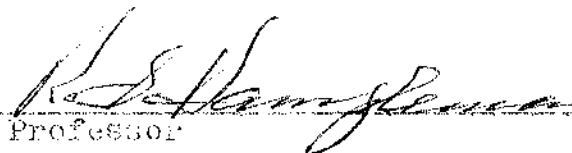
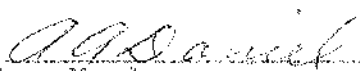


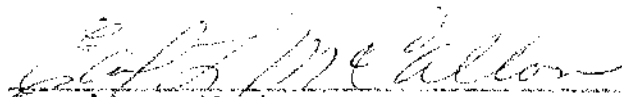
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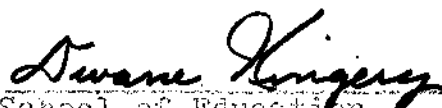
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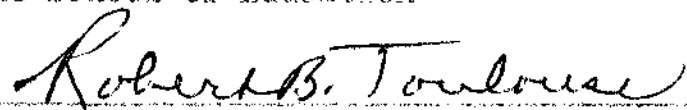
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THE EFFECT OF MICRO-TEACHING LABORATORY EXPERIENCES  
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PRE-SERVICE ELEMENTARY  
SCHOOL TEACHERS

DISSERTATION

Presented to the Graduate Council of the  
North Texas State University in Partial  
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For the Degree of

DOCTOR OF EDUCATION

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## CHAPTER I

### INTRODUCTION

Science education in the elementary school is undergoing many changes. Large sums of money have been allocated through the federal funding of the National Science Foundation for research and experimentation in the field of science curricula and methods. Leaders in science education stress the importance of concepts, generalizations, scientific methods, and attitudes. As science and technology advance, there is a greater demand for better science education. Today there is a need for an adequate general orientation in science for all students. For this to occur, it is necessary for the elementary school teacher to have positive science attitudes and a better understanding of science concepts.

The meeting of the Association for the Education of Teachers in Science in 1964 was devoted to the consideration of model programs for the education of teachers in science. The group recognized that additional research is needed in all areas of elementary school science, especially in the area of teacher preparation (1, 17).

New techniques have been developed to aid in the preparation of pre-service teachers. One of the techniques which is designed to bridge the gap between college and the field

is micro-teaching. This technique is intended to help the pre-service teacher become aware of his teaching performance (1). Purpel (9) wrote that an important function of student teaching is to provide a better focus for the development of the student teacher's individual autonomous teaching style. The pre-service elementary school teacher should be cognizant of the teaching skills and have the ability to analyze the way these skills are used.

Experiences appropriate for the beginner can be provided in the micro-teaching laboratory. Lessons can be designed for the prospective teacher to encounter situations he might not encounter throughout a semester of student teaching. A wide variety of subjects, methods of teaching a topic, and types of pupils can be provided in the micro-teaching laboratory. Also, reteaching a lesson is facilitated in this situation (8).

#### Statement of the Problem

The problem of this study was to determine the effect of a micro-teaching laboratory experience on the attitudes of pre-service elementary school teachers toward the teaching of elementary school science and to determine the effect of a micro-teaching laboratory experience on the indirect verbal behavior of pre-service elementary school teachers.

The groups used to determine the effect of a micro-teaching experience on attitudes were (1) a group of pre-service elementary school teachers not enrolled in a science class nor

a science methods class, (2) a group of pre-service elementary school teachers enrolled in a science methods class which was taught in the regular manner, and (3) a group of pre-service elementary school teachers enrolled in a science methods course receiving a micro-teaching experience.

The attitude change of these groups toward the teaching of elementary school science was assessed by a pretest and post-test semantic differential technique.

The group receiving the micro-teaching experience was used to determine the effect of this experience on indirect verbal behavior. Prior to and after the micro-teaching experience, categories one, two, three, six, and seven of Flanders' system of interaction analysis were used to determine any change.

#### Hypotheses

The hypotheses tested in this study were as follows:

1. Pre-service elementary school teachers enrolled in a science methods course will achieve a more favorable attitude, which is statistically significant, toward the teaching of elementary school science by participating in a micro-teaching laboratory experience than pre-service elementary school teachers enrolled in a traditional science methods course. Pre-service elementary school teachers enrolled in both of the science methods courses will achieve a more favorable attitude, which is statistically significant, toward the



teaching of elementary school science than pre-service elementary school teachers not enrolled in a science methods course.

2. Pre-service elementary school teachers enrolled in a science methods course and participating in a micro-teaching laboratory experience will show a statistically significant increase in indirect teacher influence from onset to the end of a micro-teaching laboratory experience.

#### Significance of the Study

A review of the literature revealed that one of the main problems in science education involves the education of the science teacher (2, 3, 5, 13, 14, 15). Rosen (12) stated that in the elementary school the problem of preparing adequate teachers of science is staggering. In a recent study by Lerner (6), the inadequacy of preparation was found to be one reason for the teacher's not being desirous of teaching science in the elementary school.

In a study reported by Washton (15), the following was determined through interviews with elementary school teachers:

1. Most elementary school teachers dislike science because they did not achieve high scores on tests in high school or college. They felt their elementary school teachers disliked science, and so it was contagious to dislike science. As a result, they were afraid to teach science to their pupils.

2. To promote the learning of science by elementary school teachers, it is essential that fears be minimized or removed. Self-achievement is an effective weapon against negative attitudes or fears of teaching science.

3. Elementary school teachers need confidence in handling and manipulating materials that are used in scientific experiments and demonstrations. When the teachers were given such opportunities to develop these skills in the course, they acquired confidence and improved techniques (15, p. 34).

Lindsey (7) felt that criticisms force teacher educators to intensify their search for answers to questions about the kinds of professional experiences that should be part of pre-service education and what may be accomplished by them. Teacher educators are concerned with the problem of describing behavior of effective teachers. It seems entirely reasonable to assume that if professional education programs are to be evaluated adequately, techniques for recording descriptions of teacher behavior and for making valid interpretation of such records need to be developed. Kirk (4) ascertained that verbal behavior of pre-service teachers could be determined by careful observation.

Reynard (11) reported that professional laboratory experience seems to be the area least challenged in teacher education. Williams, Deever, and Flynn (16) concluded from their study that professional laboratory experiences in programs of teacher education are regarded as a singularly important area for research.

This study was proposed in order to determine the effectiveness of a micro-teaching laboratory experience in changing attitudes of pre-service elementary school teachers toward the teaching of elementary school science and to determine

the effectiveness of the micro-teaching laboratory experience with regard to the increase of indirect verbal behavior of the pre-service elementary school teachers.

#### Definition of Terms

Micro-teaching, as denoted in this study, is a scaled-down teaching encounter in which the pre-service elementary school teacher taught a selected science topic from five to ten minutes to a group of two to five elementary school students.

Micro-team denotes from two to four pre-service elementary school teachers who taught consecutively in a micro-teaching session.

Micro-laboratory denotes the physical facility used in this study for micro-teaching purposes. This facility was especially designed for micro-teaching. (For a description of the micro-laboratory, see Appendix B, page 65.)

Attitudes, as used in this study, denote "feelings" of subjects toward the teaching of elementary school science.

Critique, as used in this study, denotes the previewing of video tape by the micro-team, the professor and his assistant, plus self-analysis and consideration of peers' judgments as recorded on a specific critiquing instrument.

Student observer, as used in this study, denotes students, in the micro-teams assigned to a certain micro-laboratory, who were not engaged in micro-teaching. When not so engaged,

these students observed the other teams and filled out a critiquing instrument designed for evaluating a certain teaching technique.

Verbal behavior denotes any verbal communication in the micro-laboratory in which the teacher or pupil, or both, was involved.

Indirect verbal behavior denotes that behavior which maximizes the freedom of the student to respond. The words, indirect verbal behavior and indirect teacher influence, were used interchangeably in this study.

Observer denotes the person who recorded the verbal behavior of the teacher and pupils.

Flanders' System of Interaction Analysis denotes the observation method used to classify the verbal behavior of teachers and students into categories.

Matrix, as used in this study, denotes the tool on which the observed verbal behaviors were recorded to facilitate understanding of the relationships among categories.

#### Limitation of the Study

A specific limitation of this study is that the experiment was limited to three groups of elementary education students enrolled at a university in the Southwest during the Spring semester of 1969.

### Basic Assumptions

The following assumptions were made:

1. Certain assumptions were made in order to measure attitudes. Remmers (10) listed them as the following: that they vary along a linear continuum, that measurable attitudes are common to the group, and that they are held by many people.
2. It was also assumed that the pertinent categories of Flanders' system of interaction analysis included all of the important verbal responses between the students and the teacher in the micro-teaching laboratory experience.
3. This study was based on the assumption that it is possible to practice the teaching act in parts (or segments) with these parts ultimately being assimilated into the whole teaching act.

### Summary

Chapter I has revealed the basic plan of this study which was to measure (1) the attitudes of pre-service elementary school teachers toward elementary school science as assessed by the semantic differential and (2) the increase of indirect verbal influence of pre-service elementary teachers as assessed by categories one, two, three, six, and seven of Flanders' system of interaction analysis following a micro-teaching experience. Important terms have been defined, a limitation was established, and assumptions were declared. Some readings in current education literature revealed the need for further study in the preparation of elementary school teachers in science.

Chapter II consists of a review of the literature related to the different facets of this study.

Chapter III contains a description of the subjects, the experimental design, a discussion of the instruments employed, and the method used in collecting and treating the data.

Chapter IV includes an analysis of the data and a discussion of the results.

Chapter V presents the summary, findings, conclusions, and recommendations for further research.

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## CHAPTER II

### REVIEW OF RELATED LITERATURE

This review of related literature is concerned with the following areas:

1. Research related to attitudes and attitude change
2. Research related to the development of micro-teaching
3. The use of the discovery or inquiry approach in teaching science
4. Research related to interaction analysis.

#### Research Related to Attitudes and Attitude Change

Enthusiasm for science does not come from a person who feels inadequate. As Hott and Sonstegard stated, ". . . effective teaching must acknowledge matters other than the mental process of learning and the subject matter to be taught." (26, p. 348) Others concur with their opinion (20, 21, 22).

Hoffman (25), in summarizing research concerning the classroom, reported that teacher behavior has been shown to be enormously potent--affecting the socio-emotional climate of the classroom, the status relationships among the children, individual behaviors, moral orientations, and intellectual performance. He further stated that the elementary school

teacher influences not only the target of her action but the witnesses as well. In regard to teacher behavior, Baumel (10) felt that success in developing scientific attitudes depends ultimately on the teacher and that the teacher through his actions must be able to convince the students that scientific attitudes are an integral part of his behavior.

Travers stated that education is commonly based on the assumption that attitudes can be changed by communications (38).

According to Blanc (12), science educators have long recognized that scientific attitudes are among the most important outcomes which should result from science teaching. Levine and Murphy (30) found in their study that learning was affected by attitudes held. Building positive attitudes is well recognized as being a major objective of science teaching (9, 14, 23). The Fifty-Ninth Yearbook of the National Society for the Study of Education stated that much experimentation has been carried on in the field of measuring attitudes and opinions. Literally thousands of articles and many books have been written on the subject. Most of the literature deals with the measurement of attitudes on social questions. Science teachers are aware of the need of some valid and reliable test of scientific attitudes (24).

Washton (40) reported that, although some educators have recognized scientific attitudes as the by-products of concomitant forms of learning, there has been a growing tendency to view these attitudes as equal to, or superior to, the

knowledge of objectives of science instruction. Neidt and Hedlund (33) and Zim (41), in their writings, also stressed the importance of attitudes. Sweatman identified the complexity of the problem when he said, ". . . it takes a strong effort to change the behavior and attitudes of any individual." (37, p. 68) A study conducted by Flanders (17) showed that students whose teachers used more indirect influence in the classroom perceived the total classroom in a more favorable light as measured by attitudes than those students whose teachers used more direct influence in the classroom.

Osgood wrote that most authorities are agreed that attitudes are learned and implicit--they are inferred states of the organism that are presumably acquired in much the same manner that other such internal learned activity is acquired. Further, they are predispositions to respond but are distinguished from other such states of readiness in that they predispose toward an evaluative response (34).

#### Research Related to the Development of Micro-Teaching

There has been much research done on micro-teaching since it was introduced at Stanford University in 1963. The majority of studies have been done at the secondary level (2, 3, 4, 8, 11, 14, 16, 18, 19, 27, 31, 32, 36). Wayne State University, Colorado State University, University of Michigan, and Brigham Young University have incorporated the micro-teaching technique into their teacher education programs (14). Experiments with

micro-teaching performance and performance in a full sized classroom have demonstrated that a high correlation exists between the two (1). Results of research where micro-teaching was introduced experimentally seemed to indicate that students trained under those conditions performed more effectively than those trained under traditional conditions. By teaching, observing, and reteaching, trainees made significant changes in their teaching techniques (19).

Through micro-teaching, the pre-service elementary school teacher becomes aware of the acts he will perform and acquires the ability to analyze these acts, thus enabling him to perform them in a better way. Successful teaching viewed on video tape has a desirable influence on the development of a positive self-concept (8).

Some micro-teaching studies have shown (1) that self feedback is not highly effective in behavior change with pre-service teachers; (2) that the supervisor's pointing out salient cues in teaching and positive reinforcement during the video playback proved a most effective training method; and (3) that perceptual modeling excels over symbolic modeling (27).

#### The Use of the Discovery or Inquiry Approach in Teaching Science

One of the newest approaches in science teaching is called the discovery or inquiry approach. This approach is modeled after the investigative processes of scientists. It

is a strategy for learning that science educators believe to be particularly appropriate from both a psychological and a scientific point of view (29).

The discovery method as used in science teaching gives the children a chance to discover the true structure of the discipline. After the problem of the science lesson has been identified and the materials gathered, the children are the ones to carry on the investigation (25). The teacher then becomes the leader who listens to, observes, and offers leadership to the children.

The above mentioned desirable teacher functions for the discovery method of teaching science coincide with those designated as lending themselves toward indirect teacher influence as gauged by certain categories in Flanders' system of interaction analysis. In his description of the teacher-leader in science, Karplus stated the following: ". . . in general, encouraging the children to probe further and think about the observations made and . . . encouraging the children to experiment and to find answers to their questions," which is synonymous with category three; ". . . employs questions as a means to open new possibilities, enlarging upon discussed ideas . . . ," which is synonymous with category four; and ". . . praises the children when they are successful, knowing this gives them increased confidence in their ability to think and strength to be independent," which is synonymous with category two (28, p. 93).

The success of the discovery method of teaching science may well be influenced by teacher-pupil verbal interaction (or classroom talk). Many educators recognize the importance of talk in teaching, and many consider teaching to be an interactive process (5). Flanders' system of interaction analysis takes into account each interaction in the classroom and appears to be the appropriate way to measure the increase of teacher indirect influence which is deemed necessary for successful teaching of the discovery method of science in the elementary grades.

#### Research Related to Interaction Analysis

Since most of the newer science curricula stress inquiry into natural phenomena rather than the mere acquisition of the findings of others through lecture and drill, the calculation of the indirect-direct ratio becomes particularly important since it assists one in determining the relationship between what is learned and the learner's degree of freedom to decide on a course of action. It is generally felt that direct influence tends to restrict the student's freedom of action, while indirect influence tends to expand freedom of action (15).

In Flanders' study (16), it was found that an indirect approach stimulates verbal participation by students and discloses to the teacher students' perceptions of the situation. Such an approach not only provides the teacher with more

information about students' understanding of a particular problem but also often encourages students to develop more responsibility for diagnosing their difficulties and for suggesting a plan of action. It was also found that the major difference between the teachers whose students learned the most and those whose students learned the least is illustrated by actions classified as indirect. The student-response elicited from the indirect approach used by the teachers in Flanders' study (16) are the responses desired in the discovery method of teaching science in the elementary school.

The Flanders system of interaction analysis was developed and refined by Flanders in the early 1950's. The first research related children's attitudes to patterns of teacher behavior. Results of the research indicated that pupils of teachers who were observed to be indirect had more positive attitudes toward the school, the teachers, and other pupils than did the pupils of those teachers who were identified by observers as direct (7, 39).

Researchers using interaction analysis have found (1) that observers using the system perceived teacher influence in essentially the same way as did the pupils of teachers under observation; (2) that dependent-prone eighth grade students who were taught geometry by indirect teaching methods learned more than dependent-prone children taught by direct means; and (3) that in a study of junior high teachers results indicated that all types of students learned more working with

teachers using a more indirect teaching style than with teachers using a more direct teaching style (6).

#### Summary

The review of related literature was organized into the following four categories: (1) the possibility of attitude change, (2) the practicality of using micro-teaching in pre-service teacher education, (3) the reasons for using the discovery or inquiry approach in teaching science, and (4) the feasibility of applying Flanders' system of interaction analysis to measure the indirect-direct ratio of pre-service teacher influence.



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## CHAPTER III

### PROCEDURES USED TO GATHER AND TREAT THE DATA

The purpose of this chapter is (1) to describe the subjects participating in this study, (2) to point out the experimental design used, (3) to explain and substantiate the choice of instruments, (4) to present the methods of collecting data, and (5) to specify the statistical treatment given the data.

#### Subjects

The subjects for this study included one group of pre-service elementary school teachers enrolled in an elementary education curriculum course at a university in the Southwest during the Spring semester of 1969. This group was designated as control group I. The remaining subjects were composed of three classes of elementary education majors enrolled in a science methods course in the same university during the same period. Two of these classes were designated control group II, and the remaining class was designated the experimental group.

The subjects used in this study were students of junior or senior classification who were accepted in the elementary education program at the university.

### Experimental Design

The basic design of this study was the nonequivalent group design (4). Intact science methods classes were arbitrarily assigned to the experimental group and control group II. The group taking an elementary education course, but not enrolled in a science methods course, was designated group I.

The science methods course consisted of an hour lecture three days a week and a two-hour laboratory session once a week. The lectures were given on Monday, Wednesday, and Friday mornings at 9:00, 10:00, and 11:00 o'clock. Students from control group II and the experimental group were allowed to choose any one laboratory session. These sessions were held in the afternoons, Monday through Friday.

Two science methods lecture classes, designated as control group II, were taught in the regular manner by the professor and his assistant. For an outline of this course, see page 70 in Appendix B.

Students in control group I who were enrolled in a science or science methods course were not included in the instructional aspects of this study.

One science methods lecture class was assigned to the experimental group. This class received the micro-teaching laboratory treatment. This treatment was given over an eight-week period. The micro-teaching model consisted of

1. Plan.--During this period the pre-service teachers organized themselves into micro-teams and planned their

micro-lesson. The professor and his assistant supervised and assisted the students.

2. Instruction in specified teaching skill.--At this time instructions were given, based upon the skills desired for a successful micro-teaching experience in the micro-laboratory. Also, instructions for the use of the critiquing instrument were presented. The critiquing instruments for this study were based upon the evaluation techniques for micro-teaching as used by Stanford University. They were adapted to the needs of this study by the researcher. A copy of these instruments may be found in Appendix B, pages 68 and 69. Techniques for obtaining teacher-pupil interaction were presented. Special emphasis was given to the techniques described in Flanders' categories for interaction analysis which foster indirect teaching behavior.

3. Teach.--The micro-team taught the micro-lesson in the micro-laboratory. The micro-team was made up of from two to four pre-service elementary school teachers. The five- to ten-minute encounter was with from two to five children from the elementary school grades. The students observing the presentation completed the critiquing instrument on each of the micro-team participants immediately following the micro-lesson. Each session was video taped.

4. Critique.--The video tape was replayed for each micro-team. Using the critiquing instrument results and self-analysis, the professor and his assistant helped the students

evaluate their teaching session. After the critique, the students prepared for the reteach session.

5. Reteach.--The micro-team taught the same five- to ten-minute lesson to a different group of two to five elementary school children in order to improve their teaching technique. The session was video taped. The student observers completed the critiquing instrument on each micro-teacher immediately following the micro-lesson.

6. Critique.--The second video tape was replayed for each micro-team. Using the results from the critiquing instrument and self-analysis, the professor and his assistant helped the students evaluate their reteach session.

For a day by day schedule of the micro-laboratory treatment, see page 66 in Appendix B.

The plan and the critique parts of the micro-teaching treatment were conducted by the professor and his assistant. There were two micro-laboratories in which sessions were video taped at the same time during the teach and reteach parts of the micro-treatment. The professor of the science methods courses supervised one laboratory while the assistant supervised the second laboratory. These micro-laboratories were located in two different classrooms. No critiquing was done during the taping session.

The lectures for all three science methods classes were given by the same professor and his assistant. The science laboratory sessions for all participating subjects of the



experimental group were taught by the assistant. The pre- and post-tests for all groups were given by the professor or his assistant. Approximately three months elapsed between the pre- and post-test administrations.

Prior to and following the micro-teaching treatment, each student in the experimental group taught a ten- to twelve-minute lesson in the micro-laboratory to from two to five elementary school students. Each pre-service elementary school teacher taught the same lesson to different students. These sessions were video taped. Two observers who were trained in recording verbal behavior served as observers for each pre-service elementary school teacher during a video tape replay to determine the effect of the micro-teaching laboratory treatment upon indirect verbal behavior.

Most lessons used in micro-teaching in this study were selected from American Association for the Advancement of Science teaching materials. The indirect/direct ratio of teacher influence as determined in this study took into account categories one, two, three, six, and seven of Flander's categories for interaction analysis. With this technique, the indirect/direct ratio is considered to be less influenced by the nature of the content being taught (6).

## Data Gathering Instruments

### Semantic Differential

Osgood's semantic differential was used to measure subjects' attitudes toward the teaching of elementary school science. Osgood states that the semantic differential is not a test but is a technique of measurement (11).

To quote Osgood,

The semantic differential is essentially a combination of controlled association and scaling procedures. The subject is provided with a concept to be differentiated and a set of bipolar adjectival scales against which to do it, his only task being to indicate for each item (pairing of a concept with a scale), the direction of an association and its intensity on a seven-step scale (11, p. 20).

The semantic differential is a method of observing and measuring the psychological meaning of things, usually concepts. Osgood developed the semantic differential to measure the connotative meanings of concepts as points in what has been called "semantic space."

Kerlinger (8) illustrates the notion of semantic space with this example. In the room where one is sitting, assume there are three sticks at right angles to each other, meeting in the center of the room, and touching the walls, floor, and the ceiling. Label these sticks X, Y, and Z and call them axes or coordinates. Now imagine there are points scattered throughout the three-dimensional space with some of the points in any order with small letters: a, b, . . . n. If the axes have been marked off in an equal-interval system, then any

point in the space can be unambiguously identified or "defined" by using the numbers on the three axes. If, through research, some general "meaning" for the axes X, Y, and Z has been determined, then the "meaning" of each point would be the combination of the meanings of X, Y, and Z.

The semantic differential was designed to be a general measurement instrument that can be used in a wide variety of research problems.

Application of the semantic differential to empirical research in mass communication was well exemplified in the work of Tannenbaum, Greenberg, and Silverman (1962), who studied images of Kennedy and Nixon in the 1960 presidential debate, and by Kraus and Smith (1962), who investigated semantic reactions to both the candidates and the issues that they treated in the debates. Other typical applications of semantic differentiation to communication research have been reported by Evans, Wieland, and Moore (1961), as well as Kerrick and McMillan (1961), who studied attitude variables, and in studies by Kjeldergaard (1961) and Williams (1963), who investigated semantic reaction to broadcasters (5).

Staats and Staats' (13) attitude-conditioning study showed the semantic differential to be a fairly sensitive measure of attitude change.

Even though this instrument is considered experimental, Moss states that, "the results of the studies do testify to the fact that the semantic differential is measuring 'something'

consistently and in meaningful fashion, and that in this respect, it is already a useful instrument." (10, p. 53).

Kerlinger (8) reports that educators have made little use of the semantic differential, while psychologists have been enthusiastic in the use of the instrument.

Anatasi writes that "the semantic differential represents a standardized and quantified procedure for measuring the connotations of any given concept for the individual " (3, p. 626).

From the Bopp and Osgood studies, the following was concluded by Osgood:

The average errors of measurement of the semantic differential scales are always less than a single scale unit (approximately three-quarters of a scale unit) and for evaluative scales about a half of a scale unit. This means that we can expect subjects, on the average, to be accurate within a single unit of the scale, which for practical purposes is satisfactory.

A chance of greater than two units on the average scale by the average subject would be expected to occur less than five per cent of the time by change (or as a result of random errors of measurement) (11, pp. 131-132).

With attitude measurement test-retest, reliability has been obtained by Tannenbaum. Each of six concepts was judged against six evaluative scales on two occasions, separated by six weeks. The test-retest coefficients ranged from .87 to .93, with a mean  $\bar{r}$  (computed by z-transformation) of .91 (18). Osgood and Tannenbaum (19) report that in available data the reliability of the semantic differential as an attitude measurement runs in the .80's and .90's.

Face validity has had to be used to ascertain the validity of the semantic differential as there is no independent criterion available. Osgood (11) defines "face validity" as the extent that the distinctions a measurement provides corresponds with those which would be made by most observers without the aid of the instrument. A study of the effects of mixing or combining words (a set of eight adjectives) was differentiated by two hundred subjects, and mean factors were computed. Osgood reported that "reasonable" characterizations of these adjectives were found. Further, Osgood says, "throughout our work with the semantic differential we have found no reason to question the validity of the instrument on the basis of its correspondence with the results to be expected from common sense." (11, p. 141) In a thesis by Reeves (11), the evaluative locations of the Thematic Apperception Test pictures judged by subjects against the differential were found to correlate significantly with the clinical judgments of stories told about the pictures by the same subjects.

The 1952 election study used actual voting behavior as a criterion. At each sampling period the subjects indicated how they would vote. Three-and-a-half months before election day, thirty-seven subjects "expressed" themselves as certain of how they would vote (Eisenhower or Stevenson), and eighteen subjects "didn't know." Comparison was made on the semantic differential and the predictions made. Of the eighteen "don't knows" fourteen voted as predicted by the semantic differential evaluative scale (11).

The validity of the semantic differential as an attitude measure was tested by Osgood. The correlations between scores on the evaluative scales of the semantic differential and scores on the Thurstone scales on attitude toward The Church, Negro, and Capital Punishment are .74, .82, and .81, respectively. "It is apparent, then, that whatever the Thurstone scales measure, the evaluative factor of the semantic differential measures just about as well," according to Osgood (11, p. 193).

Osgood (11), in another study, compared the evaluative factors of the semantic differential to a Guttman-type scale as a measure of attitude. The rank order correlation between the two instruments was highly significant ( $\rho = -.78$ ;  $p < .01$ ).

The construction of the semantic differential used in this study was based on the criteria outlined by Osgood (11). A concept familiar to the subjects and considered significant to the research problem was chosen. This concept was Teaching Elementary School Science.

In the selection of scales two main sources were used; Osgood (11) and Gulo (7). The selection of bipolar adjectives was also based upon their relevance to the concept and to their factorial composition. These scales are primarily evaluative, although there are included representative scales of the potency and activity factors in order to obscure somewhat the purpose of the measurement.

Table I shows the scales used in the study with the factors around which the pairs tended to cluster in previous factor analyses. The adjective pairs are listed in the order they appear on the semantic differential used in this study.

TABLE I  
FACTOR REPRESENTATION OF SCALES SELECTED  
FOR CONCEPT RATING

Adjective Pair	Factor Represented
Clear--Hazy	Potency
Good--Bad	Undetermined
Cold--Hot	Undetermined
Interesting--Boring	Evaluative
Meaningful--Meaningless	Evaluative
Nice--Awful	Undetermined
Light--Heavy	Potency
Pleasant--Unpleasant	Evaluative
Deep--Shallow	Activity
Colorful--Colorless	Evaluative
High--Low	Activity
Fair--Unfair	Evaluative
Fresh--Stale	Evaluative
Stimulating--Dull	Evaluative
Valuable--Worthless	Evaluative
Active--Passive	Undetermined
Strong--Weak	Activity
Fast--Slow	Activity
Optimistic--Pessimistic	Potency
Positive--Negative	Potency

In this instrument there is a seven-step scale between the bi-polar adjectives. The bi-polar adjectives appear on the instrument in random order, and five pairs are reversed to guard against response set bias. The seven steps are given ratings of one through seven. One designates the unfavorable,

and seven designates the favorable end of the continuum. There are twenty scales included in this instrument. Instructions for taking the semantic differential are the ones suggested by Osgood (11). Copies of the instructions and the instrument may be found in Appendix A on pages 62 and 63.

#### Flanders' System of Interaction Analysis

Flanders stated that

Interaction analysis provides an explicit procedure for quantifying direct and indirect influence that is closely related to teacher behaviors. Direct influence consists of those verbal statements of the teacher that restrict freedom of action, by focusing attention on a problem, interjecting teacher authority, or both. These statements include lecturing, giving direction, criticizing, and justifying his own use of authority. Indirect influence consists of these verbal statements of the teacher that expand a student's freedom of action by encouraging his verbal participation and initiative. These include asking questions, accepting and clarifying the ideas or feelings of students, and praising or encouraging students' responses (6, p. 9).

The Flanders system is an observational method used to classify the verbal behavior of teachers and pupils as they interact in the classroom. There are seven categories for teacher behavior, two categories for pupil talk, and one category for silence or confusion (1). A summary of these categories may be found in Appendix C on page 73.

The observer writes down the appropriate category number every three seconds, or whenever behavior shifts. The data are then entered on a matrix which depicts the interaction



patterns. From this matrix may be found specific aspects concerning the teaching behavior.

Flanders (2) stated that a three-member observer team achieved correlation coefficients from 0.64 to 0.76 in six to ten hours of practice, as judged by Scott's reliability coefficient. Scott's method is unaffected by low frequencies, can be adapted to per cent figures, can be estimated more rapidly, and is sensitive at a high level of reliability (6). Trained observers were used in collecting data on Flanders' categories for interaction analysis for this study.

#### Personal Data Sheet

Subjects were asked to complete a personal information sheet which included the following items: (1) sex, (2) classification, (3) whether training in interaction analysis or not, (4) whether student teaching or not, (5) whether taking a science course or not, and (6) a list of college courses completed in the field of science.

Knowledge of the subject's classification and of whether the student was currently enrolled in student teaching or a science course was necessary to delete subjects from the study. A copy of this instrument may be viewed on page 64 in Appendix A.

#### Collection of Data

At the beginning of the Spring semester, the professor or his assistant administered the semantic differential for

measuring initial student attitudes toward the concept (Teaching Elementary School Science) to both control and experimental groups. Also, the Personal Data Sheets were completed at this time.

Prior to the micro-teaching laboratory experience, each student in the experimental group taught the same ten- to twelve-minute lesson in the micro-laboratory. This lesson was video taped. The recording of verbal behavior of each pre-service elementary school teacher was tallied by two trained observers during a video tape replay. Matrices for Flanders' system of interaction analysis were completed for each student.

The micro-laboratory experiences extended over a six-week period. At the end of this time the experimental group again taught the same ten- to twelve-minute lesson in the micro-laboratory. The lesson was video taped. Verbal behavior was recorded by two trained observers, and matrices for Flanders' system of interaction analysis were completed for each student.

Approximately three months after the pretest, the professor or his assistant administered the semantic differential for measuring attitudes toward the concept (Teaching Elementary School Science) to both control and experimental groups.

#### Treatment of Data

Examination and treatment of the data were conducted in the following manner:

1. Each scale position of the semantic differential was assigned a number. The unfavorable pole was arbitrarily assigned a "1"; the favorable pole was assigned a "7"; and the neutral position (middle scale position) was assigned "4."

2. Raw scores were summed over subjects ( $N = 98$ ), and a Pearson product-moment correlation was calculated, yielding a 20 x 20 intercorrelation matrix of every scale with every other scale.

3. The intercorrelation matrix was subjected to a principle axis factor analysis followed by a varimax rotation, thereby revealing the factor composition of the semantic differential.

4. Those scales having a high loading on the post-test evaluative factor and minimal loadings on the other factors were taken as a measure of attitude. The mean of the scales meeting this criteria on the pretest constituted the subjects' original attitude score. The mean of the same scales on the post-test was taken as the subjects' post-test attitude score.

5. Hypothesis one was tested statistically by subjecting the mean attitude change score for the subjects in the three groups to a one-way analysis of covariance treatment.

6. Hypothesis two was tested statistically using a  $t$  test for correlated groups to ascertain the difference between means of the first to last verbal behavior observations for the revised indirect/direct ratio of the experimental group.

### Summary

The semantic differential instrument was designed according to the criteria espoused by Osgood. The purpose of this instrument was to detect any attitude change of the subjects in this study.

Flanders' system of interaction analysis was used to detect any increase of indirect verbal behavior of subjects in the experimental group.

The basic idea of this study was to measure the change of attitude toward teaching elementary school science and the increase of indirect verbal behavior of the experimental group after a micro-laboratory teaching experience.

Means for collecting data and treating the data statistically were described in this chapter.

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## CHAPTER IV

### STATISTICAL ANALYSIS AND DISCUSSION OF RESULTS

The purpose of this chapter was to analyze the compiled data in order to determine if a micro-teaching laboratory experience (1) influenced the attitudes of pre-service elementary teachers toward teaching elementary school science and (2) supported the increase of indirect verbal behavior of pre-service elementary school teachers.

The chapter is divided into the following sections:

1. An analysis of the results of the factor analysis of the semantic differential data
2. An analysis of statistical data and discussion of the results with regard to hypothesis one
3. An analysis of statistical data and discussion of the results with regard to hypothesis two.

The data assembled from the one-concept, twenty-scale semantic differential were subject to a principal-axis factor analysis followed by a varimax rotation in order to obtain the factor composition of the semantic differential. The .05 level of confidence was selected as an acceptable criterion for statistical validity.

Factor Analysis of the Semantic  
Differential Data

Table II shows the means and standard deviations for all the pretest and post-test semantic differential scale ratings for the concept--Teaching Elementary School Science.

TABLE II

PRETEST AND POST-TEST MEANS AND STANDARD DEVIATIONS  
FOR SCALE RATINGS OF THE CONCEPT SUMMED  
OVER ALL SUBJECTS

Scale	Mean	Standard Deviation	Mean	Standard Deviation
Clear--Hazy	4.77	1.67	5.51	1.42
Good--Bad	4.68	1.38	6.18	1.04
Cold--Hot	5.49	1.38	4.86	1.36
Interesting--Boring	5.55	1.36	6.54	.89
Meaningful--Meaningless	5.78	1.18	6.66	.68
Nice--Awful	4.81	1.17	5.66	1.32
Light--Heavy	4.43	1.29	4.22	1.40
Pleasant--Unpleasant	5.15	1.29	6.00	1.46
Deep--Shallow	6.02	1.11	4.95	1.29
Colorful--Colorless	6.37	1.04	6.07	1.19
High--Low	5.85	1.26	5.23	1.43
Fair--Unfair	6.16	1.00	5.86	1.25
Fresh--Stale	6.53	.75	5.87	1.23
Stimulating--Dull	5.70	1.32	6.47	1.02
Valuable--Worthless	5.62	1.12	6.71	.59
Active--Passive	6.35	1.07	6.09	1.33
Strong--Weak	4.07	1.23	5.76	1.30
Fast--Slow	6.68	.60	5.09	1.29
Optimistic--Pessimistic	5.89	1.11	6.14	1.29
Positive--Negative	5.93	1.19	6.26	1.15

Raw scores were summed over subjects, and a Pearson product-moment correlation was calculated, yielding a 20 x 20 intercorrelation matrix of every other scale for the post-test. The post-test semantic differential data were used for the



factor analysis to identify the evaluative scales. Previous studies conducted by Dr. Earl McCallon, North Texas State University, Denton, Texas, had indicated that, in general, post-test data for this concept tended to produce more stable and reliable factors. To check this pretest, data for this study were subjected to a principle axis factor analysis. Two factors emerged. One factor seemed to be evaluative in that all the evaluative scales identified by the post-test factor analysis loaded on this factor. Consequently, the researcher felt reasonably confident in using the scales that were selected for the attitude measurement in this study.

Table III shows the intercorrelation matrix. The bipolar adjective scales are ordered in the matrix as they are on the concept measurement instrument.

Table IV shows the rotated factor matrix of the scales for the post-test. These scales are listed from the highest to the lowest factor loadings for each successive factor.

Nine of the twenty scales on the post-test loaded on factor I. This factor was considered evaluative because of the semantic nature of the scales showing the highest loadings on it: positive--negative, clear--hazy, stimulating--dull, optimistic--pessimistic, good--bad, active--passive, strong--weak, interesting--boring, and pleasant.

The second factor was identified as the potency variable: deep--shallow, fair--unfair, and high--low.



The third factor was identified as the activity variable: light--heavy and fast--slow.

The fourth factor seemed to indicate another evaluative factor: valuable--worthless and meaningful--meaningless. This fourth factor probably reflects a different kind of evaluative connotation from the evaluative factor of the first loading.

Several scales did not seem to load heavily upon any one of these factors: nice--awful, fresh--stale, hot--cold, and colorful--colorless.

TABLE IV

ROTATED FACTOR MATRIX OF THE SCALES ON THE POST-TEST

Scale	I	II	III	IV
Positive--Negative	.91	.17	.07	.14
Clear--Hazy	.86	.18	-.06	.11
Stimulating--Dull	.83	-.01	.30	.21
Optimistic--Pessimistic	.80	.16	.06	.18
Good--Bad	.75	.27	-.22	.29
Active--Passive	.74	.09	.29	.14
Strong--Weak	.73	.33	.23	.11
Interesting--Boring	.69	-.14	.35	.33
Pleasant--Unpleasant	.64	.10	.28	.24
Deep--Shallow	.21	.76	-.03	-.00
Fair--Unfair	-.01	.74	.11	.32
High--Low	.49	.58	.34	.08
Light--Heavy	.10	-.05	.79	.15
Fast--Slow	.18	.45	.74	-.09
Valuable--Worthless	.21	.25	.02	.81
Meaningful--Meaningless	.49	.02	.18	.72
Nice--Awful	.50	.20	.35	.24
Fresh--Stale	.53	.38	.04	.03
Hot--Cold	.50	.20	.35	.24
Colorful--Colorless	.49	.30	.20	.32

Statistical Analysis of Data and Discussion  
Pertinent to Hypothesis One

The eleven scales having a high loading on the evaluative factor of the post-test semantic differential instrument were selected as a measure of attitude. The mean of these scales on the pretest constituted the subjects' original attitude score. The mean of these scales on the post-test were taken as the subjects' post-test attitude score. A group attitude score was indicated by the mean of all group subjects' attitude scores.

Table V shows the mean and standard deviation of the attitude scores of all the groups between the pretest and post-test for the concept--Teaching Elementary School Science.

TABLE V  
PRETEST AND POST-TEST GROUP ATTITUDE MEAN AND  
STANDARD DEVIATION FOR ALL GROUPS

Groups	N	Pretest		Post-test	
		Mean	Standard Deviation	Mean	Standard Deviation
Control Group I	26	5.58	.94	5.36	1.13
Control Group II	46	6.12	.61	6.58	.41
Experimental Group	26	6.12	.70	6.41	.62

The data in Table V suggest the following: (1) control group I which was not enrolled in a science methods course

tended to show a less favorable attitude toward teaching elementary school science at the end of the experiment; (2) it was noted that the two science methods groups had the same initial mean; however, control group II which was engaged in a regular science methods course developed a more positive attitude toward teaching elementary school science than did the group having a micro-teaching laboratory experience; and (3) the experimental group which was enrolled in a science methods course and was having a micro-teaching laboratory experience did show a post-test increase in positive attitude toward teaching elementary school science, although not as great a change as the group participating in a regular science methods course.

Hypothesis one of this study stated (1) that pre-service elementary school teachers enrolled in a science methods course would achieve a more favorable attitude, which would be statistically significant, toward the teaching of elementary school science by participating in a micro-teaching laboratory experience than pre-service elementary school teachers enrolled in a traditional science methods course; and (2) that pre-service elementary school teachers enrolled in one of the science methods courses would achieve a more favorable attitude, which would be statistically significant, toward the teaching of elementary school science than pre-service elementary school teachers not enrolled in a science methods course.

Analyses of covariance were performed in order to contrast (1) those having a science methods course with a micro-teaching laboratory experience with those having a science methods course but no micro-teaching laboratory experience and (2) those having a science methods course with those not having a science methods course.

A summary of the analysis of covariance contrasting control group II with the experimental group can be seen in Table VI. Because the F ratio failed to reach the required level for the .05 level of confidence, the first part of research hypothesis one, stating that the experimental group (science methods group having a micro-teaching experience) would achieve a more favorable attitude, which would be statistically significant, toward teaching elementary school science than control group II (science methods group with no micro-teaching laboratory experience) was rejected.

TABLE VI

SUMMARY OF THE ANALYSIS OF COVARIANCE CONTRASTING  
CONTROL GROUP II WITH THE EXPERIMENTAL GROUP

Source of Variation	SS	df	MS	F
Between Groups	.45	1	.45	2.26
Within Groups	<u>13.75</u>	<u>69</u>	.20	-
Total	14.20	70		

A comparison of an increase in favorable attitude toward teaching elementary school science between control group II and the experimental group (groups taking a science methods course) and control group I (group not taking a science methods course) as set forth in the second part of hypothesis one is divulged in Table VII.

TABLE VII

SUMMARY OF THE ANALYSIS OF COVARIANCE CONTRASTING  
CONTROL GROUP II AND THE EXPERIMENTAL G  
GROUP WITH CONTROL GROUP I

Source of Variation	SS	df	MS	F
Between Groups	12.16	1	12.16	35.25
Within Groups	<u>32.78</u>	<u>95</u>	.35	-
Total	44.94	96		

The F ratio is significant above the .001 level of confidence. Therefore, the second part of research hypothesis one, which states that pre-service elementary school teachers enrolled in one of the science methods courses would achieve a more favorable attitude, which would be statistically significant, toward the teaching of elementary school science than pre-service elementary school teachers not enrolled in a science methods course is rejected.

Statistical Analysis of Data and Discussion  
Pertinent to Hypothesis Two

Hypothesis two stated that pre-service elementary school teachers enrolled in a science methods course and participating in a micro-teaching laboratory experience would show a statistically significant increase in indirect teacher influence from onset to the end of a micro-teaching experience.

Before measuring the indirect teacher influence, it was necessary to establish observer reliability. Table VIII shows the data used to calculate the reliability by using the Scott Coefficient of Observer Reliability.

TABLE VIII  
DATA USED TO CALCULATE RELIABILITY BY SCOTT'S METHOD

Category	Observer A	Observer B	% A	% B	% Diff.	(Av.%) <sup>2</sup>
1	0	0	0.0	0.0	0.0	.000
2	18	20	8.7	9.9	1.2	.865
3	10	9	4.8	4.5	.3	.216
4	43	48	20.8	23.8	3.0	4.973
5	35	31	16.9	15.3	1.6	2.592
6	3	2	1.4	1.0	.4	.014
7	0	0	0.0	0.0	0.0	.000
8	8	9	3.9	4.5	.6	.76
9	75	66	36.2	32.7	3.5	11.868
10	15	17	7.2	8.4	1.2	.608
Totals	207	202	99.9	100.1	11.8	21.312

The Scott Coefficient of Observer Reliability between the two observers was .85, which met the need for a reliability level sufficient to make inferences from the data.



With Fisher's  $t$ , the difference of means between the first and last observation was obtained for the indirect/direct ratio for the experimental group. Table IX shows the mean change in verbal behavior of the experimental group.

The data for hypothesis two yielded mean scores indicating an increase in indirect verbal behavior after a micro-teaching experience. However, the mean change from the first to the last observation of the experimental group was not statistically significant; therefore, research hypothesis two was rejected.

TABLE IX  
MEAN CHANGE IN INDIRECT/DIRECT RATIO FOR  
THE EXPERIMENTAL GROUP

Means		$t$
First Observation	Last Observation	
55.46153	58.57692	-.87548

The data recorded by observers of the indirect/direct verbal behavior show pre-service elementary school teachers as not being significantly influenced by a micro-teaching laboratory experience carried out under the program designed for this study. It was noted, however, that the change in verbal behavior was in the direction anticipated in hypothesis two.

### Summary

The purpose of this chapter was to analyze and discuss the data as described in Chapter III. The presentation was organized into the following three parts:

1. Factor analysis of the semantic differential data
2. Statistical analysis of data and discussion regarding hypothesis one
3. Statistical analysis of data and discussion regarding hypothesis two.

Chapter V will be composed of the summary, findings, conclusions, and recommendations for further research.

## CHAPTER V

### SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

#### Summary

This study was proposed in order to determine if a micro-laboratory experience could be effectively used to (1) influence attitudes toward teaching elementary school science and (2) support indirect verbal behavior of pre-service elementary school teachers. A semantic differential instrument was designed to use as a pre- and post-test attitude measurement in order to determine the attitude of all subjects toward teaching elementary school science. Flanders' system of interaction analysis was used to determine the change in indirect verbal behavior of the experimental group. Observations for determining this change were made by trained observers prior to and following the micro-laboratory experiences.

The ninety-eight subjects participating in this study consisted of three groups of junior or senior elementary education majors enrolled in a university in the Southwest during the Spring semester of 1969.

The micro-teaching laboratory experience was directed and critiqued by the professor and his assistant.

The hypotheses of this study were the following:

1. Pre-service elementary school teachers enrolled in a science methods course would achieve a more favorable

attitude, which would be statistically significant, toward the teaching of elementary school science by participating in a micro-teaching laboratory experience than pre-service elementary school teachers enrolled in a traditional science methods course; and pre-service elementary school teachers enrolled in both of the science methods courses would achieve a more favorable attitude, which would be statistically significant, toward the teaching of elementary school science than pre-service elementary school teachers not enrolled in a science methods course.

2. Pre-service elementary school teachers enrolled in a science methods course and participating in a micro-teaching laboratory experience would show a statistically significant increase in indirect teacher influence from onset to the end of the micro-teaching laboratory experience.

Hypothesis one was statistically tested by subjecting the mean attitude score (derived from the administration of the pre- and post-test semantic differential instrument) for the subjects in the three groups to an analysis of covariance treatment.

Hypothesis two was statistically tested by the  $t$  test to determine the difference of the means between the first and last observations (as measured according to Flanders' system) for indirect verbal behavior of the experimental group.

The level of statistical significance was arbitrarily set at the .05 level of confidence.

### Findings

The following findings were formulated from an analysis of the data collected in this study:

1. An increase in favorable attitudes toward the teaching of elementary school science by pre-service elementary school teachers, as measured by the pre- and post-test semantic differential, occurred in the group enrolled in the traditional science methods course (control group II).

Also, an increase in favorable attitudes toward the teaching of elementary school science by pre-service elementary school teachers, as measured by the pre- and post-test semantic differential, occurred in the group enrolled in a science methods course and having a micro-teaching laboratory experience (experimental group). The greatest attitude change was noted in the group enrolled in the traditional science course (control group II).

A decrease in favorable attitudes toward the teaching of elementary school science by pre-service elementary school teachers, as measured by the pre- and post-test semantic differential, occurred in the group not enrolled in a science methods course (control group I).

Significant differences, regarding an increase in favorable attitudes toward the teaching of elementary school science, were not found when comparing the group enrolled in a science methods course and having a micro-teaching laboratory experience (experimental group) with the group enrolled in a

science methods course and not having a micro-teaching experience (control group II).

The groups having the science methods course (control group II and the experimental group), when compared with the group not having the science methods course (control group I), showed a greater increase in more favorable attitudes toward teaching elementary school science. This was statistically significant at the .001 level.

2. The group enrolled in a science methods course and having a micro-laboratory experience (experimental group) did show an increase in indirect teacher influence from first observation to last observation. However, this increase was not statistically significant.

### Conclusions

From the data studied the following conclusions were made:

1. This study, as designed and carried out, showed that pre-service elementary school teachers enrolled in a science methods course and having a micro-teaching laboratory experience did not develop any more favorable attitudes toward teaching elementary school science than did other pre-service elementary school teachers enrolled in a science methods course and not having a micro-teaching laboratory experience. In fact, while not statistically significant, the results showed that there was a trend in the direction of more favorable attitudes for

those students enrolled in a science methods course and not having micro-teaching laboratory experiences.

2. Pre-service elementary school teachers enrolled in a science methods course did develop more favorable attitudes toward the teaching of elementary school science than pre-service elementary school teachers not enrolled in a science methods course.

3. Pre-service elementary school teachers enrolled in a science methods course and having a micro-teaching laboratory experience did not significantly increase in indirect teacher influence.

4. In the light of the findings of this study, assumption number three, stating that this study is based on the assumption that it is possible to practice the teaching act in parts ultimately being assimilated into the whole teaching act, may need to be rejected. Since no statistically significant difference was found in either the measure of attitudes or teacher influence, it may well be that this assumption is incorrect.

#### Recommendations

The following recommendations are made on the basis of the conclusion of this study:

1. It is recommended that a science methods course be included in the pre-service elementary school teacher program to further positive attitudes toward teaching elementary school science. It is recommended that teachers of science

methods courses continue to strive to find means to further improve the attitudes of students toward the teaching of elementary school science.

2. Research in the area of attitudes toward science should be concerned with methods and content used in the traditional science methods course in order to determine which aspects of the instruction provide more favorable attitudes.

3. Research in the area of attitude change as the result of methods courses such as the one described in this study should consider the duration of favorable attitudes toward the teaching of elementary school science by pre-service elementary school teacher by follow-up testing at a later date.

4. It is recommended that a study be designed using a micro-teaching experience focusing on an increase in indirect verbal behavior, while a separate study be designed with the use of micro-teaching focusing on the increase of favorable attitudes toward the teaching of elementary school science. It appeared that the combination of these two factors tended to work at cross-purposes. It is deemed necessary to have several micro-laboratory teaching and reteaching sessions to obtain an increase in indirect verbal behavior; however, the time spent in such sessions in this study seemed to be disproportionate to the time allotted for the entire course. A lack of enthusiasm noted in students toward the end of the micro-teaching laboratory experience might have been due to too many micro-teaching encounters in the micro-laboratory.



This might account for the insignificant increase of favorable attitudes toward the teaching of elementary school science in the experimental group.

APPENDIX

## APPENDIX A

INSTRUCTIONS: In completing the attached rating scale, please make your judgments on the basis of what these things mean to you. You are to rate the concept on each of these scales in order.

Here is how you are to use these scales:

If you feel that the concept at the top of the page is very closely related to one end of the scale, you should place your check-mark as follows:

fair x : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : unfair

or

fair \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : x : unfair

If you feel that the concept is quite closely related to one or the other end of the scale (but not extremely), you should place your check-mark as follows:

strong \_\_\_ : x : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : weak

or

strong \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : \_\_\_ : weak

If you consider the concept to be neutral on the scale, both sides of the scale equally associated with the concept, or if the scale is completely irrelevant, unrelated to the concept, then you should place your check-mark in the middle space.

safe \_\_\_ : \_\_\_ : \_\_\_ : x : \_\_\_ : \_\_\_ : \_\_\_ : dangerous

- IMPORTANT:
1. Place your check-marks in the middle of spaces, not on the boundaries.
  2. Be sure you check every scale for every concept--do not omit any.
  3. Never put more than one check-mark on a single scale.

Make each item a separate and independent judgment. It is your first impressions, the immediate "feelings" about the items, that we want. On the other hand, do not be careless because we want your true impressions.



PERSONAL DATA SHEET

NAME \_\_\_\_\_ DATE \_\_\_\_\_

Please place an X in the appropriate box.

SEX:

Male

Female

CLASSIFICATION:

Junior

Senior

Other

Please circle Yes or No in answer to the following question:

Have you had Interaction Analysis in a college course?

Yes

No

Please circle the appropriate answer:

This semester I will be

Junior Student Teaching

Neither

Senior Student Teaching

This semester I am am not taking a science course.

Please list below college courses you have completed in the field of science.

PHYSICS	CHEMISTRY	BIOLOGY	GEOLOGY	OTHER
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

## APPENDIX B

## MICRO-TEACHING LABORATORY

The micro-laboratory is a self-contained unit which has been designed by Drs. Louise Allen and Howard Smith, North Texas State University, Denton, Texas, for micro-teaching in the pre-service education program in elementary education. The expanded laboratory is approximately seven feet in width by ten feet in length and seven feet high. The front wall has four panels of one-way glass to facilitate observation. There is a porthole with a Plexiglas covering and a foldable mount to support a television camera. In the back there is a door permitting easy entrance and exit. The micro-teaching laboratory has a built-in ventilation, lighting, and sound system.

The micro-laboratory provides a controlled environment where the video system is concealed and where the audience can observe unseen.

## Experimental Group

### MICRO-TEACHING LABORATORY EXPERIENCE

The class was divided into teams numbering from two to four pre-service elementary school teachers. The size of the team was dependent upon the size of the class. Each team was assigned a day to teach and a certain micro-laboratory in which to teach. The students assigned to teach in a certain laboratory became the student observers on the days they were not scheduled to micro-teach. The student observers completed the critiquing instrument immediately following the micro-teaching. The replay session was scheduled for later the same day.

### OUTLINE FOR THE MICRO-TEACHING

#### LABORATORY EXPERIENCE

##### First Day:

1. The researcher explained the following: (1) the meaning of micro-teaching, (2) the benefits of micro-teaching, (3) make-up of the micro-lesson, and (4) where to obtain micro-lesson materials. Selection of team members and teaching time was made.

##### Second Day:

1. The experimenter instructed the group in skills that vary the stimulus situation. The use of the critiquing instrument was discussed. Questions concerning all phases of the micro-teaching presentation were answered.

##### Third, Fourth, and Fifth Days:

- \* 1. Teach (Varying the Stimulus Situation) phase video taped in micro-laboratories.

Micro-laboratory 1    One team in each laboratory each day.  
 Micro-laboratory 2

2. Critiquing instrument (Varying the Stimulus Situation) was completed by student observers immediately following micro-teaching.
3. Critique--Replays for each team were scheduled for later the same day. Self-analysis and results of the evaluation by student observers were considered at that time by the team under the guidance of the professor and his assistant.

Sixth, Seventh, and Eighth Days:

1. Reteach (Varying the Stimulus Situation) phase video taped in the micro-laboratories.  
 Micro-laboratory 1 One team in each laboratory each day.  
 Micro-laboratory 2
2. Critiquing instrument (Varying the Stimulus Situation) was completed by student observers immediately following the micro-teaching.
3. Critique--Replay for each team will be scheduled for later the same day. Self-analysis and results of the evaluation by student observers were considered at that time by the team under the guidance of the professor and his assistant.

Ninth Day:

1. Instruction in the Reinforcement Skills were presented.
2. Students prepared new micro-lesson outside the class.

Tenth, Eleventh, and Twelfth Days:

1. Teach (Reinforcement) phase video taped in the micro-laboratories.  
 Micro-laboratory 1 One team in each laboratory each day.  
 Micro-laboratory 2
2. Critiquing instrument (Reinforcement) was completed by student observers immediately following micro-teaching.
3. Critique--Replays for each team were scheduled for later the same day. Self-analysis and results of the evaluation by student observers were considered at that time by the team under the guidance of the professor and his assistant.



Micro-teacher \_\_\_\_\_ Team \_\_\_\_\_

Date \_\_\_\_\_ Education 433 \_\_\_\_\_

## Critiquing Instrument

VARYING THE STIMULUS SITUATIONInadequate   Adequate   Excessive

## TEACHER GESTURES

1. The teacher used gestures of the body, hand, and head to enhance the presentation of the lesson.

## FOCUSING

2. The teacher used gestural (as pointing) and verbal (as "listen," "look") focusing or a combination when making a specific point.

## INTERACTION

3. The teacher varied the kinds of interaction (teacher-group, teacher-pupil, or pupil-pupil).

Micro-teacher \_\_\_\_\_ Team \_\_\_\_\_

Date \_\_\_\_\_ Education 433 \_\_\_\_\_

### Critiquing Instrument

#### REINFORCEMENT

Inadequate      Adequate      Excessive

#### POSITIVE TEACHER COMMENTS

1. When the student performed well, the teacher rewarded him with such words as "good," "fine," "excellent," etc.

#### POSITIVE TEACHER GESTURES

2. The teacher encouraged the students' participation with nonverbal cues, such as nods, smiles, moving toward pupils, etc.

#### ENTHUSIASM

3. The teacher responded to the students' questions and comments enthusiastically.

## Control Group

OUTLINE FOR EDUCATION 433, SCIENCE FOR CHILDREN

First Day:	General Overview of Course
Second Day:	The Nature of Science
Third Day:	Elementary School Science--Past and Present
Fourth Day:	Objectives in Elementary School Science
Fifth Day:	Scope and Sequencing in Elementary School Science
Sixth Day:	The Development of Science Concepts
Seventh Day:	Characteristics of Children and the Teaching of Science
Eighth Day:	Film: <u>Motivation for Science Learning</u>
Ninth Day:	Open Day, to be used as needed
Tenth Day:	Short Examination and In-Class Critique
Eleventh Day:	Emphasizing Science Processes--Observing
Twelfth Day:	Emphasizing Science Processes--Inferring
Thirteenth Day:	Emphasizing Science Processes--Space/Time Relations
Fourteenth Day:	Emphasizing Science Processes--Measuring
Fifteenth Day:	Emphasizing Science Processes--Classifying
Sixteenth Day:	Emphasizing Science Processes--Predicting
Seventeenth Day:	Open Day, to be used as needed
Eighteenth Day:	Short Examination and In-Class Critique
Nineteenth Day:	Specific Methods in Science Instruction: Experiments
Twentieth Day:	(continued)
Twenty-first Day:	Specific Methods in Science Instruction--Demonstrations

- Twenty-second Day: (continued)
- Twenty-third Day: Specific Methods in Science Instruction--  
Reading and Reports
- Twenty-fourth Day: Resource Person in Science: Mr. Art  
Martin: Regional Aerospace Education  
Director (guest speaker)
- Twenty-fifth Day: Specific Methods in Science Instruction--  
Field Trips
- Twenty-sixth Day: Film: Field Trips for Discovery
- Twenty-seventh Day: Preparation for Class Field Trip (fossil  
hunt). Field Trip on Saturday.
- Twenty-eighth Day: Specific Methods in Science Instruction--  
Films, Filmstrips, Models, and Specimens,  
etc.
- Twenty-ninth Day: (continued)
- Thirtieth Day: Film: Teaching Techniques
- Thirty-first Day: Planning for Science Instruction--  
Determining Behavioral Objectives
- Thirty-second Day: Planning for Science Instruction--  
Curriculum Guides and Science Content
- Thirty-third Day: Planning for Science Instruction--Avail-  
ability of Curriculum Resource Materials
- Thirty-fourth Day: (continued)
- Thirty-fifth Day: Elements of a Good Science Lesson
- Thirty-sixth Day: Critique of a Science Lesson (Video Tape  
Replay)
- Thirty-seventh Day: Examination of Some Newer Science Programs:  
AAAS and ESS
- Thirty-ninth Day: Short Examination and In-Class Critique
- Fortieth Day: Materials for Science Teaching--Obtaining  
Free and Inexpensive Materials
- Forty-first Day: Materials for Science Teaching--Ordering  
Science Equipment

Forty-second Day: Materials for Science Teaching--Mr. Earl Grabhorn: Texas MidContinent Oil and Gas Association (guest speaker)

Forty-third Day: Course Review

Forty-fourth Day: Final Examination.

## APPENDIX C

## SUMMARY OF CATEGORIES FOR INTERACTION ANALYSIS

T E A C H E R  T A L K	INDIRECT INFLUENCE	<p>1. ACCEPTS FEELING: accepts and clarifies the tone of the students in a nonthreatening manner. Feelings may be positive or negative. Predicting and recalling feelings are included.</p> <p>2. PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, not at the expense of another individual, nodding head or saying "uh huh?" or "go on" are included.</p> <p>3. ACCEPTS OR USES IDEAS OF STUDENT: clarifying, building, or developing ideas or suggestions by a student. As teacher brings more of his own into play, shift to category five.</p> <p>4. ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.</p>
	DIRECT INFLUENCE	<p>5. LECTURES: giving facts or opinions about content or procedures; expressing his own idea; asking rhetorical questions.</p> <p>6. GIVES DIRECTION: directions, commands, or orders with which a student is expected to comply.</p> <p>7. CRITICIZES OR JUSTIFIES AUTHORITY: statements intended to change student behavior for non-acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing, extreme self-reference.</p>
S T U D E N T  T A L K		<p>8. STUDENT TALK-RESPONSE: talk by students in response to teacher's questions in which predetermined responses are expected.</p> <p>9. STUDENT TALK-INITIATION: talk by students, which they initiate. If "calling on" student is only to indicate who may talk next, observer must decide whether student wanted to talk. If he did, use this category. In addition, student's response to open ended question such as "What is your opinion?", "What do you suggest?", etc., would go in this category.</p>
		<p>10. SILENCE OR CONFUSION: pauses, short periods of silence, and periods of confusion in which communication cannot be understood by the observer.</p>

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