# THE EFFECT OF A SYMBOLIC AND PERCEPTUAL MODEL ON THE DEVELOPMENT OF ASKING OPEN-ENDED QUESTIONS IN PRE-SERVICE ELEMENTARY TEACHERS

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## PREFACE

The development of open-ended question asking ability within pre-service and in-service teachers is receiving increased attention in educational research with the realization that this process plays an important role in the inquiry process. This study was designed to develop and test a model which would enhance the open-ended questioning ability of pre-service elementary teachers.

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# CHAPTER I

## NATURE OF THE PROBLEM

### Introduction

Carner (12) believes that questions posed by elementary teachers and children are foremost among the stimuli which trigger the child's thinking during a science lesson and, thus, set the tone of cognition. However, questioning for many teachers is based upon the "who", "what", and "when" of a subject. Although questions have the capability of initiating critical and creative thinking, surveys indicate a high percentage of all questions asked call merely for reproducing what was just read, heard, or seen by children (9,11,16,29,38).

Educators have long advocated that one way to stimulate thinking among pupils is the effective use of questions (9,17,25,48). At present, educators are still advocating the use of effective questions and questioning strategies to stimulate thinking (24,34,52,55).

Pate and Bremer (38) imply that if learning is seen as not only the acquiring of knowledge but also as skill in using this knowledge, teachers need to recognize that questions offer an excellent means of checking on pupils' skills in organizing facts and on pupils' understanding of relationships among facts.

Available evidence that demonstrates a close relationship between the nature of the question asked and the thoughts elicited from the

children illustrates the need for questioning procedures, by the teacher, to focus on cognitive operations as well as content. A study by Taba, Levine, and Elzey (53) demonstrated a nearly perfect correlation between the level of thoughts expressed verbally by children and those sought by teachers in their questions.

Much has been written citing the inadequacy of elementary teachers in formulating and using appropriate and effective questions. Moyer (37) found that teachers were unprepared to develop and use the questioning process effectively. Floyd (20) illustrates that of the 1,347 questions asked by 40 primary teachers, fewer than 100 stimulated reflection and only 6% worthy of pursuit.

Houston (28) feels a definite need exists to provide prospective teachers with skill in formulating questions. This ability should enable them to initiate the inquiry process by helping children see the most important ideas and to formulate their own questions. The need for improving the quality of questions and questioning techniques is apparent when one considers the importance that has been attached to questioning, the extensive use of questioning, the defects shown by previous studies, the desirability of improved practices in all areas of education, and the arbitrary nature of the information available in the literature on methods.

The effectiveness of the inquiry approach and the learning and teaching of science as inquiry is heavily dependent upon asking questions that call for higher levels of thinking, that encourage children to ask questions, and that stimulate and direct the inquiry process.

Ideally, according to Carin (11:13) questioning should: ". . . set the learners thinking, promote activity and energy on their parts,

and arouse the whole mental faculty into action, instead of blindly cultivating the memory at the expense of the higher intellectual powers".

## Statement of the Problem

The purpose of this study was to develop and test a symbolic and perceptual model which was intended to enhance the ability of pre-service elementary teachers to ask open-ended questions.

## Limitations

The sample consisted of a random selection of the pre-service teachers from one university's elementary teacher education program during the fall semester of 1970. Therefore, inferences based upon these data should not be used to generalize to other universities' elementary teacher education programs unless the sample population is considered to be typical of other elementary student teacher populations.

## Clarification of Terminology

### Control Group

Ten randomly assigned pre-service elementary teachers that participated in the micro-teaching but did not receive special instruction concerning questioning techniques.

### Experimental Group

Ten randomly assigned pre-service elementary teachers that

participated in the micro-teaching and did receive special instruction concerning questioning techniques.

Hold Group

Ten randomly assigned pre-service elementary teachers that were not aware of their selection for this study, did not micro-teach, and did not receive special instruction concerning questioning techniques.

Inquiry

Inquiry is the process of formulating and testing ideas and implies an open classroom climate that encourages wide student participation and the expression of divergent points of view.

Micro-teaching

Micro-teaching is a scaled-down teaching experience which was developed at Stanford University. A more detailed discussion is on page 17.

Open-ended Questions

Open-ended questions are questions which require high levels of cognitive skills. Using Blooms' Taxonomy (8) they will include all levels except the knowledge category.

Perceptual Modeling

Perceptual modeling is a process whereby one transmits desired behavior to the learner by means of a video-tape or filmed model which portrays the desired behavior.

Symbolic Modeling

Symbolic modeling is a process whereby one transmits desired behaviors to the learner by means of written or verbal instructions.

## Significance of the Study

This study should give direction to the development of methods for teaching pre-service and in-service teachers' questioning skills. It should aid in developing the ability of pre-service elementary teachers to ask open-ended questions. Carner (12), Houston (28), Massialas (35), and Pate and Bremer (38) feel this open-ended questioning ability is necessary for the inquiry approach to teaching science.

## Hypotheses

Each of the following hypotheses is stated in the null form and tested for significance at the 0.05 level.

H. 1. A significant difference will not exist between the mean number of questions asked by the experimental and by the control group during the first micro-teaching experience.

H. 2. A significant difference will not exist between the mean number of closed questions asked by the experimental and by the control group during the first micro-teaching experience.

H. 3. A significant difference will not exist between the mean number of open-ended questions asked by the experimental and by the control group during the first micro-teaching experience.

H. 4. A significant difference will not exist between the mean number of questions asked by the experimental and by the control group during the second micro-teaching experience.

H. 5. A significant difference will not exist between the mean number of closed questions asked by the experimental and by the control group during the second micro-teaching experience.

H. 6. A significant difference will not exist between the mean number of open-ended questions asked by the experimental and by the control group during the second micro-teaching experience.

H. 7. A significant difference will not exist between the mean number of questions asked by the experimental and by the hold group after ten weeks of student teaching.

H. 8. A significant difference will not exist between the mean number of closed questions asked by the experimental and by the hold group after ten weeks of student teaching.

H. 9. A significant difference will not exist between the mean number of open-ended questions asked by the experimental and by the hold group after ten weeks of student teaching.

H. 10. A significant difference will not exist between the mean number of questions asked by the experimental and by the control group after ten weeks of student teaching.

H. 11. A significant difference will not exist between the mean number of closed questions asked by the experimental and by the control group after ten weeks of student teaching.

H. 12. A significant difference will not exist between the mean number of open-ended questions asked by the experimental and by the control group after ten weeks of student teaching.

H. 13. A significant difference will not exist between the mean number of questions asked by the hold and by the control group after ten weeks of student teaching.

H. 14. A significant difference will not exist between the mean number of closed questions asked by the hold and by the control group after ten weeks of student teaching.

H. 15. A significant difference will not exist between the mean number of open-ended questions asked by the hold and by the control group after ten weeks of student teaching.

# CHAPTER II

## REVIEW OF RELATED LITERATURE

### Introduction

The growing trend in education seems to focus upon problem solving facets of teaching, the development of creativity in the child, and the critical thinking skills. The art of questioning by the teacher plays a vital role in the implementation of these goals.

Jayne (31) studied the relationship between observable teacher activities and the changes produced in the pupils as measured by tests. Jayne's work was centered around the following activities:

1. Total number of questions
2. Number of question facts
3. Number of prepared thought questions
4. Total prepared questions
5. Percentage of pupil's talk
6. Percentage of teachers' talk
7. Recall of specific fact questions
8. Prepared fact questions
9. Answers indicated to be right
10. Unprepared fact questions

Jayne concluded that little relationship existed between specific observable teacher acts and the pupil-gain criterion.

Even though Jayne's work did not produce distinct relationships between observable teacher action and pupil-gain, it did help to develop the area, for research purposes, of the observable action in the classroom.

In work specifically in the area of classroom questions, Moyer (37) studied the following areas of inquiry:

1. Types of questions asked by teachers
2. Their structural form
3. The functions of the questions asked
4. The relationship between structure and function
5. The teacher's development and utilization of questions, including the language in logical questions, the patterns in variations
6. Teacher's awareness of the questioning process.

His major findings indicated that teachers tend to be consistent in the types of questions they ask and display distinguishable patterns of questioning in terms of structure, language, function, and utilization.

The current interest in inquiry or discovery-oriented approaches to teaching has produced a renewed interest in questioning. Studies by Jones and others (32), Fish and Goldmark (19), Scott (46), Suchman (50), and Weigand (54) reflect the emphasis on this aspect of inquiry as do the writings of Gagné (21) and Alyesworth (4).

As Dunfee (18) pointed out, these studies emphasize the involvement of pupils themselves as active participants in the learning experiences associated with problem solving. She also suggested that even though much evidence is given for the value of new approaches to learning associated with inquiry and problem solving, the teachers do not find them easy to apply.

Piltz's (39) studies of teachers in Florida gave substantial evidence of the need for improvement in present approaches to methods courses. Seventy-five per cent of the teachers in this study felt totally inadequate to teach science by a process of inquiry and, therefore, were unable to help children discover for themselves. In a study in this area, Schippers (42) found the question-raising phase of a problem-solving approach to be the greatest dilemma for teachers. Strasser (49) emphasized the role of the teacher as a supporter of inquiry through effective questioning.

## Questioning

It is apparent that the teacher's role as a questioner is vital to the inquiry process particularly when one realizes that the key to effective inquiry is questioning. Schwab (44) suggested that inquiry should constitute a significant portion of the teacher's preparation so that she can be prepared to comprehend inquiry and reports of inquiries and be familiar with the kinds of questions whose answers give value to such materials.

Hunter (30) found that teachers have a tendency to narrow broad questions which are not immediately answered and often take the divergent, convergent, or evaluative question and make it cognitive-memory. Hunter suggested that, since most teachers have little training in question asking, they tend to use cognitive memories most exclusively.

Gallager and Ashner (22) pointed out that the kind of thinking that youngsters engage in depends upon the kinds of questions teachers ask. We might infer from their statement and those of others noted in this study that teachers are not aware of the varieties which may be

developed in terms of types of questions, nor do they seem to understand the patterns that might be used in classroom questioning.

Minor (36) believes that "productive questioning" makes for productive teaching. She also believes that cueing students to action through question patterns reveals the meanings they have gleaned from their interactions with their environment.

Taba (51) found that the most marked single influence on the cognitive performances seems to reside in the impact of the teaching strategies. The impact is exercised by the nature of the questions asked, by what the teacher gives the student or seeks from him, and by the timing of these acts. The nature of the questions seems to play an especially influential role. Taba (53) also infers that the pattern established by the teacher in the approach to questions often is a determinant of the success or failure of the purposes being sought at any particular time.

Houston (28) suggested that the better questions, those that cause pupil initiated activity and guide independent study, are those that stimulate curiosity, arouse a feeling of need, or require using facts in some challenging problems. Hamann (26) identified the "good question" by the thought the question provokes as judged from the discussion, interest, and expression of thought shown by children. He stated a "good question" can be noted by its clarity. Hunkins (29) suggested that "good questions" clearly relate to the established objectives of the lesson. Therefore, careful planning to develop appropriate objectives and questions that lead to achievement of these objectives is required of the teacher. He goes on to suggest that the level of thinking elicited depends heavily on the information that the

respondee brings to the question. Klebaner (33) suggested that appropriateness and flexibility are two important criteria. These are important considerations when preparing questions for different learning situations. Nevertheless, it appears obvious that criteria for effective questions and questioning practices are difficult to identify particularly when the questions cannot be dealt with out of context.

The relationship between what the teacher is seeking and that with which the children respond was shown in the study by Taba, Levine, and Elzey (53) to be significant. The fact that it could be shown that the questions of the teaching strategy directly influenced the level of thought patterns of the children bears evidence of the impact of this aspect of the teaching strategy. Horn (27) pointed out that questions that are appropriate to stimulating thinking are not easily constructed and therefore require more extensive planning by the teacher with respect to established goals.

Schreiber (43) concluded that many teachers would benefit from instruction on how to improve their question-asking practices. She also suggested a need for emphasis on purposes, types, and guidelines for more effective questions in college courses preparing teachers. Schreiber further suggests that experiences in constructing questions would be beneficial to prospective teachers.

A few recent studies reported results of efforts to change teacher questioning practices. Elementary school student teachers who came to understand cognitive levels of questions, according to the Bloom (8) system, subsequently asked more higher order questions (14,40). Also, Taba (50) found that experienced teachers trained in special questioning strategy asked more higher-order questions than did untrained

teachers. Micro-teaching procedures using perceptual or symbolic models have been found productive in raising the use of higher-order questions by secondary teacher candidates according to Berliner and others (7).

Although evidence from the literature indicates that little has been done to improve the ability of teachers to ask effective questions, a number of categories or systems for classifying questions have evolved from efforts to improve questioning practices. Many have come through a means of studying classroom verbal behavior while others represent direct attempts to identify questioning practices as a specific focus. Seldom has questioning been isolated as a single concern for analysis, and even fewer attempts have been made to cause change in the questioning ability of teachers. The classification schemes and the data from these studies serve as important bases for identifying strategies for instruction in questioning procedures. A few of these efforts represent attempts to establish a hierarchy for questioning.

Aschner and Gallagher (3) operated on the assumption drawn from the data of their study that a question asked at a given level will elicit a response that can be identified with that same level. This is to say that cognitive-memory, the lowest level question, will bring about cognitive-memory responses. The level of the teacher's question may be a vital determinant for the kind of thinking and responding that follows. Therefore, the questions asked by a teacher can be identified with one of these cognitive classifications and the resulting responses analyzed in relation to the category to describe the cognitive development that is evolving.

## Modeling

A common approach to the transmission of teaching skills has been to provide some kind of discrimination training by means of written and oral instructions. The intern teacher typically receives a description of the correct responses and their sequencing for a particular situation. She then attempts to produce these behaviors in the classroom and receives periodic feedback on her performance.

A review of the relevant literature by Bandura and Walters (5) has shown that complex social behavior may be acquired almost entirely through imitation. Bandura and Walters (5:52) stated that "the provision of face-to-face models serves to accelerate the learning process and, in cases where errors are dangerous or costly, become an essential means of transmitting behavior patterns". In addition, Bandura and others (6) have demonstrated that film-mediated models are as effective as real-life models in transmitting deviant patterns of behavior.

## Micro-Teaching

Skinner (47:21) has written ". . . the whole process of becoming competent in any field must be divided into a large number of small steps, and reinforcement must be contingent upon the accomplishment of each step".

Cooper (15) believes a micro-teaching experience with small numbers of students and lessons of short duration provides excellent opportunities for practicing teaching skills. Cooper (15) also feels that one of the main purposes of a teacher education program should be to build up teacher competence in a number of teaching skills.

The normal teaching situation contains so many variables that precise research is virtually precluded. According to Allen and Eve (1) a major attraction of the micro-teaching format is that it simplifies the teaching act and provides an opportunity for real experimental control and manipulation of variables.

Micro-teaching can and should be used as a research tool to investigate which training strategies are most effective for teacher trainees with different backgrounds and aptitudes. At the same time, it can be used as a training strategy to give individual teachers the kind of teaching most suited for their particular abilities. Such research into alternate training routes should provide educators with a means of approaching the problem of individualizing instruction within teacher education. A strong possibility exists that teachers who are prepared in such an individualized program will subsequently be more able to develop and implement individualized instructional approaches with their students. Allen and Eve (1) pointed out that micro-teaching encourages a combination of theory and practice, research and training, innovation and implementation. The technique is still in its infancy, but its ultimate potential for both research and training depends entirely upon our imagination and our ingenuity in developing and testing new ways of application.

The video-tape is a definite asset in the micro-teaching process. Allen and Fortune (2) feel the visual and audio record of the teaching allows the student to see and hear her performance. Her supervisor can help her analyze the lesson so that she can practice for improvement and micro-teach again to see if she has improved.

The literature related to teacher training revealed that teacher

training programs must be under constant study if they are to produce teachers who are qualified in both content and methodology. Goodlad (23) emphasized the importance of teacher education in curriculum reform projects when he pointed out that broad-scale implementation of current curriculum projects depends upon both the usefulness of materials produced and the in-service education of teachers who use them. Most projects have distinguished themselves on both accounts. However, continuing self-renewal of the current curriculum reform movement depends upon the pre-service preparation of teachers in new content and the education of teachers who understand and are sympathetic to the place of organized subject matter in the education of the young. He believes current projects have not distinguished themselves on this account.

Davis and Tinsley (16) implied that if students are to develop a cognitive structure by their own efforts, the usual role of teaching and of the teacher has to be reversed. The teacher needs to become a guide of the thinking process. In this kind of teaching strategy, the art of asking questions assumes a crucial role. Questions, furthermore, need a double focus: on the substance of what is being discussed and on the cognitive operations. Questioning is an art and will be most effective when the teacher understands the thought process through which the learner must progress in a given learning situation. Wellington and Wellington (55:471) have written:

> The questions we ask would be designed to create eagerness for learning and to put in motion the process of critical thinking. The questions would develop first the individual's ability to define his own questions, and then his ability to discover answers which he can use in the light of known facts and research.

Carner (12) feels that proper questioning creates the type of thinking that lies at the heart of scientific inquiry and that this thinking must be encouraged from the beginning of formal education.

Because effectively-phrased questions and the employment of effective questioning techniques can be crucial to the implementation of any methodology based on the inquiry process, it is most important that prospective elementary teachers not only be aware of, but also be proficient in the use of effective questioning practices. It is most vital for methodologies to be developed that cause prospective teachers to be more skillful in their questioning.

# CHAPTER III

## METHOD AND DESIGN

### Micro-Teaching

Micro-teaching, which was originally developed at Stanford University by Allen (2) and his associates, is designed to concentrate on the development of teaching skills. The prospective teacher teaches brief lessons to small groups of students. These teaching episodes, which last from 5 to 20 minutes, are video-taped and played back to the prospective teacher and his or her supervisor for the purpose of analysis. The prospective teacher then reteaches the same concept to a new group of students. This process is repeated until competence is achieved in a particular teaching skill.

The micro-teaching procedures used in this study were approximately 15 minutes in length with slight variations from the procedures developed at Stanford University.

Bush and Allen (10) isolated nine teaching skills (See Appendix A) at Stanford University. Skills numbered 4, (using questions effectively) and 9, (setting a model) are of particular interest in the study outlined below.

Thirty pre-service teachers enrolled in the elementary education block during the fall term of 1970 were randomly assigned, using a table of random numbers, to control, experimental, and hold groups.

The lessons used for the perceptual model and the micro-teaching sessions were modifications of lessons in the series, Science: A Process Approach (45) developed by the American Association for the Advancement of Science. Three third and/or fourth grade students were randomly assigned to the pre-service teachers during the micro-teaching sessions.

During the first meeting of the control group, micro-teaching was explained. Each member was given a science lesson (See Appendix B) and told that she would micro-teach the lesson while being video-taped. Simultaneously the first meeting for the experimental group was in progress and micro-teaching was being explained. Each member of the experimental group was given the same lesson as the control group. In addition, they were shown a symbolic and perceptual model and then told that they would micro-teach the lesson while being video-taped. The members of the hold group were not told of their selection and not given special treatment.

The symbolic model (See Appendix C) was a handout, developed by Clegg (13) listing six categories of Bloom's Taxonomy (8) with operational definitions for each, a key word, and typical question words for each category. The perceptual model (See Appendix D) was a video-tape of a micro-teaching session which demonstrated the use of open-ended questions.

## Questioning

Two of the most frequently used guides to determine the cognitive level of teachers' questions have been Bloom's Taxonomy of Educational Objectives (8), and Sander's Classroom Questions--What Kinds? (41).

This study used operational definitions formulated for each of the categories in the Bloom Taxonomy.

As in the study by Clegg (13), one of the protocals developed for this study was that only the teacher's exact, operational words and the syntax of the question would be considered to assess its cognitive level. No inferences were made from student responses or other contextual clues.

The initial micro-teaching and video-taping session was held for five members of the control group and five members of the experimental group on the fifth day following the first group meeting. On the sixth day, the session was continued for the remaining members of each group. During the following ten days members of each group individually viewed the video-tape of her micro-teaching session and received the science lesson (See Appendix E) for the second micro-teaching experience. Members of both groups were under the supervision of the researcher. While viewing the individual tapes with each member of the experimental group, the researcher pointed out ten open-ended and three closed questions.

The second micro-teaching session for both groups was held two weeks later than the first. The students were not required to view their tapes this time, but the tapes were made available to them if they wanted to compare the two micro-teaching experiences.

Following ten weeks of student teaching, the members of the control, experimental, and hold groups were instructed by their cooperating teacher to record a twenty minute science lesson. This lesson was to be of their own choice and recorded on an audio-tape in their regular classroom situation. One member of the experimental group and

two members of the control group did not turn in tapes.

The video and audio-tapes were analyzed, and the questions asked by the pre-service elementary teachers were categorized by the researcher and an expert as either open-ended or closed. The t-test was used to determine if significant differences existed in the questions asked by each group.

## CHAPTER IV

## RESULTS OF STATISTICAL ANALYSIS

To determine what effect, if any, the model had on questioning techniques of pre-service elementary teachers in a micro-teaching situation the first 6 hypotheses were tested. To determine what effect, if any, the model and/or micro-teaching had on questioning techniques of pre-service elementary teachers in the classroom the last 9 hypotheses were tested.

> Hypothesis 1: A significant difference will not exist between the mean number of questions asked by the experimental and the control group during the first micro-teaching experience.

The raw data (Appendix F) yielded a mean of 84.7 questions (Table I) for the experimental group and a mean of 42.2 questions for the control group. The analysis of data indicated the null hypothesis should be rejected and gave evidence that the model was effective in increasing the number of questions asked by the experimental group.

> Hypothesis 2: A significant difference will not exist between the mean number of closed questions asked by the experimental and the control group during the first micro-teaching experience.

The raw data (Appendix F) yielded a mean of 41.8 closed questions (Table I) for the experimental group and a mean of 32.4 closed questions for the control group. This analysis of data resulted in failure to reject the null hypothesis. Therefore, the model did not have an effect

TABLE I

QUESTIONS ASKED BY PRE-SERVICE ELEMENTARY TEACHERS DURING THEIR FIRST MICRO-TEACHING EXPERIENCE

| Questions | Experimental (N=10) | | Control (N=10) | | t | |
|---|---|---|---|---|---|---|
| | mean | standard deviation | mean | standard deviation | calculated | tabulated (p=.05) |
| Total | 84.7 | 36.246 | 42.4 | 16.304 | 3.366* | 2.101 |
| Closed | 41.8 | 18.540 | 32.4 | 11.597 | 1.359** | 2.101 |
| Open-Ended | 42.9 | 26.409 | 10.0 | 5.850 | 3.846* | 2.262 |

* Significant at .01 level
** Not significant

on the number of closed questions asked by the experimental group.

> Hypothesis 3: A significant difference will not exist between the mean number of open-ended questions asked by the experimental and the control group during the first micro-teaching experience.

The raw data (Appendix F) yielded a mean of 42.9 open-ended questions (Table I) for the experimental group and a mean of 10.0 open-ended questions for the control group. The analysis of data indicated the null hypothesis should be rejected and gave evidence that the model was effective in increasing the number of open-ended questions asked by the experimental group.

To determine whether the effect of this model would last over time an identical set of hypotheses was tested following a second micro-teaching experience.

> Hypothesis 4: A significant difference will not exist between the mean number of questions asked by the experimental and the control group during the second micro-teaching experience.

The raw data (Appendix F) yielded a mean of 53.3 questions (Table II) for the experimental group and a mean of 35.0 questions for the control group. The analysis of data indicated the null hypothesis should be rejected and gave evidence that the model was effective in increasing the number of questions asked by the experimental group.

> Hypothesis 5: A significant difference will not exist between the mean number of closed questions asked by the experimental and the control group during the second micro-teaching experience.

The raw data (Appendix F) yielded a mean of 22.6 closed questions (Table II) for the experimental group and a mean of 22.8 closed questions for the control group. This analysis of data resulted in failure to reject the null hypothesis. As before, the model did not have an

TABLE II

QUESTIONS ASKED BY PRE-SERVICE ELEMENTARY TEACHERS DURING THEIR SECOND MICRO-TEACHING EXPERIENCE

| Questions | Experimental (N=10) | | Control (N=10) | | t | |
|---|---|---|---|---|---|---|
| | mean | standard deviation | mean | standard deviation | calculated | tabulated (p=.05) |
| Total | 53.3 | 14.507 | 35.0 | 21.239 | 2.250* | 2.101 |
| Closed | 22.6 | 9.834 | 22.8 | 13.373 | 0.038** | 2.101 |
| Open-Ended | 30.7 | 14.064 | 12.2 | 9.659 | 3.429*** | 2.101 |

* Significant at .05 level
** Not significant
*** Significant at .01 level

effect on the number of closed questions asked by the experimental group.

> Hypothesis 6: A significant difference will not exist between the mean number of open-ended questions asked by the experimental and the control group during the second micro-teaching experience.

The raw data (Appendix F) yielded a mean of 30.7 open-ended questions (Table II) for the experimental group and a mean of 12.2 open-ended questions for the control group. The analysis of data indicated the null hypothesis should be rejected and gave evidence that the model was effective in increasing the number of open-ended questions asked by the experimental group.

To determine whether this enhanced ability to ask open-ended questions would be apparent in the classroom the following hypotheses were tested after 10 weeks of student teaching. The research design also provided a means to insure that if this enhanced ability existed in the classroom, it would be possible to determine whether it was caused by the model and/or micro-teaching.

> Hypothesis 7: A significant difference will not exist between the mean number of questions asked by the experimental and the hold group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 52.2 questions (Table III) for the experimental group and a mean of 50.1 questions for the hold group. The analysis of data resulted in failure to reject the null hypothesis and gave evidence that the model was not effective in increasing the number of questions asked by the experimental group.

> Hypothesis 8: A significant difference will not exist between the mean number of closed questions asked by the experimental and the hold groups after ten weeks of student teaching.

TABLE III

QUESTIONS ASKED BY PRE-SERVICE ELEMENTARY TEACHERS DURING A CLASSROOM LESSON AFTER TEN WEEKS OF STUDENT TEACHING

| | Total | | Closed | | Open-Ended | |
|---|---|---|---|---|---|---|
| | mean | standard deviation | mean | standard deviation | mean | standard deviation |
| Experimental (N=9) | 52.2 | 25.029 | 15.4 | 7.401 | 36.8 | 19.376 |
| Hold (N=10) | 50.1 | 15.602 | 37.2 | 13.045 | 12.9 | 5.300 |
| Control (N=8) | 35.0 | 14.112 | 26.1 | 12.900 | 8.9 | 5.793 |
| | | | t | | | |
| | calculated | tabulated (P=.05) | calculated | tabulated (P=.05) | calculated | tabulated (P=.05) |
| E vs H | 0.224* | 2.110 | -4.399** | 2.110 | 3.755** | 2.306 |
| E vs C | 1.715* | 2.131 | -2.126* | 2.131 | 3.908** | 2.365 |
| H vs C | 2.127*** | 2.120 | 1.799* | 2.120 | 1.537* | 2.120 |

* Not significant
** Significant at the .01 level
*** Significant at the .05 level

The raw data (Appendix F) yielded a mean of 15.4 closed questions (Table III) for the experimental group and a mean of 37.2 closed questions for the hold group. The analysis of data indicated that the null hypothesis should be rejected and gave evidence that the model and/or micro-teaching was effective in decreasing the number of closed questions asked by the experimental group.

> Hypothesis 9: A significant difference will not exist between the mean number of open-ended questions asked by the experimental and the hold group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 36.8 open-ended questions (Table III) for the experimental group and a mean of 12.9 open-ended questions for the hold group. Again, the analysis of data indicated that the null hypothesis should be rejected. Therefore, the model and/or micro-teaching was effective in increasing the number of open-ended questions asked by the experimental group.

The last three comparisons indicate that if significant differences exist, they are caused by the model and/or micro-teaching. To determine which of these factors caused the difference the following hypotheses were tested.

> Hypothesis 10: A significant difference will not exist between the mean number of questions asked by the experimental and the control group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 52.2 questions (Table III) for the experimental group and a mean of 35 questions for the control group. The analysis of data resulted in failure to reject the null hypothesis and gave evidence that the model was not effective in increasing the number of questions asked by the experimental group.

> Hypothesis 11: A significant difference will not exist between the mean number of closed questions asked by the experimental and the control group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 15.4 closed questions (Table III) for the experimental group and a mean of 26.1 closed questions for the control group. The analysis of data resulted in failure to reject the null hypothesis and gave evidence that the model was not effective in decreasing the number of closed questions asked by the experimental group.

> Hypothesis 12: A significant difference will not exist between the mean number of open-ended questions asked by the experimental and the control group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 36.8 open-ended questions (Table III) for the experimental group and a mean of 8.9 open-ended questions for the control group. The analysis of data indicated that the null hypothesis should be rejected. Thus, the model was effective in increasing the number of open-ended questions asked by the experimental group.

> Hypothesis 13: A significant difference will not exist between the mean number of questions asked by the hold and the control group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 50.1 questions (Table III) for the hold group and a mean of 35 questions for the control group. The analysis of data indicated that the null hypothesis should be rejected and gave evidence that micro-teaching was not effective in increasing the number of questions asked by the control group.

> Hypothesis 14: A significant difference will not exist between the mean number of closed questions asked by the hold and the control group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 37.2 closed questions (Table III) for the hold group and a mean of 26.1 closed questions for the control group. Again, the analysis of data resulted in failure to reject the null hypothesis and gave evidence that micro-teaching was not effective in decreasing the number of closed questions asked by the control group.

> Hypothesis 15: A significant difference will not exist between the mean number of open-ended questions asked by the hold and the control group after ten weeks of student teaching.

The raw data (Appendix F) yielded a mean of 12.9 open-ended questions (Table III) for the hold group and a mean of 8.9 open-ended questions for the control group. The analysis of data indicated that the null hypothesis should be rejected and gave evidence that micro-teaching was not effective in increasing the number of open-ended questions asked by the control group.

# CHAPTER V

# CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

## Conclusions

Analysis of the data for the first micro-teaching experience showed a significant difference favoring the experimental group in the total number of questions asked and in the number of open-ended questions asked during the first micro-teaching experience. Since no significant difference existed in the number of closed questions asked and a significant difference existed in the number of open-ended questions asked, the model was effective in enhancing the ability of pre-service elementary teachers to ask open-ended questions. Because of this it increased the total number of questions asked since significance occurred in this comparison.

The data analysis of the second micro-teaching experience showed significant differences favoring the experimental group in the total number of questions asked and in the number of open-ended questions asked. Since no significant difference existed in the number of closed questions asked and a significant difference existed in the number of open-ended questions asked, the model was effective in enhancing the ability of pre-service elementary teachers to ask open-ended questions. It was also effective in increasing the total number of questions asked.

After ten weeks of pre-service teaching, the analysis of data did

not indicate significant differences in types of questions asked by the hold and control groups. The data did show a significant difference favoring the experimental group over both the hold and control groups in asking open-ended questions. This gives conclusive evidence that the enhanced ability to ask open-ended questions in a micro-teaching situation is also apparent in the classroom and that the improvement was caused by the model. The data did not indicate a significant difference in the total number of questions asked by the experimental group and those asked by both the hold and control groups. However, a significant difference did exist in the mean number of closed questions asked by the experimental and hold group, but this difference did not exist between the experimental and control groups. This indicates the model and/or micro-teaching was effective in decreasing the number of closed questions asked in the classroom.

## Implications

Because most questions asked in the classroom call merely for reproducing what was just read, heard, or seen by children, a need exists for effective teacher training programs to implement desired questioning strategies in the classroom. Viewing a video-tape model of the behavior to be acquired and studying supplementary related materials is an effective way to influence pre-service elementary teachers' questioning behavior. However, if these programs are to succeed, it seems they need to incorporate two features. First, if teachers are expected to learn the inquiry method or any pedogogy it must be presented to them in clear, specific, defined terms. Second, teacher training should involve not only study of questioning strategies, but

also guided practice in their use.

This study represents a line of inquiry which could result in more effective methods of training teachers. It is essential to replicate research of this type with different samples and under a variety of conditions to explore questions which still remain unanswered.

## Recommendations

Because this study was concerned only with elementary pre-service teachers, an expanded study including both elementary and secondary pre-service teachers is suggested.

A follow-up study to determine whether this enhanced questioning ability is retained by the pre-service teachers would be of value.

It is recommended that the same theoretical design, or one similar to it, be applied to other teaching skills.

It would also be of value to know whether the questioning ability of in-service teachers could be enhanced by the use of this theoretical design or one similar to it.

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# APPENDIX A

## TEACHING SKILLS ISOLATED BY BUSH AND ALLEN

Teaching skills isolated by Bush and Allen. (10)

1. Establishing a set.--This is the skill of establishing a setting for the idea to be learned. The purpose is to gain rapport between students and teacher in order to obtain immediate involvement in the lesson. Experience indicates that there is a direct relationship between effectiveness in establishing set and effectiveness of the total lesson.

2. Establishing appropriate frames of reference.--A single frame of reference might be adequate for a student to learn, but several frames of reference deepen and broaden the general field of understanding.

3. Achieving closure when the major purposes, principles, and constructs of a lesson, or part of a lesson, are judged to have been learned.--This is more than a simple summary of the lesson; it should pull together the major points, act as a cognitive link between past knowledge, and new knowledge, and leave the student with the feeling that he has really learned something.

4. Using questions effectively.--The novice teacher tends to ask questions that are so general in nature, or so vague or poorly worded, that it is impossible for the students to answer them; or she tends to ask questions that are so specific they can be answered by a single word.

5. Recognizing and obtaining attentive behavior.--The prospective teacher learns to recognize visual cues of interest or boredom, of comprehension or bewilderment, and can practice changing class activities to regain attention.

6. Controlling participation.--The beginner learns how to encourage or discourage classroom participation and how to analyze his positive and negative reactions to students.

7. Providing feedback.--The new teacher tends to get feedback on how well the lesson is being learned by calling for the feedback from too few students, usually those he soon learns will know the right answers.

8. Employing rewards and punishments.--The major aim here is to learn how to use this for reinforcement purposes.

9. Setting a model.--Micro-teaching makes it possible to provide good models of specific technical skills as an integral part of training.

# APPENDIX B

## MICRO-TEACHING

# Lesson One

Title: Magnetic Poles

Materials Needed: Three Identical bars, (two magnetic)
Paper clips, tacks, iron filings, white paper.

Procedures:

1. Select a magnetic and a non-magnetic bar and have the children make observations. Have the children find out which of the two is like the third.

   (Teacher Questions)

2. Have the children find a way to use iron filings to determine which bar is magnetic without touching the bar to the filings. Some children may have suggestions. Carry out as many as possible. Be sure to include the following - place magnetic and nonmagnetic bar about 18 inches apart and cover each with a piece of white paper. Sprinkle iron filings over the bars and tap the paper slightly and observe.

   (Teacher Questions)

3. Put a bar magnet end-to-end in a linear position with another bar magnet, with north seeking end (pole) of one about 1-2 inches from the south seeking end (pole) of the other. Cover the bars with white paper (opposite poles attract). Complete this experiment based on procedures used in number 2.

   (Teacher Questions)

4. Repeat number 3 with like poles arranged 1-2 inches apart. (Like poles repel).

   (Teacher Questions)

# APPENDIX C

## THE SYMBOLIC MODEL

| Category | Key Word | Typical Question Words |
|---|---|---|
| 1. KNOWLEDGE<br><br>(Any question, regardless of complexity, that can be answered through simple recall of previously learned material.)<br><br>e.g. "Name the animal in the textbook picture." | Remember | 1. Name<br>2. List; Tell<br>3. Define<br>4. Who? When? What?<br>5. Yes or No questions:<br>e.g. "Did...?"<br>"Was...?"<br>"Is....?"<br>6. How many? How much?<br>7. Recall or identify terminology<br>8. What did the book say...? |
| 2. COMPREHENSION<br><br>(Questions that can be answered by merely restating or reorganizing material in a rather literal manner to show that the student understands the essential meaning.)<br><br>e.g. "Give the ideas in your own words." | Understand | 1. Give an example...<br>2. What is the most important idea?<br>3. What will probably happen?<br>4. What caused this?<br>5. Compare. (What things are the same?)<br>6. Contrast. (What things are different?)<br>7. Why did you say that?<br>8. Give the idea in your own words. |
| 3. APPLICATION<br><br>(Questions that involve problem solving in new situations with minimal identification or prompting of the appropriate rules, principles, or concepts.)<br><br>e.g. "How much water would you need to fill the container?" | Solve the Problem | 1. Solve<br>2. How could you find an answer to...?<br>3. Apply the generalization to... |
| 4. ANALYSIS<br><br>"Questions that require the student to break an idea into its component parts for logical analysis: assumptions, facts, opinions, logical conclusions, etc.)<br><br>e.g. "Are the conclusions supported by facts or opinion?" | Logical Order | 1. What reasons does he give for his conclusions?<br>2. What method is he using to convince you?<br>3. What does the author seem to believe?<br>4. What words indicate bias or emotion?<br>5. Does the evidence given support the conclusion? |

| Category | Key Word | Typical Question Words |
|---|---|---|
| 5. SYNTHESIS<br><br>(Questions that require the student to combine his ideas into a statement, plan, product, etc., that is new for him.)<br><br>e.g. "Can you develop a program that includes the best parts of each of those ideas?" | Create | 1. Create a plan...<br>2. Develop a model...<br>3. Combine those parts... |
| 6. EVALUATION<br><br>(Questions that require the student to make a judgment about something using some criteria or standard for making his judgment.) | Judge | 1. Evaluate that idea in terms of...<br>2. For what reasons do you favor...<br>3. Which policy do you think would result in the greatest good for the greatest number? |

# APPENDIX D

## THE PERCEPTUAL MODEL

Title: Displacement of Water

Materials Needed: Transparent container, soft drink bottle, stiff cardboard, water, drinking straws, cake coloring, wide mouthed bottle, and molding clay.

Procedures:

1. Fill a transparent container about half full of water. Using the stiff cardboard invert the soft drink bottle, which is partially filled with water, in the transparent container and then remove the cardboard. Put several drinking straws near the container. Have the children find out how to get the water out of the bottle without turning the bottle over or pulling it out of the water. (Be sure they blow air into the bottle.)

   (Teacher Questions)

2. Ask the children how they would show someone else that the air pushed the water out of the bottle. (Use cake coloring.)

   (Teacher Questions)

3. Fill the wide mouthed jar about half full of water then mold the clay around two straws and place in the mouth of the bottle so that one is in the water and the other is not. Be sure that air cannot escape around the straws and out the top of the jar. Have the children find out how to get water out of the jar without sucking the straws.

   (Teacher Questions)

# APPENDIX E

## MICRO-TEACHING

Lesson Two

Title: The candle

Materials Needed: Candle, matches, jars (3 sizes), clock

Procedures:

1. Light candle so all can see, discuss burning, i.e., fire, burning, components of fire, rate of burning, uses of fire, and danger of fire.

   (Teacher Questions)

2. Check burning under various conditions (different size jars). Measure the time of burning in each size of jar.

   (Teacher Questions)

3. Measure burning time in jar which was not ventilated (one in which a candle has just been burned).

   (Teacher Questions)

# APPENDIX F

## SUMMARY OF DATA

| | Student Teacher | Micro-Teaching #1 Total Questions | Closed | Open | Micro-Teaching #2 Total Questions | Closed | Open | After 10 Weeks of Student Teaching Total Questions | Closed | Open |
|---|---|---|---|---|---|---|---|---|---|---|
| Experimental | 1 | 40 | 25 | 15 | 36 | 21 | 15 | 73 | 23 | 50 |
| | 2 | 33 | 19 | 14 | 58 | 39 | 19 | No Tape | | |
| | 3 | 70 | 50 | 20 | 57 | 20 | 37 | 34 | 11 | 23 |
| | 4 | 109 | 47 | 62 | 44 | 19 | 25 | 57 | 17 | 40 |
| | 5 | 59 | 30 | 29 | 78 | 36 | 42 | 20 | 2 | 18 |
| | 6 | 155 | 70 | 85 | 72 | 18 | 54 | 93 | 24 | 69 |
| | 7 | 91 | 47 | 44 | 45 | 11 | 34 | 46 | 20 | 26 |
| | 8 | 92 | 70 | 22 | 45 | 33 | 12 | 31 | 16 | 15 |
| | 9 | 88 | 21 | 67 | 62 | 16 | 46 | 80 | 19 | 61 |
| | 10 | 110 | 39 | 71 | 36 | 13 | 23 | 36 | 7 | 29 |
| Control | 11 | 48 | 42 | 6 | 46 | 32 | 14 | 50 | 43 | 7 |
| | 12 | 60 | 44 | 16 | 34 | 23 | 11 | 25 | 18 | 7 |
| | 13 | 52 | 41 | 11 | 38 | 33 | 5 | 40 | 35 | 5 |
| | 14 | 13 | 11 | 2 | 10 | 3 | 7 | 11 | 10 | 1 |
| | 15 | 40 | 30 | 10 | 28 | 12 | 16 | No Tape | | |
| | 16 | 28 | 21 | 7 | 22 | 18 | 4 | 27 | 13 | 14 |
| | 17 | 51 | 38 | 13 | 41 | 24 | 17 | 53 | 35 | 18 |
| | 18 | 44 | 36 | 8 | 20 | 16 | 4 | No Tape | | |
| | 19 | 24 | 19 | 5 | 24 | 16 | 8 | 43 | 38 | 5 |
| | 20 | 64 | 42 | 22 | 87 | 51 | 36 | 31 | 17 | 14 |
| Hold | 21 | | | | | | | 50 | 43 | 7 |
| | 22 | | | | | | | 50 | 35 | 15 |
| | 23 | | | | | | | 76 | 57 | 19 |
| | 24 | | | | | | | 50 | 32 | 18 |
| | 25 | | | | | | | 61 | 45 | 16 |
| | 26 | | | | | | | 30 | 17 | 13 |
| | 27 | | | | | | | 24 | 20 | 4 |
| | 28 | | | | | | | 63 | 45 | 18 |
| | 29 | | | | | | | 57 | 50 | 7 |
| | 30 | | | | | | | 40 | 28 | 12 |

VITA ≥

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