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Title: AN ANALYSIS OF CERTAIN EFFECTS OF TEACHING STUDENTS TO CONSTRUCT AND ANALYZE QUESTIONS

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The purpose of the study was to analyze the effects of teaching elementary and secondary students the Gallagher Topic Classification System as a technique for constructing and analyzing questions.

The subjects for the study were the students of three groups of randomly selected teachers from Coos and Douglas Counties of Oregon. One group of 25 teachers, Experimental Group I, was taught the Gallagher Topic Classification System by means of the lecture method. Another group of 25 teachers, Experimental Group II, was given the same material through a work shop approach. A third group of 25 teachers were designated as the control, Group III, and were given no instruction. The experimental groups of teachers were requested to teach the material to their students in the same manner in which they were taught.

The students supplied the data for the study by means of an open-ended test on which they were instructed to write five questions on each of three pictures. The same test utilizing the same pictures was given before and after the instruction period.

The questions written by the students were coded and categorized according to the Gallagher Topic Classification System. The data were transferred to IBM cards and submitted to analysis of variance treatments.

The findings of the study were:

1. Students can be taught the Gallagher Topic Classification System as a technique for constructing and analyzing questions.

2. Instruction in question construction and analysis was most effectively presented with the workshop approach to instruction.

3. Instruction in question construction and analysis was more effective in the middle school grades than in the lower elementary or high school levels.

An Analysis of Certain Effects of Teaching Students to Construct and Analyze Questions

by

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Dedicated

To My Wife
Marjory

and
Children
Wayne
Linda
Diane
Tom

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AN ANALYSIS OF CERTAIN EFFECTS OF TEACHING STUDENTS TO CONSTRUCT AND ANALYZE QUESTIONS

CHAPTER I

INTRODUCTION

Historically and currently, questioning has been considered to play an important role in the teaching-learning processes. However, a recent survey of the research literature indicated that the emphasis has been upon studying the question-making and the question-asking behaviors of teachers rather than on the questioning behaviors of their students.

Several educators, Schwab and Brandwein (1962), Taba (1965), and Snyder (1967) contended that the development of students' abilities to construct questions could significantly enhance their learning. Further, the consensus was that this skill is learned.

If it is important to students' learning that they acquire the skill of questioning, and if this behavior can be taught, then, it would seem worthwhile to study the effects of teaching a system of question construction and analysis.

Statement of the Problem

The purpose of the study was to analyze the effects of teaching elementary and secondary students the Gallagher Topic Classification System as a technique for constructing and analyzing questions.

The Gallagher classification model can be used to categorize questions on a vertical dimension of three "levels" termed: (1) Data,

(2) Concept, and (3) Generalization; and on a horizontal dimension of five "styles" termed: (1) Description, (2) Explanation, (3) Evaluation-justification, (4) Evaluation-matching, and (5) Expansion (Gallagher, 1966). The Gallagher model is illustrated below in Figure 1.

	Description	Explanation	Evaluation-Justification	Evaluation-Matching	Expansion
Generalization					
Concept					
Data					

Figure 1. Gallagher's Topic Classification Model

The intent was to analyze the effects according to: (1) the number of questions categorized as Data and Description versus all other questions, and (2) the number of questions categorized in all levels of Description versus the questions in the other four styles.

In order to accomplish the desired analysis, pre- and post-test data were collected and the following null hypotheses were tested:

1. There will be no significant difference between the pre- and post-test data on question construction between the experimental groups and the control group.

2. There will be no significant difference between the pre- and post-test data on question construction between the students in (a) lower elementary school (grades 1-4), (b) middle school (grades 5-8), and (c) high school (grades 9-12).

Significance of the Study

Educators have emphasized the values of discovery, inquiry, and problem solving as effective methods in the teaching-learning process. Since questioning is an integral part of each of these approaches, the use of these methods makes it necessary for students to acquire the skills of designing good questions.

Even with the current emphasis on active student participation, studies have indicated that teachers do most of the talking in the classroom (Wilt, 1950), (Flanders, 1965), (Floyd, 1968). When questions were counted, the teacher scored far more in quantity than the total questions advanced by his students. It would seem that students were expected to learn questioning through example rather than by experience.

Ability to question is needed before students can effectively "discover," "inquire," or "problem solve." A strategy of questioning becomes the framework of discovery or the design of inquiry.

Hilda Taba (1962) asserted that:

> Presumably the most valuable contribution of a field of study lies in generating certain disciplined methods of forming questions, developing logical ways of relating ideas, and following a rational method of inquiry (p. 178).

Schwab (1962) supported the position of teaching students to question:

> Hence the enquiring classroom is one in which the questions asked were not designed primarily to discover whether the student knows the answer but to exemplify to the student the sorts of questions he must ask of the materials he studies and how to find the answers (p. 67).

According to Schwab (1962), questioning involves skills that must be learned. It is logical that efficiency in learning will improve if students are taught about questioning and given opportunities to practice. Francis Chase (1962) emphasized the role of inquiry and questioning to achieve needed progress in education.

> Progress in education becomes, therefore, not so much a process of adding to one's information as to a process of acquiring a number of different modes of inquiry through which one may define learning tasks, give order and rigor to learning activities, collect data and analyze them, draw inferences and test them . . . This method, not in the old pedagogical sense of a series of styles to be followed to fix a skill for a body of knowledge, but in the sense of learning to ask fruitful questions, to select and gather data relevant thereto, to draw conclusions therefrom, and to use these conclusions as a starting point for new inquiries (p. 135).

Snyder (1967) reported a scarcity of research relating to the questioning behavior of students. His survey of the research of the previous 60 years revealed that the major emphasis had been on teacher-questioning behavior with little emphasis on student-questioning behavior.

The target of the present study was the questioning behavior of students. The intent was to teach a variety of "styles" or kinds of questions and "levels" or complexity of questions as they fit into the Gallagher Topic Classification System. Then, to examine whether the students responded with a greater variety of styles and levels of questions to a given stimulus. It was reasonable that a student who could construct and use a greater variety of styles and levels of questions would become a more effective learner (Hankins, 1968).

The worth of this study as a contribution to the improvement of education was based on the following assumptions:

1. If a student can improve his questioning skills, he will be better able to increase his effectiveness in problem solving.

2. If a student can improve his questioning skills, he will be better able to develop logical thinking patterns.

3. If a student can improve his questioning skills, he will become a more effective participant in discussions.

4. If a student can improve his questioning skills, he will be able to stimulate higher level thinking in his peers.

Description of the Study

The sample population was approximately 5,600 students and 225 teachers of Coos and Douglas Counties. The 225 teachers were those who expressed a desire to be enrolled in a course in questioning strategies. The grade levels of their teaching assignments ranged from grade one through grade twelve.

Seventy-five teachers and their respective students were randomly selected from the sample population and placed into three groups of teachers and three groups of students.

Teacher Group I and Teacher Group II were designated as the experimental groups and were assigned to sections of an extension course designed for learning how to construct and analyze questions utilizing the Gallagher Topic Classification System. Teacher Group III was given no instruction and was designated as the control group.

For the purpose of a companion study by Susan Miller (1970), the teachers in Experimental Teacher Group I were instructed with the lecture method and the teachers in Experimental Group II were taught by the workshop method.

Student Group I and Student Group II were composed of those students in the classrooms of the teachers in Experimental Group I and

Experimental Group II respectfully. The control group, Student Group III, were the students of the teachers in Control Teacher Group III.

While the teachers in the experimental groups were receiving instruction in question construction and analysis, they were concurrently giving instruction to their students.

Pre- and post-test data were collected from the students by means of an open-ended test. On the test the students were presented with three pictures and were given the following instructions with each picture: "Imagine you are a teacher, write five questions about this picture you could use with the class."

The questions were then categorized using the Gallagher Topic Classification System.

The categorized questions were adapted to a data processing system which allowed an analysis of variance comparison of groups of students.

Definition of Terms

For the purpose of this study the following terms and definitions were specified:

Experimental Teacher Group I: a group of 25 teachers enrolled in a lecture course on constructing and analyzing questions utilizing the Gallagher Topic Classification System.

Experimental Teacher Group II: a group of 25 teachers enrolled in a workshop course on constructing and analyzing questions utilizing the Gallagher Topic Classification System.

Control Teacher Group III: a group of 25 teachers which did not receive instruction on constructing and analyzing questions.

Student Group I: students of the teachers in Experimental Teacher Group I.

Student Group II: students of the teachers in Experimental Teacher Group II.

Lower Elementary School Students: students assigned to grades one through four.

Middle School Students: students assigned to grades five through eight.

High School Students: students assigned to grades nine through twelve.

Gallagher Topic Classification System: James J. Gallagher (1966) developed a model for classifying topics, and designated the term topic ". . . to delineate a unit where the focus of classroom discussion centers on a given action, concept, or principle" (p.6).

The following terms and definitions were adopted from Gallagher (1966) to classify the levels and styles of the topics of questions in this study:

> Data Level: These are topics where the focus of discussion is on specifics where a particular event, object, action, or condition is considered. The emphasis is on things and people rather than abstract ideas. The student should be able to touch, see, hear, etc. the entities that are the focus of this type of topic (p. 21).
>
> Concept Level: This type of topic focuses on ideas and classes of objects, events, processes, etc. It often deals with class inclusion or exclusion. Topic focus is thus on an abstraction, even though specifics may be used in the topic for illustration (p. 22).
>
> Generalization Level: The following criteria are used to determine the presence of generalization.
> 1. Two or more concepts are involved. The topic focus thus represents a complete sentence or a statement in a logical sense.

2. These concepts are interrelated either as a set of component parts in a system (. . .) or as part of a larger generalization.

3. The topic focus in a GENERALIZATION is on a large idea having broad applicability. Another way of expressing this point is that the concepts making up the GENERALIZATION do not themselves have concrete referents (pp. 23-24).

Description Style: The focus of these topics is in describing, defining, and sometimes, in illustrating. The essence of the topic often answers, or tries to answer, the questions what, who, where, and when. It is an attempt to draw boundaries around the set of actions, ideas, or entities under discussion.

Illustrations or specific examples are most often used as part of the descriptive material on an idea or incident. They often do not expand the set of boundaries so much as they flush out the existing boundaries by providing examples of set membership.

Explanation Style: This category is used when the focus of discussion is on a deductive sequence of thinking, where the end product or conclusion is an inevitable end product from the premises. In the classroom this is rarely presented in a classic or formal sense but can be recognized if the judge looks for the deductive reasoning. (Exception: Drawing a conclusion from a hypothetical example can be deductive reasoning but will be classified EXPANSION) (p. 28).

Evaluation-Justification Style: This category is used when a judgment or decision is made and justified. The criteria used for the judgment are implicit. The judgments or decisions are made by individuals on the basis of individual or unstated standards. The decision can be along the dimensions of truth-untruth, good-bad, important-unimportant, correct-incorrect, etc. The key factor is not the dimension being asked for but that a decision or choice must be made that excludes all other choices. A probability statement or request (i.e., The chances are high that America will retain its influence in Asia.) fits this definition of evaluation (p. 29).

Evaluation-Matching Style: This category is used when there is a judgmental question or decision and criteria are explicit. The discussion is focused on matching events or instances to criteria. The act of categorization, provided the criteria for the categories are made explicit, is also considered evaluation-matching. As above, the criteria may deal with factual matter or qualitative judgment. The key element is the request or statement matching ideas or instances to a set of criteria (pp. 29-30).

Expansion Style: The focus of these topics lie in a distinct shift or broadening or amplification in the subject matter under consideration. It broadens the scope of the subject through additional associations of concepts or ideas. This may be done through:

1. Comparison or contrast of topic with other concepts or the application of ideas to a new and different problem.
2. Presenting a hypothetical set of circumstances and being asked to project an implication or supposed result.
3. When discussion moves from one medium of expression to another in dealing with the same subject matter (pp. 30-31).

Limitations of the Study

Teachers involved in the study were asked to teach their students, "the information they had learned in the same manner in which they were taught." While the proposition seemed acceptable, the teaching style of some teachers may have influenced their manner of presenting the material.

Three pictures were used to stimulate questions for the pre- and post-tests. Two of the pictures were selected because they involved ships which are commonly seen in Coos County. The third picture was a less familiar scene of Southwest Indians selected because of the interest many children have in Indians. If other pictures had been selected, the responses of students may have been different; however, other pictures may not have generated the kinds of responses found in the study.

Three coders were trained and used to classify the questions designed by students into the categories of the Gallagher Classification System mode. While the coders received the same instructions and met periodically to check agreement (90%) in coding, a different group of coders may have found a slight variation from the data reported. In such case, the variation should prove to be constant for all groups in the study, thereby yielding results similar to those found in the study.

Summary

A system of inquiry will make a student better able to organize for learning as well as improve his participation in learning with others.

In this study, students were taught a question classification system in order to determine whether any changes resulted in their questioning habits after instruction.

The students were asked to write questions about three pictures before the instruction in question classification and again after the instruction period. The questions constructed by the students were categorized and transformed to data processing systems which allowed an analysis of variance.

For analysis the data from students were classified in two experimental groups and one control group. Another analysis was run on three grade level groups, lower elementary, middle school, and high school.

CHAPTER II

REVIEW OF THE LITERATURE

Questioning is fundamental to the art of teaching. Master teachers are expert questioners. Socrates, who lived about 400 B.C., established himself as an expert questioner while with his "Socratic Irony" he veiled himself behind a profession of ignorance.

In recording a history of education, Duggan (1948) claimed that Socrates introduced "a new method . . . in his 'conversational quizzing.'" Regarding the method used by Socrates, Duggan (1948) stated, "Often by a series of questions he developed in the mind of an individual the correct idea of which his original opinion was only a part" (p.33).

"Conversational quizzing" allowed the learner to contribute the major share of the verbal exchange. The learner was asked to state his position on a particular topic and then was obliged to defend his position from every possible angle by responding to carefully designed questions. It became evident that a defensive position to expert questions required an active mind.

Throughout history good questions have stimulated thinking. In speaking to this point, Gordon Rohman (1967) noted some well designed questions that have been used often and well remembered.

> Great questions haunt our literature: "What is man that thou art mindful of him?" "To be or not to be?" "What shall it profit a man to win the whole world and lose his own soul?" "Ask not for whom the bell tolls?: These questions keep alive in us all that subtle sense of interdependency, of rival possibilities caught in the root to the word question itself: quest, the hero's journey to insight and self-renewal. To fail to question is to suffer the inestimable loss of what might have been or what might yet be (p. 241).

Great questions have stimulated much thinking down through the course of history and the question still remains the basic tool of the classroom to stimulate mental activity.

> The classroom teacher probably devotes more time and effort to asking questions than anybody else since Socrates. One might even say that the teacher is a professional question maker. Asking questions--in classroom discussion or on assignments and tests--is one of the basic ways by which the teacher stimulates student thinking and learning. And it is by asking questions and studying the answers that the teacher measures and evaluates the thinking and learning process of his students (Ashner, 1961, p. 44).

Thinking activities have been classified into four main types by Ashner (1961). These types are: remembering, reasoning, evaluating or judging, and creative thinking. Questions asked by the teacher usually determine the type of thinking done by the students. Question design deserves the teacher's serious attention, but we should remember that the ultimate goal is the student's thoughtful response.

Questioning by Teachers

The classroom teacher was referred to by Ashner (1961) as a "professional question maker." Several studies have found agreement with that label.

Corey (1941) visited classrooms engaging in discussions and recorded 39,000 student and teacher questions. He found the teacher asking nearly 10 times as many questions as all the students in the class together. He also found the teacher talking two-thirds of the time.

Using an audio-tape recorder to collect data, Floyd (1968) sampled the instruction of forty teachers classed as "best" by their principals. After reviewing the one-hour segments, Floyd determined that teachers responded to the charge to teach with a "barrage of questions."

> When questions were counted, teachers has asked a total of 6,259 questions during the recorded hours. Average teacher pupil questioning ratio was 96 to 4 with 4% representing 232 questions divided among 802 students. In a one hour session the teacher made 283 queries and the children made none at all. On the average for each question asked by a pupil, a teacher asked 27 questions. The average teacher questioning rate was 3 1/2 per minute. One teacher fired off 336 questions at 6 1/2 per minute (for the one hour session)(p.53).

The teacher not only asks most of the questions in the classroom but dominates the verbal activity as well. Flanders (1963) designed a system for categorizing verbal interaction in the classroom and divided the teacher behavior into two main areas of influence.

> Direct Influence consists of stating the teacher's own opinions or ideas, directing the pupil's action, criticizing his behavior, or justifying the teacher's authority or use of that authority.
>
> Indirect Influence consists of soliciting the opinions or ideas of the pupils, applying or enlarging on the opinions or ideas of the pupils, praising or encouraging the participation of pupils, or clarifying and accepting the feelings of pupils (p. 44).

Flanders (1965) used his model for analysis of classroom behavior and reported that teachers talk 68% of the time. He further stated that 75 to 80 per cent of the "teacher talk falls in the categories of direct influence." By his verbal behavior then, the teacher not only discourages the child from asking questions, but also restrains him from verbal participation.

> Direct influence tends to increase teacher participation and to establish restraints on student behavior . . . The net effect is less freedom of action for the students (p. 21).

Along the same vein, Hughes (1963) stated, "the teacher-student relationship is one of superior-subordinate." The teacher is in a position to develop "teacher power" or "teacher responsiveness." The teacher then, is in a decision-making role, either to exert power or to develop responsiveness. His position in this regard affects not only the overt behavior of children but it also affects the type of thinking they do.

> The teacher's decisions can play a large part in determining the kind of thinking a child does. Important in this respect are the questions the teacher decides to ask (Hughes, 1958, p. 459).

An attempt was made by Smith (1969) to explain why teachers talk more than they should.

> When time is fleeting and students are floundering, it is tempting for the teacher to help too much. When some teachers ask questions that call for creative thinking, they wait too short of time for students to do effective thinking before suggesting one or more responses they feel would have satisfied the task. From post observation conferences with these teachers, it often becomes apparent that they are not aware they are answering their most carefully planned questions themselves. Students can become used to this pattern and wait for the teacher to answer questions that call for divergent thinking (p. 434).

Part of the difficulty may be that teachers are not aware of how few questions the students ask (Wilt, 1950). It may further be assumed that the teacher is not aware he is dominating classroom verbal activity.

Davidson (1969) makes the point that teachers may be too impatient while children are thinking and learning. A good question may need a period of incubation while various answers are being mentally evaluated by students. Commenting on contrasting discussion situations Davidson (1969) stated:

> Children who were incorrect or slow in responding were given clues and encouragement to develop their own answers. . . In less productive discussions, the teacher usually called on another child or provided the answer; the focus seemed to be on the answer itself rather than on the thinking processes that would lead to it (p. 70).

Teachers seem to conceive their role to be one of passing along information they themselves have acquired. They try to develop logical trains of thought by leading the student through what they consider to be logical steps in learning. Less ingenuity on the part of the teacher is required to teach and test for facts than to design a plan of inquiry for students to discover and apply learnings.

According to Cunningham (1968), teachers can improve their questioning skills by instruction. His subjects were forty student teachers in elementary education. Video-taped lessons were used to instruct the subjects in question construction. He found:

> A significant number of student teachers changed from a greater proportion of cognitive-memory questions prior to instruction to a greater proportion of divergent questions after instruction (p. 91).

Cunningham (1968) concluded that:

> The ability of prospective elementary teachers to construct a greater proportion of effectively phrased questions can be improved by instruction . . . Results from the opinion questionnaire suggest a highly favorable attitude toward instruction on questioning (p. 91).

No attempt was made in this study to justify the elimination of lower level questions but rather to point out that the large majority of questions asked by teachers and students are on the cognitive-memory level and the use of higher level questions would improve instruction.

The effect of higher level questions employed by the teacher when related to student achievement was studied by Hankins (1968). The subjects were 260 sixth grade students in eleven classes. Two types of social studies text materials were used, one stressing questions requiring analysis and evaluation, the other stressing questions requiring knowledge. The following conclusion was reported:

> The employment of high cognitive-level questions (analysis and evaluation) produced significantly greater scores in social studies achievement than did low cognitive-level questions (knowledge)(p. 330).

Regarding the implications of his study, Hankins (1968) made the following statement:

> If questions at higher-cognitive levels are capable of stimulating high achievement, then teachers should be using these questions in much greater numbers than they currently do. Teachers, by improving their level of questioning, could very well make information more meaningful for their pupils. In addition, pupils in classrooms where high-level questions were used by teachers should be expected to employ such questions themselves when they engage in class discussions and other class work. Higher-level questions not only should stimulate higher levels of achievement, but also should make pupils better inquirers into the realm of knowledge (p. 331).

Johns (1966) concurred with Hankins' (1968) conclusion that the teacher's use of higher level questions should stimulate students to use higher level questions. Using high school English classes representing two types of teacher behavior, Johns (1968) concluded that:

> . . . there appears to be a relationship between the incidence of thought-provoking questions by students and the incidence of thought-provoking questions and statements by teacher (p. 94).

Johns (1966) also found the classroom behavior of the teacher to be related to the questioning habits of the students. He stated, "There is greater incidence of thought provoking questions by students in classes taught by teachers whose behavior was more 'indirect'" (p. 94).

Some type of objective feedback is needed for teachers to realize the changes that are needed to improve their instruction. The interaction analysis system designed by Flanders (1965) has been found to be helpful by some researchers (Parrish, 1968, Masla, 1968).

Davidson (1969) used a modified interaction analysis system that identified levels of questions and comments made by the teacher along with three levels of children's thinking. After using the system he reported:

> . . . that statistically significant ($p. < .05$) changes from lower to higher levels of children's thinking occurred when teachers were provided with objective feedback from their own teaching (p. 702).

The teacher can plan for higher levels of thinking among his students by using carefully designed questions.

The topic Classification System designed by Gallagher (1966) can be used effectively by the teacher to insure variety in styles and levels of questions planned for use. Lower level questions will be used to build a firm informational base in order to pursue higher level thinking processes through the use of higher level questions.

Questioning by Students

The important role of the student as a questioner has often been overlooked. Most studies in questioning have been related to teacher behaviors. While making no attempt to deemphasize the extremely important role of the teacher in questioning, this study attempted to examine the question-asking ability of students. Snyder (1967) quoted the 1960 Yearbook of the National Society for the Study of Education on emphasizing the importance of student question-asking.

> Of utmost importance to the method of inquiry is the question-asking ability of children. The development of a child's ability to ask meaningful questions is essential . . . The improvement of question-asking, a skill that is basic to solving science problems, will help children think more clearly and logically. Question-asking also leads to active participation rather than passive learning (p. 3).

Questioning then becomes an organized way of thinking and is not only applicable to science. Proper questioning can contribute to learning in any field of study. Hilda Taba (1962) made this statement:

> Presumably, the most valuable contribution of a field of study lies in generating certain disciplined methods of forming questions, developing logical ways of relating ideas, and following a rational method of inquiry (p. 178).

The ability of students to ask questions has not been completely overlooked. Storm (1928) collected questions from teachers and students engaged in classroom discussions. A group of forty teachers were given 100 unmarked teacher and student questions and were asked to check what they considered the best questions. On median scores the teachers were checked as having 17 good questions while the students had 27 questions checked as good.

After comparing questions designed by students to questions designed by teachers, Storm (1928) made the following observation:

> If pupils ask good questions as do the teachers, the pupils certainly ought to be the ones to ask the questions, because most all will agree that the person who is doing the real thinking is the one who is asking himself or someone else questions (p. 615).

When student questions are respected, a wider purpose is served than just his progress in learning. A glance at the scope of values to student questioning is given by LeShans (1968).

> The questioning mind has been the source of all human progress, and it seems strange indeed that we should be underestimating the spontaneous questions of students as the most natural and rewarding road to learning. First, the questions children ask tell us something about them--what interests them, what they are ready to explore, what excites them, what they really want to know about. Second, children's questions are a plea for dialogue. They want us to talk to them, to pay attention to what they are thinking about (p. 79).

There is evidence to indicate that teacher classroom behavior affects the degree to which students become involved in the learning process (Johns, 1966; Masla, 1968). More active student participation has been found with teacher behaviors classified as "indirect."

"Indirect" teacher behaviors accept and encourage student participation, and active participation of the learner is essential to learning.

A strategy of questioning procedures will enable the teacher to perform indirectly and entice students into active learning. Student questioning habits then assume a more critical role in classroom activity.

Researchers (Hankins, 1968; Johns, 1966) have found that students respond to the teacher model as a questioner. Therefore, "indirect" teaching or a teaching style which encourages student participation is not enough. The teacher must become an expert questioner in order that the students will improve their inquiry skills.

Suchman (1961) focused on the students to improve their inquiry skills. He forced them to ask questions. Special attention was given to teaching children to ask more and better questions in trying to discover scientific principles. Students were presented with a scientific phenomenon either by film or by demonstration. Regarding the phenomenon, the teacher presented one question, "Why did it happen?" The pupils were then instructed to ask questions that could be answered "yes" or "no" by the teacher. These inquiry teaching sessions were audio-taped so that the lesson could be played back for a critical review by students. The intention was for students to be faced with the problem and to move ahead in a logical manner to solve the problem. With training, Suchman (1961) found that the students increased their productivity of questions and their "questions also became more precise and controlled (p. 167)."

Suchman (1961) indicated that:

> The teacher can help the child by posing problems that are reasonably structured and will lead to exciting new discoveries. The teacher can also coach him in the techniques of data

> collection and organization that will lend power and control to his searching. The educator should be concerned above all with the child's process of thinking, trusting that the growth of knowledge will follow in the wake of inquiry (p. 151).

The value is evident for students to learn to ask good questions. Learning to design proper questions will help them develop a logical approach to solving problems and make them better able to participate effectively in classroom discussions.

Questioning and Problem Solving

Motivation of students for learning is a crucial task of the teacher. Regardless of what the teacher does, learning will not take place unless the student is motivated to act. Behavioral psychologists suggest the use of a reward system to motivate the learner. The reward system used might be completely unrelated to the material to be learned; however, it must be designed to generate learning activity on the part of the learner. Bruner (1961) contended that there is sufficient reward in learning itself:

> . . . to the degree that one is able to approach learning as a task of discovering something rather than "learning about." To that degree will there be a tendency for the child to carry out his learning activities with the autonomy of self-reward or more properly by reward that is discovery itself (p. 22).

John Dewey (1916) suggested that there are forms of activity that serve to enlist and develop the confidence motive and to make it a driving force in behavior. Over fifty years ago Dewey made one of the most significant protests against a curriculum based on the teaching of specific facts. He maintained that true education was not a mere transmission of accumulated material but rather a process of assisting development of certain natural tendencies of a child. He believed that one very powerful natural tendency was that of inquiry, trying to find out. Dewey did not dismiss factual information as being unimportant. He considered facts to be meanings that have already been established and should be used in the inquiry process. Dewey was concerned about the tendency of teachers to ask students questions requiring a return of factual information. He was interested in having the student experience success and failure, not as reward and punishment, but as information in seeking to gain control over his environment. The child could treat success as an indicator that he is on the right track and failure to indicate that he is on the wrong one. As the child comes to manipulate his environment, more actively, he achieves gratification from coping with problems.

There is a tendency among teachers to feel that no learning has taken place when the student produces a wrong answer. Students who are inflicted with this attitude soon become discouraged and assume a negative attitude toward learning.

John Holt (1964) made a stinging indictment in his book, How Children Fail.

> Schools give every encouragement to producers, the kids whose idea it is to get "right answers" by any and all means. In a system that runs on right answers, they can hardly help it, and these schools are very often discouraging places for thinkers (p. 25).

Means and Loree (1968) related a questioning procedure to problem solving. In a study with sixth graders, they found students improved with practice in problem solving.

> Increasing amounts of practice in problem solving, accompanied by questions directed toward development of the type of behavior which tend to characterize successful problem solvers, did produce significant improvement in the ability of subjects to extract information contained in the statement of the problem (p. 138).

These students improved significantly in their ability to combine operations such as classifying, comparing, abstracting, analyzing, synthesizing, evaluating, and structuring (Means and Loree, 1968). This information indicated again that the types of questions faced by the learner determine the type of learning in which he will engage.

Bruner (1961) placed the emphasis on discovery for learning rather than emphasizing the right answer. He contended that the discovery approach would enable the student to organize for more effective problem solving.

> . . . emphasis upon discovery in learning has precisely the effect upon the learner of leading him to be a constructionist to organize what he is encountering in a manner not only designed to discover regularity and relatedness but also to avoid the kind of information drift that fails to keep account of the uses to which information might have to be put. It is, if you will, a necessary condition for learning the variety of techniques of problem solving, of transferring information for better use, indeed for learning how to go about the very task of learning. Practice in discovering for oneself teaches one to acquire information in a way that makes that information more readily viable in problem solving (Bruner, 1961, p. 22).

Guilford (1965) drew a relationship between problem solving and creativity as he stated, "When educational philosophy adopts education's responsibility for developing problem solving powers in its students, it adopts responsibility for developing creativity (p. 452)."

Torrance (1963) referred to this ability as "divergent production" and contended that learning about it would improve performance. ". . . a discussion about the nature of divergent thinking with children in the fifth grade was followed by an improved performance on tests of divergent production (p. 27)."

The relatedness of divergent thinking to questioning is evident. It is logical that learning about the different styles and levels of questions will improve the performance of students and teachers in constructing questions.

Better questioning habits will enable the student to think more creatively and solve problems more efficiently.

Question Classification Systems

The science of education has been hampered by a lack of precise terminology to describe its processes. Complete agreement on a nomenclature to describe the processes of education will have to be regarded as a future goal but progress has been made in developing models for classifying cognitive behavior.

Classification systems referred to in this study were designed to analyze questions or responses to questions. Questions are the nuclei relating to various types of mental activity.

The first significant contribution in the development of a classification system for education was _The Taxonomy of Educational Objectives: Cognitive Level I_ (Bloom, et al., 1956). It has served as a base for other classification models.

The Taxonomy of Educational Objectives: Cognitive Level I has been referred to as a system for classification of "educational goals or outcomes in the cognitive area (cognitive is used to include activities such as remembering and recalling knowledge, thinking, problem solving, creating (p. 2)."

Bloom (1956) and his committee chose to organize a taxonomy for the cognitive domain first because:

> It is the domain in which most of the work in curriculum development has taken place and where the clearest definitions of objectives are to be found phrased as descriptions of student behavior (p. 7).

Major headings and the numbering system used in the Taxonomy of Educational Objectives follow:

1.00 Knowledge
1.10 Knowledge of Specifics
  1.11 Knowledge of Terminology
  1.12 Knowledge of Specific Facts
1.20 Knowledge of Ways and Means of Dealing with Specifics
  1.21 Knowledge of Conventions
  1.22 Knowledge of Trends and Sequences
  1.23 Knowledge of Classifications and Categories
  1.24 Knowledge of Criteria
  1.25 Knowledge of Methodology
1.30 Knowledge of the Universals and Abstractions in a Field
  1.31 Knowledge of Principles and Generalizations
  1.32 Knowledge of Theories and Structures

2.00 Comprehension
  2.10 Translation
  2.20 Interpretation
  2.30 Extrapolation

3.00 Application

4.00 Analysis
  4.10 Analysis of Elements
  4.20 Analysis of Relationships
  4.30 Analysis of Organizational Principles

5.00 Synthesis
  5.10 Production of a Unique Communication
  5.20 Production of a Plan, or Proposed Set of Operations
  5.30 Derivation of a Set of Abstract Relations

6.00 Evaluation
  6.10 Judgments in Terms of Internal Evidence
  6.20 Judgments in Terms of External Criteria

(Bloom, 1956, forward)

Using the Taxonomy of Educational Objectives as a base, Sanders (1966) developed a taxonomy of questions and declared it could be used in "a number of ways to improve the intellectual climate in the classroom (p. 5)." Mastery of the taxonomy of questions was expected to assist a teacher in providing appropriate intellectual experiences for students.

Sanders (1966) stated, ". . . the teacher's knowledge of the format of each type of question helps him to be more sensitive to the opportunities of many kinds of thinking (p. 5)." Sanders (1966) further noted that ". . . after a teacher studies the taxonomy he is likely to offer his students a greater variety of intellectual experiences than he did before (p. 6)."

The relatedness of Sanders (1966) taxonomy of questions to Bloom's (1956) Taxonomy of Educational Objectives is worthy of note.

> 1. Memory: The student recalls or recognizes information.
> 2. Translation: The student changes information into a different symbolic form or language.
> 3. Interpretation: The student discovers relationships among facts, generalizations, definitions, values, and skills.
> 4. Application: The student solves a lifelike problem that requires the identification of the issue and the selection and use of appropriate generalizations and skills.
> 5. Analysis: A student solves a problem in the light of conscious knowledge of the parts and forms of thinking.
> 6. Synthesis: The student solves a problem that requires original, creative thinking.
> 7. Evaluation: The student makes a judgment of good or bad, right or wrong, according to standards he designates (p. 3).

Guilford (1959) wanted to classify types of intellectual activity and contributed significantly to question classification systems when he designed a model for the intellect(figure 2). He used a three dimensional model and gave the following explanation.

> Each cell in the model calls for a certain kind of ability that can be described in terms of operation, content, and product, for each cell is at the intersection of unique combination of kinds of operation, content and product . . . The three kinds of classifications of the factors of the intellect can be represented by means of a single solid model (p. 470).

Guilford's (1959) classifications were based on a factor analysis of test questions. He explained that ". . . each component or factor is a unique ability that is needed to do well in a certain class or tasks or tests (p. 469)." The model was referred to as the "Structure of the Intellect."

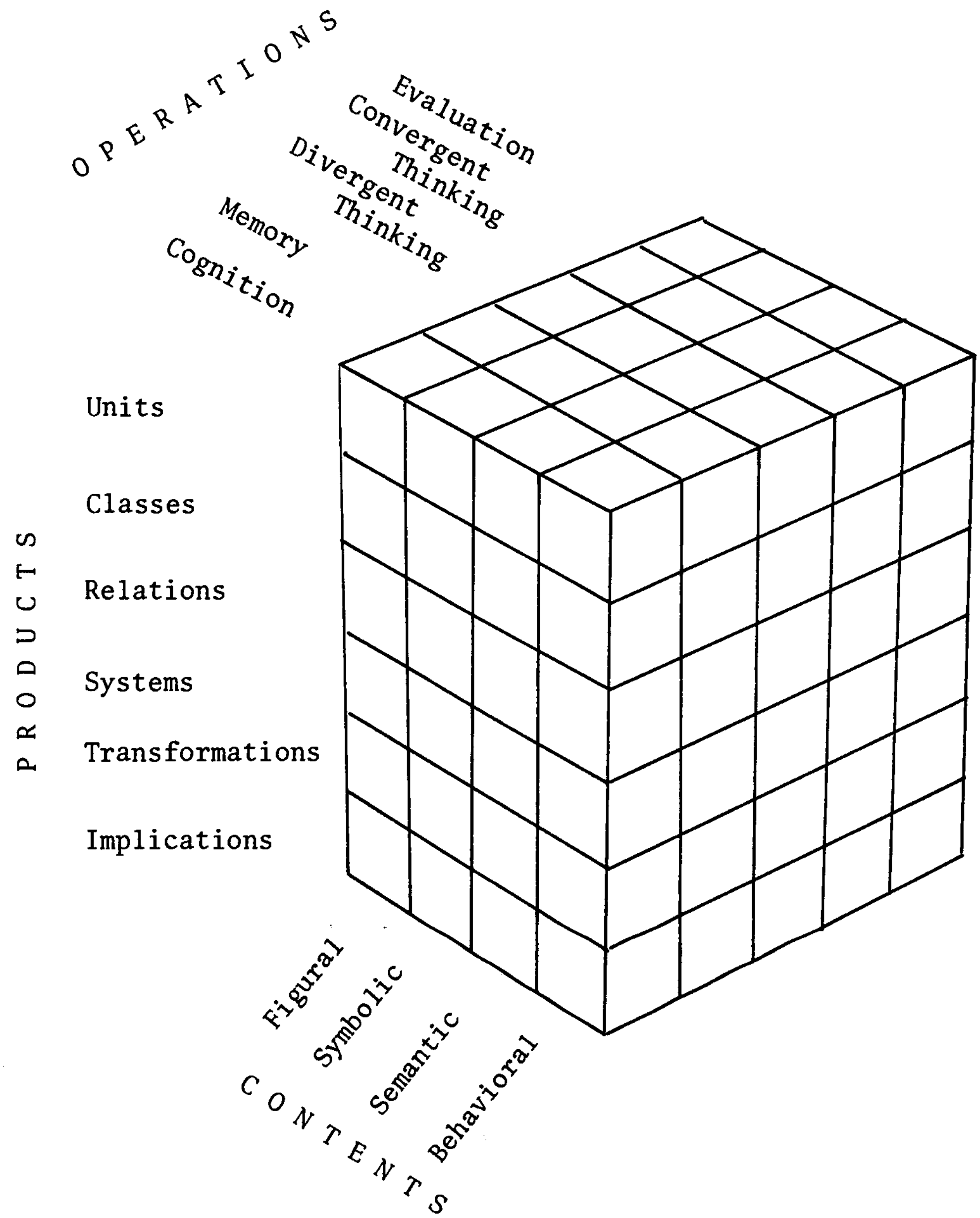

Figure 2. Guilford's Structure of the Intellect

Using the "Structure of the Intellect" as a base, Guilford, Hoephner, and Peterson (1965) undertook an investigation with the following stated purposes:

> (1) To see whether composition of measures of structure of intellect factors would yield a high degree of prediction of achievement in courses in ninth grade mathematics, compared to three test batteries of the more traditional, standard type of academic aptitude tests.
> (2) To see whether such measures would contribute predictive value over and above that available from standard test batteries (p. 680).

A major conclusion of the above study was:

> Batteries of factor scores were better predictors of achievement than two of the standard-test combinations, especially in the prediction of achievement in Algebra (p. 681).

Guilford's unique approach in using a three dimensional model to categorize intellectual activity made a valuable contribution to other classification system in the realm of education.

James J. Gallagher used Guilford's model of the intellect and designed a topic classification system (Figure 3). In referring to his model, Gallagher (1966) declared:

> The purpose of this Topic Classification System is to provide a structure within which the interested observer, teacher, or researcher, can describe present classroom behavior. Eventually it should provide a vehicle by which potential teacher modifications of behavior could systematically be introduced to study the influences of various teacher strategies. We reject categorically the notion that there is one effective teaching strategy. There is no "holy grail" in classroom interaction. What is good or effective is a function of the particular teacher, the particular group with its specific character, and perhaps the educational philosophy of the person making the judgment. As a roadmap tries to describe an area without making specific judgments on which might be a favorable destination, so this system attempts to chart the classroom performance without any one idea of teaching excellence in mind (p. 1).

S T Y L E S

L E V E L S	Description	Explanation	Evaluation-Justification	Evaluation-Matching	Expansion
Generalization					
Concept					
Data					

Figure 3. Gallagher Topic Classification Model

The Gallagher Topic Classification System does not attempt to tell a teacher how to teach. The objective is to enable the teacher to have a better understanding of what is happening in the classroom along with an impression of the level of student mental activity he is generating. It is a generally accepted truth that most teachers want to be good teachers, and as they acquire a better impression of classroom interaction and level of mental activity they will be able to design more effective teaching strategies.

Gallagher's model can be used to classify topics pursued in classroom discussion. The model has proved to be of most value in providing the teacher with a system for classifying classroom questions.

Summary

Use of the question in teaching is not new (Duggan 1948), nor has its importance as a teaching tool diminished (Hughes, 1958; Ashner, 1961). A relationship exists between the questions asked by teachers and the level of thinking by students in the classroom (Johns, 1968).

Questions requiring higher level thinking processes enabled students to score higher on a standardized thest (Hawkins, 1968). Teachers can learn to use more higher level questions with instruction (Hawkins, 1968).

Students who improved in questioning skills increased in motivation autonomy, and production (Suchman, 1961).

Several classification systems to describe classroom interaction and behavior have been designed. The intent of this project was to determine whether instruction in the use of the Gallagher Topic Classification system to categorize questions would enable students to construct a greater variety of styles and levels of questions.

CHAPTER III

DESIGN OF THE STUDY

The study was designed to analyze the effects of teaching elementary and secondary students the Gallagher Topic Classification System as a system for constructing and analyzing questions. The students were asked to write questions about three pictures before the instruction in question classification and again after the instruction period. The students were assigned to two groups for the experimental treatment and one control group. For analysis the data from students were classified by experimental and control groups and also by three grade level groups.

The design of the study was divided into the following categories: Populations and samples, instruction of teachers, instruction of students, data gathering procedures, training the coders, and statistical analysis.

Populations and Samples

The general population was the elementary and secondary public school students in Coos County, Oregon and in Reedsport School District, Douglas County, Oregon. The teachers of these students constituted the general population of teachers.

The sample population of teachers consisted of 225 teachers who had expressed an interest in participating in an extension course on questioning. Each of the teachers were asked to write their name and other identifying data on a 3" x 5" card. The cards were collected, shuffled, and dealt into three stacks.

The first 25 cards falling in each stack identified the teacher groups. Stack one was designated experimental group I, stack two was designated experimental group II, and stack three was designated control group III.

After the first 75 cards were selected, the teachers in each group were identified. If a teacher in one of the groups could not keep the commitment, the next card falling in that stack identified the alternate teacher. This enabled all groups to begin the experimental period with 25 teachers each.

The groups were designated experimental teacher group I, experimental teacher group II, and control teacher group III. The teachers in experimental groups I and II were enrolled in the extension course on questioning, and group III teachers were scheduled to receive no instruction on questioning during the experimental portion of the study during the Fall term of 1969.

The sample of students was the corresponding elementary and secondary students of the teachers in the teacher groups. These students were divided into three groups corresponding to those of their respective teachers and were designated experimental student groups I and II, and control student group III. Each student group was composed of approximately 625 students with a total sample population of approximately 1875 students. The students in groups I and II were instructed on questioning and the students in group III received no instruction on questioning.

Pre- and post-test data were returned for analysis by 831 students. There were 385 students representing group I, 280 representing group II, and 166 representing group III. The lower elementary school (1-4) level was represented by 198 students, the middle school level (grades 5-8) was represented by 254 students, and there were 213 students representing the high school level (grades 9-12) students.

Instruction of Teachers

The teachers in experimental group I studied question construction under the lecture method of instruction. They attended a two-and-one-half hour class session each Wednesday during Fall term of 1969. The length of the term was eleven weeks. The classes were held at North Bend Junior High School, North Bend, Oregon, between 5:00p.m. and 7:30 p.m.

The teachers in experimental group II studied question construction under the workshop method of instruction which was designed to involve the learners in activities individually and in groups to meet the objectives as listed below. They attended a two-and one-half hour class session each Wednesday during Fall term of 1969. The length of the term was eleven weeks. The classes were held at North Bend Junior High School, North Bend, Oregon, between 7:30 p.m. and 10:00 p.m.

Teachers in group III were in the control group and received no formal instruction in question construction during the period in which data was being collected for the study.

The instructor for both classes, Mr. David Campbell, was an extension instructor for the University of Oregon. Mr. Campbell had had previous experience in teaching the Gallagher Topic Classification System in workshops for teachers in the Lane County area of Oregon. He also participated with other members of the Northwest Regional

Educational Laboratory, Portland, Oregon, in designing the instructional package used in the study.

Material for the courses was obtained from an instructional package developed by the Northwest Regional Educational Laboratory, Portland, Oregon. The package was specifically designed to be presented in a workshop manner. However, the materials for the lecture class were adapted to conform to the lecture approach by the instructor.

The objectives for the course were arranged into two cycles for learning the Gallagher model. Cycle I involved the levels of abstraction and Cycle II involved the styles of questions. The following behavioral objectives were stated for the course. (Miller, 1969)

Cycle I

A. To identify data
B. To define data
C. To identify concept
D. To define concept
E. To order examples of data and concept
F. To identify generalizations
G. To define generalizations
H. To give examples of data, concept and generalization
I. To write related data, concept and generalization for a lesson to be taught
J. To write questions on the three levels of abstraction, place them on a one-dimensional grid and put questions into a sequential teaching order. (p. 1)

Cycle II

A. To identify description
B. To define description
C. To order on a grid questions of descriptive style
D. To identify explanation
E. To define explanation
F. To order on a grid questions of explanation style
G. To identify evaluation-justification and evaluation-matching
H. To define evaluation-justification and evaluation-matching

I. To order on a grid questions of evaluation styles
J. To identify expansion
K. To define expansion
L. To order on a grid questions of expansion style
M. To identify relationship between teacher and learner behavior
N. To write questions in five styles and at three levels of abstraction (p. 42a)

Instruction of Students

The teachers in groups I and II studied under the lecture method and the workshop method respectively, and the teachers in group III were given no instruction in questioning. The lecture-method teachers and the workshop-method teachers were requested to present the Gallagher Topic Classification System to their students in the same manner in which it was presented to them. The teachers in the control group were not required to present instruction on questioning.

The students of all the teachers in all groups were given the pre-test between September 24, 1969 and October 1, 1969, which was the week immediately following the organizational meeting of the extension class on questioning for the teachers. The post-test was given during the school week of December 15, 1969 through December 19, 1969. Both pre- and post-tests were administered by the respective teacher.

For the interim ten weeks the students in group I and II received instruction on questioning and the Gallagher Topic Classification System. The teachers cordinated their planning and teaching with the instruction they were receiving. The students in group I were taught the material by lecture while the students in group II were taught the material by the workshop method which included involvement in activities.

Data Gathering Procedures

The pre-test and the post-test constituted having the students respond with questions to the stimuli of three black and white pictures. [1]

One picture was an aerial view of a seaport and large city. Another picture showed a ship tied to a dock in an apparently small port surrounded by wooded hills. The third picture was of a drawing depicting life in an Indian village. The seaport and the ship were considered a familiar topic to students in Coos County. The Indian picture was selected because of the interest many children have in Indians.

The students were requested by the classroom teachers to write five questions for each picture. The instructions to students were, "Imagine you are a teacher, write five questions about this picture you could use with the class." First grade children were asked to dictate their questions to their teachers instead of writing them themselves.

The teachers collected the student written questions and gave them to the investigator for tabulation. The papers were assembled according to teacher and student groups before being forwarded to the coders. The coders were uninformed regarding the purpose and design of the study.

Training the Coders

Three coders were used to classify the questions written by the students. Questions from each group of students were distributed to

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[1] The three pictures used in the pre- and post-tests are included in the appendix.

all three coders in order that one coder would not have the responsibility of coding the questions from a particular group of students.

The three coders were Mrs. Monte Campbell, Mrs. Kristen Coleman, and Mrs. Sally Edmiston, all of Eugene, Oregon. They were engaged to assist with the study by Mrs. Susan Miller who was conducting a companion study investigating the effects on the question construction habits of teachers who received training in the Gallagher Topic Classification System.

The coders were paid for their service by the Northwest Regional Educational Laboratory. The Laboratory's interest in the study resulted from their desire to field test the package prepared by that organization.

The training of the coders was under the supervision of Susan Miller, a co-author of the instructional package on the Gallagher Topic Classification System.

There were four training sessions of three hours each. After each session the coders were given a list of 100 questions to code and bring with them to the next session for review, comparison, analysis, and recording. These sessions were held during the 10-week period coinciding with the extension classes in this study.

After the training period the coders worked independently on the questions in the study; however, on the questions of every tenth student all three coders worked on the same students questions as a check on the reliability of classifying. The accuracy of the coding was checked periodically by the trainer who randomly selected approximately one set of students questions per hundred for review.

Agreement among coders on the classification of questions was maintained at an average of 14 out of 15 students questions. The percentage of agreement was 93%.

The maintenance of 93% agreement among the coders was considered sufficiently reliable when the observer agreement formula proposed by Bennett (1954) was applied. Bennett's formula was designed to compensate for a higher chance factor when the number of coding categories increases.

$$S = \frac{k}{k-1} \qquad \frac{1}{P-k}$$

S is the index of consistency where P is the observed percentage of agreement between coders, and k is the number of categories. There were 15 categories in the Gallagher Topic Classification System used for the classification of questions in the study. Computation of the index of consistency (s) in coding was as follows.

$$S = \frac{k}{k-1} \qquad \frac{1}{P-k}$$

$$S = \frac{15}{15-1} \qquad 93 - \frac{1}{15}$$

$$S = 107 \text{ X } 87$$

$$S = .927$$

The questions were read by the coders and each question was marked according to the levels and styles of the Gallagher Topic Classification System. In figure IV the code symbols are identified in each particular cell of the Gallagher model.

The following coding system was used in classifying the students questions.

D-1 Description Data

D-2 Description Concept

D-3 Description Generalization

E-1 Explanation Data

E-2 Explanation Concept

E-3 Explanation Generalization

J-1 Evaluation-Justification Data

J-2 Evaluation-Justification Concept

J-3 Evaluation-Justification Generalization

M-1 Evaluation-Matching Data

M-2 Evaluation-Matching Concept

M-3 Evaluation-Matching Generalization

X-1 Expansion Data

X-2 Expansion Concept

X-3 Expansion Generalization

STYLES

LEVELS	Description	Explanation	Evaluation-Justification	Evaluation-Matching	Expansion
Generalization					
Concept					
Data					

Figure 4. Gallagher's Topic Classification Model

Statistical Analysis

An analysis of variance technique was used in processing the data after the data was transferred to International Business Machine cards. Mr. David Niess, consultant at the Computer Center of Oregon State University, agreed with the appropriateness of the statistics and designed the computer program.

An "F" test was used when three groups were compared to determine significant differences among the groups. For comparison of one group to another group the "t" test was used.

Description-Data Questions Versus All Other Questions. One effect examined was whether the training in question classification and construction would change the styles and levels of questions constructed by students. The change studied was whether the experimental treatment would cause movement from the D-1 (Description-Data) category on the pre-test to other categories on the post-test.

In order to study this effect the following computations were made. In each case below mean numbers were per student.

A. Mean number of D-1 questions on the pre-test compared to the mean number of Non-D-1 questions on the pre-test.

B. Mean number of D-1 questions on the post-test compared to the mean number of Non-D-1 questions on the post-test.

C. Mean number of D-1 pre-test questions compared to the mean number of D-1 post-test questions.

D. Mean number of Non-D-1 pre-test questions compared to the mean number of Non-D-1 post-test questions.

The comparison of D-1 questions to Non-D-1 questions is shown in Figure 5 below, as the shaded category was compared to the categories not shaded.

STYLES

LEVELS	Description	Explanation	Evaluation-Justification	Evaluation-Matching	Expansion
Generalization	D-3	E-3	J-3	M-3	X-3
Concept	D-2	E-2	J-2	M-2	X-2
Data	D-1 (shaded)	E-1	J-1	M-1	X-1

Figure 5. Description-Data Questions Versus All Other Questions

Using the computations A, B, C, and D described above, null hypothesis number one was tested.

1. There will be no significant difference between the pre- and post-test data on question construction between the experimental groups and the control group.

In order to fully examine the hypothesis, (a) Group I and Group II were compared using each of the above computations A, B, C, and D; (b) Group I and Group III were compared using each of the computations A, B, C, and D; and (c) Group II and Group III were compared using each of the computations A, B, C, and D.

Description Questions Versus All Other Questions. A second effect examined was whether the training program in question classification and construction would cause movement across the grid to other styles of questions. To investigate this effect the following computations were made on the mean number of questions per student.

E. Mean number of D questions (all levels) on the pre-test compared to the mean number of Non-D questions on the pre-test.

F. Mean number of D post-test questions compared to the mean number of Non-D post-test questions.

G. Mean number of D pre-test questions compared to the mean number of D post-test questions.

H. Mean number of Non-D pre-test questions compared to the mean number of Non-D post-test questions.

The comparison of D questions (all levels) to Non-D questions is shown in Figure 6, as the shaded area compared to the area not shaded.

STYLES

LEVELS	Description	Explanation	Evaluation-Justification	Evaluation-Matching	Expansion
Generalization	D-3	E-3	J-3	M-3	X-3
Concept	D-2	E-2	J-2	M-2	X-2
Data	D-1	E-1	J-1	M-1	X-1

Figure 6. Description Questions Versus All Other Questions

Using the computations E, F, G, and H described above, null hypothesis number one was tested.

1. There will be no significant difference between the pre- and post-test data on question construction between the experimental groups and the control group.

For a full examination of this hypothesis, (a) Group I and Group II were compared using each of the above computations E, F, G, and H; (b) Group I and Group III were compared using each of the computations E, F, G, and H; and (c) Group II and Group III were compared using each of the computations, E, F, G, and H.

Comparison Between Grade Level Groups. The effect to be examined for comparisons between grade level groups was to determine whether the training in the classification and construction of questions would cause movement in the number of questions constructed by students from the D-1 category to other categories after the experimental treatment.

To compare the grade level groups the computations listed below were made on the number of questions per student. To prevent contamination by the control group, only the data from the experimental groups were used in these computations.

I. Mean number of D-1 questions on the pre-test compared to the mean number of Non-D-1 questions on the pre-test.

J. Mean number of D-1 post-test questions compared to the mean number of Non-D-1 post-test questions.

K. Mean number of D-1 pre-test questions compared to the mean number of D-1 post-test questions.

L. Mean number of Non-D-1 pre-test questions compared to the mean number of Non-D-1 post-test questions.

Using computations I, J, K, and L described above, null hypothesis number two was tested.

2. There will be no significant difference between the pre-test and the post-test data on question construction between the students in (a) lower elementary school (grades 1-4), (b) middle school (grades 5-8), and high school (grades 9-12).

To fully examine the hypothesis (1) elementary school students and middle school students were compared using the above computations, I, J, K, and L; (2) elementary school students and high school students were compared using each of the computations I, J, K, and L; (3) middle school students and high school students were compared using the computations, I, J, K, and L.

Tests were conducted to determine whether there were significant differences at the .05 level of confidence. The tests included were the F test when all three groups were compared, and the "t" test when one grade level group was compared to another grade level group.

Summary

The purpose of the study was to analyze the effects of teaching elementary and secondary students the Gallagher Topic Classification System as a system for constructing and analyzing questions.

Two experimental groups and one control group of students were randomly selected.

The two experimental groups of students were taught the Gallagher Topic Classification System as a method of constructing and analyzing questions by their teachers who had previously received similar instruction in an extension class.

The students supplied data by means of an open-ended test on which they were instructed to write five questions about each of three pictures. The same test using the same pictures was administered before and after the instruction period.

The questions written by students were coded according to the Gallagher Topic Classification System and transferred to IBM computer cards. The data were then submitted to analysis of variance program on the computer at Oregon State University, Corvallis, Oregon.

The study examined the effect of movement from the D-1 classification to other classifications in questions constructed on the pre- and post-tests. The effect of movement from the description style (all levels) to all other styles was also examined and statistical comparisons were made.

The study of these effects was used to determine whether the pre- and post-test data revealed a significant difference at the .05 level of confidence between the experimental and the control groups and whether there was a significant difference between students in lower elementary school, middle school, and high school.

CHAPTER IV

ANALYSIS OF THE DATA

The results of the study were reported in three major sections: data-description questions, description style questions, and grade level groups. In each of these sections the statistical procedure was to compare the experimental groups and the control group by means of analysis of variance. Then, all combinations of two groups were compared by the use of "t" tests. This order was followed in reporting the results. At the end of each section the "t" test results were tabulated and reported in a summary table.

Data-Description Questions

Description-Data (D-1) questions were those questions produced by the students that were coded on the data level and in the description style of Gallagher's Topic Classification model. These questions were compared with the questions in all other styles and levels.

Analysis of variance comparisons and accompanying "t" tests were reported in the following sub-sections:

A. Description-Data (D-1) Questions Versus Non-D-1 Questions on the Pre-Test.

B. Description-Data (D-1) Questions Versus Non-D-1 Questions on the Post-Test.

C. Description-Data (D-1) Questions on the Pre-Test Versus Description-Data (D-1) Questions on the Post-Test.

D. Non-D-1 Questions on the Pre-Test Versus Non-D-1 Questions on the Post-Test.

Description-Data (D-1) Questions Versus Non-D-1 Questions on the Pre-Test. As reported in Table I below, the analysis of variance of the groups yielded an F score which indicated a difference between the groups that was significant at the .01 level of confidence when D-1 (Description-Data) questions were compared to Non-D-1 (all other) questions on the pre-test.

Table I. Comparison of D-1 Questions with Non-D-1 Questions on the Pre-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	1.62	8.10	36.17
Error	828	1.86	2.41	
Total	830	2.02		

Greater clarification of differences between the groups was found when they were compared utilizing the "t" test. A comparison of groups I and II with D-1 questions versus Non-D-1 questions on the pre-test indicated no significant difference between the groups. The "t" test value was 1.02.

A comparison of groups I and III with D-1 questions versus Non-D-1 questions on the pre-test yielded a "t" value of 8.25 which was significant at the .01 level of confidence.

A comparison of groups II and III with D-1 questions versus Non-D-1 questions on the pre-test indicated a significant difference at the .01 level of confidence with the "t" test value of 7.01.

The results of the pre-test comparisons indicated that the control group (III) asked significantly more D-1 questions than did the experimental groups (I and II). Further, there was no significant difference between the experimental groups (I and II) in D-1 questions asked on the pre-test.

Description-Data (D-1) Questions Versus Non-D-1 Questions on the Post-Test. The post-test data was examined comparing D-1 questions to Non-D-1 questions. Table II listed the information yielded on an analysis of variance of Experimental Group I, Experimental Group II, and Control Group III with D-1 questions on the post-test. The data gave an F score of 50.73 which indicated a significant difference at the .01 level of confidence.

Table II. Comparison of D-1 Questions Versus All Other Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	2.66	1.33	50.73
Error	828	2.17	2.62	
Total	830	2.44		

In order to obtain a greater clarification, the post-test data from the groups were compared with "t" tests.

A comparison of groups I and II with D-1 questions versus Non-D-1 questions on the post-test resulted in a difference that was significant at the .01 level of confidence with a "t" test value of 4.31.

A comparison of groups I and III with D-1 questions versus Non-D-1 questions on the post-test resulted in a difference that was significant at the .01 level of confidence with a "t" test value of 6.97.

A comparison of groups II and III with D-1 questions versus Non-D-1 questions on the post-test resulted in a difference that was significant at the .01 level of confidence with a "t" test value of 10.06.

The results of the post-test comparisons indicated that the Control Group III asked significantly more D-1 questions on the post-test than did the two experimental groups. Further, Experimental Group I asked significantly more D-1 questions than did Experimental Group II.

Description-Data (D-1) Questions on the Pre-Test Versus Description-Data (D-1) Questions on the Post-Test. The study compared D-1 questions on the pre-test with D-1 questions on the post-test. An analysis of variance among the groups revealed a difference that was significant at the .01 level of confidence. The F value was 6.20 as indicated below in Table III.

Table III. Comparison of D-1 Questions on the Pre-Test Versus D-1 Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	3.19	1.60	6.20
Error	828	2.13	2.57	
Total	830	2.16		

In order to obtain a greater clarification, the pre- and post-test data were compared with "t" tests.

A comparison of groups I and II with D-1 questions on the pre-test and D-1 questions on the post-test resulted in a difference that was significant at the .05 level of confidence with a "t" value of 3.52.

A comparison of groups I and III resulted in no significant difference regarding D-1 questions on the pre-test compared to D-1 questions on the post-test. The "t" test value was 1.09.

A comparison of groups II and III revealed a significant difference at the .05 level of confidence when D-1 questions on the pre-test were compared to D-1 questions on the post-test. The "t" test value was 1.79.

The results indicated that Experimental Group II experienced a significantly greater decrease in D-1 questions than did Experimental Group I or Control Group III when D-1 questions on the pre- and post-tests were compared. Further, there was no significant difference between Experimental Group I and Control Group III.

Non-D-1 Questions on the Pre-Test Versus Non-D-1 Questions on the Post-Test. The relationship of Non-D-1 questions on the pre-test to Non-D-1 questions on the post-test was examined. An analysis of variance among the groups indicated a difference that was significant at the .01 level of confidence. As shown in Table IV, the F value was 8.40.

Table IV. Comparison of Non-D-1 Questions on the Pre-Test Versus Non-D-1 Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	1.45	5.74	8.40
Error	828	5.66	6.84	
Total	830	5.77		

In order to obtain a greater clarification, the pre- and post-test data on Non-D-1 questions were compared with "t" tests.

A comparison of groups I and II with Non-D-1 questions on the pre-test with those on the post-test resulted in a significant differ ence at the .01 level of confidence with a "t" test value of 3.46.

A comparison of groups II and III with Non-D-1 questions on the pre-test with those on the post-test resulted in a significant difference at the .01 level of confidence with a "t" test value of 3.55.

A comparison of groups I and III with Non-D-1 questions on the pre-test with those on the post-test resulted in no significant difference with a "t" test value of .82.

The results indicated that Experimental Group II experienced a significantly greater increase in Non-D-1 questions than did Experimental Group I and Control Group III when Non-D-1 questions on the pre- and post-tests were compared. Further, there was no significant difference between Experimental Group I and Control Group III.

Summary of "t" Test Comparisons of Description-Data Questions. The results of the comparisons of the groups on questions coded in the Description-Data cell versus all other questions were summarized in Table V below.

Values of "t" greater than 1.65 were statistically significant at the .05 level of confidence. The "t" test values greater than 2.33 were significant at the .01 level of confidence.

Table V. Summary of "t" Test Comparisons of Questions Coded in the Description-Data Cell Versus Questions in All Other Cells

Comparisons	Group I vs. Group II	Group I vs. Group III	Group II vs. Group III
D-1 Questions, Pre-Test versus Non-D-1 Questions, Pre-Test	1.02	8.25**	7.01**
D-1 Questions, Post-Test versus Non-D-1 Questions, Post-Test	4.31**	6.97**	10.06**
D-1 Questions, Pre-Test versus D-1 Questions, Post-Test	3.52**	1.09	1.79*
Non-D-1 Questions, Pre-Test versus Non-D-1 Questions, Post-Test	3.47**	.82	3.55**

*.05 level of confidence
**.01 level of confidence

Description Style Questions

Description style (D) questions were those questions produced by students that required only memory for an answer but could involve a higher level of conceptualization. Description style categories include the three levels of the Gallagher model termed data, concept, and generalization.

Non-D or "all other questions" referred to those questions constructed by the students that were coded in cells on the Gallagher model as all styles other than description. Other styles were explanation, evaluation-justification, evaluation-matching, and expansion. All these required higher level thinking processes than did questions classified description.

The pre- and post-test data from Experimental Group I, Experimental Group II, and Control Group III were compared on description style questions versus all other questions. Analysis of variance comparisons and accompanying "t" tests were made and reported in the following sub-sections:

E. Description Style (D) Questions Versus All Other Styles (Non-D) of Questions on the Pre-Test.

F. Description Style (D) Questions Versus All Other Styles (Non-D) of Questions on the Post-Test.

G. Description Style (D) Questions on the Pre-Test Versus Description Style (D) Questions on the Post-Test.

H. All Other Styles (Non-D) of Questions on the Pre-Test Versus All Other Styles (Non-D) of Questions on the Post-Test.

Description Style (D) Questions Versus All Other Styles (Non-D) of Questions on the Pre-Test. The pre-test data comparing description questions to all other questions was examined. As reported in Table VI the analysis of variance of the the groups yielded an F score of 13.29 which indicated a difference among the groups that was significant at the .01 level of confidence.

Table VI. Comparison of D Questions Versus Non-D Questions on the Pre-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	1.44	7.22	13.29
Error	802	4.36	5.44	
Total	804	4.51		

In order to obtain a greater clarification, the pre-test data from the groups were compared with "t" tests.

A comparison of groups I and II with D questions versus Non-D questions on the pre-test resulted in a "t" test value of 2.90 which was significant at the .01 level of confidence.

A comparison of groups I and III with D questions versus Non-D questions on the pre-test resulted in a "t" test value of 4.99 which was significant at the .01 level of confidence.

A comparison of groups II and III with D questions versus Non-D questions on the pre-test resulted in a "t" test value of 2.55 which was significant at the .01 level of confidence.

The results indicated that Control Group III asked significantly more description style questions on the pre-test than did Experimental Group I and Experimental Group II. Experimental Group II asked significantly more description style questions than Experimental Group I.

Description Style (D) Questions Versus All Other Styles (Non-D) of Questions on the Post-Test. The groups were compared with D questions versus Non-D questions on the post-test. As reported in Table VII the analysis of variance of the groups resulted in an F value of 21.41 which was significant at the .01 level of confidence.

Table VII Comparison of D Versus Non-D Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	2.21	1.10	21.41
Error	802	4.13	5.16	
Total	804	4.36		

In order to obtain a greater clarification, the post-test data from the groups were compared with "t" tests.

A comparison of groups I and II with D questions versus Non-D questions on the post-test resulted in a "t" test value of 1.42 which was not significant.

A comparison of groups I and III with D questions versus Non-D questions on the post-test resulted in a "t" test value of 5.50 which was significant at the .01 level of confidence.

A comparison of groups II and III with D questions versus Non-D questions on the post-test resulted in a "t" test value of 6.36 which was significant at the .01 level of confidence.

The results indicated that Control Group III asked significantly more description style questions on the post-test than did Experimental Group I and Experimental Group II. Further, there was no significant difference between Experimental Group I and Experimental Group II on the post-test.

Description Style (D) Questions on the Pre-Test Versus Description Style (D) Questions on the Post-Test. The groups were compared with D questions on the pre-test versus D questions on the post-test. As reported in Table VIII, an analysis of variance of the groups resulted in an F value of 5.01 which was significant at the .01 level of confidence.

Table VIII. Comparison of D Questions on the Pre-Test Versus D Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	4.27	2.14	5.01
Error	802	3.42	4.26	
Total	804	3.46		

In order to obtain a greater clarification, the post-test data from the groups were compared with pre-test data by means of "t" tests.

A comparison of groups I and II with D questions on the pre-test versus D questions on the post-test resulted in a "t" test value of 3.09 which was significant at the .01 level of confidence.

A comparison of groups I and III with D questions on the pre-test versus D questions on the post-test resulted in a "t" test value of .40 which was not significant.

A comparison of groups II and III with D questions on the pre-test versus D questions on the post-test resulted in a "t" test value of 1.97 which was significant at the .05 level of confidence.

The results indicated that Experimental Group II experienced a statistically greater decrease in description style questions than did Experimental Group I and Control Group III. Further, there was no significant difference between Experimental Group I and Control Group III.

<u>All Other Styles (Non-D) of Questions on the Pre-Test Versus All Other Styles (Non-D) of Questions on the Post-Test</u>. The groups were compared with Non-D questions on the pre-test versus Non-D questions on the post-test. As reported in Table IX, an analysis of variance among

the groups resulted in an F value of 5.96 which was significant at the .01 level of confidence.

Table IX. Comparison of Non-D Questions on the Pre-Test Versus Non-D Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Group	2	2.31	1.16	5.96
Error	802	1.55	1.94	
Total	804	1.58		

In order to obtain a greater clarification, the pre- and post-test data from the groups on Non-D questions were compared by means of "t" tests.

A comparison of groups I and II with Non-D questions on the pre-test versus Non-D questions on the post-test resulted in a "t" test value of 2.59 which was significant at the .01 level of confidence.

A comparison of groups I and III with Non-D questions on the pre-test versus Non-D questions on the post-test resulted in a "t" test value of 1.28 which was not significant.

A comparison of groups II and III with Non-D questions on the pre-test versus Non-D questions on the post-test resulted in a "t" value of 3.19 which was significant at the .01 level of confidence.

The results indicated that Experimental Group II experienced a significantly greater increase in Non-D questions than did Experimental Group I and Control Group III. Further, there was no significant difference between Experimental Group I and Control Group III.

Summary of "t" Test Comparisons of Description Style Questions. The results of the comparisons of the groups on questions coded in the description style cells versus all other styles of questions were summarized in Table X below.

Values of "t" greater than 1.65 were statistically significant at the .05 level of confidence. The "t" test values greater than 2.33 were significant at the .01 level of confidence.

Table X. Summary of "t" Test Comparisons of Questions Coded in the Description Style Cells Versus Questions in All Other Styles

Comparisons	Group I vs. Group II	Group I vs. Group III	Group II vs. Group III
D Questions, Pre-Test versus Non-D Questions, Pre-Test	2.90**	4.99**	2.54**
D Questions, Post-Test versus Non-D Questions, Post-Test	1.42	5.54**	6.36**
D Questions, Pre-Test versus D Questions, Post-Test	3.09**	.39	1.97*
Non-D Questions, Pre-Test versus Non-D Questions, Post-Test	2.59**	1.28	3.19**

*.05 level of confidence
**.01 level of confidence

Grade Level Groups

The subjects were divided into three grade level groups in order to determine whether the experimental treatment caused any difference that was significant for any grade level group. The grade level groups were lower elementary (grades 1-4), middle school (grades 5-8), and high school (grades 9-12). The lower elementary level was represented by 198 students, middle school by 254 students, and high school by 213 students for a total of 665 students. The control group students were not included in these figures since they had not received the experimental treatment.

Analysis of variance comparisons and accompanying "t" tests were reported in the following sub-sections:

I. Data-Description (D-1) Questions Versus Non-D-1 Questions on the Pre-Test.

J. Data-Description (D-1) Questions Versus Non-D-1 Questions on the Post-Test.

K. Data-Description (D-1) Questions on the Pre-Test Versus Data-Description (D-1) Questions on the Post-Test.

L. Non-D-1 Questions on the Pre-Test Versus Non-D-1 Questions on the Post-Test.

Data-Description (D-1) Questions Versus Non-D-1 Questions on the Pre-Test. The pre-test data of the grade level groups were compared with D-1 questions versus Non-D-1 questions. As reported in Table XI, an analysis of variance resulted in an F value of 10.36 which was significant at the .01 level of confidence.

Table XI. Comparison of Grade Level Groups with D-1 Questions Versus Non-D-1 Questions on the Pre-Test

Source	DF	Sum of Squares	Mean Square	F
Level	2	4.38	2.19	10.36
Error	662	1.40	2.11	
Total	664	1.44		

The grade level groups were further compared with "t" tests.

A comparison of lower elementary and middle school levels with D-1 questions versus Non-D-1 questions on the pre-test resulted in a "t" test value of 3.99 which was significant at the .01 level of confidence.

A comparison of lower elementary and high school levels with D-1 questions versus Non-D-1 questions on the pre-test resulted in a "t" test value of .30 which was not significant.

A comparison of middle school and high school levels with D-1 questions versus Non-D-1 questions on the pre-test resulted in a "t" test value of 3.74 which was significant at the .01 level of confidence.

The results indicated that the middle school students asked significantly more D-1 questions on the pre-test than did the lower elementary or high school students. Further, there was no significant difference between the lower elementary and high school students in the number of D-1 questions on the pre-test.

<u>Data-Description (D-1) Questions Versus Non-D-1 Questions on the Post-Test</u>. The post-test data of the grade level groups were compared with D-1 questions versus Non-D-1 questions. As reported in Table XII,

an analysis of variance among the groups resulted in an F value of 12.24 which was significant at the .01 level of confidence.

Table XII. Comparison of Grade Level Groups with D-1 Questions Versus Non-D-1 Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Level	2	6.26	3.13	12.24
Error	662	1.69	2.56	
Total	664	1.76		

The grade level groups were further compared with "t" tests.

A comparison of lower elementary and middle school levels with D-1 questions versus Non-D-1 questions on the post-test resulted in a "t" test value of 4.58 which was significant at the .01 level of confidence.

A comparison of lower elementary and high school levels with D-1 questions versus Non-D-1 questions on the post-test resulted in a "t" test value of .91 which was not significant.

A comparison of middle school and high school levels with D-1 questions versus Non-D-1 questions on the post-test resulted in a "t" test value of 3.71 which was significant at the .01 level of confidence.

The results indicated that the middle school students constructed significantly fewer D-1 questions on the post-test than did the lower elementary or high school students. Further, there was no significant difference between the lower elementary and high school students on the number of D-1 questions asked on the post-test.

Data-Description (D-1) Questions on the Pre-Test Versus Data-Description (D-1) Questions on the Post-Test. A comparison of D-1 questions on the pre-test versus D-1 questions on the post-test was made. An analysis of variance as shown in Table XIII resulted in an F value of 1.75 which was not significant.

Table XIII. Comparison of Grade Level Groups with D-1 Questions on the Pre-Test Versus D-1 Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Level	2	9.27	4.64	1.75
Error	662	1.76	2.66	
Total	664	1.77		

The grade level groups were further compared with "t" tests.

A comparison of lower elementary and middle school levels with D-1 questions on the pre-test versus D-1 questions on the post-test resulted in a "t" test value of 1.80 which was significant at the .05 level of confidence.

A comparison of lower elementary and high school levels with D-1 questions on the pre-test versus D-1 questions on the post-test resulted in a "t" test value of .53 which was not significant.

A comparison of middle school and high school levels with D-1 questions on the pre-test versus D-1 questions on the post-test resulted in a "t" test value of 1.27 which was not significant.

The results indicated that middle school students showed a significantly greater decrease in D-1 questions than did the lower elementary school students. Further, there was no significant difference between lower elementary and high school students in the number of D-1 questions asked when pre- and post-test data were compared.

Non-D-1 Questions on the Pre-Test Versus Non-D-1 Questions on the Post-Test. A comparison of Non-D-1 questions on the pre-test to Non-D-1 questions on the post-test was made. An analysis of variance among the grade levels as shown in Table XIV resulted in an F value of 12.24 which was significant at the .01 level of confidence.

Table XIV. Comparison of Grade Level Groups with Non-D-1 Questions on the Pre-Test Versus Non-D-1 Questions on the Post-Test

Source	DF	Sum of Squares	Mean Square	F
Level	2	6.26	3.13	12.24
Error	662	1.69	2.56	
Total	664	1.76		

The grade level groups were further compared with "t" tests.

A comparison of lower elementary and high school levels with Non-D-1 questions on the pre-test versus Non-D-1 questions on the post-test resulted in a "t" test value of .17 which was not significant.

A comparison of middle school and high school levels with Non-D-1 questions on the pre-test versus Non-D-1 questions on the post-test resulted in a "t" test value of 1.83 which was significant at the .05 level of confidence.

A comparison of lower elementary and middle school levels with Non-D-1 questions on the pre-test versus Non-D-1 questions on the post-test resulted in a "t" test value of 1.62 which was not significant.

The results indicated that the middle school students showed a significantly greater increase in Non-D-1 questions than did high school students. Further, there was no significant difference between the lower elementary and high school students on the number of Non-D-1 questions when pre- and post-test data were compared.

Summary of "t" Test Comparisons of Grade Level Groups. The results of the comparisons of the grade level groups on questions coded in the Description-Data cell versus all other questions were summarized in Table XV. The values of "t" greater than 1.65 were significant at the .05 level of confidence. The "t" test values greater than 2.33 were significant at the .01 level of confidence.

Table XV. Summary of "t" Test Comparisons of Grade Level Groups on Data-Description Questions Versus All Other Styles of Questions

Comparisons	Lower Elem. versus Middle Sch.	Lower Elem. versus High Sch.	Middle Sch. versus High Sch.
D-1 Questions, Pre-Test versus Non-D-1 Questions, Pre-Test	3.99**	.30	3.74**
D-1 Questions, Post-Test versus Non-D-1 Questions, Post-Test	4.58**	.91	3.71**
D-1 Questions, Pre-Test versus D-1 Questions, Post-Test	1.80*	.53	1.27
Non-D-1 Questions, Pre-Test versus Non-D-1 Questions, Post-Test	1.62	.17	1.83*

*.05 level of confidence
**.01 level of confidence

Summary

Data-Description Questions. Pre-test comparisons indicated that Control Group III asked significantly more Data-Description (D-1) questions than did Experimental Group I and Experimental Group II. There was no significant difference between Experimental Group I and Experimental Group II on Data-Description (D-1) questions asked on the pre-test.

Post-test comparisons indicated that Control Group III asked significantly more Data-Description (D-1) questions on the post-test than did Experimental Group I and Experimental Group II. Experimental Group I asked significantly more D-1 questions than did Experimental Group II.

On pre- and post-test comparisons of Data-Description (D-1) questions, Experimental Group II experienced a significantly greater decrease in D-1 questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

On pre- and post-test comparisons of Non-Data-Description (Non-D-1) questions, Experimental Group II experienced a significantly greater increase in Non-D-1 questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

Description Style Questions. Control Group III asked significantly more Description Style (D) questions on the pre-test than did Experimental Group I and Experimental Group II. Experimental Group II asked significantly more Description Style (D) questions than did Experimental Group I.

Control Group III asked significantly more Description Style (D) questions on the post-test than did Experimental Group I and Experimental Group II. There was no significant difference between Experimental Group I and Experimental Group II.

Experimental Group II experienced a statistically greater decrease in Description Style (D) questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

Experimental Group II experienced a significantly greater increase in Non-D questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

Grade Level Groups. Middle school students asked significantly more Data-Description (D-1) questions on the pre-test than did lower elementary and high school students. There was no significant difference between lower elementary and high school students.

Middle school students constructed significantly fewer Data-Description (D-1) questions on the post-test than did lower elementary and high school students. There was no significant difference between lower elementary and high school students.

Middle school students showed a significantly greater decrease in Data-Description (D-1) questions than did lower elementary and high school students. There was no significant difference between lower elementary and high school students.

Middle school students showed a significantly greater increase in Non-D-1 questions than did high school students.

There was no significant difference between lower elementary and high school students.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

Purpose. The study was designed to analyze the effects of teaching elementary and secondary students the Gallagher Topic Classification System as a technique for constructing and analyzing questions.

The Gallagher model can be used to categorize questions on a vertical dimension of three "levels" termed: (1) Data, (2) Concept, and (3) Generalization; and on a horizontal dimension of five "styles" termed: (1) Description, (2) Explanation, (3) Evaluation-justification, (4) Evaluation-matching, and (5) Expansion. The Gallagher Topic Classification Model is illustrated below in Figure 7.

	Description	Explanation	Evaluation-Justification	Evaluation-Matching	Expansion
Generalization					
Concept					
Data					

Figure 7. Gallagher's Topic Classification Model

The intent was to analyze the effects according to: (1) the number of questions categorized as Data and Description versus all other questions, and (2) the number of questions categorized in all levels of Description versus the questions in the other four styles.

Procedure. In the study, seventy-five teachers were randomly selected and divided into two experimental and one control group. Experimental Group I was taught the Gallagher Topic Classification System utilizing the lecture method of instruction while Experimental Group II was taught the same material using the workshop approach. Experimental groups I and II were asked to teach the system to their students in the manner in which they had been taught. The control group received no instruction.

The students involved in the study were those in the respective classrooms of the randomly selected teachers. Data were collected from an open-ended pre-test and post-test in which the students were asked to write five questions each about three pictures. The questions constructed by the students were categorized and transformed to a data processing system for the purpose of analysis.

For analysis the data from students were classified in the two experimental groups and one control group. Another analysis was made of the data with the experimental students grouped into grade level groups of lower elementary (grades 1-4), middle school (grades 5-8), and high school (grades 9-12).

The criteria for determining whether the experimental treatment caused significant differences was the quantitative relationship of questions categorized as Data-Description (D-1) to questions classified in all other categories (Non-D-1) on the Gallagher Topic Classification Model (Figure 7, p. 67). A further analysis was made regarding the relationship of questions classified in all levels of Description (D) to questions in all other categories of styles and levels (Non-D).

Results of the study. The results were listed according to the two null hypotheses tested.

1. There will be no significant difference between the pre- and post-test data on question construction between the experimental groups and the control group.

a. Pre-test comparisons indicated that Control Group III asked significantly more Data-Description (D-1) questions than did Experimental Group I and Experimental Group II. There was no significant difference between Experimental Group I and Experimental Group II.

b. Post-test comparisons indicated that Control Group III asked significantly more Data-Description (D-1) questions than did Experimental Group I and Experimental Group II. Experimental Group I asked significantly more D-1 questions than did Experimental Group II.

c. On pre- and post-test comparisons of Data-Description (D-1) questions, Experimental Group II experienced a significantly greater decrease in D-1 questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

d. On pre- and post-test comparisons of Non-Data-Description (Non-D-1) questions, Experimental Group II experienced a significantly greater increase in Non-D-1 questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

e. Control Group III asked significantly more Description Style (D) questions on the pre-test than did Experimental Group I and Experimental Group II. Experimental Group II asked significantly more Description Style (D) questions than did Experimental Group I.

f. Control Group III asked significantly more Descriptive Style (D) questions on the post-test than did Experimental Group I and Experimental Group II. There was no significant difference between Experimental Group I and Experimental Group II.

g. Between pre-test and post-test Experimental Group II had a statistically greater decrease in Description Style (D) questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

h. Between pre-test and post-test Experimental Group II experienced a significantly greater increase in Non-D style questions than did Experimental Group I and Control Group III. There was no significant difference between Experimental Group I and Control Group III.

Analyses were made to test null hypothesis number two.

2. There will be no significant difference between the pre- and post-test data on question construction between the students in (a) lower elementary school (grades 1-4), (b) middle school (grades 5-8), and (c) high school (grades 9-12).

To analyze this hypothesis the three designated grade level groups were compared with questions coded Description-Data (D-1) versus questions classified in all other categories (Non-D-1).

a. Middle school students asked significantly more Data-Description (D-1) questions on the pre-test than did lower elementary and high school students. There was no significant difference between lower elementary and high school students.

b. Middle school students constructed significantly fewer Data-Description (D-1) questions on the post-test than did lower elementary and high school students. There was no significant difference between lower elementary and high school students.

c. Between pre-test and post-test middle school students showed a significantly greater decrease in Data-Description (D-1) questions than did lower elementary students. There was no significant difference between elementary and high school students.

d. Between pre-test and post-test middle school students showed a significantly greater increase in Non-D-1 questions than did high school students. There was no significant difference between lower elementary and high school students.

Conclusions

The following numbered conclusions were drawn from the results of the testing of the two null hypotheses. The first two conclusions were the stating of the rejections of the null hypotheses.

1. There was a significant difference between the pre- and post-test data on question construction between the experimental groups and the control group.

2. There was a significant difference between the pre- and post-test data on question construction between the students in (a) lower elementary school (grades 1-4), (b) middle school (grades 5-8), and (c) high school (grades 9-12).

3. Students can be taught the Gallagher Topic Classification System as a technique for constructing and analyzing questions.

4. Students will increase their production of questions classified in the more complex styles and higher levels if they have been taught by teachers who have received instruction on the Gallagher Topic Classification System by means of the workshop approach.

5. The Gallagher Topic Classification System can be more effectively utilized to teach question construction and analysis to middle grade students (grades 5-8) than to lower elementary (grades 1-4) or to high school (grades 9-12).

Implications

From the results and conclusions of the study the following implications were made that extended beyond the scope of this study.

1. Instruction in questioning skills through the Gallagher Topic Classification System should enable the student to develop strategies that will improve his logical thinking patterns and consequently increase his effectiveness in problem definition and problem solving.

2. Instruction in questioning skills that enables a student to construct more complex, higher level questions should provide the student with processes of learning that will increase his effectiveness in acquiring knowledge.

3. Use of the workshop method of instruction can provide the kind of immediate involvement in question construction and analysis that will be more productive in the learning process.

4. The teaching of question construction and analysis should be emphasized during the middle school years to provide students a more opportune time for effective instruction and to provide them with bases for learning in subsequent school years.

5. Teachers who are teaching or who plan to teach in grades five through eight should receive instruction in question construction and analysis with emphasis on the Gallagher Topic Classification System.

Recommendations

The following recommendations for further study were suggested:

1. Similar studies should be conducted utilizing other question classification systems, such as proposed by Taba (1962), Sanders (1966), and Suchman (1961).

2. A study should be designed to draw comparisons between two or more of the systems used in classifying and analyzing questions to determine whether one system is more effective than others in teaching students to construct and use a variety of questions.

3. A longitudinal study should be conducted over a period of years to determine the lasting effect of teaching students to construct and analyze questions. A method of reinforcement in designing a variety of questions might prove to be useful.

4. A study should be made that would be specifically designed to compare the workshop approach with other teaching methods of question construction and analysis.

BIBLIOGRAPHY

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Ashner, Mary J. McCue. Asking questions to trigger thinking. National Education Association Journal. 50:44-46. September, 1961.

Ashner, Mary J. McCue. The analysis of verbal interaction in the classroom. In: Theory and research in teaching, ed. by Arno Bellach, New York, Columbia University, Teachers College, Bureau of Publications, 1963, p. 53-78.

Bennett, E. M., R. Alpert, and A. C. Goldstein. Communications through limited response questioning. Public Opinion Quarterly. 18:303-308. Fall, 1954.

Bloom, Benjamin S., et al. Taxonomy of educational objectives, handbook 1: cognitive domain. New York, David McKay Co., Inc., 1956. 207 p.

Bruner, Jerome S. The act of discovering. Harvard Educational Review. 31:21-32. January, 1961.

Chase, Francis S. Some effects of current curriculum projects on educational policy and practice. The School Review. 70:132-147. Spring, 1962.

Corey, Stephen M. The teachers out-talk the pupils. Education Digest. 6:8-9. January, 1961.

Cunningham, Roger T. A descriptive study determining the effects of a method of instruction designed to improve the question-phrasing practices of prospective elementary teachers. Doctoral dissertation. Bloomington, Indiana University, 1968. 213 numb. leaves. (Microfilm)

Davidson, R. L. Teacher influence and children's levels of thinking. The Reading Teacher. 22:702-704. May, 1969.

Dewey, John. Democracy and education. New York, The Macmillan Co., 1916. 360 p.

Duggan, Stephan. A student's textbook in the history of education. Third edition. New York, Appleton-Century-Croft, Inc., 1948. 512 p.

Flanders, Ned A. Teacher influence in the classroom. In: Theory and research in teaching, ed. by Arno Bellach, New York, Columbia University, Teachers College, Bureau of Publications, 1963, p. 37-52.

Floyd, William D. Do teachers talk too much? The Instructor. 78:53+. Ocdtober, 1968.

Gallagher, James J. Productive thinking of gifted children. Urbana, University of Illinois, 1965. 112 p. (Institute for Research on Exceptional Children, Cooperative Research Project No. 965)

Gallagher, James J. et al. A system of topic classification: classroom interaction study. Urbana, University of Illinois, 1966. 45 p. (Institute for Research on Exceptional Children, Grant #3224, Bureau of Research, U.S. Office of Education) (Mimeographed)

Guilford, James P. Creativity in secondary school. The High School Journal. 48:451-458. May, 1965.

Guilford, James P. Three faces of the intellect. American Psychologist. 14:469-470. April, 1959.

Guilford, James P., Ralph Hoephner, and Hugh Peterson. Predicting achievement in ninth grade mathematics from measurement of intellectual aptitude factors. Educational and Psychological Measurement. 25:659-682. January, 1968.

Hankins, F. P. Influence of analysis and evaluation questions on achievement in sixth grade social studies. Educational Leadership. 25:326-332. January, 1968.

Holt, John. How children fail. New York, Dell Publishing Company, Delta Books, 1964. 181 p.

Hughes, Marie M. Teaching is interaction. Elementary School Journal. 58:457-464. May, 1958.

Hughes, Marie M. Utah study of the assessment of teaching. In: Theory and research in teaching, ed. by Arno Bellach, New York, Columbia University, Teachers College, 1963. p. 25-36.

Johns, Joseph P. The relationship between teacher behaviors and the incidence of thought provoking questions by students in secondary schools. Doctoral dissertation. Ann Arbor, University of Michigan, 1966. 114 numb. leaves. (Microfilm)

LeShans, Eda J. How do parents respond to children's questions? Childhood Education. 45:79-82. October, 1968.

Masla, John A. The effects of instruction in interaction analysis on the verbal inquiry patterns of elementary science methods students. Doctoral dissertation. Bloomington, Indiana University, 1968. 131 numb. leaves. (Microfilm)

Means, G. H. and M. R. Loree. Influence on problem solving ability of following an efficient model. Journal of Educational Research. 62:136-141. November, 1968.

Miller, Susan. A companion study examining the effects of teaching the Gallagher Topic Classification System to teachers. Doctoral dissertation. Eugene, University of Oregon, 1970. (Incomplete)

Parrish, H. Wayne. A study of the effects of in-service training in interaction analysis on the verbal behavior of experienced teachers. Doctoral dissertation. Eugene, University of Oregon, 1968. 95 numb. leaves. (Microfilm)

Rohman, D. Gordon. A few kind words for the problem child. Illinois School Journal. 47:235-241. Winter, 1967.

Sanders, Norris M. Classroom questions, what kinds? New York, Harper and Row Publishers, 1966. 176 p.

Schwab, Joseph I. and Paul F. Branwein. The teaching of science as inquiry. Cambridge, Harvard University Press, 1962. 152 p.

Smith, R. J. Questions for teachers; creative reading. The Reading Teacher. 22:430-434. February, 1969.

Snyder, William R. The questions asking behavior of gifted junior high school science students and their teachers. Doctoral dissertation. Urbana, University of Illinois, 1966. 206 numb. leaves. (Microfilm)

Storm, H. C. Who can ask better questions - teachers or pupils? Elementary School Journal. 28:610-615. April, 1928.

Suchman, J. Richard. The elementary school training program in scientific inquiry. Urbana, University of Illinois, 1964. 68 p. (Project No. 216, National Defense Education Act)

Taba, Hilda. Curriculum development, theory and practice. New York, Harcourt, Brace and World, 1962. 529 p.

Taba, Hilda and James L. Hills. Teacher handbook for Contra Costa social studies. San Francisco, San Francisco State College, 1965. 136 p.

Torrance, E. Paul. Education and the creative potential. Minneapolis, The University of Minnesota Press, 1963. 167 p.

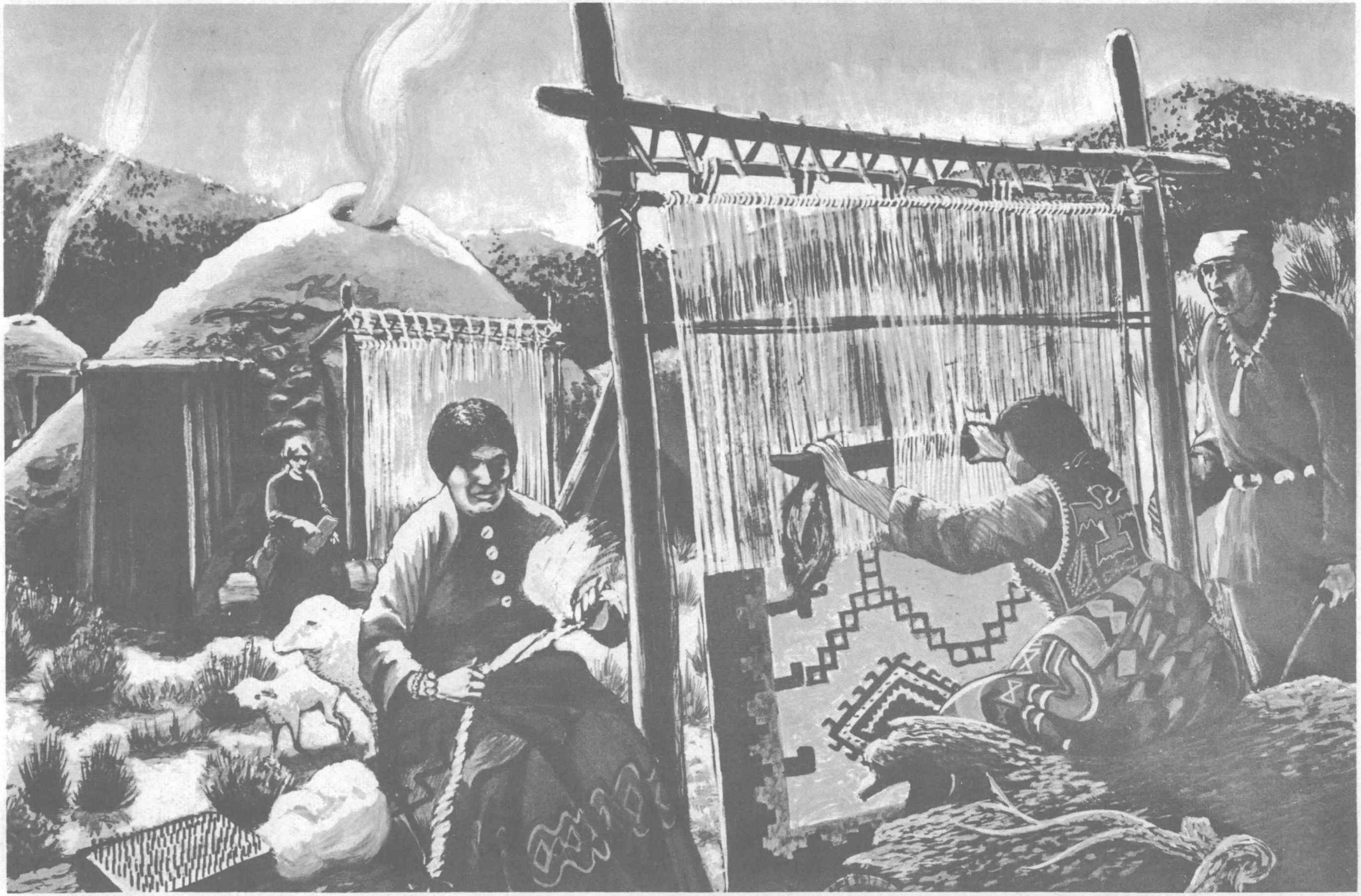
Wilt, Miriam E. A study of teacher awareness of listening as a factor in elementary education. Journal of Educational Research. 43:626-636. April, 1950.

APPENDICES

APPENDIX A

Picture Stimuli for Question Construction


NADINA



APPENDIX B

Course of Study on Questioning Strategies

TABLE OF CONTENTS FOR CYCLE

CYCLE I-A: To identify data

Behavioral Objective: Given the typescript, trainees will underline items on the list that can be classified as data. Each trainee will use his own definition and understanding of "data" to complete the activity.

Rationale: This activity allows the trainees to identify "data" and clarify different ideas of the term.

Approximate Time: 1 - 1 1/2 hours

Procedural Steps	Materials
1. Read the typescript.	I-A-I Typescript (pages 3,4,& 5)
2. Select a member of your trio to record the responses to the question, "Why was it difficult for these two men to understand each other?	
3. On paper set up two columns individually, one Mr. S. and one Mr. H. Select some examples from the typescript of language used by each.	
4. Compare the two lists by answering the following questions: a. How is their language different? b. How do you account for these differences?	
5. Discuss the differences you found with the other members of your trio.	
6. Read the sample provided for further clarification.	I-A-2 Clarification (page 6)
7. Underline items on the list that can be classified as data in terms of your own definition.	I-A-3 List (page 7)
8. Discuss your reasons for underlining different items than the members of your trio. Answer the question, "Why couldn't we agree?"	
9. Read the material titled We Use Words Differently to clarify not only some communication problems of the two men, but also some communication problems within your trio.	I-A-4 We Use Words Differently (pages 8 and 9)

CYCLE I-A cont.

10.	Compare your list with the list provided, which has the data items underlined.	I-A-5 List with data underlined (page 10)

Behavioral Objectives: Given two topics trios will write related data items.

Rationale: This activity provides an opportunity to have additional practice in identifying data items in their relation to levels of abstraction.

Approximate Time: 15 minutes

	Procedural Steps	Materials
1.	Trios select two items form the list that were not underlined. Write some related data items for each.	I-A-5 (page 10)
2.	Read the summary and discuss	I-A-6 Summary (page 11)

CYCLE I-B: To define data

Behavioral Objective: Each trainee will be able to write his own definition of data, share it with other members of the trio and be able to write a definition that all members agree upon after discussion.

Rationale: This activity adds new dimensions to each individual definition through sharing and discussing with others. A person defines terms according to his own understanding of the meaning.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Individually write your own definition for data against which you can test whether an item is data or not.	
2. Share your definitions for data.	
3. Write one definition which all trio members can agree upon.	
4. Read the definition at the top of page 11 of I-B-1. Compare your definition with the one provided. a. How are they alike? b. How are they different? c. Would you change yours in any way?	I-B-1 Definition (page 13)
5. Read the remainder of page 13 and discuss	I-B-1 Discussion

CYCLE I-C: To identify concept

Behavioral Objective: The trio will be able to select a topic from the list and build a hierarcy of concepts with data items included.

Rationale: This activity provides the opportunity for trainees to establish levels of abstraction.

Approximate Time: 45 minutes

Procedural Steps	Materials
1. Underline all items in the list that are concepts.	I-C-1 List (page 15)
2. Compare the items you underlined with the underlined items on I-C-2.	I-C-2 List with items underlined (page 16)
3. Discuss the items underlined in which there is disagreement.	
4. Read the discussion and examine the diagram.	I-C-3 Discussion and diagram (page 17 and 18)
5. Discuss what this means to you.	
6. Trios select a topic and build a diagram showing a hierarcy of concepts. Add some data items.	

CYCLE I-D: To define concept

Behavioral Objective: Having completed the previous activities, each trainee should be able to write an operational definition of concept.

Rationale: This activity provides an opportunity to use communication skills which will help clarify written definitions.

Approximate Time: 30 - 45 minutes

Procedural Steps	Materials
1. Write your own definition of concept	
2. Share definitions. Look at likenesses and differences and discuss.	
3. Evaluate group processes of paraphrasing and asking for clarification. The effectiveness of your work depended upon the extent to which accurate communication took place. Take three minutes to discuss the communication in your group. a. Did you consciously try to understand the other members contributions? b. Did you ask for clarification of meaning or attempt to paraphrase during the session? (Try to recall specific instances)	
4. Write a definition of concept that you can all agree upon. Use paraphrasing and clarification skills.	
5. Compare your definition with the one provided in the materials.	I-D-1 Definition and discussion (page 20)
6. If your trio has difficulty understanding concept, refer back to the list I-C-2 and match your definition and the one provided with some of the items on that list.	

CYCLE I-E: To order examples of data and concept

Behavioral Objective: Trios should be able to write inferences about structure and hierarchy of data and concepts.

Rationale: This activity reinforces knowledge of data and concept.

Approximate Time: 1 hour

Procedural Steps	Materials
1. Each member of the trio should group items on the list any way that you wish. Select a name for each group which will include all of the items within the group. This name may be an item from the list or one you have added. (You may wish to cut the paper to make your arrangement or write your arrangement of the items on paper.)	I-E-1 Items listed (page 23)
2. Trios examine the arrangements. Present your reasons for grouping as you did. a. Record inferences about structure and hierarchy of data and concepts. b. Hypothesize as to what would happen to your arrangements if you were to read a paper which included all of the items on the list.	
3. Read the paper which discusses questions and teaching.	I-E-2 Discussion (page 24)
4. Individually rearrange your items according to the paper you read.	
5. Trios compare arrangements. Did you prove or disprove your hypotheses?	
6. Summarize by using the model to answer the questions below the model.	I-E-3 Models and questions (page 25)

CYCLE I-E cont.

Behavioral Objectives: Each trainee should be able to rate his own perception of himself while working with the trio.

Rationale: This activity is designed to make each member more aware of self in building effective helping behavior. Each trainee needs to look at his own role within the group in order to effectively work as a member of the trio.

Approximate Time: 15 minutes

Procedural Steps	Materials
1. Read the description sheet. As you read the characteristics of A, B, and C decide which set of characteristics you would like to possess in order to be an effective team helper. Place your initial on the triangle following the description.	I-E-4 Helper exercise (pages 26 and 27)
2. Rate yourself on the basis of the descriptions provided. Place a check beside the characteristics that you feel most suit you. Do you have more checks in A, B, or C? Place an X on the diagram by the letter which most suits you. You do not need to be identified as one type or another but may fit somewhere between two classifications.	
3. Trios discuss: a. Which characteristics are best suited for an effective team helper? b. Why are these the best?	
4. (Optional) If you feel free to discuss your perceptions of yourself with your trio members, you may do so. What specific instances led to the placing of yourself? Do your trio members perceive you differently?	

CYCLE I-F: To identify generalizations

Behavioral Objectives1 Given a list, each trainee will place an X beside each concept and be able to write criteria for identifying generalizations.

Rationale: The purose of this activity is to provide an understanding of the relationship between concepts and generalizations. It is necessary to recognize the elements in a generalization to do this.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Place an X by each concept on the list.	I-F-1 List (page 29)
2. Check the marked list provided. Trios discuss differences for clarification.	I-F-2 List with concepts marked (page 30)
3. The items that are not marked with an X are generalizations. Look at these items. Trios write criteria for identifying generalizations.	
4. Match each statement on the list with your criteria. If all statements do not fit make the necessary changes in your criteria. Be sure that each member of the trio agrees with the criteria. Refine until all agree.	
5. Trios complete the group perception survey. Allow time for individuals to answer questions on the survey. Share and briefly discuss perceptions in the group. Share statements of behavior that each individual feels contributed to the group's effectiveness.	I-F-3 Group Perception Survey (page 31)

CYCLE I-G: To define generalizations

Behavioral Objective: Trainees will write five generalizations using the concepts marked with an X from the previous list. These generalizations should match the criteria for a generalization.

Rationale: This activity provides the opportunity for the trainees to apply their understanding of concepts and generalizations.

Approximate Time 45 minutes

Procedural Steps	Materials
1. Read the criteria for a generalization	I-C-1 Criteria (page 33)
2. Trios match your own criteria with that provided. Discuss.	
3. Refer to I-F-2 (Concepts and generalizations) Circle some concepts within each generalization. Discuss your reasons for circling with members of your trio.	I-F-2 List of concepts and generalizations (page 30)
4. Trios experiment with concepts that have been circled. Delete concepts, substitute concepts, discuss relationships with other concepts and match against the criteria.	
5. Individuals write five generalizations using the concepts marked with an X.	
6. Discuss your generalizations and match them against the criteria.	
7. You have been working with data, concepts and generalizations. They are the levels of abstraction used to make up the first dimension of the model. The model in the materials shows the first dimension. Refer to I-E-3 and see if your statements of relationship between concept and data may also include generalizations. Refine your statements if necessary, to include generalizations.	I-G-2 Models of levels of abstraction (page 34) I-E-3 Model of data and concepts (page 25)

CYCLE I-H: To give examples of data, concept, generalization

Behavioral Objective: After looking at the pictures provided each individual will be able to select a concept, state a generalization and choose supporting data.

Rationale: This activity provides a common frame of reference for the trio and allows the trainees practice in using the first dimension of the model.

Approximate Time: 30 minutes

Prodedural Steps	Materials
1. Look at the pictures in the fron of the manual.	
2. Individually select a concept from the four pictures. State a generalization which includes that concept and choose supporting data for the concept selected. Data comes from the pictures.	
3. Trios share ideas developed. Make suggestions to help clarify. Try to be effective helpers.	

CYCLE I-H cont.

Behavioral Objective: Using the examples of data, concept, and generalization just developed each trainee will phrase a question for each.

Rationale: This activity is designed to provide practice in writing questions and in identifying the levels of abstraction.

Approximate Time: 1 hour

Procedural Steps	Materials
1. Using the examples of data, concept and generalization just developed in the preceding exercise, try to rephrase each item into the form of a question.	
2. Share your questions with the members of your trio using the round robin technique. a. Trio member one read your questions. b. Trio members two and three code the questions: 1 - Data 2 - Concept 3 - Generalization c. Compare the coding and discuss. d. Repeat steps a, b, and c for each member of the trio.	
3. A sample of questions is provided. You may wish to compare yours with the sample.	I-H-1 Sample of questions (page 37)

CYCLE I-I: To write related data, concept and generalization for a lesson to be taught.

Behavioral Objective: Each trainee will write a generalization that can be used in his own classroom situation. Each individual will be able to state a generalization, select a concept and choose supporting data.

Rationale: This activity provides practice in utilizing the skills that are being developed and allows the individual to make an application of the skills to his own situation.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Select a generalization that you could use in your classroom. Choose the concept or concepts you wish to develop and select the data necessary to develop the concept and generalization. The data may come for a short story, a film, pictures, news article, a poem or a direct experience of your particular group. (Note) If you are not a classroom teacher select data that would be appropriate for those who work directly with you. (e.g. a principal might select data and questions which would be appropriate for a faculty meeting.)	Your own data source.

CYCLE I-J: To write questions on the three levels of abstraction, place on a one-dimensional grid and put questions into a sequential teaching order.

Behavioral Objective:

1. Trainees will be able to write questions on each of the three levels of abstraction.

2. Trainees will be able to place these questions on a one-dimensional grid of the model.

3. Trainees will be able to number the questions in sequential order for teaching.

Rationale: This activity gives the trainee the opportunity to prepare a lesson of questions for teaching and to plan his own strategy for asking questions.

Approximate Time: 30 - 45 minutes

Procedural Steps	Materials
1. Use the data, concepts, and generalizations you prepared in the preceding lesson and prepare questions on each of the levels of abstraction. Place them on the one-dimensional model provided.	I-J-1 Model (page 40)
2. Number the questions in the order in which you will ask them.	

CYCLE I-K: To teach from own plan and analyze lesson

Behavioral Objective: The trainees will ask questions in the order they planned. Each trainee will be able to code the questions of the group into categories of data, concept, or generalization.

Rationale: In this activity each lesson is presented and each trainee receives feedback about his questioning strategy in order to make improvements and changes.

Approximate Time: 30 - 45 minutes for each member

Procedural Steps	Materials

There are two alternatives presented. Your trio may select the one they wish to use. You may decide to do both. Be sure every member of your trio agrees.

Alternative #1:

1. One member of the trio asks his questions in the order planned. The other two members respond to the questions. (This will provide the teacher with some feedback as to how the others respond to the questions asked)

2. Read the questions again to the other two members and have them code whether the question was D (Data), C (Concept) or G (Generalization).

3. Compare the coding with the teacher placement of the questions on the grid. Discuss any discrepancies.

4. Each member of the trio becomes a teacher and repeats steps 1, 2, and 3.

Alternative #2:

1. Ask the questions of a group of students. (Tape the lesson and the responses. (You will need a small group of students so that you can pick up their responses on the recorder)

2. Each member of the trio brings tapes and listen to questions and responses.

3. Code the questions asked and the responses given by the students.

4. Trio members compare results and discuss discrepancies.

TABLE OF CONTENTS FOR CYCLE II

CYCLE II-A: To identify description

Behavioral Objective: Using a description of the Model of the Intellect each trainee will circle a word or words which describe the model. Trainees will be able to write ten questions which will ellicit that circled word or group of words as a response.

Rationale: This activity provides an exercise in writing questions that describe. It gives the trainees an opportunity to take a look at the model which was used as a base for the model presented in this manual.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Look at the model.	II-A-1 Model of Intellect (pages 45, 46, and 47)
2. Circle words or combinations of words which describe the model.	
3. Individually write ten questions for each circled word or combination of words which would allow your circled items to become the answers.	
4. Trios ask questions in this manner: a. One member asks questions written b. One member responds to questions c. One member writes down responses. Match responses to the questions and discuss if discrepant. Reword the question. Rotate so that each person does all three tasks.	
5. Trios answer the following questions: a. What questions did you ask? b. Did they all begin with the same words? c. Was it necessary to begin your questions differently? Why? d. List the different ways of beginning the questions. e. What concept does this model focus upon? f. What generalization might you state from the information on this model?	

CYCLE II-B: To define description

Behavioral Objective: Trios will be able to define description. Trios will write their own definition of description, compare it with the definition provided and make changes.

Rationale: This activity allows trios to develop their own meaning for description.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Trios write the answer to the question, "What is description?" (The answer will be your group definition.)	
2. Read the paper which includes a definintion of description followed by a discussion of description.	II-B-1 Definition and and discussion of description. (pages 49 and 50)
3. Compare your definition with the one provided and make any changes you wish to make in your own definition.	

CYCLE II-C To order on a grid questions of descriptive style on three levels of abstraction.

Behavioral Objective: Trainees will be able to use two grids of the model and fill in questions in the descriptive style.

Rationale: This activity provides practice in developing descriptive questions which could apply to trainees' own teaching areas.

Approximate Time: 20 minutes

Procedural Steps	Materials
1. Make two copies of the model as shown.	II-C-1 Model (page 52)
2. Select two generalizations and write questions in the descriptive style for each generalization. Place them on the two models.	
3. Trios share the questions. Discuss and help each other clarify questions.	
Note: Save these two grids so that you can add to them throughout Cycle II.	

CYCLE II-D: To identify explanation

Behavioral Objective: Given two items, trios will be able to list attributes of explanation.

Rationale: This activity will clarify the trainees' understanding of explanation as characteristics are stated.

Approximate Time: 20 minutes

Procedural Steps	Materials
1. Look at the two items following this page. Each one is someone's way of explaining.	II-D-1 Paragraph (page 54) II-D-2 Outline (page 55)
2. Write your own explanation in response to the question, "Why are discussion skills helpful for teachers?"	
3. Trios compare the three explanations and list the attributes for explanation.	
4. Compare your list with the suggested list of attributes provided.	II-D-3 Attributes (page 56)

CYCLE II-E: To define explanation

Behavioral Objective: Using his own list of attributes, each trainee should be able to define explanation and write a question for each of the items provided in the previous activity.

Rationale: This activity provides practice in using a clear definition of explanation and in writing explanatory questions.

Approximate Time: 45 minutes

Procedural Steps	Materials
1. Individuals write a definition for explanation using the list of attributes.	
2. Trios share definitions and agree upon one definition.	
3. Using your definition write a question for the two items in II-D which would require that entire explanation as an answer to your question.	
4. Trios ask questions in this manner: a. One member ask questions written. b. Other two persons decide if that question would call for the response written. Help clarify the question if necessary. c. Rotate so that each member of the trio asks questions.	
5. Trios answer the following questions: a. How did your questions begin? b. List other ways to begin an explanation question. c. Compare explanation questions with escription questions.	
6. Read the definition provided and discuss. Compare your definition with the one just read.	II-E-1 Definition and discussion (pages 58 and 59)

CYCLE II-F: To order on a grid questions of explanation style

Behavioral Objective: Trainees will be able to use two grids of the model and fill in questions in explanation style.

Rationale: This activity provides practice in developing explanation questions which could apply to trainees' own teaching area.

Approximate Time: 20 minutes

Procedural Steps	Materials
1. Add questions in the explanation style two grids that you started in description. Remember to ask questions which are related to the same data, concept and generalization already developed.	Own two grids.
2. Trios share the questions with each other. Discuss and help clarify. If you are having difficulty communicating with each other practice some of the skills discussed in Cycle I.	

CYCLE II-G: To identify evaluation-justification and evaluation-matching.

Behavioral Objective: Each trainee will be able to anwer an evaluation question and srite criteria for that answer.

Rationale: This activity provides practice in evaluating and stating criteria.

Approximate Time: 30 minutes

Procedural Steps	Materials
You may wish to refer to an example of two persons, A and B, following the same procedural steps as listed below:	
1. Beginning with the assumption that teaching is not always given the status of a profession, what one area could we as teachers concern ourselves with, that would give teaching a more professional standing?	II-G-1 Example (page 62)
Individually write your choice of an area of concern in a word or phrase.	
2. "Why did you select that topic?" List five reasons for your choice. (These reasons are your own criteria.)	
3. Trios try to convince your trio members that your choice is best because of your stated reasons - your own criteria. (Limit this activity to 15 minutes.)	
4. "Do you think you have convinced the other two members of your trio that your choice was best? Why?" Discuss with each other.	

CYCLE II-G cont.

Behavioral Objective: Trainees will be able to answer an evaluation question by using explicit criteria.

Rationale: This activity provides practice in making an evaluation using explicit criteria which helps distinguish between evaluation justification and evaluation matching.

Approximate Time: 45 minutes

Procedural Steps	Materials
You may wish to refer to the example of persons A and B with the steps included.	II-G-2 Example (pages 64 and 65)

1. Trios select one member's criteria to be used by the other two members as explicit criteria.

2. "According to trio member 1's criteria is your area of concern the best way to give teaching a more professional standing?"

3. Rotate for each member of the trio.

4. Trios establish group criteria. As a result of your previous discussions and any additional thoughts you may have, set up criteria which you can agree upon, for the establishment of teaching as a tru profession. (Seven to ten items should be sufficient.)

5. "According to your group criteria which area of concern would be the best way to give teaching a more professional standing?" (One way to rate them against each item in the group criteria would be on a 1 to 10 point scale.)

6. Add the points given to each area of concern to see which would be best according to the group criteria. "Have choices changed? Why?"

CYCLE II-H: To define evaluation-justification and evaluation-matching.

Behavioral Objective: Trios will be able to define evaluation and state the difference between evaluation-justification and evaluation-matching.

Rationale: This activity provides trainees the opportunity to understand the difference between implicit and explicit criteria as used in evaluation.

Approximate Time: 20 minutes

Procedural Steps	Materials
1. Trios review the questions asked in the prodedural steps in II-G, pages 61 and 63.	II-G (pages 61 and 63)
2. Using these questions as a guide, write a definition for evaluation. Include in your definition the distinction between evaluation-justification and evaluation-matching.	
3. Read the definition provided and compare with yours.	II-H-1 Definition and discussion. (pages 67 and 68)
4. Discuss with each other in order to clarify the meaning.	

CYCLE II-I: To order on a grid questions of evaluation style.

Behavioral Objective: Trainees will be able to use two grids and fill in questions in evaluation-justification and evaluation-matching styles.

Rationale: This activity provides practice in developing evaluation questions which can apply to trainees own teaching area.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Add questions in the two evaluation styles to your own two grids which you started at the beginning of this cycle. Your questions should still be related to the generalizations, concepts, and data already developed.	Own two grids.
2. Each member of trio can read his questions while the other two members check to see if the question allows a choice.	
3. Rotate so that each member reads his questions.	

CYCLE II-J: To identify expansion.

Behavioral Objective: Trainees will be able to anwer questions in explanation and expansion style. They will record the differences.

Rationale: This activity allows trainees to respond to convergent and divergent questions in order to distinguish between the two.

Approximate Time: 30 minutes

Procedural Steps	Materials
1. Individually answer the questions on the next page.	II-J-1 Questions (page 71)
2. Write any differences noted in responses in column A and responses in Column B.	
3. Trios tally the variety of responses in each column and discuss the differences listed.	

CYCLE II-K: To define expansion.

Behavioral Objective: Trios will be able to write their own definition for expansion.

Rationale: This activity allows trainees to build their own meaning for expansion and compare with the one provided in the materials.

Approximate Time: 20 minutes

Procedural Steps	Materials
1. After having completed the previous exercises you should be able to answer the question: "What is expansion?" Trios decide what expansion means to you and record.	
2. Compare your definition with the one in the materials.	II-K-1 Definition and discussion (pages 73 and 74)
3. Alter yours if you wish and discuss expansion questions.	

CYCLE II-L: To order examples of questions using the expansion style.

Behavioral Objective: Trainees will be able to complete the two-dimensional grids by adding questions in the expansion style.

Rationale: This activity provides practice in developing questions of the expansion style which could apply to trainees' own teaching area.

Approximate Time: 20 minutes

Procedural Steps	Materials
1. Add questions in the expansion style to the two grids that you started in description.	
2. Trios share the questions. Discuss and clarify.	
3. Look over the total grid to check all the items in relation to the generalization selected.	

CYCLE II-L cont.

Behavioral Objective: Trainees will be able to write 10 questions using pictures at the beginning of the model. They will be able to code the sets of questions completed at the beginning and the ones just written. They will answer questions to note differences in behavior.

Rationale: This activity provides the trainees with a self-evaluation tool to check skills and understandings with relation to questions.

Approximate Time: 45 minutes

Procedural Steps	Materials
1. Individually write 10 questions related to the pictures provided in the front of the manual. Compare the questions you wrote at the beginning with these questions. a. Did you ask a greater variety of questions the second time? b. Were your questions more related to one generalization? c. Code your questions for both sets: 1 - data, 2 - concept, 3 - generalization D - description, E - explanation, J - evaluation-justification, M - evaluation-matching and X - expansion. d. Fold back your own coding and have one of the members of your trio code your questions. e. Compare and discuss discrepancies in coding. f. Did you improve your questioning skill?	Pictures at beginning of the manual. 10 questions written about the pictures.
2. Refer to your original grid that you filled out in the pre-test. a. Would you change any of the questions now? Why? b. Was your previous style of asking questions the same or different from what it is now? How is it the same or different? c. Share the differences with the members of your trio.	Pre-test grid

CYCLE II-N: To be able to state the relationship between teacher and learner behavior in each of the styles.

Behavioral Objective:

1. Each trainee will be able to write student and teacher requirements for each of the styles of questions.
2. Each trainee design a strategy which will help students understand each of the styles of questions.

Rationale: This activity provides for trainees to devise a plan for working with their own students to help them understand the differences in the styles of question. Unless there are student changes very little change will take place in the classroom.

Approximate Time: 1 hour

Procedural Steps	Materials
1. Answer the following questions for each of the styles of questions. a. What would students have to do if the teacher asked nothing but__________ questions? b. What would the teacher have to do to prepare only__________questions? c. Why is__________an important style of question? Note: There is no correct or incorrect response to the above questions. You will respond according to your own meaning for each of the styles.	
2. Read the short discussion on student awareness.	II-M-1 Discussion (page 78)
3. Trios share your responses from step No. 1. See how many ideas you can develop that would help students become aware of the various styles of questions.	
4. Design a strategy that might be useful in your classroom to help students understand the styles of questions.	

CYCLE II-N: To write questions in five styles at three levels of abstraction, place on a two-dimensional grid and put questions into a sequential teaching order.

Behavioral Objective:

1. Trainees will be able to write questions in the five styles at three levels of abstraction.

2. Trainees will be able to place these questions on a two-dimensional grid of the model.

3. Trainees will be able to number the questions in sequential order for teaching.

Rationale: This activity gives the trainee the opportunity to prepare a lesson of questions for his own teaching situation and to plan his own strategy for asking the questions.

Approximate Time: 30 - 45 minutes

Procedural Steps	Materials
1. Select a story, some pictures, a news article or some other source that you might use in your classroom.	
2. Using the two-dimensional model fill in the questions you might ask that are related to the material you selected.	
3. Number the questions in the order you will ask them. (You do not need to ask all of them during on discussion. Number only those you are planning to ask your students.)	

CYCLE II-O: To teach from designed plan and analyze lesson.

Behavioral Objective: The trainees will ask questions in the order planned. Each trainee will be able to code the questions of the group into categories of styles and levels of abstraction.

Rationale: This activity allows each trainee to put into practice the knowledge and skills developed and to receive feedback about his questioning strategy in order to make improvements and changes.

Approximate Time: 30 - 45 minutes for each member

Procedural Steps	Materials

You have two alternatives. Your trio may select the one they wish to use. Be sure every member of your trio agrees.

Alternative #1:

1. One member of the trio asks his questions in the order planned. The other two members respond to the questions. (This will provide the teacher with some feedback as to how the others respond to his questions.)

2. Read the questions again and have the other two members code each question as to level and style.

3. Compare coding and discuss any problems.

4. Rotate so that each member of the trio asks questions planned.

Alternative #2:

1. Ask the questions of a group of your students. (Tape the lesson and the responses. You will need a small group of students so that you can record all of their responses.)

2. Each member play his tape. Code the questions asked as to level and style.

3. Discuss student responses in relation to different styles of questions.

4. Trio members help each other by making suggestions for improvement.