# A STUDY OF FACTORS CONCERNING INSERVICE PROGRAMS ASSOCIATED WITH NEWER ELEMENTARY SCIENCE CURRICULA IN SELECTED MINNESOTA SCHOOLS

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# PREFACE

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# CHAPTER I

## INTRODUCTION

Inservice education for teachers was begun when most teachers were poorly educated. The teachers' institute, first established by Henry Barnard in 1839, was concerned with revising and extending the knowledge of teachers and acquainting them with principles and methods of education. By the end of the nineteenth century, however, teachers' institutes were unable to modify their programs and organization to meet the needs of the different groups of teachers. At this time, two new inservice institutions evolved, namely, the summer school and university extension.

By the beginning of the 1930's, development in the fields of group dynamics and upgrading the teaching profession modified the concept of inservice education. Inservice education came to mean the professional growth of all the staff members in cooperative attack upon educational problems. This was a radical departure from the past when the main function, as mentioned, had been primarily to upgrade. In many cases the work was remedial in nature. During this period of time two other innovations evolved, action research and the workshop.

The basic concept of the workshop was developed during the 1930's by the Progressive Education Association. Initially, the purpose of the workshop was to gather a number of teachers from a single discipline to identify common problems and discuss solutions. A plan of operation including group meetings, materials and resource persons was made after the participants arrived. Although a workshop member was expected to work on committees, no individual assignments were made. The implementation of workshop results was insured by maintaining communication within the group by occasional meetings and round robin letters.

Today, the concept of inservice education has broadened to include all formal or planned training a teacher receives after entering the teaching profession. Smith (74) has identified some of the more important techniques as follows:

1. Post school meetings
2. Extension courses and workshops
3. Summer school courses and workshops
4. Faculty meetings
5. Sabbatical leaves
6. Inservice programs offered by local school systems
7. Inservice programs offered by state departments of education
8. Teacher exchange programs
9. Professional meetings

Basically, the overall purpose of inservice education is the improvement of the professional competence and functioning of the teacher. We may then think of four specific goals or objectives closely related to this basic purpose:

1. To continue on-the-job learning.
2. To cover the gaps left by the university preservice programs. (This filling in of the gaps is referred to as the remedial function of inservice education.)

3. To keep the teacher abreast of methods, materials, techniques, and their educational implications.
4. To increase the classroom teacher's efficiency in dealing with day-to-day classroom problems.

New curricula have been developed in the mathematics and the sciences by cooperating groups of academicians, psychologists and teachers. The results of these cooperative efforts have been well-designed learning experiences for students. However, a significant point with regard to these curricula is that they have developed outside the context of the local classroom. Since these curricula have been developed for one primary reason--change in classroom practice--it is of interest to ask to what extent these programs are capable of instigating change and why, in many cases, change does not occur after inservice training.

A study of the curriculum materials reveals that a philosophy of teaching is implicit in these programs. These are programs in which the role of the student and that of the teacher are quite different from the traditional pattern. The student becomes the focal point, and as such, he becomes increasingly responsible for learning. The teacher is an effective companion and guide in the learning experience. Since a person tends to take from the printed page only that information which past experience has prepared him to take, what happens to a teacher whose preparation or past experience is at variance with the philosophies of the new programs? Does he change, or does he teach "new" programs in the "old" way? What can be done to assist the teacher in both knowing and experiencing the "new" way?

In the years immediately ahead much attention undoubtedly will be focused on elementary science programs since interest in improving course content and methods of teaching science is still supported widely by many governmental agencies. The faculty committees that work on elementary science programs in the next few years will find that much of the material currently produced is unfamiliar to the teachers. They will need a great deal of small group hands-on type instruction in order to effectively use the materials. Since the materials are unfamiliar, faculty committees may be asked to make recommendations on the nature and amount of inservice training necessary to institute the improvements. Hassard (41) believes that "some form of inservice program is absolutely necessary." Although teachers' guides are produced to accompany many of the new materials, there is a question as to the effectiveness of these guides for the elementary teacher who does not have special inservice training. Many elementary teachers who look at the new and strange materials must wonder if they are designed for use by exceptional teachers.

Inservice education is one answer to the need for classroom teachers to become acquainted with both the programs and their philosophies. Inservice education, however, can be designed in several formats. This brings to light two questions: "What type of program will be most effective in helping the classroom teacher cope with the new curriculum?" and "What conditions do teachers feel are the main sources of resistance to adaptation of a new science curriculum?" The purpose of this study is to help answer these questions.

## Justification of the Study

This research was an attempt to determine the relative effectiveness of four types of inservice workshops as perceived by teacher participants and to identify resistances to implementation of new science programs. Most of the studies conducted in the past in the aforementioned area consisted of small populations, usually of less than fifty, restricted to one geographic area. To the investigator's knowledge, no one has attempted to study the relative effectiveness of science workshops conducted by a state department of education, colleges and universities and local school systems on a statewide basis.

The importance of this study is further emphasized by the recent guidelines as revealed in a communication by Dr. Howard Hausman (42) of the National Science Foundation. Dr. Hausman has repeatedly emphasized the careful planning and needs assessment in the area of science education at all levels.

It is anticipated that this study will (1) enable other colleges and universities to offer inservice programs modeled from the knowledge gained by this study, (2) provide information and future direction for inservice programs held by local school districts, and (3) provide a firmer foundation for a coordinated effort in elementary science inservice by state departments of education, colleges, and universities and local school systems.

## Statement of the Problem

It is a known fact that new curriculum materials have been developed and produced for elementary science over the past decade but many classroom teachers are still unaware of this development. The foremost problem facing science educators for the seventies is not necessarily production of more materials but modification and effective implementation of materials already available.

In the winter of 1969 a major effort toward inservicing these programs in the public schools was undertaken in Minnesota. This occurred on primarily four fronts: The design of school workshops conducted by colleges and universities; extension workshops conducted by colleges and universities; workshops conducted by the Minnesota State Department of Education and workshops conducted by local school systems. The majority of the teacher participants were primarily involved with two of the newer curricula, either Science-A Process Approach, (AAA) or the Elementary Science Study (ESS). A lesser number were involved with the Science Curriculum Improvement Study (SCIS).

The purpose of this study is: (1) To assess the relative effectiveness of the inservice instruction in these workshops as measured by teacher attitude; (2) To assess the relative effectiveness of the structure of the workshops as perceived by teachers; (3) To assess teachers' perception of what they believe to be resistance to implementing new science programs; and (4) To identify factors necessary for inclusion in inservice science programs for this population. The information gained in the final analysis, should provide useful information for the construction of inservice models for the implementation of elementary science programs.

## Definition of Terms

AAAS--refers to the elementary science program developed by the American Association for the Advancement of Science entitled, "Science - A Process Approach."

ESS--refers to an elementary science program entitled, "Elementary Science Study."

SCIS--refers to an elementary science program entitled, "Science Curriculum Improvement Study."

Newer Curricula--refers to AAAS, ESS, and SCIS elementary science programs.

Elementary Teachers--are those teaching in grades kindergarten through sixth grade.

Extension Workshops--refers to a college or university off-campus workshop with a minimum of twenty hours of classroom instruction dealing with one or more of the newer elementary science curricula.

Lower Elementary Teachers--refers to those teaching in grades kindergarten through three.

Upper Elementary Teachers--refers to those teaching in grades four through six.

State Department of Education Workshop--refers to program of a minimum of twenty classroom hours of instruction conducted solely or in part by the state science specialist dealing with one or more of the newer elementary science curricula.

Local School District Workshop--refers to a workshop of a minimum of twenty classroom hours of instruction initiated and financially supported by the local school district dealing with one or more of the newer elementary science curricula.

Summer School Workshop--refers to a college or university offered on-campus workshop with a minimum of twenty hours of classroom instruction dealing with one or more of the newer elementary science curricula.

Perception of Resistance to Implementation--is defined by the measure of the responses on a five point Likert-type Scale for each of the questions 24-37.

Teacher Attitude--is defined by the responses of a five point Likert-type scale for each of the questions 1-37.

Index Value--is the number determined for each of the first thirty-seven questions by dividing the total number of responses marked strongly agree or agree for each question by the total number marked strongly agree, agree, disagree and strongly disagree for each question.

Relative Effectiveness--will be determined by comparing index values.

## Limitations of the Study

The population of the study was limited to five hundred fifty elementary teachers in the Minnesota Public Schools who attended a minimum of one science inservice workshop conducted by: either one of the three selected school districts or the Minnesota State Department of Education, or by a college or university. Only workshops with a minimum of twenty classroom hours of instruction and conducted from January 1969 through August 1971 were considered. In addition, the workshops in this study dealt specifically with one or more of the new science curricula.

Three basic assumptions concerning the study were made. They are:

(1) The sample was representative of the population.

(2) The questionnaire as constructed gave the desired and needed information.

(3) The returned questionnaires had usable information.

Research Questions

1. What are the biographical profiles of the participants in the workshops?
2. What are the strengths and weaknesses concerning instruction in the four types of workshops as measured by the index value?
3. What are the strengths and weaknesses in the structure of the four types of workshops as measured by the index value?
4. What do teachers perceive as resistance to innovation of new programs and how does it vary with respect to community size?
5. Do teachers with more teaching experience perceive resistance to change differently than those with less teaching experience?
6. Do teachers with better science backgrounds rate the instruction of the workshops differently than those with poorer backgrounds in science?
7. What reasons do teachers give for attending science workshops?
8. Do teachers believe there should be separate workshops for lower and upper elementary teachers?
9. Do teachers of lower grades evaluate instructors and workshop structure differently than upper grade teachers?
10. Do teachers believe college credit should be offered for workshop participation?
11. How much time should be spent during inservice to prepare a teacher for a new science curriculum as perceived by participants

and how does it vary for each of the four types of workshops?

12. Has the inservice experience resulted in changed classroom behaviors as perceived by teachers?

## General Procedures

The population in this study was five hundred fifty teachers in the state of Minnesota who attended a minimum of one elementary science workshop dealing with one or more of the newer elementary science curricula from January of 1969 through the summer of 1971. Included in the study were extension workshops conducted by colleges and universities, State Department of Education workshops and workshops conducted by three local school systems.

The sample consisted of those questionnaires returned by teachers in the defined population. The sample was composed of one hundred fifty-one teachers in summer workshops conducted by colleges and universities; one hundred forty-six teachers in extension workshops conducted by colleges and universities; fifty-five teachers in State Department of Education workshops and sixty-four teachers in workshops conducted by local school systems.

The sample returning questionnaires (four hundred fourteen) consisted of eighty-one percent of those teachers enrolled in extension workshops, seventy-nine percent enrolled in summer school workshops, sixty-eight percent of teachers enrolled in the Minnesota State Department of Education workshops and sixty-four percent previously enrolled in one of the three local school district workshops. The systems selected, Bagley, Wayzeta, and South St. Paul, were chosen because of outstanding inservice programs as judged by the State

Science Consultant and the investigator.

## Summary

The purpose of this chapter has been to give a general overview and design of the study. Major areas discussed were selection of teachers, collection of data, scope and validity, and method of analyzing data.

# CHAPTER II

## REVIEW OF SELECTED LITERATURE

Education today, as David Clark (19) has suggested, may be at about the same point agriculture was toward the end of the nineteenth century. The primary means of communicating to the farmer was by way of the printed word which made very little impact on agricultural practices. Agriculture has found new ways of helping farmers use new methods. Education, too, is finding new ways of closing the idea-practice gap: one of the most promising is inservice education.

Since the inservice programs in the study are concerned with science at the elementary level, this chapter will deal with a brief historical development of science education, a description of the newer programs and their strategies and a review of selected research based primarily on teacher attitudes toward science inservice programs.

### The Historical Development of Science Education in the Past Thirty Years

A moment's reflection on science teaching over the past thirty years may put into focus the changes in emphasis the future seems to hold. During the forties the United States was influenced by a wartime philosophy. There was a great deal of discussion about making use of the marvels of modern science. It was generally thought that students should be able to say something intelligible about the machines of modern technology such as radar, the internal combustion engine, the telephone, etc. In short, science courses tended to consist of surveys of interesting technological products rather than true scientific experiences which treated the technologies as illustrations and applications of principles of science. For the most part these courses consisted of memorization and verification of facts with little emphasis on understanding.

Following this period, the trend shifted to helping the students learn more about the world in which they lived. Understanding basic concepts became more important than knowledge of specific technological devices. Many of the conceptual schemes developed in this period are still advocated by some leading science educators today.

In 1957 the U.S.S.R. launched the first orbiting satellite and the reverberations from the shock to the citizenry of the United States are still being felt. Recriminations, public concern, and questions were directed first and foremost at the educational programs of this country.

Almost immediately federal monies were appropriated to upgrade the academic competence of teachers in science and mathematics. For the first time, a variety of federally funded scholarships became available to teachers in both these fields. At about the same time, funds were appropriated for the purchase of science equipment in the public schools on a large-scale basis. Needless to say, a good deal of waste through duplication, faulty judgment, and expediency transpired. The overall effect, however, has been far reaching.

The academic institute programs emphasized cognitive learning and academic achievement. Teachers returning from National Science

Foundation academic year institutes, summer institutes, or research participation experiences brought back increased skills and knowledge of science (41). Federal monies in large amounts were also appropriated for curriculum and materials development and for leadership conferences.

Assessing the situation of science in the public schools and knowing the need for change, the American Association for the Advancement of Science, with financial aid from the National Science Foundation in 1961, sponsored three regional conferences of scientists, teachers, school administrators and psychologists to consider the following aspects of science instruction: present policies, practices and materials, and recent experiments in teaching young children. It was agreed a substantial effort should be made to improve science teaching and science materials. The following are the points, according to Karplus and Thier (49) that were agreed upon at these conferences.

1. Science should be a basic part of general education for all students at the elementary and junior high school levels.
2. Instruction at the elementary levels should deal in an organized way with science as a whole.
3. There must be a clear progression in the study of science from grade to grade.
4. There should not be a single national curriculum in science.
5. Science teaching should stress the spirit of discovery characteristic of science itself.
6. New instructional materials must be prepared for inservice and pre-service programs for science teachers.
7. The preparation of instructional materials will require the

combined efforts of scientists, classroom teachers, and specialists in learning and teacher preparation.

8. There is great urgency to get started on the preparation of improved instructional materials for science.

As a direct outgrowth of the conferences many people became vitally interested in initiating teaching programs to increase the scientific literacy in the school and adult populations. To accomplish this aim, different groups of people formulated views of the nature and structure of science. These groups, according to their views, also devised learning experiences that achieved a secure connection between the pupil's intuitive attitudes and the concepts of a modern scientific point of view. These different curriculum study groups attempted to construct science programs that could be understood not only by teachers but by students as well.

With this philosophical base the National Science Foundation underwrote the development of many new curriculum programs. While some have already perished, others continue to grow and to do research for building a more efficient curriculum for the elementary schools. In this study the writer will confine the discussion to three major study groups that have written materials which are in the process of being implemented in many different types of elementary schools throughout the country. These three major curriculum study programs are (1) American Association for the Advancement of Science-Science a Process Approach (AAAS-SAPA), (2) Science Curriculum Improvement Study (SCIS) and (3) Elementary Science Study (ESS).

## Description of Newer Programs and Philosophies

### Science - A Process Approach

The American Association for the Advancement of Science (AAAS) in 1961 supported an elementary science curriculum program based on the educational philosophy of Robert Gagne (49). The project entitled, Science - A Process Approach, is basically process oriented. This program provides an opportunity for the child to discover, to participate in scientific adventure, and to establish a foundation which will serve him as he continues to explore throughout his life.

Instead of approaching science education as a series of units designed to add to the student's inventory of facts about the world of science, the program concentrates on the processes believed to be the essence of science. This does not mean that the content is unimportant. The primary emphasis, however, is on the processes, and it is expected that ability to use them will remain long after many of the details of the content have been forgotten.

The program is divided into two cleraly integrated levels, primary and intermediate. The primary level is developed for kindergarten through third grade.

The core of the primary level consists of eight processes which are basic to science. These are:

1. Observing
2. Classifying
3. Using space time relations
4. Using numbers
5. Communication
6. Measuring
7. Inferring
8. Predicting

The intermediate level, beginning with Part E (4th grade), is the transition point in the program. There are six integrated processes in this level. They are:

1. Interpreting Data
2. Controlling Variables
3. Defining Operationally
4. Formulating Hypotheses
5. Experimenting
6. Formulating Models

A behavioral hierarchy constitutes the "skeleton" of Science--A Process Approach and the rationale for selecting and ordering the sequence of exercises. Thus the behavioral hierarchies orient the teacher to the purposes of the program. The teacher may examine the progression of behavioral development depicted in these hierarchies and derive from them a view of where teaching starts and where it is expected to go. In addition, they show the interrelationships between any one exercise and others which precede and follow it including those primarily devoted to other processes.

In the AAAS program there are two approaches which are methods for testing the achievement of the children. These two approaches are called the appraisal and the competency measure. In the appraisal, which is designed for the entire class, the overall class performance is measured. Its purpose is to determine whether a majority of the children in the class have satisfactorily attained the behavioral objectives of an exercise. The competency measure is designed to evaluate individual achievement and tasks are employed to test the children's attainment of one or more objectives of the exercise while using content material different from that of the exercise.

Science Curriculum Improvement Study

The Science Curriculum Improvement Study is currently being directed by Robert Karplus, professor of Physics at the University of California at Berkeley. This program is developed on the basis of the theories of Jean Piaget on how children learn. Piaget, a Swiss psychologist, has constructed a plausible developmental theory for human development. With a primary focus on children's cognitive or intellectual development, he states that children go through different stages of development. The first stage called the sensorimotor period is from birth to approximately two years of age. During the preoperational period, which is from about two to seven years of age, the gradual development of conservation begins, including understanding the concepts of mass at about age five, weight at about age six, and volume at about age seven. During the operational period a child is able to use logical operations such as reversibility (in arithmetic), classification (organizing objects into hierarchies of classes), and seriation (organizing objects into ordered series). During the formal operation period a person is capable of abstract thinking, conceptualization and hypothesis-testing thus, according to this theory, a child cannot be taught certain concepts and ideas until he has reached the developmental stage when he is capable of comprehending it.

The objectives of the SCIS program include intellectual development and scientific literacy based on a conceptual scheme. Each lesson has specific objectives stated in performance terms. Evaluation activities are presently being designed which will encompass the cognitive, affective, and the psychomotor domain.

The program consists of two series of related sequential units, the physical science and life science units. The basic units in the physical science series are entitled: Material Objects, Interaction and Systems, Subsystems and Variables, Relative Position and Motion, Energy Sources and Models: Electric and Magnetic Interaction. The basic units in the life science series are entitled: Organisms, Life Cycles, Populations, Environments, Communities, and the Ecosystems.

The program, designed for six different levels, includes units for the first through the sixth grades. The material consists of kits containing most of the materials required for the experiments, a teacher's guide and student manuals. The kits consists of two or three boxes that contain enough materials for a class of thirty-two children. The SCIS teaching program is not organized into tightly structured lessons. Instead a unit is composed of several parts having specific objectives, the parts are divided into chapters, and the chapters are divided into activities.

In reference to the flexibility of the program, Karplus and Thier (49) have stated the following:

> More important than anything else is that you think of this science course as your course. Feel free to incorporate your own ideas into each activity and thereby to adopt the program to the capabilities, interests, and special needs of your pupils.

Although a student manual is included, it is not a workbook type device, but a teaching aid and not a mainstay of the course. The workbook is useless in the absence of classroom activities. It is designed as a bridge to help the children understand better the relationship between the concrete world of objects and the world of words, abstractions, and ideas. The children's oral and written responses to the student manual questions can be used as valuable feedback. The results are intended not to be graded but checked to determine the quality of each students' understanding. The success of the program depends heavily on the teacher because the most important part of the learning process is the conversation among the children and between the teacher and the children. The questions the teachers ask and the way they are asked will affect the children's work and their attitudes. The type of questions used will be determined by the type of discussion that is wanted; thus the teacher should develop divergent, convergent, and evaluative questioning techniques. The children's experiences and investigations are built on four extremely important process-oriented concepts; properties, reference frames, systems, and models. These four major process concepts are then woven into four major scientific concepts; matter, energy, organisms, and ecosystems.

## Elementary Science Study

The third major curriculum study program is the Elementary Science Study (ESS). It has been in existence since 1960 and is a curriculum development project of Educational Services Incorporated, a private nonprofit organization. The major source of financial support has been provided by the National Science Foundation. The program is developed around fifty-five non-sequential units designed for use from kindergarten through eighth grade.

The ESS materials are different because they are so highly flexible. The units can be varied in the length of time they are used. The philosophy of ESS is to enrich every child's understanding rather than to create scientific prodigies. The hope is to make all children at home with modern science and technology and not intimidated by it. The actual materials in the investigations satisfy the children and appeal to their imagination, their senses, and their aesthetic instincts. Many items in the kits are commonplace items which are used in creative ways. The teacher's guide provides background information and suggestions for teaching the materials. The student materials include worksheets and booklets which mainly serve to give directions and places to record observations. Film loops are an integral part of the material teachers have to work with when using ESS. ESS has worked successfully with students from varied socio-economic backgrounds and in advanced and average classes as well as remedial classes. It has also been shown that the program works well with children whose reading skills are poor.

## Learning Strategies

Since the workshops in this study were conducted parallel to the content, processes, strategies and philosophies of the new elementary programs, it is important to understand the nature of these programs.

Inquiry in its most general sense could be defined as a method of seeking information by the asking of questions. Beyond this generalization one finds as many definitions and interpretations of inquiry as there are articles published on the topic. Thus, the question "What is inquiry?" becomes a very difficult question to answer. Gagne (34) points out that most authors have spent most of their time describing what it is <u>not</u>, rather than what it is. Nevertheless, the question exists, and rather than give a simple synoptic definition of inquiry, it would seem more appropriate to present brief summaries of the major interpretations of the inquiry approach.

The basic formula for inquiry has as its intent to involve the student as an active participant in the learning process. He is involved in various activities, characterized by a problem-solving approach, with the intent that each new encounter will lead him to increased understanding and application. Few authors question the meaning of inquiry at this level; however, when one approaches the problem of implementation of the inquiry approach in the classroom, considerable controversy results. Lee S. Shulman (71) points out that this controversy centers about the question of "How much and what kind of guidance ought to be provided to the students in the learning situation?" In addition, there appears to be varying opinions as to the developmental level deemed necessary to insure success with the inquiry approach.

Of the authors attending to the problem of amount and type of guidance needed, most can be placed in one of two camps, discovery learning or guided learning. Those preferring discovery learning propose the teaching of broad principles and problem-solving through a minimum amount of teacher guidance and a maximum amount of opportunity for exploration and experimentation on the part of the student according to Shulman (73). On the other hand, those advocating guided learning recommend a carefully developed sequence of instructional experiences. In addition, this group places more importance upon the necessity of basic associations and facts in the eventual mastery of various principles and problem-solving skills.

The disciples of discovery propose a program designed to enable the learner to direct and control his own learning. Needless to say, the teacher must provide both the materials and climate needed to facilitate the process. Thus, the teacher assumes the role of a "facilitator" while the student acts as a "programmer" of his own learning. Directions come not from the teacher, but from the student once the inquiry has begun. The teacher's task becomes that of establishing the necessary conditions that will sustain the inquiry. This approach does not employ a great deal of teacher-questions, nor is there a competitive factor evident (intrinsic reward, grades, etc.) according to Fish and Goldmark (30).

Discovery learning invariably begins with the manipulation of materials that illustrate some principle. This exposure to concrete examples allows the student to analyze and experiment with the materials in order to operationally grasp the bases of the principle. Once operational understanding is "discovered" the student is faced with formulating the rules or principles involved in his work. Ultimately, the student, if productive learning has occurred, should be able to verbalize his generalizations and, more important, should be able to exhibit behavioral evidence of his understanding.

Content of the subject matter is seen in a somewhat different light in discovery learning. Taba (79) states that rather than an array of facts that are to be committed to memory, content is viewed as something that is the structure of various concepts and principles. Content in this approach might be considered as those facts and pieces of information a student needs to know as a result of his investigation.

Bruner (14) in his discovery learning approach to inquiry considers learning a process in which the nature of inquiry is inherent. For Bruner (15) the emphasis is not on products of learning but on the processes of learning. In his book, Toward a Theory of Instruction, he states that "To instruct someone...is to teach him to participate in the process that makes possible the establishment of knowledge.... Knowing is a process, not a product."

As might be expected, the instructional style characteristic of discovery learning does not require large degrees of order or structure; however, what is of major importance is once the learner "knows" he knows something, the facilitator must provide the appropriate counter-example to challenge the learner with a contrasting example of his "established" knowledge. Thus, as the student needs to know more, he proceeds to inquire again.

Robert M. Gagne, presently of Florida State University, was a prime mover in the guided learning approach. Gagne (35) in his book The Conditions of Learning, emphasizes the importance of behavioral objectives and how to achieve them by using a carefully constructed hierarchy of learning tasks. In another article, "The Learning Requirements for Inquiry," he incorporates the guided learning approach into what he terms the "instructional basis for inquiry," (34). Gagne (34) first establishes the desired outcomes of the inquiry approach in terms of "terminal capabilities." Once these are established the appropriate instructional procedures can be established in terms of prerequisites necessary to reach the terminal capabilities.

Inquiry, according to Gagne (34),

> ...is a set of activities or processes characterized by a problem-solving approach, in which each newly encountered phenomenon becomes a challenge for thinking. Such thinking begins with a careful set of systematic observations, proceeds to design the measurements required, clearly distinguishes between what is observed and what is inferred, invents interpretations which are under ideal circumstances brilliant leaps, but always testable, and draws reasonable conclusions, in other words...the essence of scientific research.

These words set forth the terminal capabilities desired in one who uses the inquiry approach to investigation. What then are the prerequisites necessary to become a successful inquirer? Gagne's writings (34) indicate two major prerequisites: (1) a background of broad generalized knowledge which can be utilized in the inductive process, and (2) a sufficient amount of incisive knowledge, which gives one the capability of discriminating between a good idea and a bad one.

The possession of broad, generalized knowledge is not to be equated with knowing a large number of facts. Most would agree that there is a great deal of difference between knowing facts and being able to operationally apply a certain principle to a given situation. Obviously, to involve the student in practicing strategies of inquiry is extremely important; however, without suitable background knowledge, inquiry can have a narrowing and cramping effect on the individual's development of independent thinking (85). It should be apparent at this point that discovery learning, as described by Bruner, would be an ideal instructional method to <u>insure</u> adequate understanding of various principles. Gagne does consider this technique as a viable means of gaining the necessary understanding; however, he states that it is only one way and there are others (35). In addition, he states that the applicability of discovery learning to this aspect of inquiry (gaining and understanding of principles) should not be confused with the process of inquiry as he defined it (34).

The capability for self-criticism of ideas is viewed as the other essential prior to the exercise of productive inquiry (34). In short, the practice of inquiry is of little value to the individual if its techniques, hypotheses, etc., are not critically analyzed by the student. Incisive knowledge is of tremendous value, not just in and of itself, but because it constitutes an essential basis for acquiring other knowledge.

To summarize, Gagne's guided learning approach to inquiry is to analyze the process of inquiry in terms of a hierarchial scheme in which the ability to scientifically inquire is the terminal capability. Before this ability can be reached, the learner must first know certain principles, and to understand the principles, he must know specific concepts, and prior to the grasping of these concepts are particular simple associations or facts. Thus, to reach the capability one should determine what prerequisites the learner has mastered and then provide those prerequisites necessary to enable the learner to master the terminal capability.

The two camps of thought previously discussed were not compared because of the obvious difference in their criteria for success. For Bruner the emphasis is on the processes of learning--of "knowing." For Gagne (35) "knowledge is made up of content principles, not heuristic ones." Though both espouse the acquisition of knowledge as the major objective of education, their definitions are so dissimilar that the educational objectives sought by each scarcely overlap. In spite of this disparity, both strongly support the inquiry process as perhaps the most essential objective of science instruction. Whatever the differences in rationale, those considering the implementation of an inquiry approach should <u>not</u> ask which of these approaches is best. A far better question to ask is "Under what conditions are each of these instructional approaches, some sequence or combination of the two, or some synthesis of them, most likely to be appropriate?"

## Review of Selected Research

Piltz (63) in 1954 using a questionnaire, interviews, and observation techniques, made a study in Florida to determine what factors, in the opinion of the classroom teachers, handicap the teaching of science in the elementary school; to find what, if any, relationship exists between the aspiration of teachers and the difficulties they think they face. He concluded the following:

1. There is general agreement as to what teachers think are limiting factors in teaching science.
2. There is conflict among many teachers as to content emphasis.
3. The majority of teachers recognize the category of "physical facilities" as the greatest obstacle of all to science teaching.
4. The category of "materials, equipment, and resources" appeared in the forefront of difficulty.
5. The majority of teachers were weak in methodology of science.
6. Almost all principals in the school indicated lack of training, interest, time, and materials limited science.
7. The findings clearly reveal a need for complete reconstruction.

Applegate (3) surveyed inservice programs in Minnesota. Through the use of a stratified random sample, she found that over sixty percent of the school systems had workshops in 1955 and seventy-five percent expected to have them in 1956. Despite these findings on the increasing size of workshops teachers did not rate them highly.

Karbal (48) in his study of the effectiveness of a workshop as a means of inservice education, pointed out that:

1. Methods of sharing workshop learning with fellow teachers should be part of the workshop concern.
2. Principals should be active participants along with teachers.
3. Research needs to be done as to which features of workshops best change teacher behavior in the classroom and to what degrees these changes influence children's ability to learn.

Using an audio interview technique, Duncan (24) conducted a study to determine what factors were associated with successful inservice programs. Ten school systems were chosen by the doctoral committee and educational leaders that were deemed to have successful inservice programs. He concluded:

1. The existence and operation of inservice programs should be governed by policies adopted by the board of education.
2. Local administrators must lend support and participate in an effective inservice program.
3. The organization of inservice programs should give adequate consideration to factors such as continuity, time of meetings, resources, and participation of the professional staff in program planning, operation, and evaluation.
4. Careful consideration should be given to the relationship of inservice education efforts to the improvement of instruction.

Factors related to the physical science background of elementary teachers and the feasibility of using secondary science teachers to conduct inservice workshops for elementary teachers was investigated by Brandou (12). He found a significant relationship existed between the contribution to the inservice program and the amount of teaching experience the secondary teacher had. He also found elementary teachers with more experience tended to participate more frequently in the inservice programs and contributions of the inservice programs were more relevant to upper grade elementary teachers.

Ramig (66) surveyed programs and practices of a selected group of Indiana schools and pointed out that the major obstacle to a successful inservice program was the excessive load that teachers felt was forced upon them. The two most desirable incentives were provisions for time and effective leadership in the inservice program according to his investigation.

A study in 1967 sought to test the hypothesis that teachers and administrators view the effectiveness of inservice education differently (70). The findings suggest that teachers' perception of the effectiveness of inservice education, as indicated by attitudes, is one of indifference. Administrators generally view inservice education as more effective than do teachers. No evidence was found to support the following contentions:

1. Male and female teachers perceive the effectiveness of inservice education differently.
2. Teachers of different subjects perceive the effectiveness differently.
3. Teachers with different levels of professional training perceive the effectiveness of inservice training differently.

Savage further stated the most important aspect of his study is that inservice is something that must not be done to teachers, but something they do to and for themselves.

Working with three hundred fifty-eight randomly selected teachers in New York, Cardany (18) concluded that teachers with positive attitudes perceive inservice education as more effective, valuable, relevant, and less burdensome than do teachers holding negative attitudes.

Whether an intensive inservice program in science for elementary teachers would have any significant positive effects on the attitudes toward science of the teachers and their students was investigated by Dean (23). This study also attempted to determine whether there would be any favorable changes in cognitive achievement by the participants and whether any change was associated with the attitudinal response. His findings and conclusions were that no significant relationship of a similarity in the patterns of attitudes toward science between teachers and students was found to exist. Furthermore, using an analysis of covariance, he found that:

1. women teachers and girls in the classroom had the most significant changes in the evaluation factor of attitudes toward science.
2. significant improvements in cognition of the Test on Understanding Science (TOUS) were related to district size (large) and women teachers.
3. significant positive changes by the student on science cognition were related to district size (small), sex (male), I.Q. (high), and upper grade levels (five and six).

Borgealt's (11) extremely fine study investigated whether teachers with different professional backgrounds and experience agreed on the degree of effectiveness of inservice education for improving their professional competency. The following conclusions were based on the findings of his study.

1. In terms of effectiveness, the inservice activities were ranked in this descending order: interclassroom visitations, conferences and clinics, individual inservice conference with specialists, directed professional reading, county and state workshops, local workshops, and faculty meetings.
2. Teachers with eighteen or more years of experience view inservice as being more effective than do teachers with less experience.
3. Elementary teachers generally view inservice as being more effective than secondary teachers.
4. For most inservice activities, teachers favor teacher-planned rather than administrative-planned activities.
5. Teachers with less than a bachelor's degree consider faculty meetings, local workshops and county and state workshops to be more effective than teachers with a bachelor's degree.

Merkle (58) designed a study on the Michigan State University Leadership Workshop on Elementary School Science. The workshop was designed to instruct college teachers and school consultants in two of these new curricula: the Science--A Process Approach (AAAS) and Science Curriculum Improvement Study (SCIS).

Meaningful changes in the behaviors of the participants were noted. Increased inservice activities and an altering of pre-service courses to include more of the AAAS and SCIS philosophies and activities were among the changes reported. The results of this study seem to indicate that workshops can be an effective instrument for producing desired behavioral changes.

Schmidt (71) at the University of Oklahoma conducted a study designed to investigate two problems. In the first of these, an attempt was made to determine if the instructional patterns of elementary teachers in science classes could be significantly altered after the experience of a summer institute in "new science." The direction of suggested modification was outlined by the objectives and philosophy of inquiry-centered science. The second problem investigated the possibility that social studies classes might be influenced in an analogous manner by the same summer institute experience in "new science."

The findings of the study were:

1. The use by teachers of the rational powers (except recall) after the summer institute in "new science" was statistically significantly greater than the use before the institute in both science and social studies classes.
2. The utilization by teachers of the essential learning experiences after the summer institute was statistically significantly greater than the utilization before the summer institute in both science and social studies classes.
3. Teachers used a statistically significantly greater number of divergent questions when totals before the summer institute were compared with totals after the institute.
4. Teachers' use of convergent and recall questions showed a statistically significant decrease comparing incidences between and after the institute.
5. Teacher demonstrations were used about five times as frequently in science classes as in social studies classes.

Three questions were posed by Lindberg (54) in his study of an inservice course in science education methods for elementary teachers. The three main questions dealt with were: (1) Does participation in an inservice course in science education methods change teachers' attitudes toward science? (2) After an inservice course in science education methods, do teachers rank science, in comparison to other elementary school subjects, differently from the way they did prior to the course? (3) Is there a measurable difference between the attitudes of teachers who have been taught by a lecture-demonstration method and those who have been taught by a discovery method?

The findings were:

1. Teachers had favorable attitudes toward science before and after the course.
2. Participants' responses to the questionnaires lead to the conclusion that an inservice course does influence the way teachers teach.
3. Teachers prefer an inservice science methods course to be conducted by the discovery method.

Information from the questionnaires leads to the conclusion that teachers taught by the discovery method enjoy the course more, and that they will utilize more ideas garnered from such a course.

Barnes (8) at Michigan State conducted a study to ascertain teacher reaction to the Science Curriculum Improvement Study (SCIS) training and implementation program as carried out at Michigan State University during 1968-1969. Also of interest were the relationships which may have existed between the teachers' reactions and selected teacher characteristics, as well as the effects of the SCIS training and materials in the cooperating schools.

An analysis of the questionnaire and test data, along with the statistical tests, seems to support the following data: (1) the elementary teachers did agree on the relative merit of the workshop experiences of the SCIS inservice training program; (2) teachers' reactions to the workshop experiences were significantly different in August than were their reactions the following April; (3) the elementary teachers consistently rated the lectures on the "Nature of Science" as low in value as an aid in implementing the SCIS program; (4) the teachers' reactions to the workshop experiences appeared to be related to the teacher characteristics considered; (5) the workshop activities which the teachers considered as most valuable required their active participation.

Blough (10) at the University of Pennsylvania, conducted a study designed to present a detailed account of a thirty-day workshop held at Glassboro State College, New Jersey during the summer of 1968 to familiarize fifty elementary teachers from four school districts with the materials and teaching techniques of the <u>Science Curriculum Improvement Study</u>.

His conclusions were:

The total group showed a slight mean gain in knowledge of science concepts. Those members of the group who were identified as highly creative accounted for more of this gain than did those who identified as low in creativity.

The total group showed a considerable gain in the amount of indirect verbal influence used in teaching science to children. The older members of the group accounted for more of this gain than did the younger members.

The total group showed a slight mean gain on the *Watson-Glaser Critical Thinking Appraisal and on Mednick's Remote Associates Test.* Differences in gain scores for sub-groups were not significant for these tests.

After the workshop participants had been teaching the *Science Curriculum Improvement Study* lessons to children for thirteen weeks, a survey indicated that they were teaching science with greater enthusiasm and that they believed their pupils were having better science learning experiences.

At the University of Oklahoma, Waller (83) conducted a study that was to investigate and analyze the opinions of two groups of teachers in regard to teaching procedures, materials, content, and time for elementary school science. One group of teachers included those who had received instruction in the inquiry approach using the Science Curriculum Improvement Study (SCIS) methods. The second group included those who had training to teach from a textbook only.

The following conclusions were drawn: 1. The inquiry type of methods courses are better oriented toward educating teachers in obtaining a wholesome attitude toward science teaching and increasing the teachers' interest in science. 2. The inquiry-centered teachers have had education which has guided them in the selection of science content which is directed toward the achievement of elementary science objectives. 3. The inquiry-centered teachers are better equipped with physical and library facilities which enhance the elementary science program than are the textbook-centered teachers. 4. The program of the inquiry-centered teachers is both process and subject-matter centered; whereas the textbook-centered teachers' program is subject-matter centered only. 5. The inquiry-centered teachers spend more time on science; this fact indicates that they have more interest in science teaching than the textbook-centered group. 6. By allowing the pupils to spend more time performing demonstrations and experiments, the inquiry-centered teachers are providing them with the opportunity to have the five essential learning experiences: observation, measurement, experimentation, data interpretation, and prediction. 7. The inquiry-centered teachers are better qualified to cope with the problems involved in classroom management and the necessary aids to classroom procedures for teaching elementary school science.

Baker (7) at the University of Rochester, conducted a study to answer the question, "What are the effects of science teaching materials on teachers' verbal behavior during elementary science instruction?" Specifically, the investigation was conducted to determine if there are any differences in the teaching behavior of teachers using the nontextbook, Elementary Science Study (ESS) materials as compared to the teaching behavior of teachers using the more conventional textbook materials during elementary science instruction.

The results of the study support the following propositions:

1. Teachers using ESS materials foster greater student involvement and participation during science instruction.
2. Teachers using ESS materials are more learner-centered in their teaching behavior during science instruction.
3. Teachers using textbook materials restrict student involvement and participation during science instruction.
4. Teachers using textbook materials are more content-oriented in their teaching behavior during science instruction.

Zurhellen's (86) study was designed to investigate changes in attitudes of teachers from selected East Tennessee schools during an inservice education program in classroom communications skills and to assess the relationships of these changes to age, sex, type of teacher, and certain personality variables.

Results of the study indicated significant negative changes in attitudes toward students and reaction to classroom situations. Non-significant changes were recorded in those attitudes measured by the semantic differential. All changes except the Ideal Teacher concept were negative. The participants' estimates of the program's effects were significantly positive.

While the changes were almost wholly negative, variations were found in the analyses of data for selected groups. Elementary teachers exhibited the least negative shift. They maintained more positive self-concepts than the secondary teachers.

Bunsen (16) compared methods of inservice education in science for elementary teachers. All teachers involved in this study used Science: A Process Approach. The sixteen elementary teachers participating in the study were categorized as (1) "lead teachers," who had worked with the AAAS materials and had taught a science inservice class to other elementary teachers; (2) "inservice teachers," who had participated as students in this inservice program; (3) "methods teachers," who had received their training in an elementary science methods course in some college or university; and (4) "unexposed teachers," who had no formal exposure to the AAAS materials prior to using them in the classroom.

Bunsen concluded that using AAAS materials in a teaching situation prior to implementing the program in the classroom is favorably associated with higher student score means in the process of communication. This may result from the fact that this process, in the AAAS program, focuses on developing student competencies in graphing and graph interpretation. Student achievement in this area may be more highly dependent upon prior teacher preparation than is achievement in the processes of classification and space/time relations.

Other studies that are noteworthy include the following. Westmeyer (84) and colleagues investigated different methods of inservice education with the adoption of the AAAS program. This project involved one hundred twenty teachers and three thousand six hundred students. Three different approaches to teach education were investigated: (1) summer institute training, (2) an inservice course, and (3) the use of a specially-designed teacher manual which substituted for more formal training in the use of AAAS materials. A fourth group, in which AAAS materials were not used with children, served as a control group.

Westmeyer et al., did find that teachers who had received formal instruction in the use of the AAAS program appeared to be more enthusiastic about teaching it than were those who had received their inservice education via the manual. In addition, the teachers in the inservice courses seemed to have received more desirable long-term benefits, as evidenced by their expressed opinions and observed classroom behavior.

The New Hampshire program (77) involving inservice education in art and science for elementary teachers had four operational goals to help teachers (1) develop a set of contemporary goals for elementary school science programs, (2) redefine their role in the learning process in terms of the new goals they had established, (3) develop a series of science activities which could be used in guiding children toward the contemporary goals of elementary science education, and (4) conduct science activities in a manner consistent with their new concept of the teacher's role in the learning process.

Evidence from the questionnaires indicated that (1) there had been a significant decrease in the number of teachers using the textbook as the main source of ideas for science activities, (2) the frequency with which the textbook was used as the primary science experience (reading, writing, recitation) had decreased, (3) there was a significant increase in the number of teachers offering their pupils a wider variety of science experiences, allowing the children to develop many of the skills of scientific inquiry, (4) the number of teachers encouraging their pupils to become actively involved in planning science activities increased significantly, and (5) fewer than half of the teachers who felt that a lack of science knowledge was a major obstacle to teaching science retained this feeling after completing the inservice course.

In Rowe and Hurd's (47) study, factors related to resistance to innovation in the elementary school science curriculum were identified through the evaluation of an inservice education program. The sample was composed of two hundred ninety elementary teachers and administrators with varied mathematics and science backgrounds, teaching experience, and teaching or administrative assignments. Twice during the years, the teachers attended three, three-hour lessons in an elementary science inservice program. Interest and utility scales were administered after each lesson and questionnaires were administered after each of the two major sessions. All teachers indicated interest in the program. Teachers with sixteen to twenty years of experience were not as interested, nor did they find the program as useful, as the other experience subgroups. Teachers with up to fifteen hours of college mathematics found the program more useful than teachers with more hours of mathematics. There was no significant relationship between the teachers' science background, whether they had taken a science methods course, and their rating of the program for usefulness and interest. The teachers indicated a belief that children learn best by doing, but expressed a concern for related discipline problems. Administrators were more concerned with the teacher's lack of knowledge of science content than with discipline problems arising from student activities.

## Summary

Many of the findings concerning the research dealing with inservice education are confusing and contradictory. Several points, however are in agreement. Inservice training affects the way teachers perform in the classroom (Blough, Bunsen, Lindberg, Westmeyer, and Merkle). After a teacher has participated in a science inservice experience employing an inquiry approach, teachers spend more time on science and there is more student involvement in the classes they teach (Baker, New Hampshire Program and Waller). Teachers rate science workshops using an inquiry approach high (Lindberg) and rate a lecture approach low (Barnes). Science inservice workshops have a high positive effect on the affective domain (Bunsen, Lindberg, Schmidt, Waller, and

Westmeyer) as well as the cognitive domain (Blough and Schmidt). Elementary teachers like workshops, (Barnes) and older teachers, elementary teachers, and more experienced teachers perceive greater benefits (Blough and Borgealt).

Resistance to change the science curriculum as perceived by teachers range from such things as lack of materials (Peltz), excessive load (Rameg), and discipline problems (Rowe and Hurd).

# CHAPTER III

# INSTRUMENTATION OF THE STUDY

## Construction of the Questionnaire

The questionnaire was the sole source of data. The process of determining the validity of the information requested in the questionnaire included the compiling of preliminary questions from samples of questionnaires found in the related literature. With the help of the author's committee members and also from Dr. Roger Johnson and Dr. Arlen Gullickson of the University of Minnesota, and Mr. Richard Clark, State Science Consultant, Minnesota State Department of Education, the questions were more precisely focused. The questionnaire was then reviewed at a science education doctoral seminar and individually reviewed by six other doctoral students in science education. Final review was made by the Chairman of the writer's doctoral committee and Dr. Billy Elsom of the College of Education at Oklahoma State University. After revisions were made, the questionnaire was administered to a selected group of elementary teachers to assure clarity.

## Design of the Questionnaire

The approved questionnaire was composed of four sections. The first section was concerned with attitudes toward the instruction in workshops associated with the newer curriculum programs. This section was composed of ten items on which the teachers responded to a five point Likert-type scale which ranged from strongly agree to strongly disagree.

The second part of the questionnaire was composed of thirteen items directed at teacher attitudes toward the structure and usefulness of the workshop experience. A similar five point Likert scale was used.

The third section concerned attitudes toward the teacher's perception of what they viewed as resistance to implementation of new curriculum programs. It was composed of fourteen Likert-type questions ranging from strongly agree to strongly disagree.

The fourth and last section of the questionnaire was designed to gather biographical data.

Each questionnaire was assigned a code number for identification purposes. Two methods were used. In the first case, the code number simply appeared on the first page. In the second, the code number was secreted in the postal mark. The percentage of returns for both methods proved nearly equal. A sample of the questionnaire is found in Appendix A.

## Submission of Questionnaires to Teachers

A list of participants in workshops was obtained from college registrars and the State Department of Education. Relying on personal experience and consultation with the State Department of Education Science Consultant, three schools deemed to have outstanding inservice programs were chosen.

The questionnaires, accompanied by a letter of explanation, were designed so as to have a stamped, self-address return by simply folding and stapling the corners of the questionnaire instrument.

### Follow-up Letters

In order to insure as large a return as possible, a follow-up letter was mailed to nonrespondents four weeks after the original questionnaire was mailed. A second stamped, self-addressed questionnaire was included with the follow-up letter.

### Analysis of Data

Since this is an ex post facto descriptive study, the following statistics were deemed appropriate. Using a modified Biomedical Computer Program (BMD 026) developed by W. L. Dixon of the University of California, Berkeley, a contingency table analysis was employed. Questions developed around the research questions were categorized and information was also sorted into seventeen groups according to the questions in the biographical data, an index value, which would eliminate neutral responses was computed by the following formula.

$$I.V. - \frac{H.N.R.}{H.N.R. + L.N.R.}$$

where:

I.V. - Index Value

H.N.R. - Total number of responses checked strongly agree and agree.

L.N.R. - Total number of responses checked disagree and strongly disagree.

The results were presented in tabular form with interpretation and discussion.

The questionnaire was constructed during January, 1972. It was validated in February, 1972, and the final questionnaire was organized for data collection by April 1, 1972. The tabulation and analysis of the data was completed by July of 1972.

## CHAPTER IV

## RESULTS OF THE STUDY

The concern of the first three chapters has been a general introduction to the study, a review of related literature and a discussion of the design of the study.

In this chapter, a presentation of the findings from the questionnaire will be presented. Data from the questionnaire will be tendered and discussed. Data will be presented according to the research questions listed in Chapter I and the data will be compared and analyzed on the basis of variables stated in each question.

All data presented in the chapter is presented in terms of percentage of participant responses to items on the questionnaire that are directly related to each research question and in terms of an index value for research question numbers one and two. Figures in parenthesis represent the number of respondents.

### Research Question Number One

What type of teachers participate in the inservice programs of this study?

To answer this question the information provided by the respondents in the last seventeen questions was tabulated and presented in percentages as well as the number of respondents. The variation of the number of respondents resulted from some of the questions not being answered. Some have probably left teaching, possibly through retirement, and thus could not answer the first question on the grade taught.

A few points of interest include the fact, from Table III, p. 49, that 42.2% of the respondents came from communities of less than five thousand population. Most studies concerning inservice involve larger metropolitan districts.

The data from Table IV, p. 49, also indicates that 39.4% of the respondents are thirty-five years of age or less. Beyond this age there is a decided trend toward a smaller percentage of respondents.

The data on the level of educational experience in Table V, p. 50, points out two interesting pieces of information. First, 10.6% of the respondents do not have Bachelor's degrees and only 9.8% have a Master's degree or a Master's plus additional credits.

The data on the number of minutes spent teaching science from Table VIII, p. 51, indicates that even after the workshop experience, 53.2% of the teachers are teaching science less than ninety minutes per week.

When asked the main reason for participating in workshops, 55.2% indicated they were participating to strengthen their teaching according to the data in Table XV, p. 55. Additional information presented in Table XVI, p. 55, shows that 95% of the respondents either agree or strongly agree that college credit should be offered for workshop participation and inservice science activities.

Other information presented include data that may be highly interesting to those readers who may be responsible for inservice programs. This data, although necessarily surprising, is highly informative and is therefore presented at this time.

TABLE I

NUMBER AND PERCENT OF THE TOTAL RESPONDENTS FOR THEIR PRESENT TEACHING ASSIGNMENT ACCORDING TO GRADE

| Grade Taught Presently | Percent of Respondents | Number of Respondents |
|---|---|---|
| K | 9.1% | 36 |
| 1 | 16.4 | 65 |
| 2 | 12.3 | 49 |
| 3 | 13.9 | 55 |
| 4 | 12.3 | 49 |
| 5 | 14.4 | 57 |
| 6 | 16.5 | 66 |
| 7-9 | 3.5 | 14 |
| Other | 1.5 | 6 |
| | 100.0% | 397 |

TABLE II

NUMBER AND PERCENT OF TOTAL RESPONDENTS ACCORDING TO SEX

| Sex | Percent of Respondents | Number of Respondents |
|---|---|---|
| Female | 78.0% | 322 |
| Male | 22.0 | 91 |
| | 100.0% | 413 |

TABLE III

NUMBER AND PERCENT OF THE TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE SIZE OF THE COMMUNITY IN WHICH THEY TEACH

| Community Size | Percent of Respondents | Number of Respondents |
|---|---|---|
| Metropolitan--Inner-city (Mpls., St. Paul or Duluth) | 1.0% | 4 |
| Suburban-Metropolitan area (Mpls., St. Paul or Duluth) | 22.6 | 88 |
| City other than suburban population (25,000-100,000) | 2.1 | 8 |
| City other than suburban population (10,000-24,000) | 14.9 | 58 |
| City other than suburban population (5,000-9,999) | 17.2 | 67 |
| City other than suburban population (less than 5,000) | 42.2 | 164 |
| | 100.0% | 389 |

TABLE IV

NUMBER AND PERCENT OF RESPONDENTS CATEGORIZED ACCORDING TO AGE IN YEARS

| Age of Participants | Percent of Respondents | Number of Respondents |
|---|---|---|
| 20-24 | 4.2% | 17 |
| 25-30 | 17.8 | 73 |
| 31-35 | 17.4 | 71 |
| 36-40 | 13.7 | 56 |
| 41-45 | 12.5 | 51 |
| 46-50 | 9.8 | 40 |
| 51-55 | 11.7 | 48 |
| 55-60 | 10.0 | 41 |
| Over 60 | 2.9 | 12 |
| | 100.0% | 409 |

TABLE V

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE LEVEL OF EDUCATIONAL EXPERIENCE

| Level of Educational Experience | Percent of Respondents | Number of Respondents |
|---|---|---|
| Less than Bachelor's | 10.6% | 44 |
| Bachelor's | 27.1 | 112 |
| Bachelor's + 15 qt. hrs. | 27.8 | 115 |
| Bachelor's + 30 qt. hrs. | 13.0 | 54 |
| Bachelor's + 45 qt. hrs. | 11.6 | 48 |
| Master's Degree | 4.3 | 18 |
| Master's + 15 qt. hrs. | 1.4 | 6 |
| Master's + 30 qt. hrs. | 1.7 | 7 |
| Master's + 45 qt. hrs. | 2.4 | 10 |
| | 100.0% | 414 |

TABLE VI

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE NUMBER OF YEARS OF TEACHING EXPERIENCE

| Years of Teaching Experience | Percent of Respondents | Number of Respondents |
|---|---|---|
| 1-3 | 10.0% | 41 |
| 4-6 | 15.1 | 62 |
| 7-9 | 16.6 | 68 |
| 10-12 | 12.4 | 51 |
| 13-15 | 12.0 | 49 |
| 16-18 | 6.8 | 28 |
| 19 or more | 27.1 | 111 |
| | 100.0% | 410 |

TABLE VII

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO GRADE LEVEL WHERE MOST TEACHING EXPERIENCE HAS BEEN

| Grade Level | Percent of Respondents | Number of Respondents |
|---|---|---|
| K-3 | 49.3% | 202 |
| 4-6 | 43.3 | 177 |
| 7-9 | 3.7 | 15 |
| 10-12 | 2.4 | 10 |
| Other | 1.2 | 5 |
| | 100.0% | 409 |

TABLE VIII

NUMBER AND PERCENT OF TOTAL RESPONDENTS GROUPED ACCORDING TO THE NUMBER OF CLASSROOM MINUTES DEVOTED TO TEACHING SCIENCE EACH WEEK

| Minutes Teaching Science | Percent of Respondents | Number of Respondents |
|---|---|---|
| 30 minutes or less per week | 13.2% | 50 |
| 31-60 minutes per week | 20.0 | 76 |
| 61-90 minutes per week | 20.0 | 76 |
| 91-120 minutes per week | 18.7 | 71 |
| 121-150 minutes per week | 11.8 | 45 |
| 151-180 minutes per week | 5.0 | 19 |
| More than 180 minutes per week | 11.3 | 43 |
| | 100.0% | 380 |

TABLE IX

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE NUMBER OF BIOLOGY COURSES COMPLETED AT THE COLLEGE LEVEL

| Biology Courses in College | Percent of Respondents | Number of Respondents |
|---|---|---|
| None | 14.0% | 58 |
| One | 32.4 | 134 |
| Two | 26.1 | 108 |
| Three | 19.1 | 79 |
| Four or more | 8.5 | 35 |
| | 100.0% | 414 |

TABLE X

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE NUMBER OF EARTH-SPACE SCIENCE COURSES COMPLETED AT THE COLLEGE LEVEL

| Earth-Space Science Courses in College | Percent of Respondents | Number of Respondents |
|---|---|---|
| None | 28.5% | 117 |
| One | 35.5 | 146 |
| Two | 22.4 | 92 |
| Three | 8.3 | 34 |
| Four or more | 5.4 | 22 |
| | 100.0% | 411 |

TABLE XI

NUMBER AND PERCENT OF TOTAL RESPONDENTS GROUPED ACCORDING TO THE NUMBER OF PHYSICS COURSES COMPLETED AT THE COLLEGE LEVEL

| Physics Courses in College | Percent of Respondents | Number of Respondents |
|---|---|---|
| None | 53.8% | 222 |
| One | 32.2 | 133 |
| Two | 8.5 | 35 |
| Three | 3.9 | 16 |
| Four or more | 1.7 | 7 |
| | 100.0% | 413 |

TABLE XII

NUMBER AND PERCENT OF TOTAL RESPONDENTS GROUPED ACCORDING TO THE NUMBER OF CHEMISTRY COURSES COMPLETED AT THE COLLEGE LEVEL

| Chemistry Courses in College | Percent of Respondents | Number of Respondents |
|---|---|---|
| None | 59.5% | 245 |
| One | 27.7 | 114 |
| Two | 8.0 | 33 |
| Three | 2.4 | 10 |
| Four or more | 2.4 | 10 |
| | 100.0% | 412 |

TABLE XIII

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE TYPE OF INSERVICE ACTIVITY IN WHICH THE RESPONDENT PARTICIPATED

| Type of Inservice Activity | Percent of Respondents | Number of Respondents |
|---|---|---|
| Summer school workshop | 35.6% | 141 |
| Extension Workshop | 38.1 | 151 |
| Local inservice programs | 13.9 | 55 |
| State Dept. of Education-Inservice program | 12.4 | 49 |
| | 100.0% | 396 |

TABLE XIV

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE TYPE OF INSERVICE MATERIALS

| Type of Inservice Materials | Percent of Respondents | Number of Respondents |
|---|---|---|
| AAAS | 42.8% | 175 |
| ESS | 15.4 | 63 |
| SCIS | 4.2 | 17 |
| Composite | 34.5 | 141 |
| Other | 3.2 | 13 |
| | 100.0% | 409 |

TABLE XV

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE REASON GIVEN FOR PARTICIPATION IN THE WORKSHOP

| Main Reason for Participation | Percent of Respondents | Number of Respondents |
|---|---|---|
| To advance on salary schedule | 13.3% | 55 |
| To complete a degree | 12.6 | 52 |
| Satisfy a professional requirement | 13.6 | 56 |
| To strengthen my teaching | 55.2 | 228 |
| Other | 5.3 | 22 |
| | 100.0% | 413 |

TABLE XVI

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE TYPE OF CREDIT GIVEN FOR WORKSHOP ACTIVITIES

| Workshop Credit Offered | Percent of Respondents | Number of Respondents |
|---|---|---|
| College credit | 80.1% | 326 |
| Credit for salary schedule | 12.8 | 51 |
| No credit | 7.1 | 22 |
| | 100.0% | 399 |

TABLE XVII

NUMBER AND PERCENT OF TOTAL RESPONDENTS CATEGORIZED ACCORDING TO THE NUMBER OF HOURS OF INSERVICE RECOMMENDED TO FEEL COMPETENT TO BEGIN TEACHING ONE OF THE NEW CURRICULA

| Length of Inservice Recommended By Respondents | Percent of Respondents | Number of Respondents |
|---|---|---|
| Ten hours | 8.3% | 29 |
| Twenty hours | 22.4 | 82 |
| Thirty hours | 32.2 | 113 |
| Forty hours | 22.2 | 78 |
| More than forty hours | 14.0 | 49 |
| | 100.0% | 351 |

Research Question Number Two

What are the strengths and weaknesses concerning instruction in the four types of workshops?

To answer this question responses from the first ten questionnaire statements were categorized according to the four types of workshops; summer school, extension, local school district, and State Department of Education. From this information, index values were computed by dividing the number of responses indicated as strongly agree and agree by the sum of the responses marked strongly agree, agree, disagree and strongly disagree.

Table XVIII, p. 58, shows that 63.1% of the participants strongly agreed that the instructor was well prepared for summer school workshops. Only 49.7% responded similarly toward extension workshop instructors. The difference of 13.4% is noteworthy.

Although responses regarding the comprehensive knowledge of the instructor were very high for all workshops, more participants strongly agreed, that instructors of summer school and extension workshops had a more comprehensive knowledge than instructors in the State Department of Education and local school district workshops according to the data in Table XIX, p. 58.

Table XX, p. 59, shows more participants strongly agreed (53.1%) that the State Department of Education workshops use more appropriate methodology than any of the other workshops. Table XXI, p. 59, also points out that more participants strongly agreed (61.2%) that the State Department of Education was more adept at presenting material that was appropriate to the level of the preparedness of the student.

More participants (52.3%) indicated that extension workshop instructors acknowledge all questions. This represents a 9.4% difference when compared to a similar figure computed for the State Department of Education (42.9%) from the data in Table XXII, p. 60.

Over 90% of the participants either strongly agreed or agreed that the instructor established a good rapport. On this subject, participants strongly agreed 70.9% for summer school workshop instructors. This is approximately ten percent more than for either of the other two types of workshops.

To summarize, the quality of instruction in all four workshops was rated very highly by the participants. The strengths of summer school workshops included being well prepared, knowledgeable and establishing a good rapport with the respondents. Extension workshops

TABLE XVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS PREPARED FOR THE CLASS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 63.1 | 33.3 | 2.1 | 1.4 | 0.0 | 0.98 |
| Extension workshops (151) | 49.7 | 46.4 | 2.6 | 1.3 | 0.0 | 0.99 |
| Local inservice programs (55) | 61.8 | 36.4 | 1.8 | 0.0 | 0.0 | 1.0 |
| State Dept. of Education-- (49) Inservice programs | 57.1 | 34.7 | 8.2 | 0.0 | 0.0 | 1.0 |

TABLE XIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR EXHIBITED A COMPREHENSIVE KNOWLEDGE OF HIS SUBJECT

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 66.0 | 29.8 | 2.8 | 1.4 | 0.0 | 0.98 |
| Extension workshops (151) | 63.6 | 31.1 | 4.6 | 0.7 | 0.0 | 0.99 |
| Local inservice programs (55) | 60.0 | 38.2 | 0.0 | 1.8 | 0.0 | 0.98 |
| State Dept. of Education-- (49) Inservice programs | 59.2 | 38.8 | 2.0 | 0.0 | 0.0 | 1.0 |

TABLE XX

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE USED TEACHING METHODS WHICH ENABLED ME TO ACHIEVE THE OBJECTIVES OF THE CLASS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 49.6 | 43.3 | 5.0 | 1.4 | 0.7 | 0.98 |
| Extension workshops (151) | 44.4 | 47.7 | 6.0 | 1.3 | 0.7 | 0.98 |
| Local inservice programs (55) | 43.6 | 47.3 | 7.3 | 0.0 | 1.8 | 0.98 |
| State Dept. of Education-- (49) Inservice programs | 53.1 | 40.8 | 6.1 | 0.0 | 0.0 | 1.00 |

TABLE XXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE COMMUNICATED EFFECTIVELY AT LEVELS APPROPRIATE TO THE PREPAREDNESS OF THE STUDENT

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 53.2 | 38.3 | 6.4 | 2.1 | 0.0 | 0.98 |
| Extension workshops (151) | 45.0 | 44.4 | 7.9 | 0.7 | 2.0 | 0.97 |
| Local inservice programs (55) | 36.4 | 47.3 | 12.7 | 1.8 | 1.8 | 0.96 |
| State Dept. of Education-- (49) Inservice programs | 61.2 | 34.7 | 4.1 | 0.0 | 0.0 | 1.00 |

TABLE XXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ACKNOWLEDGED ALL QUESTIONS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 50.4 | 41.8 | 5.7 | 2.1 | 0.0 | 0.98 |
| Extension workshops (151) | 52.3 | 42.4 | 4.6 | 0.7 | 0.0 | 0.99 |
| Local inservice programs (55) | 47.3 | 43.6 | 7.3 | 1.8 | 0.0 | 0.99 |
| State Dept. of Education-- (49) Inservice programs | 42.9 | 51.0 | 4.1 | 2.0 | 0.0 | 0.99 |

TABLE XXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ESTABLISHED A GOOD RAPPORT WITH THE STUDENTS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 70.9 | 24.1 | 2.8 | 1.4 | 0.7 | 0.98 |
| Extension workshops (151) | 61.6 | 34.4 | 4.0 | 0.0 | 0.0 | 1.0 |
| Local inservice programs (55) | 58.2 | 32.7 | 9.1 | 0.0 | 0.0 | 1.0 |
| State Dept. of Education-- (49) Inservice programs | 69.4 | 28.6 | 2.0 | 0.0 | 0.0 | 1.0 |

showed a definite strength in the knowledge of the instructor and indicated weakness because of the lack of preparation. Local school district workshop instructors were well prepared, according to the respondents, but did not establish as good a rapport as the other workshop instructors. The State Department of Education Workshop showed strength in the areas of using appropriate methods to achieve the objectives of the workshop in communicating effectively. The main weakness as indicated by a respondent was in not acknowledging all questions.

Research Question Number Three

What are the strengths and weaknesses in the structure of the four types of workshops?

Information from questions eleven through twenty-three was grouped according to the four types of workshops and presented in the tabular form.

When considering supplies and equipment, only 36.4% of extension workshop participants and only 38.2% of local inservice participants strongly agreed a sufficient supply was available according to the data in Table XXIV, p. 62. Only 16.6% of the participants in the extension workshops strongly agreed that the physical facilities were adequate as pointed out in Table XXV, p. 62.

Participants felt problems of implementation were better handled in the local inservice program and felt more attention should be given to the subject than in other types of workshops where 41% either agreed or strongly agreed. The supporting data is found in Table XXVI, p. 64.

TABLE XXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: A SUFFICIENT SUPPLY OF SCIENCE EQUIPMENT AND MATERIALS WERE AVAILABLE FOR THE INSERVICE TRAINING

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 42.6 | 50.4 | 4.3 | 2.8 | 0.0 | 0.97 |
| Extension workshops (151) | 36.4 | 51.0 | 6.6 | 5.3 | 0.7 | 0.94 |
| Local inservice programs (55) | 38.2 | 54.5 | 1.8 | 5.5 | 0.0 | 0.94 |
| State Dept. of Education-- (49) Inservice programs | 42.9 | 49.0 | 8.2 | 0.0 | 0.0 | 1.0 |

TABLE XXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE PHYSICAL FACILITIES (ROOMS, SINKS, TABLES) WERE SUITABLE FOR THE INSERVICE PROGRAMS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 26.2 | 51.5 | 10.0 | 9.2 | 2.8 | 0.87 |
| Extension workshops (151) | 16.6 | 49.0 | 18.5 | 12.6 | 3.3 | 0.81 |
| Local inservice programs (55) | 29.1 | 38.2 | 21.8 | 7.3 | 3.6 | 0.86 |
| State Dept. of Education-- (49) Inservice programs | 22.4 | 55.1 | 8.2 | 14.3 | 0.0 | 0.84 |

In data found in Table XXVII, p. 64, participants either agreed or strongly agreed from a range of 64% to 69%, that there should be separate inservice programs for grades kindergarten through three and grades four through six.

State Department of Education workshop participants felt they relied less on their texts after their workshop than other participants. This is revealed by the index value of 0.97 given in Table XXVIII, p. 65. This is quite interesting since it is considerably higher than those values for other workshops.

Data found in Tables XXIX, XXX, and XXXI, pp. 65 and 66, indicate a high degree of usefulness and satisfaction with all four types of workshops.

The overall evaluations of the structure of all the workshops are very high. Each has unique and characteristic strengths as well as weaknesses as pointed out by the preceding tables. The most discernable have been discussed.

## Research Question Number Four

What do teachers perceive as resistance to new programs and how does it vary with respect to community size?

In order to organize this information, questionnaire responses for items twenty-four through thirty-seven were sorted into six categories according to the biographical information concerning the size of the community in which the participant taught.

Because of the small number of inner-city responses the data will not be discussed.

According to the data in Table XXXII, p. 68, inservice activities

TABLE XXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE TIME SHOULD HAVE BEEN SPENT DISCUSSING PROBLEMS OF CLASSROOM IMPLEMENTATION OF NEW ELEMENTARY SCIENCE CURRICULA

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 2.8 | 31.9 | 28.4 | 31.9 | 5.0 | 0.48 |
| Extension workshops (151) | 6.6 | 34.4 | 27.8 | 24.5 | 6.6 | 0.58 |
| Local inservice programs (55) | 5.5 | 23.6 | 38.2 | 23.6 | 9.1 | 0.47 |
| State Dept. of Education-- (49) Inservice programs | 4.1 | 30.6 | 28.6 | 16.3 | 20.4 | 0.57 |

TABLE XXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL THERE SHOULD BE SEPARATE INSERVICE TRAINING PROGRAMS FOR TEACHERS OF SCIENCE IN GRADES K-3 AND GRADES 4-6

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshop (141) | 24.1 | 40.4 | 17.7 | 12.1 | 5.7 | 0.79 |
| Extension workshops (151) | 31.1 | 35.8 | 15.9 | 13.2 | 4.0 | 0.79 |
| Local inservice programs (55) | 29.1 | 40.0 | 18.2 | 7.3 | 5.5 | 0.84 |
| State Dept. of Education-- (49) Inservice programs | 24.5 | 44.9 | 12.2 | 14.3 | 4.1 | 0.79 |

TABLE XXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FIND THAT I DO NOT RELY ON MY TEXTBOOK FOR SCIENCE AS MUCH AS I DID BEFORE THE SCIENCE INSERVICE

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 31.9 | 43.3 | 15.6 | 7.8 | 1.4 | 0.89 |
| Extension workshops (151) | 23.8 | 39.7 | 27.8 | 6.0 | 2.6 | 0.89 |
| Local inservice programs (55) | 10.9 | 43.6 | 34.5 | 10.9 | 0.0 | 0.83 |
| State Dept. of Education-- (49) Inservice programs | 36.7 | 40.8 | 20.4 | 2.0 | 0.0 | 0.97 |

TABLE XXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: SINCE MY INSERVICE SCIENCE EXPERIENCE MY SCIENCE CLASSES HAVE GREATER STUDENT INVOLVEMENT

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 34.0 | 46.8 | 14.2 | 5.0 | 0.0 | 0.94 |
| Extension workshops (151) | 27.2 | 49.0 | 20.5 | 2.6 | 0.7 | 0.97 |
| Local inservice programs (55) | 21.8 | 54.5 | 20.0 | 3.6 | 0.0 | 0.95 |
| State Dept. of Education-- (49) Inservice programs | 44.9 | 34.7 | 20.4 | 0.0 | 0.0 | 1.0 |

TABLE XXX

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE CONFIDENT AND ENTHUSIASTIC ABOUT TEACHING SCIENCE BECAUSE OF THE INSERVICE SCIENCE EXPERIENCE

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 35.5 | 50.4 | 10.6 | 3.5 | 0.0 | 0.95 |
| Extension workshops (151) | 26.5 | 49.7 | 21.2 | 2.0 | 0.7 | 0.97 |
| Local inservice programs (55) | 23.6 | 43.6 | 25.5 | 7.3 | 0.0 | 0.91 |
| State Dept. of Education-- (49) Inservice programs | 38.8 | 46.9 | 12.2 | 2.0 | 0.0 | 0.98 |

TABLE XXXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: PERIODIC INSERVICE TRAINING IN SCIENCE SHOULD NOT BE REQUIRED OF TEACHERS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshop (141) | 3.5 | 4.3 | 14.2 | 43.3 | 34.8 | 0.02 |
| Extension workshops (151) | 2.6 | 7.9 | 21.9 | 37.1 | 30.5 | 0.09 |
| Local inservice programs (55) | 5.5 | 5.5 | 20.0 | 52.7 | 16.4 | 0.03 |
| State Dept. of Education-- (49) Inservice programs | 6.1 | 2.0 | 18.4 | 42.9 | 30.6 | 0.03 |

become more of a burden, as viewed by teachers, in smaller communities than in larger ones. Interestingly, Table XXXIII, p. 68, shows on the average that only 20.3% of the participants agreed or strongly agreed that the elementary curriculum director was a good source of help while 35.8% either disagreed or strongly disagreed. The value of the elementary curriculum director to solve problems in science in communities of ten to twenty-four thousand was thought to be good by 22.4% but was thought not to be good by 48.3% of the participants.

Data in Table XXXIV, p. 70, points out that on the average 46.2% of the participants either agreed or strongly agreed that lack of support and enthusiasm by fellow teachers was a serious hindrance. This becomes even more interesting when compared to the data in Table XXXV, p. 71, where it is shown that 36.8% of the teachers either agreed or strongly agreed that the lack of administrative support and enthusiasm was a serious hindrance to developing a good science program.

In Table XXXVI, p. 72, teachers indicate that innovation in smaller communities is more of a hindrance than in larger communities. Data in Table XXXVII, p. 73, points out that larger communities need people that are responsible for equipment and replenishment more than smaller communities.

Authoritarian administrators, as shown in Table XXXVIII, p. 74, become more of a serious problem in larger communities for those included in the sample of this study.

TABLE XXXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: INSERVICE ACTIVITIES IMPOSE UNREASONABLE BURDENS ON MOST TEACHERS

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 0.0 | 0.0 | 25.0 | 75.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 1.1 | 1.1 | 20.5 | 59.1 | 18.2 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 0.0 | 12.5 | 87.5 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 0.0 | 0.0 | 12.1 | 65.5 | 22.4 |
| City other than suburban-population (5,000-9,999) (67) | 1.5 | 6.0 | 16.4 | 52.2 | 23.9 |
| City other than suburban-population (less than 5,000) (164) | 1.2 | 4.3 | 23.2 | 53.7 | 17.7 |
| Percentage responses by all participants responding (389) | 1.0 | 3.1 | 19.5 | 57.3 | 19.0 |

TABLE XXXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: MY ELEMENTARY CURRICULUM DIRECTOR IS A GOOD SOURCE TO HELP SOLVE CLASSROOM PROBLEMS THAT DEVELOP IN SCIENCE

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 25.0 | 50.0 | 0.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 4.6 | 19.5 | 31.0 | 17.2 | 27.6 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 25.0 | 37.5 | 12.5 | 25.0 |
| City other than suburban-population (10,000-24,000) (58) | 3.4 | 19.0 | 29.3 | 34.5 | 13.8 |
| City other than suburban-population (5,000-9,999) (67) | 6.0 | 13.4 | 50.7 | 16.4 | 13.4 |
| City other than suburban-population (less than 5,000) (164) | 4.3 | 12.8 | 53.0 | 12.8 | 17.1 |
| Percentage responses by all participants responding (389) | 4.6 | 15.7 | 43.8 | 17.5 | 18.3 |

TABLE XXXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: LACK OF SUPPORT AND ENTHUSIASM BY FELLOW TEACHERS IS A SERIOUS HINDRANCE TO THE DEVELOPMENT OF A GOOD SCIENCE PROGRAM

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth)(4) | 25.0 | 0.0 | 25.0 | 25.0 | 25.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 11.4 | 38.6 | 18.2 | 26.1 | 5.7 |
| City other than suburban-population (25,000-100,000) (8) | 12.5 | 37.5 | 0.0 | 37.5 | 12.5 |
| City other than suburban-population (10,000-24,000) (58) | 8.6 | 27.6 | 17.2 | 37.9 | 8.6 |
| City other than suburban-population (5,000-9,999) (67) | 28.4 | 31.3 | 23.9 | 13.4 | 3.0 |
| City other than suburban-population (less than 5,000) (164) | 11.6 | 31.1 | 25.6 | 26.2 | 5.5 |
| Percentage responses by all participants responding (389) | 14.1 | 32.1 | 21.9 | 26.0 | 5.9 |

TABLE XXXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: LACK OF SUPPORT AND ENTHUSIASM BY THE ADMINISTRATION IS A SERIOUS HINDRANCE TO THE DEVELOPMENT OF A GOOD SCIENCE PROGRAM

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 0.0 | 25.0 | 50.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 4.5 | 29.5 | 20.5 | 33.0 | 12.5 |
| City other than suburban-population (25,000-100,000) (8) | 25.0 | 12.5 | 0.0 | 62.5 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 10.3 | 15.5 | 20.7 | 29.3 | 24.1 |
| City other than suburban-population (5,000-9,999) (67) | 17.9 | 34.3 | 16.4 | 16.4 | 14.9 |
| City other than suburban-population (less than 5,000) (164) | 10.4 | 25.6 | 23.2 | 32.9 | 7.9 |
| Percentage responses by all participants responding (389) | 10.8 | 26.0 | 20.6 | 30.3 | 12.3 |

TABLE XXXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: NONACCEPTANCE OF INNOVATIVE PROGRAMS IN MY COMMUNITY PROVIDES A SERIOUS HINDRANCE WHEN TRYING TO IMPLEMENT A NEW PROGRAM

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 0.0 | 25.0 | 50.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 1.1 | 10.2 | 12.5 | 59.1 | 17.0 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 0.0 | 0.0 | 87.5 | 12.5 |
| City other than suburban-population (10,000-24,000) (58) | 3.4 | 6.9 | 32.8 | 36.2 | 20.7 |
| City other than suburban-population (5,000-9,999) (67) | 4.5 | 19.4 | 20.9 | 40.3 | 14.0 |
| City other than suburban-population (less than 5,000) (164) | 3.0 | 11.0 | 31.1 | 45.7 | 9.1 |
| Percentage responses by all participants responding (389) | 3.1 | 11.3 | 24.7 | 47.3 | 13.6 |

TABLE XXXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: NEW SCIENCE PROGRAMS WILL NOT BE MAINTAINED UNLESS ONE INDIVIDUAL IN EACH BUILDING IS RESPONSIBLE FOR REPLENISHMENT AND DISTRIBUTION OF MATERIALS

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 50.0 | 50.0 | 0.0 | 0.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 11.4 | 36.4 | 25.0 | 25.0 | 2.3 |
| City other than suburban-population (25,000-100,000) (8) | 12.5 | 37.5 | 25.0 | 25.0 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 8.6 | 32.8 | 24.1 | 31.0 | 3.4 |
| City other than suburban-population (5,000-9,999) (67) | 19.4 | 41.8 | 11.9 | 23.9 | 3.0 |
| City other than suburban-population (less than 5,000) (164) | 8.5 | 36.6 | 31.7 | 22.0 | 1.2 |
| Percentage responses by all participants responding (389) | 11.6 | 37.0 | 25.2 | 24.2 | 2.1 |

TABLE XXXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: AUTHORITARIAN ADMINISTRATORS WHO FORCE TEACHERS TO PARTICIPATE IN INSERVICE PROGRAMS PRESENT A SERIOUS PROBLEM TO A SUCCESSFUL IMPLEMENTATION OF A SCIENCE PROGRAM IN MY SCHOOL

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 0.0 | 50.0 | 0.0 | 25.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 6.8 | 23.9 | 28.4 | 28.4 | 12.5 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 12.5 | 12.5 | 62.5 | 12.5 |
| City other than suburban-population (10,000-24,000) (58) | 3.4 | 15.5 | 27.6 | 39.7 | 13.8 |
| City other than suburban-population (5,000-9,999) (67) | 7.5 | 16.4 | 29.9 | 34.3 | 11.9 |
| City other than suburban-population (less than 5,000)(164) | 3.7 | 15.2 | 32.9 | 42.7 | 5.5 |
| Percentage responses by all participants responding (389) | 5.1 | 17.2 | 30.3 | 37.5 | 9.8 |

## Research Question Number Five

Do teachers with more teaching experience perceive resistance to change differently than those with less teaching experience?

In answer to this question, teachers were grouped by years of experience according to the information gained from question number six in the biographical data portion of the questionnaire. Responses for questions twenty-four through thirty-seven were then reported in percentages and presented in tabular form.

The results found in Table XXXIX, p. 76, indicate that broken and poor quality equipment are more of a problem for younger teachers with one to three years experiences and for older teachers with nineteen or more years of experience.

It is interesting to note that 76.2% of the participants either agreed or strongly agreed that inservice activites impose an unreasonable burden on teachers as shown in Table XL, p. 77.

The curriculum director would appear to be a more effective source of help for teachers with one to three years of experience than any other group. However, on the average 35.7% of the participants do not believe he is a good source to help solve classroom problems in science compared with 22.3% that believe he is, as shown in Table XLI, p. 78.

For some reason, the sixteen to eighteen years of experience group is highly anomalous in almost every question situation. This, also pointed out by Rowe (65), may be due to married teachers returning to teaching after their children are grown.

Teachers on the average (43.6%) indicated that lack of support by

TABLE XXXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: BROKEN AND POOR QUALITY EQUIPMENT WERE DEFINITE PROBLEMS WHEN TRYING TO IMPLEMENT THE NEW SCIENCE CURRICULA IN MY SCHOOL

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 12.2 | 51.2 | 14.6 | 14.6 | 7.3 |
| 4-6 (62) | 11.3 | 24.2 | 19.4 | 32.3 | 12.9 |
| 7-9 (68) | 16.2 | 30.9 | 22.1 | 22.1 | 8.8 |
| 10-12 (51) | 3.9 | 41.2 | 21.6 | 21.6 | 11.8 |
| 13-15 (49) | 20.4 | 28.6 | 24.5 | 24.5 | 2.0 |
| 16-18 (28) | 3.6 | 35.7 | 28.6 | 17.9 | 14.3 |
| 19 or more (111) | 17.7 | 37.8 | 15.3 | 18.9 | 10.8 |
| Percentage responses by all participants responding (410) | 13.4 | 35.1 | 19.8 | 22.0 | 9.8 |

TABLE XL

PARTICIPANTS' RESPONSE TO THE STATEMENT: INSERVICE ACTIVITIES IMPOSE AN UNREASONABLE BURDEN ON MOST TEACHERS

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 13.9 | 63.9 | 16.7 | 5.6 | 0.0 |
| 4-6 (62) | 20.4 | 50.0 | 24.1 | 3.7 | 0.0 |
| 7-9 (68) | 25.8 | 48.5 | 22.7 | 3.0 | 0.0 |
| 10-12 (51) | 14.0 | 66.0 | 14.0 | 6.0 | 0.0 |
| 13-15 (49) | 21.3 | 61.7 | 1.7 | 0.0 | 0.0 |
| 16-18 (28) | 25.9 | 48.1 | 22.2 | 0.0 | 3.7 |
| 19 or more (111) | 14.4 | 61.3 | 19.8 | 2.7 | 1.8 |
| Percentage responses by all participants responding (410) | 18.7 | 57.5 | 19.7 | 3.1 | 1.0 |

TABLE XLI

PARTICIPANTS' RESPONSE TO THE STATEMENT: MY ELEMENTARY CURRICULUM DIRECTOR IS A GOOD SOURCE TO HELP SOLVE CLASSROOM PROBLEMS THAT DEVELOP IN SCIENCE

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 4.9 | 34.1 | 26.8 | 24.4 | 9.8 |
| 4-6 (62) | 3.2 | 16.1 | 50.0 | 17.7 | 12.9 |
| 7-9 (68) | 4.4 | 17.6 | 38.2 | 17.6 | 22.1 |
| 10-12 (51) | 2.0 | 11.8 | 41.2 | 23.5 | 21.6 |
| 13-15 (49) | 12.2 | 8.2 | 46.9 | 20.4 | 12.2 |
| 16-18 (28) | 3.6 | 28.6 | 35.7 | 14.3 | 17.9 |
| 19 or more (111) | 4.5 | 15.5 | 45.5 | 16.4 | 18.2 |
| Percentage responses by all participants responding (410) | 4.9 | 17.4 | 42.1 | 18.8 | 16.9 |

fellow teachers is a serious problem as can be seen in Table XLII, p. 80.

It is also interesting to note in Table XLIII, p. 81, that pupil movement and incidental noise is a far more serious problem for teachers with one to three years of experience (12.2%) than any other group.

On the other hand Table XLIV, p. 82, shows that only 35.8% either agreed or strongly agreed that lack of support by the administration was a problem.

Table XLV, p. 83, would seem to point out as teachers become experienced the problem of community acceptance of innovative ideas becomes less of a problem.

Table XLVI, p. 84, points out more younger teachers indicated cost was a serious problem for implementing of new science curricula than older teachers.

Nearly twice as many participants (48.2%) agreed or strongly agreed that one individual must be responsible for distribution and replenishment of equipment if a program is to be maintained compared with 26.2% that disagreed or strongly disagreed. This information is shown in Table XLVII, p. 85.

As pointed out in Table XLVIII, p. 86, it would appear that science coordinators are more adept at helping beginning teachers with one to three years of experience. On the average, only 25.1% feel the science coordinator is a helpful resource person compared to 19.5% who indicated he is not.

TABLE XLII

PARTICIPANTS' RESPONSE TO THE STATEMENT: LACK OF SUPPORT AND ENTHUSIASM BY FELLOW TEACHERS IS A SERIOUS HINDRANCE TO THE DEVELOPMENT OF A GOOD SCIENCE PROGRAM

| Year of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 17.1 | 26.8 | 22.0 | 22.0 | 12.2 |
| 4-6 (62) | 19.4 | 22.6 | 32.3 | 17.7 | 8.1 |
| 7-9 (68) | 13.2 | 36.8 | 22.1 | 17.6 | 10.3 |
| 10-12 (51) | 15.7 | 31.4 | 15.7 | 29.4 | 7.8 |
| 13-15 (49) | 8.2 | 30.6 | 26.5 | 34.7 | 0.0 |
| 16-18 (28) | 14.3 | 35.7 | 17.9 | 21.4 | 10.7 |
| 19 or more (111) | 11.7 | 31.5 | 17.1 | 34.2 | 5.4 |
| Percentage responses by all participants responding (410) | 13.9 | 30.7 | 21.7 | 26.3 | 7.3 |

TABLE XLIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: INCIDENTAL NOISE AND PUPIL MOVEMENT DURING SCIENCE ACTIVITIES IS BOTHERSOME TO ME AS A TEACHER

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 7.3 | 4.9 | 7.3 | 56.1 | 24.4 |
| 4-6 (62) | 0.0 | 4.8 | 16.1 | 41.9 | 37.1 |
| 7-9 (68) | 1.5 | 7.4 | 16.2 | 48.5 | 26.5 |
| 10-12 (51) | 2.0 | 7.8 | 13.7 | 54.9 | 21.6 |
| 13-15 (49) | 0.0 | 6.1 | 16.3 | 51.0 | 26.5 |
| 16-18 (28) | 3.6 | 3.6 | 14.3 | 57.1 | 21.4 |
| 19 or more (111) | 1.8 | 0.9 | 16.2 | 58.6 | 22.5 |
| Percentage responses by all participants responding (410) | 2.0 | 4.6 | 14.9 | 52.7 | 25.9 |

TABLE XLIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: LACK OF SUPPORT AND ENTHUSIASM BY THE ADMINISTRATION IS A SERIOUS HINDRANCE TO THE DEVELOPMENT OF A GOOD SCIENCE PROGRAM

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 14.6 | 29.3 | 14.6 | 36.6 | 4.9 |
| 4-6 (62) | 11.3 | 21.0 | 29.0 | 24.2 | 14.5 |
| 7-9 (68) | 10.3 | 32.4 | 19.1 | 27.0 | 10.3 |
| 10-12 (51) | 7.8 | 29.4 | 27.5 | 29.4 | 5.9 |
| 13-15 (49) | 10.2 | 20.4 | 18.4 | 34.7 | 16.3 |
| 16-18 (28) | 17.9 | 14.3 | 21.4 | 35.7 | 10.7 |
| 19 or more (111) | 9.0 | 24.3 | 15.3 | 34.2 | 17.1 |
| Percentage responses by all participants responding (410) | 10.7 | 25.1 | 20.2 | 31.5 | 12.4 |

TABLE XLV

PARTICIPANTS' RESPONSE TO THE STATEMENT: NONACCEPTANCE OF INNOVATIVE PROGRAMS IN MY COMMUNITY PROVIDES A SERIOUS HINDRANCE WHEN TRYING TO IMPLEMENT A NEW PROGRAM

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 8.3 | 8.3 | 44.4 | 33.3 | 5.6 |
| 4-6 (62) | 3.7 | 11.1 | 22.2 | 50.0 | 13.0 |
| 7-9 (68) | 3.0 | 21.2 | 21.2 | 43.9 | 10.6 |
| 10-12 (51) | 4.0 | 6.0 | 30.0 | 54.0 | 6.0 |
| 13-15 (49) | 2.1 | 10.6 | 23.4 | 51.1 | 12.8 |
| 16-18 (28) | 3.7 | 18.5 | 22.2 | 44.4 | 11.1 |
| 19 or more (111) | 0.9 | 7.2 | 19.8 | 48.6 | 23.4 |
| Percentage responses by all participants responding (410) | 3.1 | 11.3 | 24.6 | 47.3 | 13.8 |

TABLE XLVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: COST OF NEW SCIENCE MATERIALS IS THE MAIN REASON MY SYSTEM IS NOT DOING MORE IN SCIENCE

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 12.2 | 26.8 | 26.8 | 31.7 | 2.4 |
| 4-6 (62) | 21.0 | 27.4 | 19.4 | 27.4 | 4.8 |
| 7-9 (68) | 16.2 | 22.1 | 17.6 | 38.2 | 5.9 |
| 10-12 (51) | 11.8 | 29.4 | 25.5 | 29.4 | 3.9 |
| 13-15 (49) | 4.1 | 26.5 | 18.4 | 36.7 | 14.3 |
| 16-18 (28) | 17.9 | 32.1 | 10.7 | 35.7 | 3.6 |
| 19 or more (111) | 8.1 | 18.0 | 18.9 | 34.2 | 20.7 |
| Percentage responses by all participants responding (410) | 12.4 | 24.4 | 19.8 | 33.4 | 10.0 |

TABLE XLVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: NEW SCIENCE PROGRAMS WILL NOT BE MAINTAINED UNLESS ONE INDIVIDUAL IN EACH BUILDING IS RESPONSIBLE FOR REPLENISHMENT AND DISTRIBUTION OF MATERIALS

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 2.8 | 50.0 | 19.4 | 25.0 | 2.8 |
| 4-6 (62) | 18.5 | 24.1 | 33.3 | 22.2 | 1.9 |
| 7-9 (68) | 13.6 | 43.9 | 24.2 | 18.2 | 0.0 |
| 10-12 (51) | 6.1 | 44.9 | 20.4 | 24.5 | 4.1 |
| 13-15 (49) | 12.8 | 29.8 | 31.9 | 23.4 | 2.1 |
| 16-18 (28) | 14.8 | 40.7 | 14.8 | 29.6 | 0.0 |
| 19 or more (111) | 10.8 | 32.4 | 27.0 | 27.0 | 2.7 |
| Percentage responses by all participants responding (410) | 11.5 | 36.7 | 25.6 | 24.1 | 2.1 |

TABLE XLVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: OUR SCHOOL SCIENCE COORDINATOR IS A GOOD SOURCE TO HELP SOLVE CLASSROOM PROBLEMS IN SCIENCE

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 4.9 | 29.3 | 41.5 | 17.1 | 7.3 |
| 4-6 (62) | 4.8 | 12.9 | 50.0 | 6.5 | 12.9 |
| 7-9 (68) | 7.4 | 16.2 | 52.9 | 11.8 | 8.8 |
| 10-12 (51) | 10.0 | 20.0 | 48.0 | 10.0 | 10.0 |
| 13-15 (49) | 10.2 | 8.2 | 55.1 | 14.3 | 10.2 |
| 16-18 (28) | 3.6 | 25.0 | 67.9 | 0.0 | 0.0 |
| 19 or more (111) | 6.3 | 20.7 | 53.2 | 10.8 | 9.0 |
| Percentage responses by all participants responding (410) | 6.8 | 18.3 | 52.1 | 10.5 | 9.0 |

Research Question Number Six

Do teachers with better science backgrounds rate the instruction of the workshops differently than those with poorer backgrounds in science?

To answer this question, responses for the first ten statements on the opinionnaire were sorted according to the biographical information on college science background.

The only general statement that can be made is that participants with better science backgrounds were somewhat less critical in their evaluation of the instruction.

It is interesting to note that 51% of the participants have had either one or less courses in biology, 63.9% have had one or less courses in physics, and 85.9% have had one or less courses in chemistry. This data is presented in previous tables IX, XI, XII, pp. 52 and 53. Additional data is presented in Appendix C.

One might infer that elementary teachers dislike teaching science because they have so little training in the subject.

Research Question Number Seven

What reasons do teachers give for attending science workshops?

In the tabulated biographical information, previously presented in Table XV, p. 55, over 55% of the participants responded that they were participating to improve their teaching skills. The other reasons given, to advance on the salary schedule, to complete a degree and to satisfy a professional requirement, were evenly shared, with the percentages being 13.3%, 12.6%, and 13.6%, respectively. This information is particularly important to those attempting to promote inservice workshops and supports evidence that teachers are more likely to engage in inservice activities if the information is primarily useful.

## Research Question Number Eight

Do teachers believe there should be separate workshops for lower and upper elementary teachers?

To gain data for this question, information was sorted into categories according to the grade level taught by the respondent. The information is presented in Table XLIX, p. 89.

It is interesting to note that 82.2% of the teachers at the primary level either agreed or strongly agreed that there should be separate programs. Upper elementary teachers responded similarly with 62.1% falling into the above category.

In smaller communities, it may not be feasible to offer separate programs, but when possible, perhaps portions of workshops should be offered separately to primary and upper elementary teachers. This is supported by the fact that 67.8% of all of the respondents either strongly agreed or agreed that separate training program should be employed.

## Research Question Number Nine

Do teachers of lower grades evaluate instructors and workshop structure differently than upper grade teachers?

For the purpose of obtaining data for this research question, participants were divided into five groups according to the grade level

TABLE XLIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL THERE SHOULD BE SEPARATE INSERVICE TRAINING PROGRAMS IN GRADES KINDERGARTEN THROUGH THREE AND GRADES FOUR THROUGH SIX

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 35.6 | 36.6 | 14.4 | 9.9 | 3.5 |
| 4-6 (177) | 19.2 | 42.9 | 17.5 | 14.1 | 6.2 |
| 7-9 (15) | 33.3 | 26.7 | 26.7 | 6.7 | 6.7 |
| 10-12 (10) | 00.0 | 60.0 | 30.0 | 10.0 | 00.0 |
| Other (5) | 20.0 | 00.0 | 20.0 | 40.0 | 20.0 |
| Percentage responses by all participants responding (409) | 27.2 | 39.6 | 16.5 | 11.9 | 4.9 |

taught. The primary concerns of this study were the first two groups, teachers of grades K-three and teachers of grades four-six, Responses concerning the first twenty-three questions were then presented in tabular form.

In general, the teacher of grades K-three responded less critically and more positively toward the quality of instruction and the structure of the workshops than those teachers of grades four-six. Nearly twice as many K-three teachers (35.6%) as teachers of grades four-six (19.2%) feel strongly that there should be separate programs for each group. Over three-fourths of both K through three and four through six teachers believe in separate inservice programs for each group.

This attitude may have developed because primary teachers have been required to participate in inservice programs that have not pertained to their grade level.

An overwhelming majority (70.9%) of teachers K through three either disagreed or strongly disagreed with the statement that teachers should not be required to participate in inservice activities.

As pointed out in Table LI, p. 91, upper elementary teachers (40.1%) felt more time should have been spent on implementation of the new curricula than primary teachers. Additional data not presented in this chapter are found in Appendix C.

Research Question Number Ten

Do workshop participants feel college credit should be offered for workshop activities?

The information for the answer to this question was gained by investigating responses given by male and female respondents sorted into groups according to the type of inservice program in which they participated.

Although local inservice programs and State Department of Education workshops usually did not carry college credit, 94.6% and 95.9%, respectively agreed or strongly agreed that college credit should be offered.

The largest groups of people that disagreed with college credit were male participants and participants in local inservice programs.

It would seem that college credit is a very strong incentive for inservice programs in science.

TABLE L

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE TIME SHOULD HAVE BEEN SPENT DISCUSSING PROBLEMS OF CLASSROOM IMPLEMENTATION OF NEW ELEMENTARY SCIENCE CURRICULA

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 4.0 | 29.7 | 25.7 | 32.7 | 7.9 |
| 4-6 (177) | 5.6 | 34.5 | 31.6 | 18.6 | 9.6 |
| 7-9 (15) | 6.7 | 20.0 | 33.3 | 26.7 | 13.3 |
| 10-12 (10) | 10.0 | 30.0 | 30.0 | 30.0 | 00.0 |
| Other (5) | 00.0 | 20.0 | 60.0 | 20.0 | 00.0 |
| Percentage responses by all participants responding (409) | 4.9 | 31.1 | 29.1 | 26.2 | 8.7 |

TABLE LI

PARTICIPANTS' RESPONSE TO THE STATEMENT: PERIODIC INSERVICE TRAINING IN SCIENCE SHOULD NOT BE REQUIRED OF TEACHERS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 4.5 | 4.5 | 17.3 | 45.5 | 28.2 |
| 4-6 (177) | 4.0 | 6.2 | 21.5 | 38.4 | 29.9 |
| 7-9 (15) | 00.0 | 13.3 | 13.3 | 26.7 | 46.7 |
| 10-12 (10) | 00.0 | 20.0 | 20.0 | 50.0 | 10.0 |
| Other (5) | 20.0 | 00.0 | 00.0 | 00.0 | 80.0 |
| Percentage responses by all participants responding (409) | 4.1 | 6.3 | 18.7 | 41.3 | 29.6 |

TABLE LII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL COLLEGE CREDIT SHOULD BE OFFERED FOR SCIENCE INSERVICE ACTIVITIES

| Sex | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Female (313) | 65.8 | 28.1 | 5.1 | 1.0 | 0.0 |
| Male (86) | 59.3 | 31.4 | 4.7 | 2.3 | 2.3 |
| Percentage responses by all participants responding | 62.4 | 28.4 | 5.1 | 1.0 | 0.7 |

TABLE LIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL COLLEGE CREDIT SHOULD BE OFFERED FOR SCIENCE INSERVICE ACTIVITIES

| Curricula | Strongly Agree | Agree | Nuetral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Summer school workshops (141) | 63.1 | 31.2 | 5.0 | 0.0 | 0.0 |
| Extension workshops (151) | 64.9 | 29.8 | 4.6 | 0.7 | 0.0 |
| Local inservice programs (55) | 65.5 | 29.1 | 3.6 | 1.8 | 0.0 |
| State Dept. of Education-- (49) Inservice programs | 67.3 | 28.6 | 4.1 | 0.0 | 0.0 |

## Research Question Number Eleven

How much time should be spent during inservice to prepare a teacher for a new science curriculum as perceived by participants and how does it vary for each of the four types of workshops?

The participants were separated into four groups according to the type of workshop in which they participated. The information for the question concerning the number of classroom hours of inservice instruction necessary to feel competent to begin teaching on the new program is shown in Table LIV, p. 94.

The data indicates that a greater number of inservice hours of instruction are needed in the summer school workshop followed by extension workshops, locally conducted workshops and with the least number by the State Department of Education. This may be interpreted in several ways. Perhaps summer workshops are less well organized and thus need more time. On the other hand, possibly they incorporated a more comprehensive treatment of the material.

The overall average for the total number of inservice hours is slightly over thirty.

## Research Question Number Twelve

Has the inservice experience resulted in changed classroom behavior as perceived by teachers?

To answer this question information was tabulated on questions numbered twenty through twenty-two.

Sixty-eight and one-half percent of the participants indicated they did not rely on their text as much as they had before the inservice.

TABLE LIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE TOTAL INSERVICE TIME NECESSARY FOR ONE TO FEEL COMPETENT TO BEGIN TEACHING SCIENCE USING ONE OF THE NEW CURRICULA WOULD BE:

| Curricula | Total Inservice Time (Hours) 10 | 20 | 30 | 40 | More than 40 hours |
|---|---|---|---|---|---|
| Summer school (141) | 7.23 | 19.28 | 25.3 | 23.4 | 13.2 |
| Extension (151) | 6.25 | 21.59 | 29.55 | 18.18 | 11.36 |
| Local school (55) | 6.25 | 37.50 | 34.38 | 6.25 | 9.38 |
| State Dept. (49) | 23.53 | 29.41 | 23.53 | 23.53 | |

TABLE LV

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FIND THAT I DO NOT RELY ON MY TEXTBOOK FOR SCIENCE AS MUCH AS I DID BEFORE THE SCIENCE INSERVICE

| Sex | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Female (323) | 26.8 | 41.2 | 23.6 | 7.0 | 1.3 |
| Male (91) | 25.0 | 45.0 | 21.2 | 6.3 | 2.5 |
| Percentage responses by all participants responding (414) | 26.5 | 42.0 | 23.2 | 6.9 | 1.5 |

TABLE LVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: SINCE MY INSERVICE SCIENCE EXPERIENCE MY SCIENCE CLASSES HAVE GREATER STUDENT INVOLVEMENT

| Sex | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Female (323) | 29.7 | 47.0 | 19.8 | 3.2 | 0.3 |
| Male (91) | 37.2 | 45.3 | 14.0 | 3.5 | 0.0 |
| Percentage responses by all participants responding (414) | 32.0 | 46.1 | 18.4 | 3.2 | 0.2 |

TABLE LVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE CONFIDENT ABOUT TEACHING SCIENCE BECAUSE OF THE INSERVICE SCIENCE EXPERIENCE

| Sex | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Female (323) | 30.7 | 48.6 | 16.6 | 3.8 | 0.3 |
| Male (91) | 32.6 | 46.5 | 15.1 | 4.7 | 1.2 |
| Percentage responses by all participants responding (414) | 30.0 | 47.3 | 16.0 | 4.6 | 1.7 |

Over three-fourths (78.1%) indicated greater student involvement and 77.3% indicated they were more confident about teaching science after the inservice experience.

Male and female participants responded almost identically to the questions analyzed for changed classroom behavior.

CHAPTER V

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Summary

The major purposes of this study were to compare the instruction and structure of four different types of inservice programs for new elementary science curricula: to determine resistance to innovative change as perceived by teachers, and: to gain biographical data on the background of the teachers participating in the programs. The following agencies cooperated closely by providing information and/or financial support for the study; the National Aeronautics and Space Administration, Oklahoma State University Research Foundation, St. Cloud State College, Bemidji State College, the Minnesota State Department of Education, Bagley (Minnesota) Public Schools, South St. Paul (Minnesota) Public Schools, and Wayzata (Minnesota) Public Schools.

Five hundred fifty elementary teachers in the state of Minnesota who attended at least one of the four types of workshops studied, comprised the population. Questionnaires were sent to all five hundred fifty to obtain the necessary data. Four hundred fourteen participants returned questionnaires. Data from all four hundred fourteen were used in this study.

## Conclusions and Recommendations

Information gained in the biographical section concerning background in science courses is condemning. It is recommended that a program be developed for the purpose of improving the background of teachers. It would seem logical that one cannot teach a subject unless one knows something of the structure and the factual knowledge of the subject.

The strengths far outweigh the weaknesses of the instruction in all four types of workshops. Instructors generally were well prepared and presented relevant material and at an appropriate level that fulfilled the objectives of the workshop. It would seem fitting that since the workshops in this study were conducted in a manner and philosophy similar to the inquiry approach employed in elementary science programs, future workshops would be well advised to use a similar approach. Instructors in future extension-type workshops in the area of science education would be well advised to incorporate more time in preparation for the class and also spend more time consulting with participants. These were two of the main weaknesses shown by the study.

The structure of the four types of workshops in this study were quite similar and well received. The study, however, points out several recommendations. First, when feasible, an attempt should be made to offer at least a portion of the workshop separately to teachers of kindergarten through grade three and for teachers of grades four through six. Particular emphasis on implementation of the entire program should be stressed more strongly for the upper elementary teachers. Physical facilities for extension workshops in science should be examined more closely by the instructor before the meeting of the first class. Also extension and local workshop instructors need to be much more cognizant of the needs of supplies for workshops. This would indicate more careful overall planning before the first meeting of the workshop.

An important point brought out by this investigation shows that workshops conducted by the State Department of Education and those conducted by colleges and universities during the summer were rated higher than those conducted by local school systems or college extension.

The points perceived as resistance to new programs should be noted. Teachers perceive smaller communities as more reluctant to innovate. Also teachers in smaller communities feel that inservice is more of a burden than teachers in larger communities. With these points in mind, smaller communities, particularly, should inform the citizenry and involve them in the planning of change and innovation. This perhaps could be accomplished, in part, by allowing certain parents and laymen to participate alongside teachers during inservice training activities. These persons could perhaps then serve as a resource group. Smaller schools would be well advised to assess community, as well as school demands, on outside teacher time before beginning any new inservice training program.

Because of the large number of negative responses to the value of curriculum consultants and science consultants, their function, usefulness, and value to the total educational program should be carefully examined and assessed. Working cooperatively, the State Department of Education, colleges and universities and school districts, should try to develop a minimum set of skills and competencies for qualifying for these positions. These positions can and should be important. They should merit the best personnel available.

It is interesting to note that lack of support and enthusiasm by fellow teachers is perceived more often as a problem than lack of support and enthusiasm by administrators. This point should be well taken by administrators attempting to adapt any of the new curriculum programs. Although a principal or a superintendent may be the change agent, he usually is responsive to the feelings of a majority of his faculty members. This point might possibly create further implications. Training individuals from a number of schools at summer school or extension workshops may not be as effective as the development of cells containing several teachers from each school. This point and the limits of the concept of leverage by teaching teacher-trainers are closely related and need further study.

The workshops evidently were successful as evidenced by a perceived changed behavior in over seventy-five percent of the participants. Teachers, although they indicate their main interest in attending was for improvement of teaching skills, overwhelmingly prefer college credit for inservice activities. The optimum length of time for science inservice for a new curriculum was perceived by the participants as approximately thirty classroom hours.

Areas for further study in the state of Minnesota include the gathering of biographical information on teachers not participating in these types of inservice activities investigated in this study. Since a large portion of the teachers in this study were motivated, because of self-initiated participation, it is likely that their backgrounds are better than average.

It is also recommended that a better coordinated effort be initiated in the area of not only science inservice education for teachers, but for all areas of inservice education.

Presently two agencies, the Department of Natural Resources and the State Department of Aeronautics are developing separate teacher inservice programs. These governmental agencies, as well as others, are vitally interested in this area. It would seem economically advisable and educationally advantageous if a special governor's committee were appointed for the intent purpose of instituting and coordinating teacher inservice education.

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APPENDIX A

PARTICIPANT QUESTIONNAIRE

## OPINIONNAIRE

Leaders in science education stress the importance of concepts, scientific method and attitudes. While progress has been made in most of these areas, much work must be directed toward the development and evaluation of inservice programs. The term, "science inservice activity" may refer to a summer or extension workshop, workshop activities conducted locally or by the Minnesota State Department of Education.

This instrument is designed to measure how you feel about inservice and science education. Please indicate your feelings by marking the response which indicates the degree with which you agree or disagree with each statement.

TABLE

SA-Strongly Agree A-Agree N-Neutral D-Disagree SD-Strongly Disagree

| | | SA | A | N | D | SD | |
|---|---|---|---|---|---|---|---|
| Example: | Scientists are interesting people. | = | = | X | = | = | |
| Workshop -- Instruction | | | | | | | |
| 1. | The workshop instructor was prepared for the class. | = | = | = | = | = | (1) |
| 2. | The instructor exhibited a comprehensive knowledge of his subject. | = | = | = | = | = | (2) |
| 3. | He used teaching methods which enabled me to achieve the objectives of the class. | = | = | = | = | = | (3) |
| 4. | He communicated effectively at levels appropriate to the preparedness of the student. | = | = | = | = | = | (4) |
| 5. | He encouraged independent thought by the student. | = | = | = | = | = | (5) |
| 6. | The workshop lacked a logical organization. | = | = | = | = | = | (6) |
| 7. | The instructor treated students with respect. | = | = | = | = | = | (7) |
| 8. | The instructor acknowledged all questions. | = | = | = | = | = | (8) |
| 9. | The instructor established a good rapport with the students. | = | = | = | = | = | (9) |
| 10. | The instructor was available for consultation with students. | = | = | = | = | = | (10) |

Questions 11-37 concern the science inservice activities in which you participated. New curricula refers to programs such as ESS, SCIS, and AAAS.

| | | SA | A | N | D | SD | |
|---|---|---|---|---|---|---|---|
| 11. | A sufficient supply of science equipment and materials was available for the inservice training. | = | = | = | = | = | (11) |
| 12. | The physical facilities (rooms, sinks, tables) were suitable for the inservice programs. | = | = | = | = | = | (12) |
| 13. | I feel college credit should be offered for science inservice activities. | = | = | = | = | = | (13) |
| 14. | I feel less time should have been spent on activities involving the use of materials, kits, and experiments. | = | = | = | = | = | (14) |
| 15. | I feel more time should have been spent on methods and techniques of science teaching. | = | = | = | = | = | (15) |
| 16. | I feel the workshop would have been more successful if we had studied more science content and subject matter. | = | = | = | = | = | (16) |
| 17. | I feel more time should have been spent discussing problems of classroom implementation of new elementary science curricula. | = | = | = | = | = | (17) |
| 18. | I feel more of the workshop time should have been spent developing new curriculum materials. | = | = | = | = | = | (18) |
| 19. | I feel there should be separate inservice training programs for teachers of science in grades K-3 and grades 4-6. | = | = | = | = | = | (19) |
| 20. | I find that I do not rely on my text book for science as much as I did before the inservice workshop. | = | = | = | = | = | (20) |
| 21. | Since my inservice science experience my science classes have greater student involvement. | = | = | = | = | = | (21) |
| 22. | I feel more confident and enthusiastic about teaching science because of the inservice science experience. | = | = | = | = | = | (22) |

| | SA | A | N | D | SD | |
|---|---|---|---|---|---|---|
| 23. Periodic inservice training in science should not be required of teachers. | = | = | = | = | = | (23) |

Questions 24-37 refer to your school, community and personal situation.

| | SA | A | N | D | SD | |
|---|---|---|---|---|---|---|
| 24. Broken and poor quality equipment were definite problems when trying to implement the new science curricula in my school. | = | = | = | = | = | (24) |
| 25. Inservice activities impose an unreasonable burden on most teachers. | = | = | = | = | = | (25) |
| 26. My elementary curriculum director is a good source to help solve classroom problems that develop in science. | = | = | = | = | = | (26) |
| 27. Lack of support and enthusiasm by fellow teachers is a serious hindrance to the development of a good science program. | = | = | = | = | = | (27) |
| 28. Incidental noise and pupil movement during science activities is bothersome to me as a teacher. | = | = | = | = | = | (28) |
| 29. Lack of support and enthusiasm by administration is a serious hindrance to the development of a good science program. | = | = | = | = | = | (29) |
| 30. Nonacceptance of innovative programs in my community provides a serious hindrance when trying to implement a new program. | = | = | = | = | = | (30) |
| 31. A professional library is very little help on inservice education since few teachers use one. | = | = | = | = | = | (31) |
| 32. Recent science text adoptions in my school pose a serious problem to implementing a new science curricula. | = | = | = | = | = | (32) |
| 33. Cost of new science materials is the main reason my system is not doing more in science. | = | = | = | = | = | (33) |
| 34. Teachers will participate in inservice programs even if they must pay their tuition expenses. | = | = | = | = | = | (34) |

| | SA | A | N | D | SD | |
|---|---|---|---|---|---|---|
| 35. New science programs will not be maintained unless one individual in each building is responsible for replenishment and distribution of materials. | = | = | = | = | = | (35) |
| 36. Authoritarian administrators who force teachers to participate in inservice programs present a serious problem to a successful implementation of a science program in my school. | = | = | = | = | = | (36) |
| 37. Our school science coordinator is a good source to help solve classroom problems in science. | = | = | = | = | = | (37) |

## Elementary Science Inservice Questionnaire

Please place an (x) in the most appropriate blank:

1. Grade you now teach

_____(a) Kindergarten
_____(b) 1st
_____(c) 2nd
_____(d) 3rd
_____(e) 4th
_____(f) 5th
_____(g) 6th
_____(h) 7-9
_____(i) 10-12
_____(j) Curriculum director or Science Supervisor
_____(k) Principal

2. Sex

_____(a) female
_____(b) male

3. The community in which you now teach could best be described as:

_____(a) Metropolitan - Inner-City (Minneapolis, St. Paul or Duluth)
_____(b) Suburban - Metropolitan Area (Minneapolis, St. Paul or Duluth)
_____(c) City other than Suburban, population 25,000-100,000
_____(d) City other than Suburban, population 10,000-24,000
_____(e) City other than Suburban, population 5,000-9,999
_____(f) City other than Suburban, population less than 5,000

4. Your present age

_____(a) 20-24
_____(b) 25-30
_____(c) 31-35
_____(d) 36-40
_____(e) 41-45
_____(f) 46-50
_____(g) 51-55
_____(h) 56-60
_____(i) over 60

5. My level of educational experience is:

_____(a) less than a Bachelors degree

_____(b) Bachelors degree

_____(c) Bachelors + 15 quarter hours

_____(d) Bachelors + 30 quarter hours

_____(e) Bachelors + 45 quarter hours

_____(f) Masters degree

_____(g) Masters degree + 15 quarter hours

_____(h) Masters degree + 30 quarter hours

_____(i) Masters degree + 45 quarter hours

6. Years of Teaching Experience

_____(a) 1-3

_____(b) 4-6

_____(c) 7-9

_____(d) 10-12

_____(e) 13-15

_____(f) 16-18

_____(g) 19 or more

7. At what level have you had most of your teaching experience

_____(a) K-3

_____(b) 4-6

_____(c) 7-9

_____(d) 10-12

_____(e) other

8. I normally teach science now on an average of

_____(a) 30 minutes or less per week

_____(b) 31-60 minutes per week

_____(c) 61-90 minutes per week

_____(d) 91-120 minutes per week

_____(e) 121-150 minutes per week

_____(f) 151-180 minutes per week

_____(g) more than 180 minutes per week

9. How many of the following courses have you taken since secondary school

Biology

_____(a) none
_____(b) one
_____(c) two
_____(d) three
_____(e) four or more

10. Earth-Space Science

_____(a) none
_____(b) one
_____(c) two
_____(d) three
_____(e) four or more

11. Physics

_____(a) none
_____(b) one
_____(c) two
_____(d) three
_____(e) four or more

12. Chemistry

_____(a) none
_____(b) one
_____(c) two
_____(d) three
_____(e) four or more

13. The Science In-service activities I participated in could best be categorized as:

_____(a) Summer School Workshops offered by colleges or universities
_____(b) Extension Workshops offered by the local school system by colleges or universities

_____(c) In-service programs conducted locally by the local school administration.

_____(d) Local in-service program conducted by the Minnesota Department of Education.

14. Workshops, courses or in-service activities I participated in included materials dealing primarily with:

_____(a) Science a Process Approach (AAAS)

_____(b) Elementary Science Study (ESS)

_____(c) Science Curriculum Improvement Study (SCIS)

_____(d) Composite of two or more of the above

_____(e) Other, please specify

15. My main reason for participating in the science in-service activity was:

_____(a) To advance on the salary schedule

_____(b) To complete a degree

_____(c) To satisfy a professional requirement, i.e., a minimum number of hours required by the school district or to keep professional certificate in force.

_____(d) To strengthen my teaching

_____(e) Other (please state)

16. The science in-service activity I participated in was:

_____(a) for college credit

_____(b) not for college credit but accepted by school district for salary schedule

_____(c) for neither college nor school district credit

17. From your previous experience, in your estimation, the necessary total in-service time required for a comfortable familiarization so that one would feel competent to begin teaching science using one of the newer curricula would be:

_____(a) 10 hours

_____(b) 20 hours

_____(c) 30 hours

_____(d) 40 hours

_____(e) more than forty hours

APPENDIX B

COVER LETTERS TO PARTICIPANTS

**OKLAHOMA STATE UNIVERSITY • STILLWATER**

Research Foundation
(405) 372-6211, Ext. 271

74074

March 17, 1972

Dear Colleague:

During the past several years, colleges, school districts, and the State Departments of Education have conducted science workshops in Minnesota. Many differences such as length, instruction, credit, content, etc., exist between these workshops.

In order to improve more relevancy in terms of real teacher needs, we are asking you to participate in an evaluation of past workshops to help in planning the future. This study is being conducted in cooperation with the Minnesota State Department of Education, the Oklahoma State University Research Foundation, and Bemidji State College.

In order to facilitate the study, would you please take a few minutes of your time and fill out the enclosed evaluation instrument. Simply staple the corners and mail as soon as possible. It has been pre-stamped for your convenience.

Needless to say, all information will be held in strict confidence.

Thank you for your cooperation.

Sincerely,

Duane L. Sea
Assistant Professor of Physics
Bemidji State College

Kenneth E. Wiggins
Associate Director
Research Foundation and
Chairman, Doctoral Committee

OKLAHOMA STATE UNIVERSITY • STILLWATER
Research Foundation
(405) 372-6211, Ext. 271
74074

May 12, 1972

Dear Fellow Colleague:

It has been a few weeks since we asked you to participate in an evaluation study of science workshops in Minnesota. According to our records we have not received a reply from you. We know how busy you must be, particularly at this time of the year. However, your information is vitally important to our study. Would you please take a few minutes and complete the questionnaire. We have included another copy for your convenience.

Thank you very much.

Sincerely,

Duane L. Sea
Assistant Professor of Physics
Bemidji State College

Kenneth E. Wiggins
Associate Director
Research Foundation and
Chairman, Doctoral Committee

Enc.

Oklahoma State University
EDUCATION AND RESEARCH FOUNDATION, INCORPORATED
Stillwater, Oklahoma 74074

Dec. 2, 1971

Mr. Richard Clark
State Science Consultant
State Department of Education
St. Paul, Minnesota

Dear Dick,

The purpose of this communication is to reinterate our telephone communication of November 28th. At that time I briefly described the nature of my doctoral dissertation study and the need for the following information:

1. A list of participants who have been involved in elementary science workshops conducted by the Minnesota State Department of Education.
2. A list of schools in Minnesota that have developed their own in-service program in elementary science.

Before sending out any questionnaires, I would like to have you examine and evaluated the instrument.

I greatly appreciate the extra effort on your behalf that is necessary in acquiring this information.

I am looking forward to again working with you in the near future. I have several ideas which I think you will find quite interesting.

Best wishes for a happy holiday season .

Cordially,

Duane L. Sea

**State of Minnesota**

Department of Education
Capitol Square, 550 Cedar Street
St. Paul, Minnesota 55101

January 11, 1972

Mr. Duane L. Sea
Oklahoma State University
Education and Research Foundation, Inc.
Stillwater, Oklahoma 74074

Dear Mr. Sea:

Enclosed is the information you requested in December. I hope that this list of participants will be of some help to you.

The colleges in Minnesota which have developed their own in-service program in elementary science and their directors are as follows: Southwest State-Stevins, St. Cloud State-Coulter, U of M-Johnson, Mankato-Darling, Morthfield and Minneapolis.

I am sorry for this information being delayed in getting to you. I hope that it will not be too late for your use.

Sincerely,

Barbara Carlson

Barbara Carlson, Secretary
Richard C. Clark
SCIENCE CONSULTANT

/bjc

encs.

BSC

BEMIDJI STATE COLLEGE

BEMIDJI, MINNESOTA 56601

218-755-2000

OFFICE OF THE REGISTRAR

218-755-2020

January 25, 1972

Duane L. Sea
Research Foundation
Oklahoma State University
Stillwater, Oklahoma 74074

Dear Duane,

It was nice to receive greetings from the land where I am sure you are more comfortable than we are. We trust that you are enjoying your studies at Stillwater.

Your request is receiving consideration and I think that we can comply with it. It is going to take a little work. Unfortunately none of the courses, because they are extension and workshop type courses, will be in our data processing bank. It will take a little special effort for some secretary to dig this out of our microfilm files. I hope that you do not have an immediate deadline to get this done.

Sincerely yours,

E. J. Aalberts
Registrar

EJA:lm

# APPENDIX C

# ORIGINAL DATA OF MINOR IMPORTANCE

TABLE LVIII

PARTICIPANTS'RESPONSE TO THE STATEMENT: HE ENCOURAGED INDEPENDENT THOUGHT BY THE STUDENT

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 53.2 | 37.6 | 6.4 | 2.1 | 0.7 | 0.97 |
| Extension workshops (151) | 49.7 | 43.0 | 6.0 | 0.7 | 0.7 | 0.97 |
| Local inservice programs (55) | 43.6 | 38.2 | 10.9 | 7.3 | 0.0 | 0.92 |
| State Dept. of Education--(49) Inservice programs | 57.1 | 40.8 | 2.0 | 0.0 | 0.0 | 1.0 |

TABLE LIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP LACKED LOGICAL ORGANIZATION

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 4.3 | 4.3 | 4.3 | 49.6 | 37.6 | 0.09 |
| Extension workshops (151) | 5.3 | 7.3 | 11.3 | 44.4 | 31.8 | 0.04 |
| Local inservice programs (55) | 0.0 | 10.9 | 5.5 | 50.9 | 32.7 | 0.15 |
| State Dept. of Education--(49) Inservice programs | 10.2 | 2.0 | 14.3 | 44.9 | 28.6 | 0.04 |

TABLE LX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR TREATED THE STUDENTS WITH RESPECT

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 69.5 | 27.0 | 1.4 | 1.4 | 0.7 | 0.98 |
| Extension workshops (151) | 57.6 | 39.1 | 3.3 | 0.0 | 0.0 | 1.0 |
| Local inservice programs (55) | 56.4 | 36.4 | 7.3 | 0.0 | 0.0 | 1.0 |
| State Dept. of Education-- (49) Inservice programs | 63.3 | 32.7 | 2.0 | 2.0 | 0.0 | 0.98 |

TABLE LXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR WAS AVAILABLE FOR CONSULTATION WITH THE STUDENTS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 38.3 | 48.9 | 9.9 | 2.8 | 0.0 | 0.97 |
| Extension workshops (151) | 33.1 | 45.0 | 16.6 | 4.0 | 1.3 | 0.94 |
| Local inservice programs (55) | 38.2 | 40.0 | 10.9 | 9.1 | 1.8 | 0.87 |
| State Dept. of Education--(49) Inservice programs | 38.8 | 46.9 | 12.2 | 2.0 | 0.0 | 0.97 |

TABLE LXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL COLLEGE CREDIT SHOULD BE OFFERED FOR SCIENCE INSERVICE ACTIVITIES

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 63.1 | 31.2 | 5.0 | 0.0 | 0.0 | 1.0 |
| Extension workshops (151) | 64.9 | 29.8 | 4.6 | 0.7 | 0.0 | 0.99 |
| Local inservice programs (55) | 65.5 | 29.1 | 3.6 | 1.8 | 0.0 | 0.98 |
| State Dept. of Education-- (49) Inservice programs | 67.3 | 28.6 | 4.1 | 0.0 | 0.0 | 1.0 |

TABLE LXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL LESS TIME SHOULD HAVE BEEN SPENT ON ACTIVITIES INVOLVING THE USE OF MATERIALS, KITS AND EXPERIMENTS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 2.1 | 4.3 | 4.3 | 46.1 | 42.6 | 0.07 |
| Extension workshops (151) | 1.3 | 2.6 | 8.6 | 38.4 | 49.0 | 0.04 |
| Local inservice programs (55) | 1.8 | 7.3 | 9.1 | 40.0 | 41.8 | 0.10 |
| State Dept. of Education-- (49) Inservice programs | 2.0 | 4.1 | 0.0 | 37.2 | 57.1 | 0.02 |

TABLE LXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE TIME SHOULD HAVE BEEN SPENT ON METHODS AND TECHNIQUES OF SCIENCE TEACHING

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 4.3 | 21.3 | 29.8 | 34.0 | 10.6 | 0.37 |
| Extension workshops (151) | 9.3 | 18.5 | 29.1 | 33.8 | 9.3 | 0.39 |
| Local inservice programs (55) | 5.5 | 25.5 | 27.3 | 30.9 | 10.9 | 0.42 |
| State Dept. of Education-- (49) Inservice programs | 0.0 | 18.4 | 36.7 | 24.5 | 20.4 | 0.29 |

TABLE LXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL THE WORKSHOP WOULD HAVE BEEN MORE SUCCESSFUL IF WE HAD STUDIED MORE SCIENCE CONTENT AND SUBJECT MATTER

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 0.0 | 7.8 | 17.0 | 52.5 | 22.7 | 0.09 |
| Extension workshops (151) | 2.6 | 5.3 | 20.5 | 53.6 | 17.9 | 0.10 |
| Local inservice programs (55) | 1.8 | 12.7 | 21.8 | 47.3 | 16.4 | 0.21 |
| State Dept. of Education-- (49) Inservice programs | 2.0 | 2.0 | 18.4 | 40.8 | 36.7 | 0.05 |

TABLE LXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE OF THE WORKSHOP TIME SHOULD HAVE BEEN SPENT ON DEVELOPING NEW CURRICULUM MATERIALS

| Curricula | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Index Value |
|---|---|---|---|---|---|---|
| Summer school workshops (141) | 0.0 | 9.2 | 23.4 | 53.9 | 13.5 | 0.03 |
| Extension workshops (151) | 2.0 | 12.6 | 27.2 | 40.4 | 17.9 | 0.23 |
| Local inservice programs (55) | 0.0 | 12.7 | 20.0 | 47.3 | 20.0 | 0.16 |
| State Dept. of Education-- (49) Inservice programs | 0.0 | 6.1 | 18.4 | 42.9 | 32.7 | 0.08 |

TABLE LXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: BROKEN AND POOR QUALITY EQUIPMENT WERE DEFINITE PROBLEMS WHEN TRYING TO IMPLEMENT THE NEW SCIENCE CURRICULA IN MY SCHOOL

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 0.0 | 0.0 | 75.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 3.4 | 19.3 | 14.8 | 42.0 | 20.5 |
| City other than suburban-population (25,000-100,000) (8) | 25.0 | 12.5 | 12.5 | 37.5 | 12.5 |
| City other than suburban-population (10,000-24,000) (58) | 3.4 | 20.7 | 15.5 | 34.5 | 25.9 |
| City other than suburban-population (5,000-9,999) (67) | 11.9 | 23.9 | 22.4 | 35.8 | 6.0 |
| City other than suburban-population (less than 5,000) (164) | 12.8 | 25.6 | 24.4 | 28.7 | 8.5 |
| Percentage responses by all participants responding (389) | 9.5 | 22.6 | 20.1 | 34.4 | 13.4 |

TABLE LXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: INCIDENTAL NOISE AND PUPIL MOVEMENT DURING SCIENCE ACTIVITIES IS BOTHERSOME TO ME AS A TEACHER

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 0.0 | 0.0 | 25.0 | 25.0 | 50.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 1.1 | 2.3 | 12.5 | 55.7 | 28.4 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 12.5 | 12.5 | 75.0 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 1.7 | 3.4 | 13.8 | 51.7 | 29.3 |
| City other than suburban-population (5,000-9,999) (67) | 0.0 | 6.0 | 16.4 | 47.8 | 29.9 |
| City other than suburban-population (less than 5,000) (164) | 1.8 | 3.7 | 16.5 | 54.9 | 23.2 |
| Percentage responses by all participants responding (389) | 1.3 | 3.9 | 15.2 | 53.5 | 26.2 |

TABLE LXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: A PROFESSIONAL LIBRARY IS VERY LITTLE HELP TO INSERVICE EDUCATION SINCE VERY FEW TEACHERS USE ONE

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 25.0 | 25.0 | 0.0 | 25.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 4.5 | 19.3 | 30.7 | 34.1 | 11.4 |
| City other than suburban-population (25,000-100,000) (8) | 12.5 | 12.5 | 25.0 | 50.0 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 3.4 | 10.3 | 24.1 | 46.6 | 15.5 |
| City other than suburban-population (5,00-9,999) (67) | 3.0 | 23.9 | 20.9 | 40.3 | 11.9 |
| City other than suburban-population (less than 5,000) (164) | 1.2 | 14.0 | 34.1 | 40.2 | 10.4 |
| Percentage responses by all participants responding (389) | 3.1 | 16.5 | 29.3 | 30.6 | 11.6 |

TABLE LXX

PARTICIPANTS' RESPONSE TO THE STATEMENT: RECENT SCIENCE TEXT ADOPTIONS IN MY SCHOOL POSE A SERIOUS PROBLEM TO IMPLEMENTING A NEW SCIENCE CURRICULA

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 25.0 | 25.0 | 0.0 | 25.0 | 25.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 3.4 | 3.4 | 19.3 | 45.5 | 28.4 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 0.0 | 12.5 | 62.5 | 25.0 |
| City other than suburban-population (10,000-24,000) (58) | 1.7 | 3.4 | 25.9 | 46.6 | 22.4 |
| City other than suburban-population (5,000-9,999) (67) | 3.0 | 7.5 | 25.4 | 49.3 | 14.9 |
| City other than suburban-population (less than 5,000) (164) | 2.4 | 16.5 | 22.0 | 46.3 | 12.8 |
| Percentage responses by all participants responding (389) | 2.8 | 9.8 | 22.1 | 46.8 | 18.5 |

TABLE LXXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: COST OF NEW SCIENCE MATERIALS IS THE MAIN REASON MY SYSTEM IS NOT DOING MORE IN SCIENCE

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 50.0 | 50.0 | 0.0 | 0.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 14.8 | 23.9 | 17.0 | 33.0 | 11.4 |
| City other than suburban-population (25,000-100,000) (8) | 00.0 | 25.0 | 25.0 | 25.0 | 25.0 |
| City other than suburban-population (10,000-24,000) (58) | 8.6 | 8.6 | 22.4 | 41.4 | 19.0 |
| City other than suburban-population (5,000-9,999) (67) | 10.4 | 20.9 | 35.8 | 23.9 | 9.0 |
| City other than suburban-population (less than 5,000) (164) | 13.4 | 29.3 | 14.0 | 36.6 | 6.7 |
| Percentage responses by all participants responding (389) | 12.6 | 23.7 | 19.8 | 33.7 | 10.3 |

TABLE LXXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: TEACHERS WILL PARTICIPATE IN INSERVICE PROGRAMS EVEN IF THEY MUST PAY THEIR TUITION EXPENSES

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth (88) | 11.4 | 55.7 | 19.3 | 11.4 | 2.3 |
| City other than suburban-population (25,000-100,000) (8) | 0.0 | 25.0 | 37.5 | 37.5 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 8.6 | 39.7 | 34.5 | 13.8 | 3.4 |
| City other than suburban-population (5,000-9,999) (67) | 7.5 | 43.3 | 28.4 | 17.9 | 3.0 |
| City other than suburban-population (less than 5,000) (164) | 6.1 | 51.8 | 20.1 | 17.1 | 4.9 |
| Percentage responses by all participants responding (389) | 7.7 | 48.8 | 24.2 | 15.7 | 3.6 |

TABLE LXXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: OUR SCHOOL SCIENCE COORDINATOR IS A GOOD SOURCE TO HELP SOLVE CLASSROOM PROBLEMS IN SCIENCE

| Community | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Metropolitan-Inner-city (Mpls., St. Paul, or Duluth) (4) | 50.0 | 0.0 | 50.0 | 0.0 | 0.0 |
| Suburban-Metropolitan Area (Mpls., St. Paul, or Duluth) (88) | 5.7 | 29.5 | 38.6 | 11.4 | 14.8 |
| City other than suburban-population (25,000-100,000) (8) | 12.5 | 37.5 | 25.0 | 25.0 | 0.0 |
| City other than suburban-population (10,000-24,000) (58) | 8.6 | 10.3 | 62.1 | 6.9 | 12.1 |
| City other than suburban-population (5,000-9,999) (67) | 13.4 | 13.4 | 53.7 | 10.4 | 9.0 |
| City other than suburban-population (less than 5,000) (164) | 3.7 | 18.3 | 60.4 | 11.0 | 6.1 |
| Percentage response by all participants responding (389) | 7.2 | 19.0 | 53.7 | 10.5 | 9.3 |

TABLE LXXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: A PROFESSIONAL LIBRARY IS VERY LITTLE HELP TO INSERVICE EDUCATION SINCE FEW TEACHERS USE ONE

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 2.4 | 22.0 | 24.4 | 41.5 | 9.8 |
| 4-6 (62) | 6.5 | 11.3 | 25.8 | 41.9 | 14.5 |
| 7-9 (68) | 2.9 | 20.6 | 38.2 | 27.9 | 10.3 |
| 10-12 (51) | 2.0 | 17.6 | 37.3 | 35.3 | 7.8 |
| 13-15 (49) | 4.1 | 12.2 | 24.5 | 53.1 | 6.1 |
| 16-18 (28) | 0.0 | 7.1 | 35.7 | 35.7 | 21.4 |
| 19 or more (111) | 1.8 | 19.8 | 25.2 | 38.7 | 14.4 |
| Percentage responses by all participants responding (410) | 2.9 | 16.8 | 29.5 | 38.8 | 12.0 |

TABLE LXXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: RECENT SCIENCE TEXT ADOPTIONS IN MY SCHOOL POSE A SERIOUS PROBLEM TO IMPLEMENTING A NEW SCIENCE CURRICULA

| Years of Teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 4.9 | 7.3 | 24.4 | 53.7 | 9.8 |
| 4-6 (62) | 3.2 | 11.3 | 30.6 | 35.5 | 19.4 |
| 7-9 (68) | 0.0 | 5.9 | 30.9 | 42.6 | 20.6 |
| 10-12 (51) | 3.9 | 9.8 | 17.6 | 56.9 | 11.8 |
| 13-15 (49) | 0.0 | 10.2 | 18.4 | 53.1 | 18.4 |
| 16-18 (28) | 3.6 | 21.4 | 25.0 | 35.7 | 14.3 |
| 19 or more (111) | 3.6 | 11.7 | 13.5 | 47.7 | 23.4 |
| Percentage responses by all participants responding (410) | 2.7 | 10.5 | 22.0 | 46.6 | 18.3 |

TABLE LXXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: TEACHERS WILL PARTICIPATE IN INSERVICE PROGRAMS EVEN IF THEY MUST PAY THEIR TUITION EXPENSES

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 9.8 | 43.9 | 31.7 | 14.6 | 0.0 |
| 4-6 (62) | 8.1 | 45.2 | 25.8 | 19.4 | 1.6 |
| 7-9 (68) | 13.2 | 50.0 | 17.6 | 19.1 | 0.0 |
| 10-12 (51) | 12.0 | 52.0 | 22.0 | 12.0 | 2.0 |
| 13-15 (49) | 4.1 | 53.1 | 20.4 | 14.3 | 8.2 |
| 16-18 (28) | 3.6 | 46.4 | 21.4 | 21.4 | 7.1 |
| 19 or more (111) | 5.4 | 50.5 | 26.1 | 11.7 | 6.3 |
| Percentage responses by all participants responding (410) | 8.1 | 49.1 | 23.7 | 15.4 | 3.7 |

TABLE LXXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: AUTHORITARIAN ADMINISTRATORS WHO FORCE TEACHERS TO PARTICIPATE IN INSERVICE PROGRAMS PRESENT A SERIOUS PROBLEM TO A SUCCESSFUL IMPLEMENTATION OF A SCIENCE PROGRAM IN MY SCHOOL

| Years of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1-3 (41) | 4.9 | 19.5 | 36.6 | 31.7 | 7.3 |
| 4-6 (62) | 9.7 | 22.6 | 35.5 | 24.4 | 8.1 |
| 7-9 (68) | 8.8 | 14.7 | 39.7 | 33.8 | 2.9 |
| 10-12 (51) | 6.0 | 22.0 | 28.0 | 34.0 | 10.0 |
| 13-15 (49) | 0.0 | 12.2 | 32.7 | 40.8 | 12.2 |
| 16-18 (28) | 0.0 | 21.4 | 32.1 | 35.7 | 10.7 |
| 19 or more (111) | 4.5 | 15.3 | 27.0 | 40.5 | 12.6 |
| Percentage responses by all participants responding (410) | 5.4 | 17.6 | 32.5 | 35.0 | 9.3 |

TABLE LXXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS PREPARED FOR THE CLASS

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 58.6 | 34.5 | 5.2 | 1.7 | 0.0 |
| One (134) | 58.2 | 38.1 | 3.7 | 0.0 | 0.0 |
| Two (108) | 57.4 | 36.1 | 4.6 | 1.9 | 0.0 |
| Three (79) | 51.9 | 48.1 | 0.0 | 0.0 | 0.0 |
| Four or more (35) | 62.9 | 34.3 | 0.0 | 2.9 | 0.0 |
| Percentage responses by all participants responding (414) | 57.2 | 38.6 | 3.1 | 1.0 | 0.0 |

TABLE LXXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR EXHIBITED A COMPREHENSIVE KNOWLEDGE OF HIS SUBJECT

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 62.1 | 34.5 | 3.4 | 0.0 | 0.0 |
| One (134) | 61.9 | 35.1 | 2.2 | 0.7 | 0.0 |
| Two (108) | 63.9 | 27.8 | 6.5 | 1.9 | 0.0 |
| Three (79) | 62.0 | 35.4 | 2.5 | 0.0 | 0.0 |
| Four or more (35) | 65.7 | 25.7 | 5.7 | 2.9 | 0.0 |
| Percentage responses by all participants responding (414) | 62.8 | 32.4 | 3.9 | 1.0 | 0.0 |

TABLE LXXX

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE USED TEACHING METHODS WHICH ENABLED ME TO ACHIEVE THE OBJECTIVES OF THE CLASS

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 43.1 | 48.3 | 6.9 | 0.0 | 1.7 |
| One (134) | 50.0 | 44.0 | 5.2 | 0.7 | 0.0 |
| Two (108) | 48.1 | 41.7 | 6.5 | 1.9 | 1.9 |
| Three (79) | 48.1 | 48.1 | 3.8 | 0.0 | 0.0 |
| Four or more (35) | 54.3 | 37.1 | 5.7 | 2.9 | 0.0 |
| Percentage responses by all participants responding (414) | 48.6 | 44.2 | 5.6 | 1.0 | 0.7 |

TABLE LXXXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE COMMUNICATED EFFECTIVELY AT LEVELS APPROPRIATE TO THE PREPAREDNESS OF THE STUDENT

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 48.3 | 43.1 | 6.9 | 0.0 | 1.7 |
| One (134) | 53.0 | 39.6 | 5.2 | 2.2 | 0.0 |
| Two (108) | 49.1 | 38.0 | 8.3 | 1.9 | 2.8 |
| Three (79) | 43.0 | 43.0 | 12.7 | 1.3 | 0.0 |
| Four or more (35) | 51.4 | 42.9 | 5.7 | 0.0 | 0.0 |
| Percentage responses by all participants responding (414) | 49.3 | 40.6 | 7.7 | 1.4 | 1.0 |

TABLE LXXXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE ENCOURAGED INDEPENDENT THOUGHT BY THE STUDENT

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 49.1 | 43.6 | 5.5 | 1.8 | 0.0 |
| One (134) | 50.8 | 39.8 | 7.8 | 1.6 | 0.0 |
| Two (108) | 52.0 | 37.3 | 5.9 | 3.9 | 1.0 |
| Three (79) | 48.0 | 42.7 | 6.7 | 1.3 | 1.3 |
| Four or more (35) | 60.0 | 37.1 | 2.9 | 0.0 | 0.0 |
| Percentage responses by all participants responding (414) | 51.1 | 40.0 | 6.3 | 2.0 | 0.5 |

TABLE LXXXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP LACKED LOGICAL ORGANIZATION

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 6.9 | 6.9 | 6.9 | 51.7 | 27.6 |
| One (134) | 6.7 | 8.2 | 10.4 | 41.8 | 32.8 |
| Two (108) | 10.2 | 5.6 | 10.2 | 43.5 | 30.6 |
| Three (79) | 11.4 | 3.8 | 5.1 | 50.6 | 29.1 |
| Four or more (35) | 5.7 | 8.6 | 0.0 | 40.0 | 45.7 |
| Percentage responses by all participants responding (414) | 8.5 | 6.5 | 8.0 | 45.2 | 31.9 |

TABLE LXXXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR TREATED THE STUDENTS WITH RESPECT

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 51.7 | 41.4 | 5.2 | 1.7 | 0.0 |
| One (134) | 67.9 | 29.9 | 2.2 | 0.0 | 0.0 |
| Two (108) | 61.1 | 34.3 | 2.8 | 0.9 | 0.9 |
| Three (79) | 59.5 | 36.7 | 3.8 | 0.0 | 0.0 |
| Four or more (35) | 62.9 | 34.3 | 0.0 | 2.9 | 0.0 |
| Percentage responses by all participants responding (414) | 61.8 | 34.3 | 2.9 | 0.7 | 0.2 |

TABLE LXXXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ACKNOWLEDGED ALL QUESTIONS

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 43.1 | 50.0 | 5.2 | 1.7 | 0.0 |
| One (134) | 54.5 | 39.6 | 4.5 | 1.5 | 0.0 |
| Two (108) | 50.0 | 43.5 | 4.6 | 1.9 | 0.0 |
| Three (79) | 53.2 | 41.8 | 5.1 | 0.0 | 0.0 |
| Four or more (35) | 51.4 | 37.1 | 8.6 | 2.9 | 0.0 |
| Percentage responses by all participants responding (414) | 51.2 | 42.3 | 5.1 | 1.4 | 0.0 |

TABLE LXXXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ESTABLISHED A GOOD RAPPORT WITH THE STUDENTS

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 63.8 | 29.3 | 6.9 | 0.0 | 0.0 |
| One (134) | 66.4 | 29.1 | 3.0 | 0.7 | 0.7 |
| Two (108) | 63.0 | 32.4 | 2.8 | 0.9 | 0.9 |
| Three (79) | 59.5 | 34.2 | 6.3 | 0.0 | 0.0 |
| Four or more (35) | 71.4 | 22.9 | 5.7 | 0.0 | 0.0 |
| Percentage responses by all participants responding (414) | 64.3 | 30.4 | 4.3 | 0.5 | 0.5 |

TABLE LXXXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR WAS AVAILABLE FOR CONSULTATION WITH STUDENTS

| No. of courses in Biology | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (58) | 30.9 | 45.5 | 18.2 | 5.5 | 0.0 |
| One (134) | 35.9 | 49.2 | 11.7 | 3.1 | 0.0 |
| Two (108) | 32.4 | 43.1 | 15.7 | 6.9 | 2.0 |
| Three (79) | 38.7 | 46.7 | 13.3 | 1.3 | 0.0 |
| Four or more (35) | 51.4 | 42.9 | 0.0 | 2.9 | 2.9 |
| Percentage responses by all participants responding (414) | 36.2 | 46.1 | 12.9 | 4.1 | 0.8 |

TABLE LXXXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS PREPARED FOR THE CLASS

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 48.7 | 47.0 | 3.4 | 0.9 | 0.0 |
| One (146) | 61.6 | 34.9 | 2.1 | 1.4 | 0.0 |
| Two (92) | 57.6 | 37.0 | 4.3 | 1.1 | 0.0 |
| Three (34) | 70.6 | 29.4 | 0.0 | 0.0 | 0.0 |
| Four or more (22) | 59.1 | 31.8 | 9.1 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 57.7 | 38.2 | 3.2 | 1.0 | 0.0 |

TABLE LXXXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR EXHIBITED A COMPREHENSIVE KNOWLEDGE OF HIS SUBJECT

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 58.1 | 36.8 | 4.3 | 0.9 | 0.0 |
| One (146) | 67.8 | 26.7 | 4.1 | 1.4 | 0.0 |
| Two (92) | 59.8 | 33.7 | 5.4 | 1.1 | 0.0 |
| Three (34) | 67.6 | 32.4 | 0.0 | 0.0 | 0.0 |
| Four or more (22) | 63.3 | 36.4 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 63.0 | 32.1 | 3.9 | 1.0 | 0.0 |

TABLE XC

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE USED TEACHING METHODS WHICH ENABLED ME TO ACHIEVE THE OBJECTIVES OF THE CLASS

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 47.9 | 43.6 | 6.0 | 0.9 | 1.7 |
| One (146) | 50.7 | 43.2 | 4.1 | 1.4 | 0.7 |
| Two (92) | 40.2 | 50.0 | 8.7 | 1.1 | 0.0 |
| Three (34) | 58.8 | 38.2 | 2.9 | 0.0 | 0.0 |
| Four or more (22) | 59.1 | 36.4 | 4.5 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 48.7 | 44.0 | 5.6 | 1.0 | 0.7 |

TABLE XCI

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE COMMUNICATED EFFECTIVELY AT LEVELS APPROPRIATE TO THE PREPAREDNESS OF THE STUDENT

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 46.2 | 40.2 | 10.3 | 0.9 | 2.6 |
| One (146) | 50.0 | 42.1 | 6.8 | 1.4 | 0.7 |
| Two (92) | 48.9 | 42.4 | 5.4 | 3.3 | 0.0 |
| Three (34) | 61.8 | 26.5 | 11.8 | 0.0 | 0.0 |
| Four or more (22) | 45.5 | 50.0 | 4.5 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 49.4 | 40.0 | 7.8 | 1.5 | 1.0 |

TABLE XCII

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE ENCOURAGED INDEPENDENT THOUGHT BY THE STUDENT

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 47.7 | 38.7 | 9.9 | 3.6 | 0.0 |
| One (146) | 54.0 | 39.6 | 4.3 | 0.7 | 1.4 |
| Two (92) | 50.0 | 40.9 | 5.7 | 3.4 | 0.0 |
| Three (34) | 60.6 | 33.3 | 6.1 | 0.0 | 0.0 |
| Four or more (22) | 45.5 | 50.0 | 4.5 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 51.4 | 39.7 | 6.4 | 2.0 | 0.5 |

TABLE XCIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP LACKED LOGICAL ORGANIZATION

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 8.5 | 4.3 | 10.3 | 43.6 | 33.3 |
| One (146) | 12.3 | 6.8 | 6.8 | 44.5 | 29.5 |
| Two (92) | 5.4 | 9.8 | 12.0 | 48.9 | 23.9 |
| Three (34) | 2.9 | 0.0 | 0.0 | 44.1 | 52.9 |
| Four or more (22) | 0.0 | 13.6 | 0.0 | 40.9 | 45.5 |
| Percentage responses by all participants responding (411) | 8.3 | 6.6 | 8.0 | 45.0 | 32.1 |

TABLE XCIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR TREATED THE STUDENTS WITH RESPECT

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 53.8 | 40.2 | 6.0 | 0.0 | 0.0 |
| One (146) | 67.8 | 30.8 | 0.7 | 0.0 | 0.7 |
| Two (92) | 62.0 | 30.4 | 4.3 | 3.3 | 0.0 |
| Three (34) | 67.6 | 32.4 | 0.0 | 0.0 | 0.0 |
| Four of more (22) | 54.5 | 45.5 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 61.8 | 34.3 | 2.9 | 0.7 | 0.2 |

TABLE XCV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ACKNOWLEDGED ALL QUESTIONS

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 48.7 | 41.0 | 8.5 | 1.7 | 0.0 |
| One (146) | 54.1 | 41.8 | 2.7 | 1.4 | 0.0 |
| Two (92) | 51.1 | 43.5 | 4.3 | 1.1 | 0.0 |
| Three (34) | 58.8 | 35.3 | 2.9 | 2.9 | 0.0 |
| Four or more (22) | 36.4 | 54.5 | 9.1 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 51.3 | 42.1 | 5.1 | 1.5 | 0.0 |

TABLE XCVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ESTABLISHED A GOOD RAPPORT WITH THE STUDENTS

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 60.7 | 33.3 | 6.0 | 0.0 | 0.0 |
| One (146) | 67.1 | 28.1 | 2.7 | 1.4 | 0.7 |
| Two (92) | 65.2 | 27.2 | 6.5 | 0.0 | 1.1 |
| Three (34) | 64.7 | 35.3 | 0.0 | 0.0 | 0.0 |
| Four or more (22) | 68.2 | 27.3 | 4.5 | 0.0 | 0.0 |
| Percentage responses by all participants responding (411) | 64.7 | 29.9 | 4.4 | 0.5 | 0.5 |

TABLE XCVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR WAS AVAILABLE FOR CONSULTATION WITH STUDENTS

| No. of courses in Earth-Space Science | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (117) | 36.0 | 45.9 | 12.6 | 4.5 | 0.9 |
| One (146) | 33.1 | 48.2 | 12.9 | 5.0 | 0.7 |
| Two (92) | 33.0 | 47.7 | 15.9 | 2.3 | 1.1 |
| Three (34) | 45.5 | 45.5 | 9.1 | 0.0 | 0.0 |
| Four or more (22) | 54.5 | 27.3 | 9.1 | 9.1 | 0.0 |
| Percentage responses by all participants responding (411) | 36.1 | 46.1 | 13.0 | 4.1 | 0.8 |

TABLE XCVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS PREPARED FOR THE CLASS

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 55.0 | 41.4 | 3.2 | 0.5 | 0.0 |
| One (133) | 61.7 | 33.1 | 4.5 | 0.8 | 0.0 |
| Two (35) | 54.3 | 40.0 | 0.0 | 5.7 | 0.0 |
| Three (16) | 68.8 | 31.3 | 0.0 | 0.0 | 0.0 |
| Four or more (7) | 42.9 | 57.1 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 57.4 | 38.5 | 3.1 | 1.0 | 0.0 |

TABLE XCIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR EXHIBITED A COMPREHENSIVE KNOWLEDGE OF HIS SUBJECT

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 62.6 | 34.2 | 2.7 | 0.5 | 0.0 |
| One (133) | 64.7 | 30.1 | 4.5 | 0.8 | 0.0 |
| Two (35) | 57.1 | 28.6 | 8.6 | 5.7 | 0.0 |
| Three (16) | 68.8 | 31.3 | 0.0 | 0.0 | 0.0 |
| Four or more (7) | 57.1 | 28.6 | 14.3 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 63.0 | 32.2 | 3.9 | 1.0 | 0.0 |

TABLE C

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE USED TEACHING METHODS WHICH ENABLED ME TO ACHIEVE THE OBJECTIVES OF THE CLASS

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 45.5 | 46.8 | 6.8 | 0.0 | 0.9 |
| One (133) | 51.1 | 41.4 | 5.3 | 1.5 | 0.8 |
| Two (35) | 54.3 | 37.1 | 2.9 | 5.7 | 0.0 |
| Three (16) | 56.3 | 43.8 | 0.0 | 0.0 | 0.0 |
| Four or more (7) | 57.1 | 42.9 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 48.7 | 44.1 | 5.6 | 1.0 | 0.7 |

TABLE CI

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE COMMUNICATED EFFECTIVELY AT LEVELS APPROPRIATE TO THE PREPAREDNESS OF THE STUDENT

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 50.9 | 40.5 | 6.8 | 0.5 | 1.4 |
| One (133) | 47.4 | 41.4 | 9.0 | 1.5 | 0.8 |
| Two (35) | 45.7 | 40.0 | 5.7 | 8.6 | 0.0 |
| Three (16) | 68.8 | 18.8 | 12.5 | 0.0 | 0.0 |
| Four or more (7) | 14.3 | 71.4 | 14.3 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 49.4 | 40.4 | 7.7 | 1.5 | 1.0 |

TABLE CII

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE ENCOURAGED INDEPENDENT THOUGHT BY THE STUDENT

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 47.0 | 44.2 | 5.6 | 2.8 | 0.5 |
| One (133) | 58.6 | 32.8 | 7.0 | 0.8 | 0.8 |
| Two (35) | 50.0 | 37.5 | 9.4 | 3.1 | 0.0 |
| Three (16) | 64.3 | 28.6 | 7.1 | 0.0 | 0.0 |
| Four or more (7) | 20.0 | 80.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 51.3 | 39.8 | 6.3 | 2.0 | 0.5 |

TABLE CIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP LACKED LOGICAL ORGANIZATION

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 8.1 | 5.9 | 9.9 | 44.6 | 31.5 |
| One (133) | 8.3 | 6.0 | 7.5 | 42.1 | 36.1 |
| Two (35) | 8.6 | 14.3 | 0.0 | 51.4 | 25.7 |
| Three (16) | 12.5 | 0.0 | 6.3 | 56.3 | 25.0 |
| Four or more (7) | 14.3 | 14.3 | 0.0 | 57.1 | 14.3 |
| Percentage responses by all participants responding (413) | 8.5 | 6.5 | 8.0 | 45.0 | 32.0 |

TABLE CIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR TREATED THE STUDENTS WITH RESPECT

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 61.7 | 36.5 | 1.4 | 0.5 | 0.0 |
| One (133) | 58.6 | 34.6 | 6.0 | 0.0 | 0.8 |
| Two (35) | 68.6 | 22.9 | 2.9 | 5.7 | 0.0 |
| Three (16) | 87.5 | 12.5 | 0.0 | 0.0 | 0.0 |
| Four or more (7) | 28.6 | 71.4 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 61.7 | 34.4 | 2.9 | 0.7 | 0.2 |

TABLE CV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ACKNOWLEDGED ALL QUESTIONS

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 51.4 | 43.7 | 4.1 | 0.9 | 0.0 |
| One (133) | 48.9 | 42.1 | 7.5 | 1.5 | 0.0 |
| Two (35) | 62.9 | 28.6 | 5.7 | 2.9 | 0.0 |
| Three (16) | 50.0 | 43.8 | 0.0 | 6.3 | 0.0 |
| Four or more (7) | 42.9 | 57.1 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 51.3 | 42.1 | 5.1 | 1.5 | 0.0 |

TABLE CVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ESTABLISHED A GOOD RAPPORT WITH THE STUDENTS

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 65.8 | 30.6 | 2.7 | 0.5 | 0.5 |
| One (133) | 63.2 | 29.3 | 6.8 | 0.8 | 0.0 |
| Two (35) | 62.9 | 28.6 | 5.7 | 0.0 | 2.9 |
| Three (16) | 75.0 | 18.8 | 6.3 | 0.0 | 0.0 |
| Four or more (7) | 28.6 | 71.4 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 64.4 | 30.5 | 4.2 | 0.5 | 0.5 |

TABLE CVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR WAS AVAILABLE FOR CONSULTATION WITH THE STUDENTS

| No. of courses in Physics | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (222) | 34.4 | 44.7 | 14.0 | 6.0 | 0.9 |
| One (133) | 36.7 | 48.4 | 13.3 | 1.6 | 0.0 |
| Two (35) | 43.8 | 43.8 | 6.3 | 3.1 | 3.1 |
| Three (16) | 57.1 | 28.6 | 14.3 | 0.0 | 0.0 |
| Four or more (7) | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (413) | 36.3 | 45.9 | 12.9 | 4.1 | 0.8 |

TABLE CVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS PREPARED FOR THE CLASS

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 59.2 | 37.1 | 3.3 | 0.4 | 0.0 |
| One (114) | 57.0 | 38.6 | 2.6 | 1.8 | 0.0 |
| Two (33) | 51.5 | 39.4 | 6.1 | 3.0 | 0.0 |
| Three (10) | 40.0 | 60.0 | 0.0 | 0.0 | 0.0 |
| Four or more (10) | 50.0 | 50.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 57.3 | 38.6 | 3.2 | 1.0 | 0.0 |

TABLE CIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR EXHIBITED A COMPREHENSIVE KNOWLEDGE OF HIS SUBJECT

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 64.5 | 32.2 | 2.9 | 0.4 | 0.0 |
| One (114) | 62.3 | 34.2 | 2.6 | 0.9 | 0.0 |
| Two (33) | 57.6 | 24.2 | 12.1 | 6.1 | 0.0 |
| Three (10) | 50.0 | 30.0 | 20.0 | 0.0 | 0.0 |
| Four or more (10) | 60.0 | 40.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 62.9 | 32.3 | 3.9 | 1.0 | 0.0 |

TABLE CX

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE USED TEACHING METHODS WHICH ENABLED ME TO ACHIEVE THE OBJECTIVES OF THE CLASS

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 47.8 | 44.5 | 6.5 | 0.4 | 0.8 |
| One (114) | 49.1 | 45.6 | 3.5 | 0.9 | 0.9 |
| Two (33) | 51.5 | 36.4 | 6.1 | 6.1 | 0.0 |
| Three (10) | 40.0 | 50.0 | 10.0 | 0.0 | 0.0 |
| Four or more (10) | 60.0 | 40.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 48.5 | 44.2 | 5.6 | 1.0 | 0.7 |

TABLE CXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE COMMUNICATED EFFECTIVELY AT LEVELS APPROPRIATE TO THE PREPAREDNESS OF THE STUDENT

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 49.0 | 40.0 | 9.0 | 0.4 | 1.6 |
| One (114) | 48.2 | 43.9 | 5.3 | 2.6 | 0.0 |
| Two (33) | 54.5 | 30.3 | 9.1 | 6.1 | 0.0 |
| Three (10) | 50.0 | 50.0 | 0.0 | 0.0 | 0.0 |
| Four or more (10) | 50.0 | 40.0 | 10.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 49.3 | 40.5 | 7.8 | 1.5 | 1.0 |

TABLE CXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE ENCOURAGED INDEPENDENT THOUGHT BY THE STUDENT

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 50.2 | 39.3 | 7.1 | 2.9 | 0.4 |
| One (114) | 53.2 | 40.4 | 4.6 | 0.9 | 0.9 |
| Two (33) | 50.0 | 46.2 | 3.8 | 0.0 | 0.0 |
| Three (10) | 44.4 | 33.3 | 22.2 | 0.0 | 0.0 |
| Four or more (10) | 50.0 | 50.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 50.9 | 40.2 | 6.4 | 2.0 | 0.5 |

TABLE CXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP LACKED LOGICAL ORGANIZATION

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 7.3 | 5.3 | 8.2 | 44.5 | 34.7 |
| One (114) | 9.6 | 5.3 | 10.5 | 47.4 | 27.2 |
| Two (33) | 18.2 | 12.1 | 3.0 | 45.5 | 21.2 |
| Three (10) | 0.0 | 20.0 | 0.0 | 50.0 | 30.0 |
| Four or more (10) | 0.0 | 20.0 | 0.0 | 40.0 | 40.0 |
| Percentage responses by all participants responding (412) | 8.5 | 6.6 | 8.0 | 45.4 | 31.6 |

TABLE CXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR TREATED THE STUDENTS WITH RESPECT

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 63.7 | 33.1 | 2.4 | 0.4 | 0.4 |
| One (114) | 53.5 | 41.2 | 4.4 | 0.9 | 0.0 |
| Two (33) | 72.7 | 21.2 | 3.0 | 3.0 | 0.0 |
| Three (10) | 60.0 | 40.0 | 0.0 | 0.0 | 0.0 |
| Four or more (10) | 70.0 | 30.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 61.7 | 34.5 | 2.9 | 0.7 | 0.2 |

TABLE CXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ACKNOWLEDGED ALL QUESTIONS

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 47.3 | 46.9 | 5.3 | 0.4 | 0.0 |
| One (114) | 54.4 | 38.6 | 4.4 | 2.6 | 0.0 |
| Two (33) | 66.7 | 24.2 | 6.1 | 3.0 | 0.0 |
| Three (10) | 40.0 | 40.0 | 10.0 | 10.0 | 0.0 |
| Four or more (10) | 60.0 | 40.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 51.0 | 42.5 | 5.1 | 1.5 | 0.0 |

TABLE CXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ESTABLISHED A GOOD RAPPORT WITH THE STUDENTS

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 65.3 | 30.6 | 3.7 | 0.4 | 0.0 |
| One (114) | 63.2 | 31.6 | 2.6 | 0.9 | 1.8 |
| Two (33) | 54.5 | 27.3 | 18.2 | 0.0 | 0.0 |
| Three (10) | 70.0 | 30.0 | 0.0 | 0.0 | 0.0 |
| Four or more (10) | 70.0 | 30.0 | 0.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 64.1 | 30.6 | 4.4 | 0.5 | 0.5 |

TABLE CXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS AVAILABLE FOR CONSULTATION WITH STUDENTS

| No. of courses in Chemistry | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| None (245) | 37.2 | 42.3 | 14.6 | 5.0 | 0.8 |
| One (114) | 30.3 | 56.9 | 10.1 | 2.8 | 0.0 |
| Two (33) | 50.0 | 30.8 | 11.5 | 3.8 | 3.8 |
| Three (10) | 33.3 | 55.6 | 11.1 | 0.0 | 0.0 |
| Four or more (10) | 30.0 | 60.0 | 10.0 | 0.0 | 0.0 |
| Percentage responses by all participants responding (412) | 35.9 | 46.3 | 13.0 | 4.1 | 0.8 |

TABLE CXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP INSTRUCTOR WAS PREPARED FOR THE CLASS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 62.9 | 34.7 | 2.5 | 00.0 | 00.0 |
| 4-6 (177) | 49.7 | 44.1 | 4.0 | 2.3 | 00.0 |
| 7-9 (15) | 73.3 | 20.0 | 6.7 | 00.0 | 00.0 |
| 10-12 (10) | 50.0 | 50.0 | 00.0 | 00.0 | 00.0 |
| Other (5) | 60.0 | 40.0 | 00.0 | 00.0 | 00.0 |
| Percentage response by all participants responding (409) | 57.0 | 38.8 | 3.2 | 1.0 | 00.0 |

TABLE CXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR EXHIBITED A COMPREHENSIVE KNOWLEDGE OF HIS SUBJECT

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 67.8 | 27.7 | 3.5 | 1.0 | 00.0 |
| 4-6 (177) | 56.5 | 39.0 | 3.4 | 1.1 | 00.0 |
| 7-9 (15) | 73.3 | 26.7 | 00.0 | 00.0 | 00.0 |
| 10-12 (10) | 40.0 | 40.0 | 20.0 | 00.0 | 00.0 |
| Other (5) | 80.0 | 20.0 | 00.0 | 00.0 | 00.0 |
| Percentage response by all participants responding (409) | 62.6 | 32.5 | 3.9 | 1.0 | 00.0 |

TABLE CXX

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE USED TEACHING METHODS WHICH ENABLED ME TO ACHIEVE THE OBJECTIVES OF THE CLASS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 51.5 | 41.6 | 5.4 | 1.0 | 0.5 |
| 4-6 (177) | 42.9 | 48.6 | 6.2 | 1.1 | 1.1 |
| 7-9 (15) | 60.0 | 40.0 | 00.0 | 00.0 | 00.0 |
| 10-12 (10) | 30.0 | 60.0 | 10.0 | 00.0 | 00.0 |
| Other (5) | 100.0 | 00.0 | 00.0 | 00.0 | 00.0 |
| Percentage response by all participants responding (409) | 48.3 | 44.4 | 5.6 | 1.0 | 0.7 |

TABLE CXXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE COMMUNICATED EFFECTIVELY AT LEVELS APPROPRIATE TO THE PREPAREDNESS OF THE STUDENT

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 51.5 | 38.1 | 7.9 | 1.0 | 1.5 |
| 4-6 (177) | 45.8 | 44.6 | 6.8 | 2.3 | 0.6 |
| 7-9 (15) | 53.3 | 40.0 | 6.7 | 00.0 | 00.0 |
| 10-12 (10) | 50.0 | 10.0 | 40.0 | 00.0 | 00.0 |
| Other (5) | 60.0 | 40.0 | 00.0 | 00.0 | 00.0 |
| Percentage response by all participants responding (409) | 49.3 | 40.3 | 8.0 | 1.5 | 1.0 |

TABLE CXXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: HE ENCOURAGED INDEPENDENT THOUGHT BY THE STUDENT

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 54.4 | 37.3 | 5.2 | 3.1 | 00.0 |
| 4-6 (177) | 46.6 | 44.3 | 6.8 | 1.1 | 1.1 |
| 7-9 (15) | 61.5 | 30.8 | 7.7 | 00.0 | 00.0 |
| 10-12 (10) | 50.0 | 25.0 | 25.0 | 00.0 | 00.0 |
| Other (5) | 40.0 | 60.0 | 00.0 | 00.0 | 00.0 |
| Percentage response by all participants responding (409) | 50.9 | 40.3 | 6.3 | 2.0 | 0.5 |

TABLE CXXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE WORKSHOP LACKED LOGICAL ORGANIZATION

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 10.4 | 5.9 | 8.4 | 42.1 | 33.2 |
| 4-6 (177) | 2.8 | 7.3 | 9.0 | 50.8 | 29.9 |
| 7-9 (15) | 20.0 | 6.7 | 00.0 | 40.0 | 33.3 |
| 10-12 (10) | 20.0 | 00.0 | 00.0 | 40.0 | 40.0 |
| Other (5) | 00.0 | 00.0 | 00.0 | 40.0 | 60.0 |
| Percentage response by all participants responding (409) | 8.0 | 6.6 | 8.0 | 45.4 | 32.0 |

TABLE CXXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR TREATED STUDENTS WITH RESPECT

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 62.4 | 32.7 | 4.0 | 0.5 | 0.5 |
| 4-6 (177) | 59.3 | 37.9 | 1.7 | 1.1 | 00.0 |
| 7-9 (15) | 73.3 | 26.7 | 00.0 | 00.0 | 00.0 |
| 10-12 (10) | 60.0 | 30.0 | 10.0 | 00.0 | 00.0 |
| Other (5) | 100.0 | 00.0 | 00.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 61.9 | 34.2 | 2.9 | 0.7 | 0.2 |

TABLE CXXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ACKNOWLEDGED ALL QUESTIONS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 56.4 | 38.1 | 4.5 | 1.0 | 00.0 |
| 4-6 (177) | 44.6 | 49.7 | 4.0 | 1.7 | 00.0 |
| 7-9 (15) | 53.3 | 26.7 | 13.3 | 6.7 | 00.0 |
| 10-12 (10) | 50.0 | 30.0 | 20.0 | 00.0 | 00.0 |
| Other (5) | 40.0 | 40.0 | 20.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 51.0 | 42.5 | 5.1 | 1.5 | 00.0 |

TABLE CXXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR ESTABLISHED A GOOD RAPPORT WITH THE STUDENTS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 67.3 | 26.7 | 5.0 | 0.5 | 0.5 |
| 4-6 (177) | 63.3 | 32.2 | 3.4 | 0.6 | 0.6 |
| 7-9 (15) | 66.7 | 33.3 | 00.0 | 00.0 | 00.0 |
| 10-12 (10) | 50.0 | 30.0 | 20.0 | 00.0 | 00.0 |
| Other (5) | 60.0 | 40.0 | 00.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 64.8 | 29.9 | 4.4 | 0.5 | 0.5 |

TABLE CXXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE INSTRUCTOR WAS AVAILABLE FOR CONSULTATION WITH STUDENTS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 38.3 | 42.5 | 13.5 | 5.2 | 0.5 |
| 4-6 (177) | 31.8 | 51.1 | 13.1 | 2.8 | 1.1 |
| 7-9 (15) | 38.5 | 38.5 | 15.4 | 7.7 | 00.0 |
| 10-12 (10) | 62.5 | 37.5 | 00.0 | 00.0 | 00.0 |
| Other (5) | 60.0 | 40.0 | 00.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 36.2 | 46.1 | 12.9 | 4.1 | 0.8 |

TABLE CXXVIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: A SUFFICIENT SUPPLY OF SCIENCE EQUIPMENT AND MATERIALS WERE AVAILABLE FOR THE INSERVICE TRAINING

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 45.0 | 45.5 | 6.4 | 2.5 | 0.5 |
| 4-6 (177) | 33.9 | 54.8 | 5.1 | 5.6 | 0.6 |
| 7-9 (15) | 26.7 | 73.3 | 00.0 | 00.0 | 10.0 |
| 10-12 (10) | 40.0 | 40.0 | 10.0 | 00.0 | 00.0 |
| Other (5) | 60.0 | 40.0 | 00.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 39.6 | 50.0 | 5.8 | 3.9 | 0.7 |

TABLE CXXIX

PARTICIPANTS' RESPONSE TO THE STATEMENT: THE PHYSICAL FACILITIES (ROOMS, SINKS, TABLES) WERE SUITABLE FOR THE INSERVICE PROGRAMS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 24.8 | 49.5 | 15.3 | 6.9 | 3.5 |
| 4-6 (177) | 23.7 | 45.2 | 13.6 | 15.8 | 1.7 |
| 7-9 (15) | 33.3 | 40.0 | 13.3 | 6.7 | 6.7 |
| 10-12 (10) | 30.0 | 50.0 | 20.0 | 00.0 | 00.0 |
| Other (5) | 00.0 | 80.0 | 20.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 25.0 | 47.3 | 14.6 | 10.4 | 2.7 |

TABLE CXXX

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL COLLEGE CREDIT SHOULD BE OFFERED FOR SCIENCE INSERVICE ACTIVITIES

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 63.9 | 27.7 | 5.4 | 1.0 | 2.0 |
| 4-6 (177) | 62.1 | 33.3 | 3.4 | 0.6 | 0.6 |
| 7-9 (15) | 66.7 | 13.3 | 00.0 | 13.3 | 6.7 |
| 10-12 (10) | 40.0 | 30.0 | 10.0 | 00.0 | 20.0 |
| Other (5) | 60.0 | 20.0 | 20.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 62.1 | 29.4 | 4.6 | 1.5 | 2.4 |

TABLE CXXXI

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL LESS TIME SHOULD HAVE BEEN SPENT ON ACTIVITIES INVOLVING THE USE OF MATERIALS, KITS AND EQUIPMENT

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 2.5 | 4.0 | 6.9 | 43.6 | 43.1 |
| 4-6 (177) | 2.3 | 2.8 | 7.3 | 37.9 | 49.2 |
| 7-9 (15) | 00.0 | 13.3 | 00.0 | 40.0 | 46.7 |
| 10-12 (10) | 00.0 | 30.0 | 10.0 | 20.0 | 40.0 |
| Other (5) | 00.0 | 20.0 | 00.0 | 40.0 | 40.0 |
| Percentage responses by all participants responding (409) | 2.2 | 4.9 | 6.8 | 40.5 | 45.4 |

TABLE CXXXII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE TIME SHOULD HAVE BEEN SPENT ON METHODS AND TECHNIQUES OF SCIENCE TEACHING

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 4.7 | 19.7 | 30.6 | 31.6 | 13.5 |
| 4-6 (177) | 6.3 | 23.3 | 27.3 | 33.0 | 10.2 |
| 7-9 (15) | 7.7 | 7.7 | 53.8 | 30.8 | 00.0 |
| 10-12 (10) | 25.0 | 12.5 | 12.5 | 50.0 | 00.0 |
| Other (5) | 00.0 | 00.0 | 80.0 | 20.0 | 00.0 |
| Percentage responses by all participants responding (409) | 5.8 | 20.5 | 30.1 | 32.4 | 11.1 |

TABLE CXXXIII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL THE WORKSHOP WOULD HAVE BEEN MORE SUCCESSFUL IF WE HAD STUDIED MORE SCIENCE CONTENT AND SUBJECT MATTER

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 1.5 | 8.9 | 18.3 | 52.0 | 19.3 |
| 4-6 (177) | 2.3 | 6.2 | 19.8 | 48.6 | 23.2 |
| 7-9 (15) | 00.0 | 6.7 | 26.7 | 46.7 | 20.0 |
| 10-12 (10) | 00.0 | 30.0 | 10.0 | 50.0 | 10.0 |
| Other (5) | 00.0 | 00.0 | 20.0 | 40.0 | 40.0 |
| Percentage responses by all participants responding (409) | 1.7 | 8.3 | 18.9 | 50.2 | 20.9 |

TABLE CXXXIV

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE OF THE WORKSHOP TIME SHOULD HAVE BEEN SPENT DEVELOPING NEW CURRICULUM MATERIALS

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 2.0 | 10.4 | 22.8 | 48.0 | 16.8 |
| 4-6 (177) | 1.7 | 9.6 | 25.4 | 44.6 | 18.6 |
| 7-9 (15) | 00.0 | 13.3 | 20.0 | 26.7 | 40.0 |
| 10-12 (10) | 00.0 | 30.0 | 10.0 | 50.0 | 10.0 |
| Other (5) | 00.0 | 40.0 | 20.0 | 40.0 | 00.0 |
| Percentage responses by all participants responding (409) | 1.7 | 11.4 | 23.3 | 45.6 | 18.0 |

TABLE CXXXV

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FIND THAT I DO NOT RELY ON MY TEXTBOOK FOR SCIENCE AS MUCH AS I DID BEFORE THE SCIENCE INSERVICE

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagre | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 26.9 | 40.9 | 24.4 | 6.2 | 1.6 |
| 4-6 (177) | 26.1 | 43.8 | 19.9 | 8.5 | 1.7 |
| 7-9 (15) | 23.1 | 46.2 | 30.8 | 00.0 | 00.0 |
| 10-12 (10) | 25.0 | 25.0 | 50.0 | 00.0 | 00.0 |
| Other (5) | 40.0 | 20.0 | 40.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 26.6 | 41.8 | 23.3 | 6.8 | 1.5 |

TABLE CXXXVI

PARTICIPANTS' RESPONSE TO THE STATEMENT: SINCE MY INSERVICE SCIENCE EXPERIENCE MY SCIENCE CLASSES HAVE GREATER STUDENT INVOLVEMENT

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 31.7 | 46.5 | 18.8 | 3.0 | 00.0 |
| 4-6 (177) | 31.6 | 49.2 | 14.7 | 4.0 | 0.6 |
| 7-9 (15) | 46.7 | 33.3 | 20.0 | 00.0 | 00.0 |
| 10-12 (10) | 20.0 | 50.0 | 30.0 | 00.0 | 00.0 |
| Other (5) | 20.0 | 20.0 | 60.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 31.8 | 46.8 | 18.0 | 3.2 | 0.2 |

TABLE CXXXVII

PARTICIPANTS' RESPONSE TO THE STATEMENT: I FEEL MORE CONFIDENT AND ENTHUSIASTIC ABOUT TEACHING SCIENCE BECAUSE OF THE INSERVICE SCIENCE EXPERIENCE

| Level of teaching experience | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| K-3 (202) | 32.7 | 45.5 | 14.9 | 5.0 | 2.0 |
| 4-6 (177) | 28.8 | 50.8 | 17.5 | 2.3 | 0.6 |
| 7-9 (15) | 20.0 | 53.3 | 20.0 | 6.7 | 00.0 |
| 10-12 (10) | 30.0 | 50.0 | 10.0 | 00.0 | 10.0 |
| Other (5) | 40.0 | 20.0 | 40.0 | 00.0 | 00.0 |
| Percentage responses by all participants responding (409) | 30.3 | 47.6 | 16.3 | 4.4 | 1.5 |

# VITA

Duane Leonard Sea

Candidate for the Degree of

Doctor of Education

Thesis: A STUDY OF FACTORS CONCERNING INSERVICE PROGRAMS ASSOCIATED WITH NEWER ELEMENTARY SCIENCE CURRICULA IN SELECTED MINNESOTA SCHOOLS

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Personal Data: Born in Pekin, Illinois, January 12, 1936, the son of Leonard and Anna Marriott Sea.

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