A teacher moves toward a student who is not paying attention, and writes his name on a piece of paper.
2. During an activity period, the teacher puts his hands on the shoulders of a student and directs him to his proper position.
3. The teacher, in walking around a room, notices a student working on another assignment. He picks up the paper, tears it, and throws it into the wastepaper basket.