A LEADERSHIP WORKSHOP ON ELEMENTARY SCHOOL SCIENCE: AN IN-DEPTH EVALUATION

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
DALE GORDON MERKLE, SR.
1969

This is to certify that the

thesis entitled

A LEADERSHIP WORKSHOP ON ELEMENTARY SCHOOL SCIENCE:
AN IN-DEPTH EVALUATION

presented by

Dale Gordon Merkle, Sr.

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Education

Wayne Taylor
Major professor

Date May 12,1969

O-169

ABSTRACT

A LEADERSHIP WORKSHOP ON ELEMENTARY SCHOOL SCIENCE:
AN IN-DEPTH EVALUATION

By

Dale Gordon Merkle, Sr.

Problem

New elementary school science curricula are emerging rapidly today. The Michigan State University Leadership Workshop on Elementary School Science 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).

This Workshop, held at Michigan State University in the summer of 1968, had as one of its objectives the influencing of the participants to promote these curricula and initiate change. It was unique in structure in that it incorporated into the format of the Workshop not just orientation to the programs, but also training in group-process skills, change-agent skills, and a participant-operated workshop which established initial contact for the participants with school systems in their areas.

This study was designed to evaluate the reactions of the participants to the activities of the Workshop and to interpret the effect these activities have on the behavior of the participants after they leave the Workshop.

Methodology

Pre-Workshop, post-Workshop, and follow-up Mid-winter Conference measures were made on: knowledge of the two elementary science curricula, knowledge of group-process skills, knowledge of change-agent skills, and attitudes of the participants toward the two new curricula. An assessment was also made of the participants' perceived needs (pretest) and satisfied needs (posttest). Other attitudes were measured also.

Statistical tests were made of the data to determine if meaningful learning took place and to identify correlations between the measures.

Findings

Significant differences in knowledge of the two programs, knowledge of group-process skills, knowledge of change-agent skills, and in attitudes toward the two elementary science curricula were found. Investigations of the correlations between measures were made to determine if significant positive relationships between attitude and knowledge, or attitude and satisfaction of needs existed.

No significant correlations were discovered with total group comparisons.

When the participants returned to Michigan State University in December 1968 for the follow-up conference, instruments were administered to evaluate both the content of the Workshop and how the participants utilized the Summer Workshop experience.

Meaningful changes in the behaviors of the participants were noted. Increased in-service 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.

A LEADERSHIP WORKSHOP ON ELEMENTARY SCHOOL SCIENCE: AN IN-DEPTH EVALUATION

By

Dale Gordon Merkle, Sr.

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

College of Education

1969

ACKNOWLEDGMENTS

The writer wishes to express his appreciation to Dr. T. Wayne Taylor, chairman of his Doctoral Committee, for generous counsel and encouragement in the completion of this study.

This study could not have been completed without the cooperation, advice, and understanding of Dr. Richard J McLeod, Director of the Leadership Workshop on Elementary School Science, who also served as a Committee member.

The writer desires to express his gratitude to Dr. W. Robert Houston and Dr. Jack B. Kinsinger, the remaining members of the Committee, for their interest and assistance. Appreciation is also due Dr. Glenn D. Berkheimer and Dr. John M. Mason for valuable counsel throughout the duration of the writer's program.

The thirty participants of the Leadership Workshop, their school administrations, the elementary teachers involved in the three day participant-run workshop, and cooperating staff of the Science and Mathematics Teaching Center are recognized for their contributions to this study.

The writer is indebted to his wife, Mary Lynn, and their sons, Gordon and Christopher, whose patience, confidence, understanding, and love made the whole endeavor possible.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

General statement of problem area

There is a need to study summer institutes to determine what takes place in the institutes and how these activities relate to subsequent changes in the behavior of the institute members. Also, there is an urgent need to follow up participants of institute programs to determine the effectiveness of the programs in which they have engaged.

It was proposed that this type of evaluation be conducted with participants from the Leadership Workshop on Elementary School Science which was held at Michigan State University during the summer of 1968. This Workshop was conducted by the Science and Mathematics Teaching Center of the University under the direction of Dr. R. J McLeod and was funded by the National Science Foundation.

During the past several years a number of national projects have produced new curricular materials for teaching elementary school science. The try-out programs which accompanied the development of the new curricula have already indicated the potential of these programs. The

emphases of the curricular efforts all purport to embody the best of current educational thought and to lead to a richer understanding of science on the part of the children involved.(2) School districts are becoming increasingly interested in the new science curricula. Some of these new curricular developments are now in commercial publication, but there is a paucity of resource people available to consult with schools concerning implementation problems.

The Leadership Workshop on Elementary School Science, held at Michigan State University from July 29, 1968, to August 23, 1968, was designed to help fill this need. The Workshop was designed to prepare the participants to help schools implement two of the new elementary science curricula. They are Science--A Process Approach developed by the American Association for the Advancement of Science (AAAS) and the Science Curriculum Improvement Study (SCIS).

This Workshop is part of a large implementation model (Appendix I) aimed at the need for a fairly rapid retraining of large numbers of in-service elementary school teachers to make effective use of the new curricular materials. At the same time, this Workshop for college teachers sought to produce changes in the pre-service preparation of elementary teachers to include the content and teaching modes recommended for the new materials so as to reduce or eliminate, if possible, the need for retraining.

There is a large investment in terms of time and money in new curricular materials and in summer workshops for teachers. The subsequent influences on national education could prove noteworthy. Evidence was gathered in this study to determine whether a workshop such as that held at Michigan State University in 1968 is worth repeating; and, if so, the modifications necessary to improve the effectiveness. There was a need to determine the degree of effectiveness of this Leadership Workshop on Elementary School Science as a producer of change agents.

Each summer a large number of teachers gather at various universities and colleges across the United States to take part in summer workshops, institutes, or planning sessions. The participants spend their time in a variety of ways: developing new materials or methods of teaching, being introduced to new materials or methods, or practicing with new materials or methods, or a combination of these.

One objective of such an institute is to provide a meaningful learning experience for the participants. Hopefully they grow in awareness, interest, and competence in the subject of the institute as well as develop a positive attitude toward the programs with which the institute dealt.

A second objective is the extent to which material learned at the institute is utilized when the participants return to their respective schools. This utilization takes two forms: as used in their own work, and as used in

introducing the material to other teachers. Since the number of teachers attending institutes is far less than the total population of teachers, we must depend on those who attend to help disseminate the results of the institutes to those who did not attend.

A logical and legitimate activity of institute post-mortems concerns the success or failure of the institute. Evaluation serves as one measure of feedback of the institute or workshop for the purpose of possible alteration in the format for the next year. In the past, institute and workshop evaluations have pointed to the astounding faith that educators have in themselves to develop and conduct institutes and workshops, costing the taxpayers millions of dollars annually, with little anxiety, or even regard, to the efficiency with which they have met their objectives. What is done is not really well known. With what effect is - seldom considered.

The Leadership Workshop group at Michigan State University was composed of twenty-one college teachers and nine science consultants. These participants were chosen for the institute on the bases of their involvement with pre-service teaching and in-service preparation of elementary school science teachers. Their administrators indicated a willingness to permit them to engage in consulting and implementation activities subsequent to the Workshop. The participants agreed to return to Michigan State

University for a Mid-winter Conference where the influence of the institute would be discussed and evaluated. Preference was given to applicants from schools and colleges in Michigan.

This Workshop was unique and lent itself to the evaluation proposed since it included as its objectives: (1) providing the participants with considerable knowledge of the purposes, history, recommended modes of teaching, objectives, materials, and teacher education procedures of the Science Curriculum Improvement Study and of Science--A Process Approach; (2) providing opportunities for the participants to teach science to children using the new curriculum materials and to provide the participants with feedback on their teaching; (3) engaging the participants in giving feedback to elementary classroom teachers whom they have observed teaching children with the new curriculum materials; (4) familiarizing the participants with the school settings and with the administrative aspects of implementation; (5) assisting the participants as a group and as individuals to plan and to prepare appropriate materials and activities for orientation sessions and in-service programs; (6) providing experience in organizing and presenting orientation sessions on the programs to groups of school teachers and administrators; and (7) that the participants would be engaging in change-agent activities after they left the Workshop; i.e., put what was learned into practice.

It was also unique in that experiences in group-process skills and change-agent strategies were an integral part of the program in addition to the training in the philosophies, processes, concepts, and materials of the AAAS and SCIS programs. The participants, as part of the Workshop activities, also prepared and gave a three day workshop for elementary school teachers and administrators. This three day participant-directed workshop served as an initial contact with elementary school personnel selected from the geographic area of the participant's institution. The three day workshop was meant to establish an awareness in the surrounding communities concerning the new science programs and the availability of consultants. The participants were prepared to engage in a large scale implementation project to develop a network model involving college or resource teachers (referred to as T_3's), experienced in-service pilot teachers (referred to as T_2's), and pilot teachers (referred to as T_1's). (See Appendix I)

The major thrust of this Workshop was toward the preparation of the participants to accept active roles as resource trainers in the implementation model.

Assumptions and limitations

Evaluating the effects of a four week summer workshop on the careers of participants is difficult. Persons who seek such experiences are already likely to be

energetic, motivated, and successful achievers. Since four weeks is a short time in the lives of the participants, miracles of learning and redirection cannot be expected. Even if the summer workshop did have considerable cumulative influence on a participant, this influence may be slow in appearing or clouded by interaction with other influences.

Nevertheless, evidence needs to be gathered to determine whether or not such programs are worth repeating; and, if so, how they should be modified in order to be more effective.

Within the limits of the following assumptions, it was the purpose of this thesis to study these effects.

It was assumed that the Leadership Workshop on Elementary School Science held at Michigan State University in the summer of 1968 could make a contribution to the educational community and was worthy, therefore, of study. It was further assumed that the elementary science curricula which were studied in the Workshop are viable representatives of modern science education and that they were appropriate to the goals of the Workshop and to the needs of school districts in Michigan. Also, it was assumed that the instruments utilized in this study were suitable for use with the group, and that in using the instruments adequate test conditions were maintained.

Finally, it was assumed that there exists a wider population of college teachers and resource persons described by the participant description herein. The thirty participants of this Workshop are considered a representative sample of this population.

While no specific population from which the participants are a random sample is delineated, conclusions are certainly not restricted just to these participants. There exists an additional unspecified population "like those observed." Inferences are made to this unspecified population. This procedure lengthens the statistical span of the study at the price of leaving the location at the far end vague. "This lengthening and blurring is likely to be worthwhile." (1)

Objectives of study

This study was an attempt to describe and evaluate the Leadership Workshop on Elementary School Science for College Teachers of Science and Science Education held July 29, to August 23, 1968, at Michigan State University. The principal focus of the study was concerned with the following items.

1. To report the content, methods, and procedures of the Workshop.
2. To report the participants' evaluation of their perceived needs and how the Workshop met these needs.

3. To describe the changes in knowledge of and attitude toward AAAS and SCIS elementary school science curricula as measured on pre, post, and mid-winter evaluations.
4. To describe the effects of various aspects of the Workshop activities on the attitudes of the participants. The activities considered are:
   A. Orientation to programs
   B. Laboratory and micro-teaching involvement using the AAAS and SCIS materials
   C. Group-process skills
   D. Change-agent skills
   E. Three-day workshops conducted by the college teachers (T_3) for elementary school teachers (T_1) and administrators.
5. To describe the relationships that exist between attitude towards the SCIS and AAAS programs and attitudes towards the various aspects of Workshop activities as mentioned in objective number 4.
6. To describe the relationships that exist between knowledge of the program characteristics and their implementation procedures, and the attitude toward various aspects of Workshop activities as mentioned in objective number 4.

7. To describe the relationships that exist in attitude and knowledge between Workshop measures and Mid-winter Conference measures.
8. To describe the behavioral changes of the participants in their on-the-job implementation of curriculum change in activities related to the two programs studied in detail at the Leadership Workshop.
9. To make recommendations for future workshop evaluations.

Hypotheses of study

1. There will be a significant increase in knowledge of program characteristics and program implementation procedures from pretest to posttest by the participants of the Workshop as measured on Instrument A (appended).
2. There will be a significant positive change in attitude toward the programs (SCIS and AAAS) of the Workshop from pretest to posttest as measured on Instrument B (appended).
3. There will be a significant change in the analysis scores of group-process skills from pretest to posttest by the participants of the Workshop as measured on Instrument C (appended).

4. There will be a significant increase in knowledge of change-agent skills from pretest to posttest by the participants of the Workshop as measured on Instrument D (appended).
5. There will be a significant positive correlation between the participants' scores on their attitude toward the various aspects of the Workshop activities as measured on Instrument F (appended) and the participants' knowledge of program characteristics and program implementation procedures as measured on Instrument A (appended). (The correlations are made with measures taken at the close of the Workshop and at the Mid-winter Conference.)
6. There will be a significant positive correlation between the participants' scores on their attitude toward the various aspects of the Workshop activities as measured on Instrument F (appended) and the participants' attitude toward the SCIS and AAAS programs as measured on Instrument B (appended). (The correlations are made with measures taken at the close of the Workshop and at the Mid-winter Conference.)
7. There will be a significant positive correlation between the increase in knowledge of program characteristics and program implementation procedures as measured on Instrument A (appended) from pretest

to posttest and change in attitude toward the AAAS and SCIS programs as measured on Instrument B (appended) from pretest to posttest.

8. There will be a significant positive correlation between the satisfaction of perceived needs of the participants as measured on Instrument E (appended) and change in attitude toward the AAAS and SCIS programs as measured on Instrument B (appended) and utilizing:
   A. the difference between Workshop pretest and end-of-Workshop posttest given in August on Instrument B versus the posttest of Instrument E
   B. the Workshop posttests given in August
   C. the Mid-winter Conference tests given in December.

Knowledge of program characteristics and program implementation procedures is defined as the amount of information and understanding concerning the purposes, history, recommended modes of teaching, objectives, materials, and the teacher education procedures of the SCIS and AAAS projects as revealed on Instrument A (appended). Attitude toward the programs and their content is defined as the amount of self-perceived value and relevancy of the content for the individual and for inclusion into elementary school curricula as revealed on Instrument B (appended). Analysis

of personal behavior in groups is defined as the participants' personal ratings in the specific concepts and processes of group procedures as revealed on Instrument C (appended). Knowledge of change-agent strategies is defined as the amount of information and understanding the participants have concerning methods of effecting change, as revealed on Instrument D (appended).

A behavioral change of a participant is defined as a change in pre-service or in-service procedures resulting from participation in the Workshop and communicating the instructional intent of the Workshop. This change was evaluated by analysis of Instrument G (appended). One criterion of the failure or success of objectives of this Workshop was whether or not a significant change occurred in these areas.

Overview of the study

The general plan of this thesis is as follows:

Chapter two is a review of the literature and its implications for the study. The first section of the review covers the value of the institute and viability of the elementary school science curricula that were the focus of the institute. After a discussion of the need for studies such as the one done here, the literature on related studies is reviewed. Finally, there are references and discussion of "Training the Teachers of Teachers" programs.

In chapter three the procedures that were followed for the collection of the data are reported as well as how the instruments used in collecting data were prepared. A detailed description of the participants of the study is followed by a description of the research procedures. In the last section of this chapter the hypotheses are stated along with the means that were used in testing these hypotheses.

In chapter four the data collected on each instrument is presented and analyzed in reference to each hypothesis.

In chapter five the conclusions and implications of the study are stated, and recommendations for further study are presented.

BIBLIOGRAPHY

CHAPTER I

1. Cornfield, J., and Tukey, J. W. "Average Values of Mean Squares in Factorials." The Annals of Mathematical Statistics, 27 (1956), 907-949.

2. Kuslan, L. I., and Stone, A. H. Teaching Children Science: An Inquiry Approach. Belmont, California: Wadsworth Publishing Company, Inc., 1968. pp. 183-188.

CHAPTER II

REVIEW OF THE LITERATURE

Worth of SCIS and AAAS

In order that a workshop can be worthy of the time and expense, the content of the workshop must be worthy of study. The participants should be exposed to relevant and useful material that is intellectually sound and applicable to their tasks.

Current science educators generally agree that it is no longer adequate to relegate science in the elementary school to the incidental or chance-happening style of teaching that has characterized its mode in the past. This is not to say that some excellent teaching has not been done in the past without a structural program. But, the tremendous physical increase in knowledge coupled with the advanced technologies of communication and investigation seem to make it emphatically clear that teaching of only factual matter is inadequate today. In order to understand science and scientific change it seems evident that science education needs to direct greater emphasis toward the processes of science and toward training for science literacy. In light of today's scientific advancement, the following

aspects of a structural science program seem necessary:

A. A structured program provides a framework of science principles which can help teachers unify their own experiences and give them confidence in meeting difficult classroom situations that arise. The answer suggested a decade ago to children's questions--'I don't know, but let's find out together' --is not sufficient for all of today's needs.

B. A structured program does not have to be a rigid one. Within the broad content areas, there are many choices which permit the teacher to adapt the program to the needs of the class. Both the unit approach and the provision of a variety of materials and situations which foster children's creativity and originality are possible within a structured program.

C. The freshness engendered by the use of unanticipated incidents is not lost in a structured program. Indeed, the incident becomes more significant because the teacher sees it as a part of the whole and thus may be able to convey its importance to the pupil. A structured program helps the teacher anticipate, identify, and incorporate into the program the many incidents which arise during the school year.

D. While it is true that children come to school with many interests, it is also true that interest can be aroused and cultivated by what takes place in school.

E. A structured program makes it easier for children to acquire the science concepts essential for their understanding of the complex world they live in.

F. A structured program is a democratic one: Many can share in building it and in changing it. It provides a common framework for testing and evaluation by the children as well as by the teachers. (2)

The College Teacher Workshop at Michigan State University was held in an effort to upgrade current pre-service science education classes and to stimulate elementary school science courses through in-service programs.

The AAAS Science--A Process Approach and the Science Curriculum Improvement Study curricula were chosen for the basis of study in the College Teacher Workshop.

> These curriculum projects are unmistakably significant movements in the right direction, which is to teach science because it provides immediate opportunities for children to learn what science is, how it grows, and how scientists work. (15)

Most children appear to be naturally curious of their environment. These new curricula draw upon this student interest, new knowledge of child growth, and upon the contributions of learning theory. These new elementary school science curricula, and others, are the result of national interest. The committees which spawned these new programs were composed of scientists from college and industry, educators from the university and grade schools, and consulting psychologists, who, together, were able to produce these new viable curricula.

> The insight of scientists, paired with the skill of experienced classroom teachers, has given the educational world a veritable treasure of science-teaching knowledge that was previously unavailable. (15)

Craig (4) indicated the need for such continuous science programs in the Thirty-first National Society for the Study of Education Yearbook. Powers (19), in the same

reference, pointed out some of the weaknesses of current science practices and the need for moving to curricula which reflect processes and interpretation of phenomena.

Worth of institutes

The teaching of science and the preparation of science curricular materials appear to be at the threshold of a new era. Since the initiation of the National Science Foundation in 1950 massive efforts by scientists and science educators to design entirely new curricula reflective of the best of modern education tools, philosophy, and psychology has been made possible by financial support. Pioneered by the Physical Science Study Committee, organized at the Massachusetts Institute of Technology by Dr. Jerrold R. Zacharias in 1956, new curriculum program committees are subsidizing pre-service and in-service training programs for teachers as a means of testing programs and implementation procedures. The worth of summer institutes in the innovative process is easily noted.

Hilgert (8) questioned whether a three week summer workshop actually made any significant impact upon the teacher's training. Eighty-eight percent of the participants indicated that the workshop had been beneficial. Fifty percent stated that it had prompted them to do additional study, and that the workshop had given them new insights concerning the importance of the workshop topic.

In the Fifty-ninth Yearbook of the National Society for the Study of Education Hale (7) points out that some of the most valuable contributions to the advancement of science education have been made through sponsored programs which attempt to strengthen the academic backgrounds of teachers.

Verrill (20) points out that the poor preparation of general elementary teachers to teach science makes summer school classes a necessary opportunity for improving teaching background.

Need for studies of institutes, including a follow-up of participants

One of the most important problems in science education today is the improvement of science teaching in the elementary schools. (9) One of the steps that needs to be employed in producing improvement is research of the programs that has been supported to train or retrain teachers. "Support for training of science teachers has been provided by the National Science Foundation since 1956. Few attempts to evaluate the effectiveness of summer institutes and academic year institutes have been reported to date." (13)

A Harvard group found that little follow-up of graduates is formally provided to help a school evaluate the effectiveness of its science education programs. The report from the Harvard group concludes that the programs

are "almost entirely acts of faith with little or no feedback or follow-up to support the practices that institutions follow." (5)

Studies of institutes

Very few in-depth studies of institutes and summer workshops have been reported. Fowler (6) completed a study of participants of a six-week Institute designed to train elementary school science resource teachers. The goal of the institute was to prepare persons to accept the responsibilities of a "Science Resource Teacher" in their home schools. The instructional goals of the institute were evaluated using the Reed Science Test, form AM, as a pretest and form BM as a posttest. The gains of the participants were analyzed. On the objective of the workshop, development of a working knowledge of science, the tests seemed to indicate growth in science competence.

Ziol (21) evaluated an eight-week summer institute to train instructors of instrumentation technology. The objective of the institute was to assist in the development of knowledges and skills essential for teaching specialized technical courses. The participants were sixteen (16) teachers in the technical-vocational area. A committee observed program characteristics and specific activities conducted at the institute. The purpose of the institute was successfully accomplished as evaluated by the committee.

The evaluation of knowledge and/or skill competency is not a difficult task if the objectives of the institute are clearly defined. The preceding institute evaluations accomplished this goal to varying degrees of success. But, the evaluation of the affective domain and how it may correlate with participant achievement at the cognitive level was not attempted. The preceding studies did not follow-up participants to determine the implementation of institute objectives.

In the Evaluation of National Defense Education Act Institutes for Advanced Study in Reading, Final Report (10), the evaluation of thirty-four 1965 NDEA institutes was conducted. Recommendations of this study included: (1) children should be available for demonstration purposes and practice-teaching during the institute; (2) adequate provisions should be made to evaluate the institute; and (3) each institute should provide for some kind of follow-up.

Studies of institutes with follow-up of participants

Some institutes have utilized various methods of follow-up study.

Parker (18) studied various aspects of summer institute participants after they had returned to their home schools. His principal findings related to participants

included: (1) 93% believed that they could better motivate students toward careers in science as a result of their attendance at the institute; and (2) 95% were of the opinion that they were better teachers as a result of their attendance at the institute. Responses from principals of the participants indicated that 91% believed that the participants were better teachers, were more enthusiastic in their teaching, had increased their knowledge of science, and had learned more effective use of laboratory equipment.

Brandou (3) studied the effectiveness of a pilot program of the Elementary Science In-Service Conference. This was a four-week conference of sixteen selected high school teachers who were to return to their home districts and conduct in-service programs in science for elementary teachers. The participants prepared materials and Topic Guides as outlines for their subsequent in-service classes. The major evaluation instruments were the Edwards Personal Preference Schedule and the Minnesota Teacher Attitude Inventory. Brandou, in subsequent follow-up, found that the more experienced secondary teachers may be more effective.

In another study, Bartlett and Edgerton (1) submitted to factor analysis the characteristics of summer programs as reflected by the questionnaire responses of the participants. The study was part of a 1963 follow-up of participants in the National Science Foundation's program for secondary school students.

Approximately 5500 persons returned a questionnaire representing groups who had participated in 134 Summer Science Training Programs (SSTP's). The percent of persons for each SSTP responding in a given way to each item was tabulated. Fifty-seven items from the questionnaire were judged to be relevant and were included in the analysis.

Twelve factors which emerged from the analysis were retained for interpretation. These factors described differences among SSTP's and offered cues for the evaluation of the programs. Although most of the factors were interpreted toward the positive side because of the nature of the items, some negative interpretations, such as decreased interest in school subjects, were indicated. In conclusion, the study provides a meaningful set of dimensions which describe the nature of SSTP's and may be useful in subsequent institute designs and evaluations.

Follow-up studies of year-long programs were done by Jarvi (12) and Irby (11). Both programs were rated overwhelmingly successful.

Another study of summer institutes held over a span of years not only looked at the programs and their rated success but also attempted to measure the impact of the institutes on the professional activities of the recipients. Martinen (16) completed a study designed to determine the impact of the Idaho Summer Institutes on the recipients' educational stature, professional stature, occupational

mobility, and their ability to initiate change in the curricula of the secondary schools in which they taught. The study also elicited the recipients' reactions to the social and academic climates which prevailed at the Institutes. It was hoped that as a result of the study the significance of the contributions made by the summer programs would be realized.

Data was collected by questionnaire from 206 of the 260 participants. Comparisons were made, using chi square and analysis of variance, between recipients who had one summer of training and recipients who had received three summers of training and had also received an advanced degree. The analyses revealed that the Institute training produced few changes in the recipients' educational and professional stature.

It was found that the three year, degree recipients were most apt to alter the curriculum of the school in which they taught. It was noted that almost every unit of study added to the high school's curriculum could be traced to the curriculum offered by Idaho Institutes. The level of institute training also had a significant impact on the recipients' occupational mobility. It was found that stability was correlated to the increase in Institute training frequency.

The recipients reacted positively toward the social and academic climates of the institutes, and almost all of the participants indicated that they had improved as classroom teachers as a result of the institute experience.

References to "Training the Teachers of Teachers" (T_3) type programs

There is a great need for elementary school consultants today. The new curricula emerging from various committees across the country need to be piloted, evaluated, and altered to meet the needs, interests, and abilities of today's elementary children. Because diffusion is slow and communication of research largely uninterpreted from university to grade school levels, consultants are needed who can help bridge the gap. Kleinman (14) points this out lucidly in an article in School Science and Mathematics.

The need for development of these consultants has been a guiding principle in the design and intent of the College Teacher Workshop at Michigan State University. Olson (17) pointed out the need for preparing teachers of teachers and describes the United States Office of Education's Triple T project--Training the Teachers of Teachers--in a recent report. While essentially aimed at in-service development of teacher trainers, the TTT project also helps to develop a more effective relationship between teacher education departments and the needs of the school systems.

"Training the Teachers of Teachers" programs have begun at four universities: University of Georgia, University of California at Los Angeles, Michigan State University, and Hunter College of City University of New York. Olson reports that the Office of Education hopes that it will

> provide the answer to how, in response to present-day demands and within the framework of the relatively small amount of money it has to spend, it can manage to make a dynamic and effective impact on the training of teachers through the training of those who teach teachers. (17)

It is hoped that this study will make some contribution to the design, operation, and evaluation of summer workshops which have as an objective the training of consultants and/or teachers of teachers.

BIBLIOGRAPHY

CHAPTER II

1. Bartlett, C. J., and Edgerton, H. A. "Dimensions of Summer Science Training Programs as Reflected by Their Participants." Psychological Reports, 18 (1966), 67-73.

2. Blough, G. O., et al. "Developing Science Programs in the Elementary School." Rethinking Science Education. Fifty-ninth Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1960. pp. 128.

3. Brandou, J. R. "A Study of an Experimental Program for the In-service Science Education of Elementary School Teachers." Unpublished Ph.D. dissertation, Michigan State University, 1963. pp. 29-47.

4. Chemical and Engineering News. "Chaos in Science Teacher Training." Chemical and Engineering News, 47 (February, 1969), 46-47.

5. Craig, G. S. "The Program of Science in the Elementary School." A Program for Teaching Science. Thirty-first Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1932, pp. 133-162.

6. Fowler, H. S. "Evaluation of an Institute for the Training of Elementary School Science Resource Teachers." Journal of Educational Research, 53 (May, 1960), 358-359.

7. Hale, H. E., et al. "Auxiliary Efforts to Improve the Secondary School Science Efforts." Rethinking Science Education. Fifty-ninth Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1960, pp. 172-195.

8. Hilgert, R. L. "Teacher Reaction to Summer Workshops." School and Community, 54 (1968), 14-15.

9. Hurd, P. D., and Johnson, P. "Problems and Issues in Science Education." Rethinking Science Education. Fifty-ninth Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1960, pp. 329-338.

10. International Reading Association. Final Report: Evaluation of NDEA Institutes for Advancement in Reading. Newark, Delaware: International Reading Association, 1965.

11. Irby, B. N. "A Follow-up Study of the Participants of the National Science Foundation Academic Year Institutes for High School Teachers of Science and Mathematics Held at the University of Mississippi." Dissertation Abstracts, 28 (1968), 2120-A.

12. Jarvi, M. E. "A Follow-up Study of the Carnegie Graduate Fellowship Program at George Peabody College for Teachers." Dissertation Abstracts, 22 (1962), 2706.

13. Johnson, L. H., Obourn, E. S., and Blackwood, P. E. Research in the Teaching of Science. United States Department of Health, Education and Welfare, Office of Education, Bulletin 1965, No. 10. Washington, D. C.: Government Printing Office, 1965. p. 104.

14. Kleinman, G. S. "Needed: Elementary School Science Consultants." School Science and Mathematics, 65 (November, 1965), 738-746.

15. Kuslan, L. I., and Stone, A. H. Teaching Children Science: An Inquiry Approach. Belmont, California: Wadsworth Publishing Company, Inc., 1968. p. 187.

16. Martinen, G. D. "A Study of the National Science Foundation Summer Institutes in Science and Mathematics Held at the University of Idaho from 1957 through 1964 and Their Impact on the Professional Activities of the Recipients." Dissertation Abstracts, 28 (1967), 2446-A.

17. Olson, P. A. "Training the Teachers of Teachers." American Education. United States Department of Health, Education and Welfare, Office of Education, OE-58026, No. 7. Washington, D. C.: Government Printing Office, 1969.

18. Parker, A. "A Study of Certain Aspects of Eight Summer Institutes for High School Science Teachers Conducted in Louisiana." Dissertation Abstracts, 22 (1961), 2537-25-38.

19. Powers, S. R. "Some Criticisms of Current Practices in the Teaching of Science in Elementary and Secondary Schools." A Program for Teaching Science. Thirty-first Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1932, pp. 13-26.

20. Verrill, J. E. "The Preparation of General Elementary Teachers to Teach Science." Research in the Teaching of Science. United States Department of Health, Education and Welfare, Office of Education, OE-29000-61, Bulletin 1965, No. 10. Washington, D. C.: Government Printing Office, 1965, 126-127.

21. Ziol, F. J. "An Eight Week Summer Institute Training Program to Train Instructors of Instrumentation Technology." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, AD-010-433. Washington, D. C.: Government Printing Office, 1966.

CHAPTER III

RESEARCH PROCEDURES

Participant description

Participants for the College Teacher Workshop were invited from the population of college and university professors currently teaching science and/or science education courses for pre-service elementary school teachers and from elementary science consultants and science supervisors. Since the "Training the Teachers of Teachers" model (appendix I) was established to promote educational leadership in Michigan, selection preference was given to applicants from the State of Michigan. Also, since it was expected (and proved to be so) that participants would receive requests for consultation services from local schools, selection preference was given to participants who were in a position to influence science education and who provided evidence, in writing, that their administration would permit them to engage in consulting and implementation activities. No discrimination was made for race, creed, color, national origin, or teaching locality in Michigan in selecting individuals for the Workshop.

The Workshop at Michigan State University was one of four leadership workshops held in the summer of 1968 under National Science Foundation grants. Workshops similar in intent but different in method and content were also held at Teachers College, Columbia University, New York City, New York; Pennsylvania State University, Ogontz Campus, Abington, Pennsylvania; and The University of Texas, Austin, Texas.

Of the fifty-four applicants to the Workshop at Michigan State University thirty were chosen to be participants. They ranged from twenty-nine (29) to sixty (60) years in age. The age mean was forty-one (41) years. The following table (1) shows the gender and employment assignments of the participants.

Table 1.--Gender and Employment Assignments of the Participants

	Science Education	Subject Area	Consultants or Sci. Coord.	Adminis. & Research
Female	2	3	0	0
Male	10	5	9	1

All participants in the College Teacher Workshop were college graduates. Thirteen (13) had doctorates and the remainder had master's degrees.

The colleges which employ the participants range in size from less than one thousand (1,000) to over forty thousand (40,000). Five participants are employed in colleges of 20,000 or more population. The consultants are employed in districts or schools ranging in size from less than five hundred (for a K-6 school) to greater than twenty thousand (for a large K-12 district).

Collectively, the participants have broad educational experience. Table 2, below, shows the number of participants and their years of experience at four different levels of teaching: elementary, junior high, senior high, and college.

Table 2.--Number of Participants and Their Years of Experience in Teaching

Years of Experience	Elementary	Junior High	Senior High	College
1 - 2	4	2	2	5
3 - 5	6	3	5	2
6 - 10	3	4	4	4
11 - 15	-	1		3
16 - 20	-	1	2	3
21 - 25	-	-	-	-
26 & up	-	-	-	1

The number of years in teaching ranges from zero to over forty.

A General Information Checklist was completed by each participant. A copy of this checklist and an item frequency response, as indicated by the participants, is included as Appendix N.

No participants were lost across the duration of the Workshop and subsequent Mid-winter Conference. One participant failed to take the pretest due to family illness. All participants took the posttest together on August 22, 1968. Twenty-six of the participants took the Mid-winter Conference posttest together on December 14, 1968. The other four participants were mailed the questionnaire. All thirty responses were used in the following analyses.

Description of evaluation methodology

The study of the College Teacher Workshop at Michigan State University was conducted in two phases as seen in Figure 1.

July 29- - - - - - - -August 23	December
----Workshop----	Mid-winter Conference
--Phase I--	--Phase II--

Figure 1.

Phase I was an evaluation of the first objective as measured by the learning experiences of the participants during the actual Workshop. Phase II was the evaluation made at the Mid-winter Conference.

Figure 2 shows in detail the areas evaluated in each phase.

Areas of Evaluation

Phase I	Phase II
A. Changes in:	A. Measures of:
Knowledge of program characteristics and program implementation procedures.	Knowledge of program characteristics and program implementation procedures.
Attitude toward programs and their content.	Attitude toward programs and their content.
Knowledge of change-agent strategies.	
Analysis of personal behavior in groups.	
B. Satisfaction of perceived needs.	B. Satisfaction of perceived needs.
	C. Behavioral change in participants.

Figure 2.

Phase I was an evaluation of the Workshop in these areas as well as measuring the extent to which the Workshop satisfied the perceived needs of the participants (Instrument E as appended).

Phase II evaluated the participants in many of these same areas, and measured the behavioral changes of the participants as reflected in their utilization of the two curricula studied in Workshop (Instrument G as appended).

Figure 3 shows the test schedule.

Phase I			Phase II
Pre-institute test over areas outlined in Figure 2	Attitude change evaluations corresponding to major change in the emphasis of the Institute	Post-institute test over areas outlined in Figure 2	Mid-winter test over areas outlined in Figure 2

Figure 3.

In Phase I a measurement instrument was administered at the beginning and at the close of the Workshop. This instrument included an assessment of perceived needs, knowledge of science program characteristics and program implementation procedures, attitude toward programs and their content, and knowledge of change-agent strategies, as well as an analysis of personal behavior in groups. Difference scores for each area show gain or loss for the individual participants and for the Workshop as a group. During the Workshop attitude evaluations were made at the termination of each of the major phases of emphases, which were: (1) Orientations to AAAS and SCIS; (2) Laboratory and micro-teaching activities using the AAAS and SCIS

materials; (3) Group-process skills; (4) Change-agent skills; and (5) Three-day elementary teacher workshop conducted by participants during the Leadership Workshop. On the post measure in Phase I, an evaluation of these major phases of the Workshop was made on Instrument F (as appended).

For Phase II the same tests as used for Phase I were administered at the Mid-winter Conference. Also, measures were made at the Mid-winter Conference to determine the amount and types of behavior changes that reflect the objectives of the Workshop.

This study would seem closely related to others if it were not for the unique format of the Workshop. This Institute included, within the duration of the Workshop: (1) providing the participants with considerable knowledge of the AAAS and SCIS programs, (2) opportunities to use AAAS and SCIS materials with elementary children, (3) a three-day workshop, designed by the participants, that provided an initial contact with elementary school science teachers, and (4) instruction in group-process skills and change-agent skills to assist the participants in their implementation efforts. The follow-up of participants to see if what was learned at the Workshop was put into practice is not only unique but essential to a total evaluation of the Workshop.

Description of measures

All measures and questionnaires used in this study were created by staff of Michigan State University. Instruments A, B, D, E, and F were written by members of the Science and Mathematics Teaching Center under the direction of the Workshop Director, Dr. Richard J McLeod. Instrument C was prepared by the Institute for Extension Personnel Development at Michigan State University.

Instrument A, Knowledge of Program Characteristics and Program Implementation Procedures, is a measure of Workshop content. This instrument assesses knowledge of the AAAS and SCIS programs and was constructed to reflect the objectives and operations of the College Teacher Workshop. In the opinion of the Workshop staff, the questions included in Instrument A are valid in that they represent faithfully and proportionally the content of the Workshop and provide the definition of achievement in the Workshop. (2)

Because Instrument A, and the other instruments as well, were prepared for this Workshop, no reliability information was available prior to the Workshop. The reliability established on these instruments at the College Teachers Workshop is reported later in this study.

Instrument A was administered at pre-Workshop, post Workshop, and Mid-winter Conference testing sessions. A copy of the instrument, a key, and item analysis data are included as Appendix A.

Instrument B, Attitude towards the AAAS and SCIS Programs and the Content of These Programs, was administered at pre-Workshop, post-Workshop, and Mid-winter Conference sessions. This instrument was designed to measure attitude changes due to Workshop activities and content. The seven levels of response, from very strongly disagree to very strongly agree, were weighted one (1) to seven (7). For all items except numbers nine and ten, the highest level (7) was found at the right. For items nine and ten, the ranking increases to the left with seven being at the extreme left. A "no opinion" option was weighted as four (4). Sixteen of the eighteen items could be scored as described above. The last two items, number 17 and 18, were not scored as such, only noted and mentioned as individual responses.

A copy of the instrument and testing results are included in the Appendix.

Instrument C, Analysis of Personal Behavior in Groups, was administered only as a pre and post summer Workshop measure. The participant received the same copy of the measure both pre and post. As a pre-Workshop measure the participant used an "a" to indicate the place on the

scale where he thought he was at that time in the Workshop. When used as a post-measure, the participant used a "b" to indicate his position. In a sense the instrument is self scoring since the participant could readily relate to his growth or lack of growth while he was indicating his post test responses.

The rankings were weighted one (low) to seven (high). The purpose of this measure was to obtain some idea of the effectiveness of the group process sessions in creating an awareness of and gains in personal/group behaviors.

A copy of the instrument and results of testing are included as Appendix C.

Instrument D, Knowledge of Change-Agent Strategies, was designed to determine if the participants gained significantly during the Workshop in the area of change-agent skills.

In working with schools, the identification of and communication with change agents is thought to facilitate the acceptance and successful implementation of new programs. (4) A segment of the Workshop was devoted to discussion of this topic.

The instrument was scored on a basis of the number correct. A copy of the instrument, a key, and item analysis results are included as Appendix D.

Instrument E, Satisfaction of Perceived Needs, was designed by Workshop staff to determine the areas of need, and to measure how well the Workshop satisfied these needs. A variety of topics concerning the new science curricula and school community expectation of the participant were scored on a weighted basis, from very low (1) to very high (5). Although the list of topics to be ranked were thought to be quite inclusive, additional topics were requested from participants. No additional topics were offered by the participants.

A copy of the instrument and test results are included as Appendix E.

Instrument F, Evaluation of the Divisions of the Workshop, was given as a post-Workshop and Mid-winter Conference measure. This instrument was used to determine the attitudes of the participants toward the various divisions of the Workshop. The four-week College Teacher Workshop was arbitrarily divided into five divisions. They are:

1. Orientation to programs
    a. lectures (McLeod, Arbanas, Kageyama, Irwin, Berger, Berkheimer)
    b. films of AAAS and SCIS
    c. printed materials
    d. discussions of programs
2. Laboratory and micro-teaching activities using AAAS and SCIS materials

a. taping and television replay of sessions with children and Resource Teachers (T_2's)

b. involvement with kits, and other experiences with manipulative materials of SCIS and AAAS

3. Group process skills with Dr. Mason Miller and Dr. Shirley Hurley, both of the Michigan State University staff

4. Change Agent skills session with Dr. Everett Rogers of the Michigan State University staff

5. Workshop conducted by participants at Michigan Education Association (MEA) Camp, August 19-21, 1968.

Their opinions on statements as they pertained to each division were recorded on a weighted rank scale. The range of responses was from very strongly disagree (1) to very strongly agree (7). The rankings of the divisions of the Workshop will give directors of subsequent workshops feedback that could be useful for designing those workshops.

A copy of the instrument and test results are included as Appendix F.

Description of research procedures

The design for this study is best described as a one-group pretest-posttest design. (1) Although this design has recognized weaknesses, it is sometimes necessary

to utilize the design to complete a study and to capitalize on the contribution of the design to research.

Some of the weaknesses of a one-group pretest-posttest design are not considered to be troublesome in this study. The narrow range of Workshop activities, experiences with the AAAS and SCIS programs, seems to reduce the possibility that history interferes.

Change-producing events which could have had an effect on Workshop performance are unlikely. The participants were housed together on campus, and no participant had a teaching or consultant assignment during the Workshop. Since the subject of the Workshop was unique in comparison to common daily toil, and since the interaction of participants during the Workshop was considered an integral part of the Workshop, history is not considered as a threatening rival hypothesis.

Maturation as a source of invalidity is also of low probability. The chance that consequential biological or psychological processes occurred is slight for persons of this age during the short time span involved.

Testing is not a weakness in this study since the pretest is defined as part of the treatment, i.e., Workshop. If this study has merit enough to be replicated or imitated, then testing must be accepted as an integral part of the Workshop design.

For each hypothesis a method of analysis was chosen which would describe the results of the tests in a meaningful manner. To utilize parametric statistics, some assumptions had to be made. They were: (1) independence of observations; (2) normal distribution on each dependent variable in the theoretical population; and (3) homogeneity of variance. Since testing was an integral part of the Workshop and the activities of the Workshop were not altered by testing, it was assumed that testing was not reactive. Whether the participants had been tested or not, the preceding activities of the Workshop would have remained unchanged.

The first assumption, independence of observations, is slightly suspect since the participants did interact between pretesting and posttesting. However, the testing was not affected by observer bias since the tests were paper written and the participants were tested separately.

According to Hays (3) the second assumption is not critical for this sample size. The t-test (and F test) are sufficiently robust to be used with the number of participants in the Workshop. And, since equal sample sizes were used on pretests and posttests, the third assumption tends to give relatively small consequences when using these tests.

The procedures for testing each hypothesis follow.

Testing the hypotheses

Hypothesis 1: There will be a significant increase in knowledge of program characteristics and program implementation procedures from pretest to posttest by the participants of the Workshop as measured on Instrument A (appended).

$H_0 : \mu_1 \leq \mu_2$

$H_1 : \mu_1 > \mu_2$ (hypothesis of interest)

let $\alpha = 0.05$ (one-tailed test)

μ_2 = mean of pretest

μ_1 = mean of posttest

Assumptions: (1) Normal distribution in the population

(2) Homogeneity of variance

Test: paired t-test, df = N-1 (N = number of pairs, 29)

Decision Rule: Reject H_0 if t-test value with 28 degrees of freedom exceeds 1.701, the critical value of the one-tailed t value at the 0.05 level of significance tables. (3)

Data: (1) will use 29 participant scores from pretests and posttests (one person failed to take pretest due to illness)

(2) mean scores on pretests and posttests will be recorded

(3) standard deviation on pretests and posttests will be recorded

Hypothesis 2: There will be a significant positive change in attitude toward the programs (SCIS and AAAS) of the Workshop from the pretest to posttest as measured on Instrument B (appended).

$H_0 : \mu_1 \leq \mu_2$

$H_1 : \mu_1 > \mu_2$ (hypothesis of interest)

let $\alpha = 0.05$ (one-tailed test)

Assumptions: See Hypothesis 1

Test: See Hypothesis 1

Decision Rule: See Hypothesis 1

Data: See Hypothesis 1

Recognized weaknesses: See Hypothesis 1

Hypothesis 3: There will be a significant positive change in the analysis scores of group-process skills from pretest to posttest by the participants of the Workshop as measured on Instrument C (appended).

$H_0 : \mu_1 \leq \mu_2$

$H_1 : \mu_1 > \mu_2$ (hypothesis of interest)

let $\alpha = 0.05$ (one-tailed test)

Assumptions: See Hypothesis 1

Test: See Hypothesis 1

Decision Rule: See Hypothesis 1

Data: See Hypothesis 1

Hypothesis 4: There will be a significant increase in knowledge of change-agent skills from pre-test to posttest by the participants of the Workshop as measured on Instrument D (appended).

$H_0 : \mu_1 \leq \mu_2$

$H_1 : \mu_1 > \mu_2$ (hypothesis of interest)

let $\alpha = 0.05$ (one-tailed test)

Assumptions: See Hypothesis 1

Test: See Hypothesis 1

Decision Rule: See Hypothesis 1

Data: See Hypothesis 1

Hypothesis 5: There will be a significant positive correlation between the participant's scores on their attitude toward the various aspects of the Workshop activities as measured on Instrument F (appended) and the participants knowledge of program characteristics and program implementation procedures as

measured on Instrument A (appended). The correlations will be made with measures taken both at the close of the Workshop and at the Mid-winter Conference.

A = Attitude Score

K = Knowledge Score

H_0 : $\rho = 0$ (there is no relationship between the two measures)

H_1 : H_0 is false (a linear relationship exists)

Assumptions: None (see pages 509, 510 Hays)

Test: Pearson Product-Moment Correlation and the F-test for testing the significance of correlation

Decision Rule: Correlation is significant if the F-value at $\alpha = 0.05$, and with 1 and 28 (N-2) degrees of freedom exceeds 4.20, the table value (Hays, page 677).

Data: These tests will be run on post-Workshop and Mid-winter Conference scores.

Hypothesis 6: There will be a significant positive correlation between the participant's scores on their attitude toward various aspects of the Workshop as measured on Instrument F

(appended) and the participants' attitude toward the SCIS and AAAS programs as measured on Instrument B (appended). The correlations will be made with measures taken both at the close of the Workshop and at the Mid-winter Conference. (This correlation will be run for the total group, and for those participants who elected one of the programs for emphasis (workshop run by participants) a separate attitude correlation will be run versus that selected program.)

For methodology: See Hypothesis 5

Hypothesis 7: There will be a significant positive correlation between the increase in knowledge of program characteristics and program implementation procedures as measured on Instrument A (appended) from pretest to posttest and change in attitude towards AAAS and SCIS programs as measured on Instrument B (appended) from pretest to posttest.

For methodology: See Hypothesis 5

Hypothesis 8: There will be a significant positive correlation between the satisfaction of perceived needs of the participants as measured on Instrument E (appended) and their attitude

toward AAAS and SCIS programs as measured on Instrument B (appended) and utilizing:

A. the difference between Workshop pretest and end-of-Workshop posttest on Instrument B versus the posttest of Instrument E

B. the Workshop posttests given in August

C. the Mid-winter Conference tests

For methodology: See Hypothesis 5

BIBLIOGRAPHY

CHAPTER III

1. Campbell, D. T., and Stanley, J. C. Experimental and Quasi-experimental Designs for Research. Chicago: American Education Research Association, Rand McNally and Company, 1963. p. 7.

2. Ebel, R. C. Measuring Educational Achievement. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965. p. 381.

3. Hays, W. L. Statistics for Psychologists. New York: Holt, Rinehart and Winston Co., 1963. pp. 322, 509, 510, 674, 677.

4. Rogers, E. M. Diffusion of Innovations. Galt, Ontario: Free Press of Glencoe, Division of Macmillan Co., 1962. p. 260.

CHAPTER IV

RESEARCH FINDINGS

The purposes of this chapter are: (1) to examine the events of the Workshop; (2) to discuss the results of testing; and (3) to describe and report the results of those methods, other than testing, used in evaluation.

Events of the Workshop

The schedule of the Workshop illustrating the topics that were covered during the four weeks of activities is included as Appendix O.

All of the Workshop activities were held at Michigan State University except for the three day, participant-run workshop.

During the Workshop many resource persons were invited to give leadership, and to share knowledge and experiences with the participants. Those who made major contributions to the Workshop were: Dr. Shirley Hurley and Dr. Mason Miller from the Institute for Extension Personnel Development at Michigan State University; Mr. Jack Arbanas and Dr. Scott Irwin (The University of Texas) representing the AAAS' Science--A Process Approach; Dr. Glen

Berkheimer (Michigan State University), Dr. Carl Berger, and Mrs. Christine Kageyama representing the Science Curriculum Improvement Study; and Dr. Everett Rogers from the Communications Department of Michigan State University.

On the first day of the Workshop a National Aeronautical and Space Administration (N.A.S.A.) test called Decision by Consensus was given to the participants. The participant reaction to this instrument was positive. The test showed that while consensus is difficult to reach, it is worthwhile. The problems of group processes were emphasized in this activity and related to tasks of the Workshop. The N.A.S.A. test is included in the thesis as Appendix J.

Various other handouts were distributed during the Workshop. Representatives of SCIS and AAAS made promotional materials available as well as some complimentary program texts and equipment. The materials used by the Workshop staff and the hardware examined and manipulated by the participants during the Workshop was furnished by Michigan State University under the National Science Foundation grant. The participants were exposed to the new science curricula through a variety of activities.

Consultants for AAAS and SCIS made presentations, directed activities, and discussed with the participants a broad range of topics. The philosophies, the psychological background, the role of the teacher, and the

importance of demonstration teaching were among the topics covered during Workshop sessions.

The participants received experiences in teaching children and elementary teachers in micro-teaching situations. They also participated in feedback sessions with elementary teachers (T_3's in the implementation model) who were members of another workshop that was being held at Michigan State University.

In general, the meetings began each day at 9:00 A.M. and continued until 4:00 P.M. with one hour (noon until 1:00 P.M.) for lunch.

The testing program was integrated into the schedule. Most of the testing took place during the first and last few days of the Workshop.

On Monday, Tuesday, and Wednesday of the last week of the Institute the participants presented a workshop for a small group of elementary teachers at the Michigan Education Association (M.E.A.) Camp near Battle Creek, Michigan.

After studying both of the elementary science programs, the participants selected either AAAS or SCIS for in-depth study. As the Workshop progressed, the participants studied the philosophies, implementation procedures, and activities of the program they had selected.

Preparations for giving the three day workshop were coordinated as to establish three and four man teams.

These teams were formed in such a way that both programs (SCIS and AAAS) were represented on each team.

While at the M.E.A. Camp, these teams put on a three day workshop for teachers and administrators from schools in Michigan. The teachers and administrators who attended the three day workshop were those who had accepted an invitation from the Institute Director. This invitation had been made to all school principals in the State of Michigan. It was suggested that the schools send teams of teachers (at least two) and administrators (at least one) to the workshop. All teams desiring to attend the workshop were accepted. The people attending the workshop were grouped by geographical location and then matched with the participant teams so as to put at least one participant from that geographical location in each team-teacher group, if possible.

The three day workshop utilized materials which had been brought to the M.E.A. Camp from Michigan State University.

Since the close of the Summer College Teacher Workshop, newsletters have been sent to all of the Michigan school districts in an attempt to make them aware that in-service leadership and consultant services are available from these participants.

The workshop at the M.E.A. Camp was considered by the participants to be the most important component of the total Workshop. Feedback data concerning the three day workshop is included as Appendix K. Each team prepared an outline of the activities included in the three day workshop. This outline in included as Appendix L.

Evaluations of the various activities of the College Teacher Workshop are included later in this chapter. Some feedback was obtained for each activity in addition to the testing programs outlined in Chapter Three. Also, a description of the activities of the Mid-winter Conference is included later in this chapter along with feedback obtained at that time.

Tests of hypotheses

Data from the testing instruments for the Workshop, as outlined in Chapter One, were analyzed using the CDC 3600 computer. Item responses and total scores on each measure for each participant were punched on data processing cards and programs from the Michigan State University Agricultural Experiment Station: Statistical Series were utilized in analyzing the statistical data. The t-test results, Pearson product-moment correlations, and the F-test results which are used in this thesis are taken from the computer printout.

The first four hypotheses were analyzed using the paired t-test. Each participant was matched with himself using his pretest and posttest scores as the pair. By matching, one or more sources of variability were removed, thus lowering the sampling error. When matched in this pairwise manner, the difference between the means continues to be an unbiased estimate of the population difference. However, the matching and the consequent dependence within the pairs changes the standard error of the difference; i.e., introduces a covariance of the means. This unknown value was not a problem, however. By utilizing the paired t-test and allowing N (number of scores) to represent the number of differences, an ordinary t-test for a single mean could be carried out.

In the analysis for this study it was assumed that the sample size was large enough that the normal approximations are sufficiently accurate. The t-test is relatively powerful for a population of thirty subjects at the 0.05 level of significance.

The one-tailed test was utilized for these hypotheses since it was assumed that the Workshop was of worth to the participants. No difference scores and a lessening of test scores were both considered to be unacceptable if the Workshop was to have met the objectives for which it was established.

Whether or not there exists a significant positive correlation between different sets of data is tested in the last four hypotheses. The Pearson product-moment correlation provides a precise estimate of the degree of relationship in the data. A test of each correlation was made using the F test. The F statistic is quite sensitive when used to test the significance of the correlation ratio.

The discussion of the results of testing is organized according to the hypotheses as stated in Chapter Three.

Hypothesis 1: There will be a significant increase in knowledge of program characteristics and program implementation procedures from pretest to posttest by the participants of the Workshop as measured on Instrument A (appended).

The hypothesis tested was: $H_0 : \mu_1 \leq \mu_2$

Stated symbolically the hypothesis of interest was: $H_1 : \mu_1 > \mu_2$

A one-tailed test of significance at the 0.05 level using the paired t-test was used to test the null hypothesis, $\mu_1 \leq \mu_2$. Since there were twenty-nine paired scores (one participant failed to take the pretest) analyzed, the degrees of freedom for this test is N-1 or 28. Using these degrees of freedom a t-value of greater than 1.70 is significant at the 0.05 level of significance. Data analysis gave a t-value for this test of 4.54. This

shows that there was a significant difference between pretest scores and posttest scores on Instrument A.

There was also a significant difference between the pretest scores of the Workshop and the Mid-winter Conference scores. Analysis of these scores gave a t-value for these scores of 4.34.

The null hypothesis, H_0, was rejected. It may be possible to conclude that the Workshop had an effect on the knowledge of the participants, and this knowledge persisted.

Other descriptive data collected on the raw scores for the pretest, posttest, and Mid-winter test using Instrument A are shown as part of Appendix A.

There was a shrinking of the standard deviation and a lowering of the Kuder-Richardson (Number Twenty) reliability from pretest to posttest. This was anticipated since the range of scores were expected to collapse and did so. Some items of this test proved to be poor discriminators and other items to be of too high or too low a difficulty. The coefficient of reliability could be improved by rewriting or replacing the weaker test items. If this instrument were to be used for subsequent workshop evaluations, a strengthening of the reliability is suggested.

Hypothesis 2: There will be a significant positive change in attitude toward the programs (SCIS and AAAS) of the Workshop from pretest to

posttest as measured on Instrument B (appended).

Stated symbolically the hypothesis of interest is: $H_1 : \mu_1 > \mu_2$

The paired t-test with 28 degrees of freedom and at the 0.05 level of significance was used to test the null hypothesis, $\mu_1 \leq \mu_2$. A t-value of greater than 1.70 is significant. Analysis of Instrument B scores gave a paired t-test value of 3.05 for this hypothesis test, high enough to reject the null hypothesis. This rejection may lead to the conclusion that there was a positive change in attitude toward the programs during the Workshop.

The total scores on Instrument B, and some other measures, were obtained by totaling the rank level responses of the participants to all items. Descriptive data concerning the measure is included as part of Appendix B.

Hypothesis 3: There will be a significant positive change in the analysis scores of group-process skills from pretest to posttest by the participants of the Workshop as measured on Instrument C (appended).

Stated symbolically the hypothesis of interest is: $H_1 : \mu_1 > \mu_2$

The paired t-test was also used to test the null hypothesis. The level of significance was established at 0.05 and the number of degrees of freedom was N-1 or 28.

The calculated t-value is 6.54. This value is greater than the table value of 1.70 for testing significance.

The conclusion, therefore, is to reject the hypothesis of no difference in the scores on group-process skills as indicated by the participants' reactions recorded on Instrument C.

Other statistical data are reported as part of Appendix C.

Hypothesis 4: There will be a significant increase in knowledge of change-agent skills from pretest to posttest by the participants of the Workshop as measured on Instrument D (appended).

The null hypothesis is: $H_0 : \mu_1 \leq \mu_2$

The directional hypothesis stated symbolically is: $H_1 : \mu_1 > \mu_2$

Using 28 degrees of freedom and a significance level of 0.05, a value greater than the table value of 1.70 would indicate a significant increase on this measure. The value for the paired t-test using participant scores was calculated to be 2.93.

The null hypothesis, H_0, is rejected. The possibility exists that a significant increase in change-agent skills knowledge is indicated by the participants' scores on this measure.

Descriptive data collected on the raw scores of the participants for the pretest and posttest are reported as part of Appendix D.

The low reliability, to a large degree, is due to the small number of items (nine) in this measure.

Hypothesis 5: There will be a significant positive correlation between the participants' scores on their attitude toward the various aspects of the Workshop activities as measured on Instrument F (appended) and the participants' knowledge of program characteristics and program implementation procedures as measured on Instrument A (appended). The correlations will be made with measures taken both at the close of the Workshop and at the Mid-winter Conference.

The null hypothesis, H_0, is: $\rho = 0$ (no linear relationship)

H_1 : H_0 is false (there is a linear relationship between the two measures)

A Pearson product-moment correlation coefficient of 0.09 for the post-Workshop scores was found. The relationship between these measures was not significant. The F-test further concluded this by showing a value of 0.83, well below the necessary value of 4.20 for significance.

On comparison of the Mid-winter Conference scores, calculations gave a correlation coefficient of 0.17. This value indicates that there was no significant correlation of these two measures. The F-test supported this conclusion by giving for this data a value of 0.94. This is below the necessary significance level of 4.20 given in the tables.

Hypothesis 6: There will be a significant positive correlation between the participants' scores on their attitude toward various aspects of the Workshop as measured on Instrument F (appended) and the participants' attitude toward the SCIS and AAAS programs as measured on Instrument B (appended).

The correlations were made with measures taken both at the close of the Workshop and at the Mid-winter Conference.

A correlation value of 0.36 between the Instrument B and Instrument F was reported for measures taken at the close of the Workshop. The F value for these data is 3.83, slightly below the necessary value for significance of 4.20. While this correlation is not significant at the 0.05 level, it is significant at the 0.06 level.

For the Mid-winter Conference tests a correlation coefficient of 0.22 is reported. This is a small relationship. The F-test for these data was 1.34, considerably

under the 4.20 table value for this level. The H_0 of no significant relationship cannot be rejected.

Correlations were also made for those participants who elected one of the programs for emphasis; i.e., he or she elected to concentrate on one of the two elementary school science programs, AAAS or SCIS, in preparation for the three day participant-run workshop. These correlations were made with data taken at the close of the Workshop and at the Mid-winter Conference.

When comparing the post-Workshop scores for the SCIS group, a correlation coefficient of 0.25 was obtained. This appears to be a small relationship. However, the F-test of significance gives a value of 0.76, well below the necessary value of 4.84 taken from the tables. It can be concluded, therefore, that for the SCIS group a significant relationship does not exist between the thirteen posttest scores of Instrument B and the posttest scores of Instrument F.

Analysis of the Mid-winter Conference scores on Instrument B and F yields a correlation coefficient of 0.05, not significant.

The same tests for a significant correlation were made using the scores of the AAAS group. Analysis of the fifteen AAAS post-Workshop measures gave a correlation coefficient between Instrument B and Instrument F of 0.50. This is a significant relationship. The F-value calculated

from test scores is 4.25. The correlation is significant at the 0.05 level. Members of the AAAS group apparently looked favorably on the activities of the Workshop.

The correlation coefficient found with Mid-winter Conference scores is 0.40, not significant.

Hypothesis 7: There will be a significant positive correlation between the increase in knowledge of program characteristics and program implementation procedures as measured on Instrument A (appended) from pretest to posttest and change in attitude towards AAAS and SCIS programs as measured on Instrument B (appended) from pretest to posttest.

The Pearson Product-Moment Correlation coefficient calculated for these difference scores is 0.36. This value is not significant and was confirmed by the F-test value of 3.85, slightly below the necessary value of 4.20 at the 0.05 level. This correlation coefficient is, however, significant at the 0.06 level.

Hypothesis 8: There will be a significant positive correlation between the satisfaction of perceived needs of the participants as measured on Instrument E (appended) and their attitude toward AAAS and SCIS programs as measured on Instrument B (appended) and utilizing:

A. the difference between Workshop pretest and end-of-Workshop posttest on Instrument B versus the posttest of Instrument E

B. the Workshop posttests given in August

C. the Mid-winter Conference posttests

Analysis gives a correlation coefficient for the first comparison (A) of 0.26. This is not a significant relationship and is confirmed as such by the F-test of significance which gives a value of 1.86.

For the second relationship (B from above), the Pearson product-moment correlation is 0.36. This correlational value is almost significant at the 0.05 level. The F-test for this correlation is calculated at 3.80, slightly below the necessary table value for these data of 4.20. This correlation is significant at the 0.06 level, however.

The third correlation (C) made with data collected at the Mid-winter Conference yields a coefficient of relationship of 0.12. This is not significant; therefore we cannot reject the hypothesis of no difference.

In Table 3, below, are capsulized the results of the hypothesis testing. All tests were made at the 0.05 level of significance.

Table 3.--Results of Hypothesis Testing

Hypothesis	Test used	Table value	Calculated value	Decision
1	paired t-test (df=28)	1.701	4.34	Reject null hypothesis
2	paired t-test (df=28)	1.701	3.05	Reject null hypothesis
3	paired t-test (df=28)	1.699	6.54	Reject null hypothesis
4	paired t-test (df=28)	1.701	2.93	Reject null hypothesis

		Correlation	Table value for F-test (df=1,28)	Calculated F-test value (df=1,28)	Decision
4	Pearson Product-Moment	0.09	4.20	0.83	No linear relationship
5	Pearson Product-Moment	0.36	4.20	3.83	No linear relationship
6	Pearson Product-Moment	0.36	4.20	3.85	No linear relationship
7	Pearson Product-Moment	0.26	4.20	3.80	No linear relationship

Other descriptive data

One way to examine the activities of the Workshop is through the reactions of the participants.

At the close of the various activities of the Workshop, the reactions of the participants were obtained on a short questionnaire. Appendix H shows the date of each

questionnaire and reports the activity which was evaluated. The questionnaire items were ranked on a low (1) to high (7) basis, and the total score for each person and each test recorded. Those activities that received the highest ranking by the participants were: number 10, Mrs. C. Kageyama with the SCIS demonstration lesson; number 12, Mrs. C. Kageyama with SCIS; number 13, Dr. R. McLeod with AAAS; number 17, Dr. Carl Berger with SCIS; and number 21, M.E.A. Camp workshop conducted by the participants. The activities receiving the lowest ranking by the participants were: number 4, Dr. G. Berkheimer with SCIS objectives; number 6, Mr. J. Arbanas with a general discussion of AAAS; and number 19, Dr. E. Rogers with change-agent skills. A report of the comments made by the participants on the various activities is included in the appendix following Instrument H.

It appears that activity-oriented sessions such as those directed by Dr. Berger and Mrs. Chris Kageyama, and the participant-run workshop should be considered for subsequent workshops.

Some of the tests used during the Workshop included a question or two which were short answer or comment requests.

On Instrument B the participants were asked to indicate which of the two programs they favored more.

The table below shows the responses for each of the three times that this instrument was given.

Table 4.--Elementary Science Program Preferred by Participants

	Prefer SCIS	Prefer AAAS	Both	Neither
Pretest	7	14	-	8
Posttest	12	13	4	1
Mid-winter test	15	11	3	1

There was a slight attrition of participants from the AAAS program. This is probably due in some part to the poor service which some of the participants experienced when they began to order supplies after returning to their school assignments. Those persons who were borderline at the beginning of the Workshop appear to have moved to the SCIS program. A general feeling was that the SCIS program would be easier to install and implement into traditional schools.

On Instrument E, besides the correlations run on total scores in testing Hypothesis 8, an analysis of the pretest, perceived needs, and the posttest, satisfied needs, was completed. An item by item response tally is included in the appendix following Instrument E. Those items which were perceived as the greatest needs, i.e.,

75 percent or more of the responses were at the 4 and 5 rank level, include: number 1, philosophy of the programs; number 2, knowledge of the written materials; number 3, knowledge of the manipulative materials; number 10, the types of workshops which might be used in implementing the new curricula; number 12, grade levels at which new science curricula can be implemented; number 14, how one gets materials for use in teacher workshops; number 15, orientation programs; number 16, talks to PTA, School Board, teachers, etc., about the program; number 17, workshops; number 26, on-going in-service work and help; and number 28, know how to help implement new programs.

Perceived as needs by 50 percent to 74 percent of the responses at the 4 or 5 level were: number 13, where scientific principles should first be introduced; number 18, visit classes; number 19, demonstration teaching; number 22, help schools to select appropriate program; and number 25, possibility of offering regular college courses for credit in the new programs.

At the close of the Workshop the same items were used to measure the satisfaction of perceived needs. Seventy-five percent or more of the responses indicated that the following items were at the 4 and 5 level rank: number 1, philosophy of the programs; number 10, the types of workshops which might be used in implementing the new curricula; number 12, grade levels at which new science

curricula can be implemented; number 15, orientation programs; number 16, talks to PTA, School Board, teachers, etc., about the program; number 17, workshops; number 20, consultation on problems; number 26, on-going in-service work and help; and number 28, know how to help implement new programs.

At a slightly lower percentage of response, 50 percent to 74 percent at the 4 and 5 level, were items as follows: number 2, knowledge of the written materials; number 3, knowledge of the manipulative materials; number 13, where scientific principles should first be introduced; number 14, how one gets materials for use in teacher workshops; number 19, demonstration teaching; number 22, help schools to select appropriate program; and number 27, change agent in local schools.

By putting these pretest and posttest results into a table, it is possible to get some measure of the influence of the Workshop. Table 4, below, shows that those areas that were considered to be the most outstanding needs by the participants were satisfied almost fully. It is interpreted to indicate that the Workshop was most successful in reaching its intended objective of providing the participants with knowledge and philosophy of the SCIS and AAAS programs and experiences in conducting a workshop and assisting in implementation.

Table 5.--Perceived Needs and Satisfied Needs

Pretest (Perceived Needs)		Posttest (Satisfied Needs)	
High	Greatest	High	Greatest
	1		1
	2	2	
	3	3	
	10		10
	12		12
13		13	
	14	14	
	15		15
	16		16
	17		17
18			
19		19	
	20		20
22		22	
25			
	26		26
	28	27	28

Some additional investigation of Instrument F was also accomplished. The results of the post-Workshop test were analyzed separately to find which of the five divisions of the Workshop, as arbitrarily set by the staff, were

considered to be the most worthwhile to the participants. A complete Question/Division data report is included following Appendix F.

As a result of this analysis, it was discovered that the workshop at the M.E.A. Camp scored consistently high in the ranking by the participants. Those portions of the College Teacher Workshop which dealt with orientation to programs also scored high in all categories. This further supports other evidence already reported that a workshop run by the participants probably should be included in subsequent summer workshops.

The participants ranked the sessions on Change-Agent Strategies and Group Processes low in every category of measure. This is interpreted in light of other written responses to indicate that the participants felt too much time was given to Group-Process Skills. Twenty-three of the participants indicated this opinion in comments on Instrument F. Perhaps future workshops should consider giving less time for Group Process Skills, and consider eliminating Change-Agent sessions or changing the method or personnel involved in handling this aspect of the workshop program.

The Mid-winter Conference was held at Michigan State University in December, 1968. The follow-up session was aimed primarily at exchange of feedback.

One of the objectives of this study was to describe the behavior changes of the participants in their on-the-job implementation of curriculum change in activities related to the AAAS and SCIS programs. Instrument G was designed to obtain data that might indicate how the participants were performing in comparison to how they performed a year ago.

Instrument G was given at the Workshop but was not used to test any hypothesis. This measure was rather used to obtain data on the post-Workshop activities of the participants and to look at changes in their behavior that could be considered as having resulted at least in part from their Workshop participation. This questionnaire was given at the commencement of the Mid-winter Conference. It was hoped that by giving the measure at this time, before interaction of the participants could begin, that individual responses would be recorded.

A question response data form is included in the appendix following Instrument G. Some interesting results were obtained. A notable increase in the number of formal class sessions, laboratory sessions, and assignments devoted to AAAS and SCIS programs and materials was indicated. The participants indicated that almost one hundred (100) sessions or assignments were given in SCIS and AAAS this year as compared to only twelve (12) or thirteen (13) last year.

Seven of the participants indicated they had introduced AAAS or SCIS in the first weeks of school. Thirteen of the participants had given work on these programs to their classes before returning to the Mid-winter Conference at Michigan State University.

Sixty-one workshops which have included AAAS and/or SCIS in their format were reported to have been given between the Summer Leadership Workshop and the time of the questionnaire in December.

The participants also reported that forty-two AAAS activities and thirty-six SCIS activities, all taken directly from the programs, had been included in their laboratory or regular classes. A great number of materials had also been purchased by the participants for their classes or for workshops. The amount of time that the participants are now devoting to in-service training has increased over last year. Five of the participants report that 90 percent or more of their current in-service work is in AAAS or SCIS. Eight others reported doing up to 40 percent of their in-service work in one or the other of the programs.

The effects of the Workshop appear to have diffused to colleagues of the participants. The participants report forty-four other persons on their staffs have used AAAS or SCIS this year as compared to only nine who were reported as using any of these materials a year ago.

One of the objectives of the Workshop was to create resource persons (T_1's in the implementation model). The participants reported in the mid-winter questionnaire that they had been contacted, collectively, thirty-six times for AAAS and twenty-seven times for SCIS as a direct result of the M.E.A. Camp Workshop. This indicates that the participants have been established as consultants to some degree in many Michigan areas. The participants had also been involved in discussions with nine school boards and nine parent-teacher associations.

Generally, the participants do not feel that any barriers exist in the applicability and suitability of these two elementary school science programs in reference to the grade levels for which they were designed. Almost exclusively, the problems of implementation of AAAS and SCIS programs into the pre-service classes of the participants and into elementary school classrooms are those of funding.

From the participants responses on Instrument G, it appears that a definite increase in the use of the processes of science and a definite re-alignment of many pre-service programs has begun. Most of the participants, in response to the question "What major things are you doing differently than you probably would have done if you had not attended the Leadership Workshop?" answered that they are more involved in the two programs, more involved

with workshops, and are drawing from their experiences at the Workshop.

The staff of the Workshop sought to reduce some of the problems met by the participants in their attempt to teach or implement the AAAS and SCIS programs. One problem, the difficulty in obtaining AAAS supplies, was discussed with the representative, in person, and the general sales manager of Xerox, the distributor, via a group telephone hook-up. The discussion of this problem brought into clearer focus the difficulties of articulating new national curricula.

The Workshop seems to have been very effective in preparing the participants as resource persons in elementary school science.

The response to the Mid-winter Conference was overwhelmingly positive. The questionnaire on which participants responded is included as Appendix M. Following the instrument in the appendix are the data that was collected from the participant responses. Sharing of experiences was listed as the thing they most liked about the Mid-winter Conference. One person commented, "I've completely changed my attitude about elementary science as a result of the Workshop. Thank you."

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter has two major divisions. The first section is concerned with the conclusions which can be drawn as a result of analysis and interpretation of the data collected during the study. In the second section of this chapter the implications of this study are considered, and recommendations are made.

Conclusions

The purpose of this study was to evaluate the reactions of the participants of the Leadership Workshop on Elementary School Science held at Michigan State University in the summer of 1968 so as to gain insight into the worth of the Workshop as a learning situation and as a vehicle for change. The Leadership Workshop was designed to help fill the need for resource people who could assist school districts with the implementation of two new elementary science curricula: the AAAS Science--A Process Approach and Science Curriculum Improvement Study.

In order to accomplish this evaluation, several instruments were devised to measure the cognitive and affective results of the Workshop program. Also, an instrument was designed which would look into the behaviors of the participants many months after the Workshop in order to determine if changes occurred.

The program of the Workshop was designed to prepare the thirty participants to be consultants in the new elementary school science curricula. Also, changes in the participants' pre-service classes for teachers, stressing the philosophies currently accepted by science education leaders, was desired.

The study was based on data obtained from the college teachers and science coordinators who were the participants of the Workshop. These participants are considered a representative sample of a larger population of college science teachers and science consultants. The study used statistical techniques to test directional hypotheses, and used the reactions of the participants on many measures to obtain knowledge concerning the worth of the Workshop.

The hypotheses tested are given in Chapter One. Shortened forms of these hypotheses are included below with the results of the testing. Paired t-tests and Pearson Product-Moment Correlation coefficients were used to test the hypotheses.

Hypothesis 1: There will be a significant increase in knowledge concerning the topics of the Workshop as measured on Instrument A.

The participants scored consistently higher on the posttest than on the pretest. A significant difference was found in the data from the pretest to the posttest for the Workshop, and from the Workshop pretest to the Mid-winter Conference test.

Hypothesis 2: There will be a significant positive change in attitude toward the AAAS and SCIS programs over the course of the Workshop.

A significant positive change in attitude was reported. The participants appeared to accept the two elementary school science curricula and to believe that they merit consideration for implementation in their courses and in elementary schools.

Hypothesis 3: There will be a significant increase in the participants' scores on the measure for group-process skills due to activities of the Workshop.

The paired t-test showed a significant increase in participants' scores. It was concluded that the participants gained knowledge of the necessary skills and/or confidence in their abilities to work with groups.

Hypothesis 4: A significant increase in knowledge of change-agent skills will be measured.

A significant positive change in knowledge about change-agent skills was indicated by the participants' scores.

Hypothesis 5: A significant positive correlation will exist between knowledge of the programs and attitude towards the activities of the Workshop.

No significant correlation was found. The fact that no relationship between attitude concerning the program and knowledge of the program exists suggests that factors not considered complicate this comparison.

Hypothesis 6: A positive correlation will exist between attitude towards the two elementary science curricula and attitude towards the Workshop.

The correlation generated by the data from the post-Workshop test was not significant at the 0.05 level. However, some correlation in these data did exist, and further analysis showed it to be significant at approximately the 0.06 level.

The correlations were also run with Mid-winter Conference scores and found to be not significant. Correlations were also tried between scores from those participants who stressed one of the programs (AAAS or SCIS) of the Workshop. No relationship appeared to exist between scores from the SCIS group. A significant relationship was indicated between the scores of the AAAS group.

The difference in correlation significance between the SCIS and AAAS groups may be due to a change in attitude towards the AAAS program due to the difficulties in obtaining their materials. Although in the case of SCIS some problems with obtaining materials were encountered, many more problems were found with obtaining AAAS supplies. Perhaps the logistics and mechanics of distribution need to be considered more thoroughly and more lead time planned for these programs before they are released on a commercial basis.

Hypothesis 7: There will be a correlation between the increase in knowledge concerning program topics and the increase in attitude scores towards the two elementary science curricula.

No relationship was found. The correlation coefficients were less than significant for these difference scores.

Hypothesis 8: There will be a significant positive relationship between the satisfaction of perceived needs scores and the participants' attitudes towards AAAS and SCIS curricula as measured at post-Workshop and Mid-winter Conference.

No relationship was found between the change in attitude towards the programs from pretest to posttest and the satisfaction of perceived needs. A small correlation

was found between post-Workshop measures on the two tests, but the degree of relationship was not significant at the 0.05 level.

No significant correlation was found between Mid-winter Conference test scores for these measures.

The significant differences between pre-Workshop and post-Workshop measures as indicated by the first four hypotheses show that the Workshop was a successful vehicle for increasing the knowledge of the participants in the topic of the workshop and creating a positive attitude toward the AAAS and SCIS programs. The participants also showed marked gains in knowledge of group process skills and knowledge of change-agent skills.

These gains in factual knowledge along with the significant positive change in attitudes toward the AAAS and SCIS programs are among the factors that can be positively identified as contributing to the success of the Workshop.

The attempts to show correlation among different measures were largely unsuccessful. It was anticipated that such correlations would assist future designers of workshops in their selection of activities and participants. The lack of relationships in this study does not indicate that relationships do not occur. It only indicates that, for this study, those factors chosen were not significantly related.

The results of other measures not included in the testing of hypotheses point to the positive reaction of the participants toward the activities and staff of the Workshop. Of particular importance are the comparisons of perceived needs and satisfied needs as indicated by the participants' reactions listed on Instrument E. From the twenty-eight needs listed, twelve were identified as being of greatest need on the pretest. Eight of these "greatest needs" were largely satisfied according to 75 percent or more of the participants. This high degree of satisfaction is one index of the success of the Workshop.

At the Mid-winter Conference a questionnaire was used to measure the behavioral changes of participants. There was a large increase in the number of workshops given by participants. The amount of AAAS and SCIS materials used in pre-service teacher training classes also increased significantly. Some diffusion of the participants enthusiasm for the two new elementary school science programs seems to have occurred. This is indicated by the increased numbers of colleagues of the participants who are utilizing AAAS and SCIS in their classrooms. The Leadership Workshop appears to have been a successful mechanism for producing change in the participants. This change also appears to be advantageous to the goals of the Workshop.

During the Workshop reactions and comments were periodically solicited from the participants in regard to activities. These comments were overwhelmingly favorable. The activity most

often praised was the three day participant-run workshop held during the final week of the Leadership Workshop.

Implications and Recommendations

The results of this study indicate that cognitive and affective changes were brought about in this Leadership Workshop. Furthermore, the results seem to indicate that the Workshop was an effective instrument for producing desired behavioral changes.

There now appears to be general acceptance of science as an integral part of the elementary school curriculum. This acceptance magnifies the need to train new teachers and retrain experienced teachers in science education in a manner which reflects current thought and practice. For this reason, it is recommended that more leadership workshops be given.

The writer recommends that evaluations be included as an integral part of the workshop, and that follow-up studies be included as part of the total evaluation. If instruments from this study are utilized in subsequent institutes, the investigator suggests that revisions be made to increase the reliability of the instruments. On Instrument A, for example, item analyses of test results shows that items number two, six, seven, twelve, nineteen, twenty one, forty eight and fifty seven were poor discriminators or had low difficulty indices on both of the post-Workshop measures. These and perhaps other weak items could be removed, improved, or replaced.

It is suggested that Instrument C be lengthened. Nine items are too few to insure a good sampling of participant knowledge. Typically the reliability coefficient will be greater for scores from a longer test than from a shorter test.

It is the investigator's intuitive feeling that positive correlations between measures should have been found; re: hypotheses five, six and seven. Weaknesses within the instruments may have been responsible for the lack of relationships. Perhaps if all attitude measures had used seven rank levels (Instrument E used five) and if all attitude instruments had used a parallel form a more meaningful interpretation would be possible. Also, a study of the classification of instrument questions on an hierarchial basis may lead to a strengthening of the tests.

Other studies currently in progress at Michigan State University are investigating the diffusion effects of this Leadership Workshop and various aspects of recently trained classroom teachers (T_1's).

One of the questions which emerged from this study appears to be important in light of national assessment and future finding. That is: Are science educators more, or less, amenable to change than other educators? It is recommended that future researchers look into this question.

The writer is convinced that continued support of workshops for science educators can be a meaningful and economical method for improving teacher education and elementary school science instruction.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

Campbell, D. T., and Stanley, J. C. Experimental and Quasi-experimental Designs for Research. Chicago: American Education Research Association, Rand McNally and Company, 1963.

Cox, D. R. Planning of Experiments. New York: John Wiley and Sons, Inc., 1958.

Downie, N. M., and Heath, R. W. Basic Statistical Methods. New York: Harper and Row, 1965.

Ebel, R. C. Measuring Educational Achievement. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965.

Hays, W. L. Statistics for Psychologists. New York: Holt, Rinehart, and Winston Co., 1963.

Johnson, L. H., Obourn, E. S., and Blackwood, P. E. Research in the Teaching of Science. United States Department of Health, Education and Welfare, Office of Education, Bulletin 1965, No. 10. Washington, D. C.: Government Printing Office, 1965.

Kuslan, L. I., and Stone, A. H. Teaching Children Science: An Inquiry Approach. Belmont, California: Wadsworth Publishing Company, Inc., 1968.

Rogers, E. M. Diffusion of Innovations. Galt, Ontario: Free Press of Glencoe, Division of Macmillan Co., 1962.

Articles and Pamphlets

Bartlett, C. J., and Edgerton, H. A. "Dimensions of Summer Science Training Programs as Reflected by Their Participants." Psychological Reports, 18 (1966), 67-73.

Blough, G. O., et al. "Developing Science Programs in the Elementary School." Rethinking Science Education. Fifty-ninth Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1960.

Chamberlain, W. D. "Development and Status of Teacher Education in the Field of Science for the Elementary School." Science Education, 42 (December, 1958), 406-409.

Chemical and Engineering News. "Chaos in Science Teacher Training." Chemical and Engineering News, 47 (February, 1969), 46-47.

Cornfield, J., and Tukey, J. W. "Average Values of Mean Squares in Factorials." The Annals of Mathematical Statistics, 27 (1956), 907-949.

Craig, G. S. "The Program of Science in the Elementary School." A Program for Teaching Science. Thirty-first Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1932, 133-162.

Creswell, J. C. "How Effective Are Modern Mathematics Workshops." The Arithmetic Teacher, 14 (March, 1967), 205-208.

Dunfee, M., and Greenlee, J. "Elementary School Science: Research, Theory, and Practice." Association for Supervision and Curriculum Development, 67, Washington, D. C.: the Association, 1957.

Fowler, H. S. "Evaluation of an Institute for the Training of Elementary School Science Resource Teachers." Journal of Educational Research, 53 (May, 1960), 358-359.

Hale, H. E., et al. "Auxiliary Efforts to Improve the Secondary School Science Efforts." Rethinking Science Education. Fifty-ninth Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1960, 172-195.

Hilgert, R. L. "Teacher Reaction to Summer Workshops." School and Community, 54 (1968), 14-15.

Hurd, P. D., and Johnson, P. "Problems and Issues in Science Education." Rethinking Science Education. Fifty-ninth Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1960, 329-338.

Irby, B. N. "A Follow-up Study of the Participants of the National Science Foundation Academic Year Institutes for High School Teachers of Science and Mathematics Held at the University of Mississippi." Dissertation Abstracts, 28 (1968), 2120-A.

Jarvi, M. E. "A Follow-up Study of the Carnegie Graduate Fellowship Program at George Peabody College for Teachers." Dissertation Abstracts, 22 (1962), 2706.

Johnson, L. H., Obourn, E. S., and Blackwood, P. E. Research in the Teaching of Science. United States Department of Health, Education and Welfare, Office of Education, Bulletin 1965, No. 10. Washington, D. C.: Government Printing Office, 1965.

Karplus, R. "The Science Curriculum Improvement Study." Journal of Research in Science Teaching, 2 (1964), 293-303.

Kleinman, G. S. "Needed: Elementary School Science Consultants." School Science and Mathematics, 65 (November, 1965), 738-746.

Kleinman, G. S. "Progress Report of an Experimental In-Service Institute in Science for Elementary School Teachers of Grades K-6." Science Education, 50 (March, 1966), 136-139.

Livermore, A. H. "The Process Approach of the AAAS Commission on Science Education." Journal of Research in Science Teaching, 2 (1964), 271-282.

Lyon, M. C. "Evaluation as an Integral Part of a Summer Science Program for Talented High School Students." Science Education, 47 (October, 1963), 377-382.

Martinen, G. D. "A Study of the National Science Foundation Summer Institutes in Science and Mathematics Held at the University of Idaho from 1957 through 1964 and Their Impact on the Professional Activities of the Recipients." Dissertation Abstracts, 28 (1967), 2446-A.

Michals, B. E. "The Preparation of Teachers to Teach Elementary School Science." Science Education, 47 (March, 1963), 122-132.

Olson, P. A. "Training the Teachers of Teachers." American Education. United States Department of Health, Education and Welfare, Office of Education, OE-58026, No. 7. Washington, D. C.: Government Printing Office, 1969.

Orr, D. B., and Young, A. T. "Who Attends NSF Institutes?" The Science Teacher, 30 (November, 1963), 39-40.

Parker, A. "A Study of Certain Aspects of Eight Summer Institutes for High School Science Teachers Conducted in Louisiana." Dissertation Abstracts, 22 (1961), 2537-2538.

Powers, S. R. "Some Criticisms of Current Practices in the Teaching of Science in Elementary and Secondary Schools." A Program for Teaching Science. Thirty-first Yearbook of The National Society for the Study of Education Part I. Chicago: The University of Chicago Press, 1932, 13-26.

Sims, W. C. "The Development and Evaluation of an In-Service Education Program in Elementary School Science." Science Education, 42 (December, 1958), 391-398.

Other Sources

Barnard, J. D. "Implications for Science Education." Supervision of Quality Education. United States Department of Health, Education and Welfare, Office of Education, OE-29039, Bulletin 1963, No. 3. Washington, D. C.: Government Printing Office, 1963.

Bixler, J. E. "The Effect of Teacher Attitude on Elementary Children's Science Information and Science Attitude." Unpublished Ph.D. dissertation, Stanford University, 1957.

Board of Education, Watertown, Connecticut. "Regional Elementary School Teacher Up-grading Project." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ES-000-419. Washington, D. C.: Government Printing Office, 1966.

Brandou, J. R. "A Study of an Experimental Program for the In-service Science Education of Elementary School Teachers." Unpublished Ph.D. dissertation, Michigan State University, 1963.

Cooley, W. W., and Bassett, R. D. "Evaluation and Follow-up Study of a Summer Science and Mathematics Program." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ED-002-923. Washington, D. C.: Government Printing Office, 1960.

Gatewood, C. W., Obourn, E. S., and Ellsworth, S. "Improving Science Education in The United States." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ED-011-512. Washington, D. C.: Government Printing Office, 1963.

International Reading Association. Final Report: Evaluation of NDEA Institutes for Advancement in Reading. Newark, Delaware: International Reading Association, 1965.

Kerr, E. F. "The Role of the Consultant in Elementary Science." Unpublished doctoral dissertation, Teachers College, Columbia University, 1956.

Office of the County Superintendent of Schools, Riverside, California. "Accelerating Diffusion of Innovative Science Programs." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ES-000-774. Washington, D. C.: Government Printing Office, 1966.

Taylor, T. W., et al. "Review of Research Studies in Science Education." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ED-012-235. Washington, D. C.: Government Printing Office, 1966.

Verrill, J. E. "The Preparation of General Elementary Teachers to Teach Science." Research in the Teaching of Science. United States Department of Health, Education and Welfare, Office of Education, OE-29000-61, Bulletin 1965, No. 10. Washington, D. C.: Government Printing Office, 1965, 126-127.

Westmeyer, P., et al. "A Comparison of Various Techniques for the Dissemination of a New Science Curriculum in Florida." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ED-010-632. Washington, D. C.: Government Printing Office, 1967.

Wheatland-Chili Central School, Scottsville, New York. "Regional Center for Study and Improvement of Elementary Science Education." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, ES-000-489. Washington, D. C.: Government Printing Office, 1966.

Ziol, F. J. "An Eight Week Summer Institute Training Program to Train Instructors of Instrumentation Technology." Educational Resources Information Center. United States Department of Health, Education and Welfare, Office of Education, AD-010-433. Washington, D. C.: Government Printing Office, 1966.

APPENDIX A

Appendix A NUMBER_____

DIRECTIONS: Multiple Choice. Choose the best answer.

_____ 1. Which of the following persons is the project director of AAAS?

A. Robert M. Gagne
B. Robert Karplus
C. John R. Mayor
D. Charles Walcott
E. Jerrold R. Zacharias

_____ 2. Which of the following persons is the project director of SCIS?

A. Robert M. Gagne
B. Robert Karplus
C. John R. Mayor
D. Charles Walcott
E. Jerrold R. Zacharias

_____ 3. The grade levels to be included in Science--A Process Approach are:

A. K-16
B. K-12
C. K-8
D. K-6
E. 1-6

_____ 4. The grade levels to be included in the SCIS curriculum are:

A. K-16
B. K-12
C. K-8
D. K-6
E. 1-6

_____ 5. The main funding agency for AAAS is:

A. American Association for the Advancement of Science
B. National Science Foundation

Number_____

C. National Science Teachers Association
D. United States Office of Education
E. University of California

_____ 6. The main funding agency for SCIS is:

A. American Association for the Advancement of Science
B. National Science Foundation
C. National Science Teachers Association
D. United States Office of Education
E. University of California

_____ 7. The current publishing agency (if any) for AAAS is:

A. Holt, Rinehart, Winston
B. Harcourt, Brace and World
C. Rand McNally
D. Raytheon
E. Xerox

_____ 8. The current publishing agency (if any) for SCIS is:

A. Holt, Rinehart, Winston
B. Harcourt, Brace and World
C. Rand McNally
D. Raytheon
E. Xerox

_____ 9. The approximate cost of a complete set of AAAS materials per class (30 students) in grade one is:

A. $450
B. $350
C. $250
D. $150
E. $50

_____10. The approximate cost of SCIS materials per class (32 students) in grade one is:

A. $450
B. $350
C. $250
D. $150
E. $50

Number_____

_____11. The final commercial edition of AAAS materials that will be commercially available for 1968-69 are:

A. Science--A Process Approach Parts I-II only
B. Science--A Process Approach Parts I-III only
C. Science--A Process Approach Parts I-IV only
D. Science--A Process Approach Parts I-VI only
E. Science--A Process Approach Parts I-VII

_____12. The SCIS materials that will be commercially available for 1968-69 are:

A. Interaction, Life Cycles, Material Objects, Organism, Relativity, and Subsystems
B. Interaction, Material Objects, Organisms, Relativity, and Subsystems
C. Interaction, Material Objects, Organisms, and Subsystems
D. Interaction, Material Objects, Organisms
E. None of the above are correct

_____13. The AAAS evaluation instruments that will be commercially available for 1968-69 are:

A. The "Process Instrument"
B. The "Competency Measures" for all grades covered by Science--A Process Approach
C. Both the "Process Instrument" and the "Competency Measures"
D. No evaluation instrument will be commercially available

_____14. The SCIS evaluation instruments that will be commercially available for 1968-69 are:

A. The "Process Instrument"
B. STEP
C. The "Content Instrument"
D. The "Materials and Interaction" instrument
E. No evaluation instrument will be commercially available

Number_____

_____15. The primary evaluation emphasis of SCIS has been on:

A. Comparing students who have had SCIS with those who have not
B. A definitive measure of the scientific literacy of the pupils emerging from SCIS courses
C. Evaluating the program by collecting feedback information from teachers and Trial Center Coordinators

_____16. AAAS materials that will be available for teacher workshops in 1968-69 include:

A. "Commentary for Teachers"
B. "Guide for the Instructor of a Teacher Education Program"
C. Both A and B
D. None

_____17. SCIS materials that will be available for teacher workshop in 1968-69 include:

A. SCIS Developmental Skill Commentary
B. "SCIS Sourcebook"
C. Both A and B
D. None

_____18. The major psychological influence on the AAAS program?

A. Bruner
B. Gagne
C. Piaget
D. Skinner
E. Thorndike

_____19. The major psychological influence on the SCIS program?

A. Bruner
B. Gagne
C. Piaget
D. Skinner
E. Thorndike

Number_____

_____20. Piaget's ideas of development have influenced both AAAS and SCIS. Which statement(s) best illustrate this school of thought?

A. Development is limited to external situations, and is thereby provoked.
B. Children's intellectual capacity passes through a number of qualitatively contrasting stages before adulthood.
C. A child's interaction with his environment plays a very significant role in his transition from one stage to another.
D. A child can learn any subject matter at any stage of his development.
E. Combination of A and B
F. Combination of B and C
G. Combination of B and D

_____21. The AAAS curriculum makes use of hierarchy charts. Which of the following statements about them is most accurate?

A. They illustrate the types of skills considered, and the relationships among skills within one process and among the several processes.
B. They only illustrate the types of skills considered, and the relationships among skills within one process.
C. They only illustrate the types of skills considered in flow chart form.

22-23 In comparing AAAS and SCIS approaches to the integration of their curricula, one can find significant differences in emphasis in the three elements: concepts, phenomena, and processes.

_____22. AAAS is structured on

A. Concepts
B. Concepts and Phenomena
C. Concepts and Processes
D. Phenomena
E. Processes

_____23. SCIS is structured on

A. Concepts
B. Concepts and Phenomena
C. Concepts and Processes
D. Phenomena
E. Processes

Number_____

_____24. The relative importance of sequencing in the SCIS and AAAS programs:

A. Important only in AAAS
B. Important only in SCIS
C. Important in both
D. None are sequenced

_____25. The relative amount of quantitative science incorporated in the SCIS and AAAS programs:

A. More quantitative science in SCIS than AAAS
B. More quantitative science in AAAS than SCIS
C. Both have about the same amount of quantitative science
D. Little or no quantitative science incorporated in either program

_____26. The primary objective of each of the exercises in the AAAS curriculum is:

A. to gain a better understanding of a science principle
B. to gain scientific literacy
C. to teach one or more of the processes of science
D. the development of competent scientists
E. None of the above correct

_____27. The primary purpose of the SCIS curriculum is:

A. the development of competent scientists
B. to develop more meaningful science materials for children
C. the development of specified process skills
D. the development of scientific literacy
E. None of the above

_____28. By "invention" lesson in SCIS, we mean:

A. the children recognize a scientific principle when presented with various examples of a concept
B. the children create new solutions to problems
C. the teacher introduces the science concept that describes what the children have observed
D. None of the above are correct

_____29. In the "discovery" lesson in SCIS:

A. experiences are provided that present further examples of a previously described concept
B. materials are provided whereby children can arrive at a scientific principle without teacher prompting
C. students study the history of famous scientific discoveries
D. None of the above are correct

_____30. The average amount of time required to teach each of the AAAS units (e.g., part A) in the elementary schools is about:

A. 11-12 months
B. 8-10 months
C. 5-7 months
D. 3-5 months
E. 1-2 months

_____31. The average amount of time required to teach each of the SCIS units (e.g., Organisms) in the elementary schools is about:

A. 11-12 months
B. 8-10 months
C. 6-7 months
D. 3-5 months
E. 1-2 months

_____32. The title of the first unit commonly used in SCIS is:

A. Interaction
B. Material Objects
C. Organisms
D. Subsystems
E. Temperature

_____33. The primary emphasis of Part A of the AAAS curriculum is:

A. Classifying
B. Measuring
C. Observing
D. Using space/time relationships
E. None of the above are correct

Number_____

_____34. The process(es) dealt with in Part B of the AAAS curriculum:

A. Classifying, communicating, measuring, observing, using numbers, and using space/time relationships
B. Classifying, communicating, measuring, observing, using numbers
C. Classifying, communicating, measuring, observing
D. Classifying and observing
E. Communicating

_____35. As a "laboratory director" in one of the new elementary science curriculums, you can best make use of the technique of asking questions by:

A. using them to find out if they remember what you told them yesterday
B. using them in order to allow the children to hunt for a predetermined answer
C. using mostly "why" questions
D. using mostly "how" questions

_____36. The approximate amount of preparation time needed for teaching a lesson in SCIS is:

A. 0 minutes
B. 10 minutes
C. 30 minutes
D. 45 minutes
E. 60 minutes at least

_____37. The amount of time required for preparing a SCIS lesson as compared to that required for preparing a AAAS lesson:

A. SCIS required more time
B. AAAS required more time
C. Both AAAS and SCIS require about the same time

Number_____

_____38. In considering the possibility of teacher self-instruction as a means of gaining the competency required for teaching the new science programs, which statement is most accurate?

A. Generally, both SCIS and AAAS teaching competency can be gained by teacher self-instruction
B. Generally, neither SCIS nor AAAS teaching competency can be gained by teacher self-instruction
C. Generally, only SCIS teaching competency can be gained by teacher self-instruction
D. Generally, only AAAS teaching competency can be gained by teacher self-instruction

_____39. The amount of storage space needed to adequately accommodate the AAAS materials for a class of 30 students is:

A. five cubic feet
B. ten cubic feet
C. twenty cubic feet
D. forty cubic feet

_____40. The minimum amount of storage space needed to adequately accommodate the SCIS materials for a classroom of 30 students is:

A. five cubic feet
B. ten cubic feet
C. twenty cubic feet
D. forty cubic feet

_____41. What is the intensity of the problems that a third-grade transfer student might encounter upon entering either SCIS or AAAS from some other program?

A. Could easily adapt to both SCIS or AAAS
B. Could adapt more easily to SCIS than to AAAS
C. Could adapt more easily to AAAS than to SCIS
D. Would find many adaptation problems in a similar amount in both AAAS and SCIS

Number_____

_____42. The distribution of content in the AAAS program is approximately:

A. Life Sciences 50%
Physical Sciences 25%
Mathematics 10%

B. Life Sciences 25%
Physical Sciences 25%
Mathematics 10%
Other 40%

C. Life Sciences 25%
Physical Sciences 40%
Mathematics 20%
Other 15%

D. Life Sciences 10%
Physical Sciences 75%
Other 15%

_____43. How do SCIS and AAAS lend themselves to local integration with existing curricula?

A. Content and methods can easily be adapted from both SCIS and AAAS
B. Content and methods can easily be adapted from SCIS but not from AAAS
C. Content and methods can easily be adapted from AAAS but not from SCIS
D. Content and methods cannot be easily adapted from either SCIS or AAAS

_____44. The main purpose of using Mr. O in SCIS is:

A. to aid in identifying similarities and differences among animals outside the classroom
B. to enable the students to describe properties of an entire organism
C. to experiment with, to find the origin of detritus
D. to act as a reference frame

Number_____

_____45. In studying magnetism a child used an electromagnet to attract some paperclips. Which of the following would best describe the "system" under study?

A. Child, electromagnet, and paper clips
B. Child and electromagnet
C. Electromagnet
D. Electromagnet and paper clips

_____46. In SCIS, the purpose for the activity in which the children compare similarly shaped pieces of aluminum, brass, pine, walnut, plexiglass, and polystyrene is:

A. to lead to the introduction of the concept of material
B. for the identification and naming of two or more characteristics of an object (such as color and texture)
C. for the construction and demonstration of the use of a single-stage system for classifying materials
D. to gain a better understanding of the concept of inequalities

_____47. In SCIS the investigation of freon was used as a study of a(n)

A. material object
B. using space/time relationship
C. measurement
D. subsystem
E. system

_____48. In SCIS the "systems" concept is introduced for what primary reason?

A. So that the student can better identify differences within a set of similar objects
B. So that the student can better identify body movements other than those of locomotion
C. So that the student can learn to focus his attention on parts of his environment
D. To emphasize the principle of conservation of matter as a conceptual tool for dealing with all natural phenomena

Number_____

_____49. The measurements of the earth's magnetism and the relationship of this to map reading is encountered in:

A. SCIS only
B. AAAS only
C. Both SCIS and AAAS
D. Neither SCIS nor AAAS

_____50. The ordering of clam shells by property, using comparison signs, is encountered in:

A. SCIS only
B. AAAS only
C. Both SCIS and AAAS
D. Neither SCIS nor AAAS

_____51. The best operational definition of the term "mass" is:

A. quantity of matter
B. the size of an object whether it is in space or on earth
C. that property of an object which determines the amount of acceleration that will be imparted to it by a force of a given magnitude
D. that quantity of matter that when acted upon by a force will not change its velocity

_____52. The use of "models" is found in:

A. AAAS only
B. SCIS only
C. Both SCIS and AAAS
D. Neither one

_____53. The relative amount of reading the fourth grade student is required to do in SCIS, AAAS, and ESS would be:

A. more reading in ESS than in SCIS or AAAS
B. more reading in SCIS and AAAS than in ESS
C. about the same amount of reading in all three programs

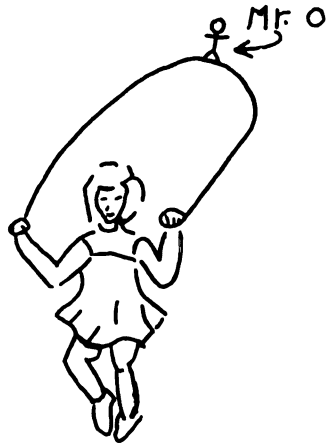
Number_____

_____54. The case of the "suffocating candle" was used in AAAS to illustrate what process?

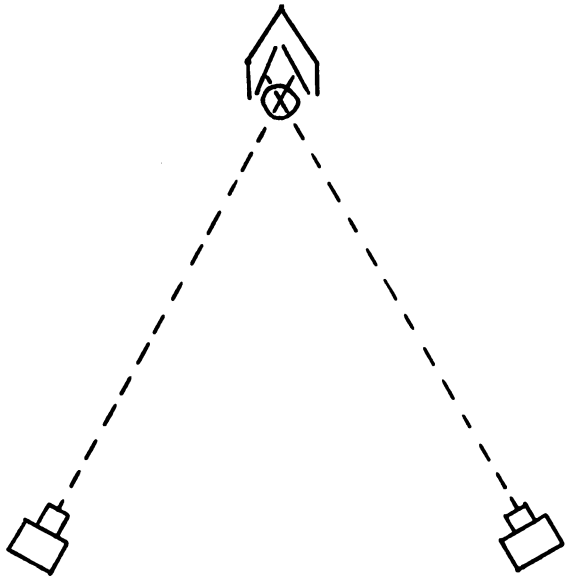
A. Observing
B. Classifying
C. Measuring
D. Communicating
E. Inferring
F. Predicting
G. None of the above

_____55. Where are we most likely to encounter such a drawing?

A. AAAS - Observation
B. AAAS - Using space/time relationships
C. SCIS - Subsystems
D. SCIS - Relativity

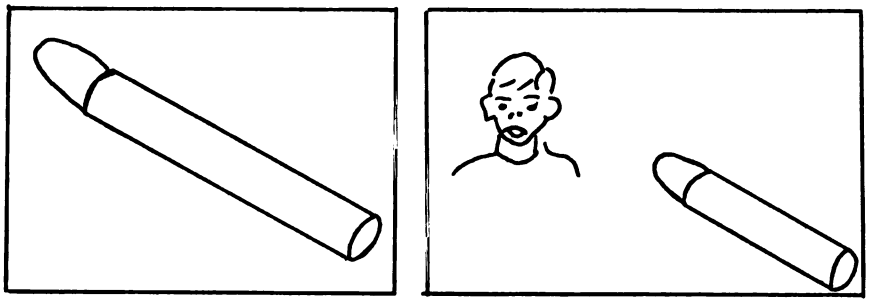


Number_____



_____56. The objective most closely associated with this laboratory setup in one of the new elementary science programs is:

A. State that if an object does not move, the forces acting upon it must be in balance
B. Identify the two-dimensional projections of a given three-dimensional object
C. Describe the positions of objects or systems
D. Isolate and manipulate groups of objects



_____57. The series of pictures above were used in SCIS to illustrate

A. Material Objects
B. Inventions
C. Measurement
D. Relativity
E. Interaction

Appendix A--Key

Question	Answer	Question	Answer
1	3	29	1
2	2	30	2
3	4	31	4
4	4	32	2
5	2	33	3
6	2	34	1
7	5	35	4
8	4	36	3
9	2	37	1
10	1	38	2
11	3	39	2
12	1	40	2
13	3	41	2
14	5	42	3
15	3	43	4
16	3	44	4
17	2	45	4
18	2	46	1
19	3	47	4
20	6	48	4
21	1	49	2
22	5	50	1
23	2	51	3
24	3	52	3
25	2	53	1
26	3	54	6
27	4	55	4
28	3	56	2
		57	5

Appendix A.--Descriptive data of Instrument A.

	Pretest	Posttest	Mid-winter Test
Range	3-43	23-45	23-49
Mean	22.71	34.89	33.68
Standard Deviation	11.90	5.55	5.55
Mean Item Difficulty	60	39	41
Mean Item Discrimin.	53	23	23
Kuder Richardson Reliability No. 20	.9319	.6770	.6769
Standard Error of Measurement	3.0499	3.0802	3.1717

APPENDIX B

Appendix B

We are interested in your opinions on the following statements. Below each statement are seven blanks that correspond to various shades of agreement and disagreement. Check the blank that most closely corresponds to your own feeling as you read that statement.

The following is an example of how to answer the questions:

1. Cigarette smoking is harmful to a person's health.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

If you very strongly agree with the statement, you should place an X in the blank labelled "very strongly agree" and your answer should look like this:

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	X VERY STRONGLY AGREE

If you moderately disagree with the statement, you should place an X in the blank labelled, "moderately disagree" and your answer should look like this:

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	X MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

CHECK ONLY ONE BLANK FOR EACH QUESTION:

ANSWER ALL QUESTIONS.

Number_____

1. As a taxpayer, I can justify the costs of SCIS being put into the schools because of the gains that will result from the use of these programs.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

2. As a taxpayer, I can justify the costs of AAAS being put into the schools because of the gains that will result from the use of these programs.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

3. I would recommend SCIS to the schools my children attend (or did attend, or will attend).

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

4. I would recommend AAAS to the schools my children attend (or did attend, or will attend).

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

5. If I had the opportunity to redesign the elementary school curriculum, I would include SCIS in the curriculum.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

Number_____

6. If I had the opportunity to redesign the elementary school curriculum, I would include AAAS in the curriculum.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

7. The de-emphasis of the teacher as the primary information source of science is a good part of the SCIS science project.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

8. The de-emphasis of the teacher as the primary information source of science is a good aspect of AAAS.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

9. The fact that many traditional concepts are excluded by SCIS is a detraction from that program's quality.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

10. The fact that many traditional concepts are excluded by AAAS is a detraction from that program's quality.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

Number_____

11. Teachers should be able to make the transition from teaching traditional science programs to the teaching of SCIS with little or no difficulty.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

12. Teachers should be able to make the transition from teaching traditional science programs to the teaching of AAAS with little or no difficulty.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

13. The learning of scientific concepts such as conservation of energy should be incidental to the learning of the process approach such as classification and serial ordering.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

14. Scientific concepts appropriate to the age level of the child should receive as much emphasis as the scientific process in the teaching of science.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

Number_____

15. I would recommend SCIS to most schools.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

16. I would recommend AAAS to most schools.

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

17. Which of the two programs do you favor more?

VERY STRONGLY DISAGREE	STRONGLY DISAGREE	MODERATELY DISAGREE	NO OPINION	MODERATELY AGREE	STRONGLY AGREE	VERY STRONGLY AGREE

18. Give three concise short reasons for your answer to number 17.

Appendix B

Table III.--Elementary science program preferred by participants.

	Prefer SCIS	Prefer AAAS	Both	Neither
Pretest	7	14	-	8
Posttest	12	13	4	1
Mid-Winter Test	15	11	3	1

Appendix B

Table III.--Descriptive data from Instrument B scores.

	Pretest	Posttest	Mid-Winter Test
AAAS Sub-Group			
Mean	80.07	87.73	87.33
Standard Deviation	9.43	9.75	6.79
SCIS Sub-Group			
Mean	77.15	88.15	90.38
Standard Deviation	10.16	9.11	6.64

APPENDIX C

MSU COLLEGE TEACHER WORKSHOP
July 29-August 23, 1968

Your Identifying
Number

ANALYSIS OF PERSONAL BEHAVIOR IN GROUPS

Direction: Read over the scales and on each one place an "A" indicating the place on the scale where you think you are at this point in this Institute.

1. Ability to listen to others in an understanding way

1 2 3 4 5 6 7
Low High

2. Tendency to build on the previous ideas of other Institute members

1 2 3 4 5 6 7
Low High

3. Likely to trust others

1 2 3 4 5 6 7
Low High

4. Willingness to discuss my feelings (emotions) in a group

1 2 3 4 5 6 7
Unwilling Willing

5. Willingness to be influenced by others

1 2 3 4 5 6 7
Unwilling Willing

6. Tendency to seek close personal relationships with others in a group

1	2	3	4	5	6	7
Low						High

7. My reaction to comments about my behavior in a group

1	2	3	4	5	6	7
Reject						Welcome

8. Awareness of the feelings of others

1	2	3	4	5	6	7
Unaware						Aware

9. Degree of understanding why I do what I do

1	2	3	4	5	6	7
Low						High

10. Reaction to conflict and antagonism in the Institute

1	2	3	4	5	6	7
Low Tolerance						High Tolerance

11. Reaction to expressions of affection and warmth in the Institute

1	2	3	4	5	6	7
Low Tolerance						High Tolerance

12. Reaction to opinions opposed to mine

1	2	3	4	5	6	7
Low Tolerance						High Tolerance

13. How easily were you able to accept the staff as persons

1	2	3	4	5	6	7
Very Difficult						Very Easy

14. Anything you want to tell the staff about themselves:

Instrument C_a--Question 14: Collected Comments

1. Communications consultant excellent. Attitude of Resources Consultant excellent.
2. Great job.
3. Great job. Keep it up.
4. Competent. Willingness to listen and react. Excellent group of professional people.
5. Very cooperative, willing to help, and well versed in their jobs.
6. Great people.
7. They had good mothers and fathers.
8. Staff has been very cooperative and down-to-earth. "Good Joes."
9. Very patient, very accepting, very hard-working.
10. Everyone I've met so far has been personable and competent in their field.
11. You're a very good bunch of guys, helpful and all. You're a wonderful bunch.
12. Good staff, good spirit. Equality of treatment of all participants was commendable.
13. Did very good job. Some lack of organization.
14. Their efforts far outshine the participants.
15. As in many institutes, there appears to be a lack of communication among staff members and some lack of organization.
16. On the whole the staff is friendly, adequate, and well organized.
17. The Workshop is moving very well, and I feel I have learned considerably from the meetings.
18. Good fellows! Sincere and anxious to help.

19. I feel that those participating in this Workshop are leaders in their own schools, and therefore there is a struggle for leadership among the group at this Workshop. Some individuals try to control the groups too much by themselves. (I still agree with the above.)

20. An effort should have been made at the very beginning to get everyone better acquainted, oriented to the campus, and to the city. Need more direction to avoid confusion. Can't trust this group any more than other.

Appendix C.--Descriptive data from Instrument C scores.

	Pretest	Posttest
Mean	64.13	67.60
Standard Deviation	8.62	7.72

Prepared by Institute for Extension Personnel Development, Michigan State University, East Lansing

APPENDIX D

Appendix D Number_____

In the blank at the left of the question number, place the letter of the best possible answer to that question.

_____ 1. Which of the following would make the better pilot teacher?

a. Mr. Roberts is the steady man of the science field. He is willing to listen to new ideas but is selective in which ones he will work with. He is not usually the first nor the last to switch to a new method or to use new materials. His advice is often sought out and is well respected.

b. Mr. Bruce is a dynamic, enthusiastic teacher who is willing to try new teaching techniques and materials when they appear. The other teachers know that if there is a new development or a new piece of equipment in science, Mr. Bruce is probably using it right now or has used it and is already using something newer. If teachers want information on the new developments, Mr. Bruce usually has the answer.

_____ 2. If the same teacher is used to initiate all new programs, which of the following is most likely to result?

a. No one else has the opportunity to test and evaluate new programs.

b. A biased result because only one person uses all the programs.

c. The effective leadership of the teacher is increased.

d. The effective leadership of the teacher is decreased.

Number_____

_____ 3. Which group would make the better pilot teachers?

a. Those who conform more closely to the society norms than the average individual.

b. Those who have a small, close circle of friends within the school and social relationships with these same people, with little overlap of social and professional relationships to people outside the school.

_____ 4. Which group would make the better pilot teachers?

a. Those who have relatively more participation in formal and informal organizations.

b. Those who have relatively more desire to concentrate on school and classroom activities.

_____ 5. When working with an Elementary Teacher, at what stage will you be of most use to him?

a. When he wants to learn about the science programs.

b. When he is forming an opinion as to the merits of the program.

c. When he is trying to convince other teachers of the merits of the program.

d. Equal importance at all stages.

_____ 6. In picking a school for a pilot program, which of the following is most important for the long-range success of the program?

a. The school system has enough money to finance the program.

b. The program fills a recognized void or deficiency in the school.

c. The superintendent, principal, and science coordinator are in favor of the program.

d. The social climate of the community exhibits a willingness and a desire for curriculum modifications.

Mark a T if the following statements are true and mark an F if the following statements are false.

_____ 7. I should experience relatively little or no resistance to the new programs once the advantages are explained.

_____ 8. I can identify the opinion leader of a group of teachers by looking for the teacher who is always willing to be one of the first to try out new ideas.

_____ 9. The responsibility for anticipating the consequences of the science program lies with those who use the program and not with those who are merely introducing it into a school.

APPENDIX E

Appendix D--Key

Question	Answer
1	a
2	d
3	a
4	b
5	a
6	b
7	F
8	F
9	F

Appendix D.--Descriptive data from Instrument D scores

	Pretest	Posttest
Range	2-8	1-8
Mean	4.68	4.89
Standard Deviation	1.72	1.64
Mean Item Difficulty	48	48
Mean Item Discrimin.	49	49
Kuder Richardson Reliability No. 20	.4303	.4742
Standard Error of Measurement	1.2832	1.3124

Appendix E Number_____

(Pre Test)

DIRECTIONS: The following items deal with the question: What do you want to get out of this Workshop concerning the new elementary science curricula?

Please circle one of the five numbers to the left of each item that most clearly represents the intensity of your desire to find out about that item.

KEY: 1. very low 2. low 3. neutral 4. high 5. very high

Very Low				Very High	
1	2	3	4	5	1. Philosophy of the programs
1	2	3	4	5	2. Knowledge of the written materials
1	2	3	4	5	3. Knowledge of the manipulative materials
1	2	3	4	5	4. How to present new programs to academic college community
1	2	3	4	5	5. Instructional pattern now prevalent in our schools
1	2	3	4	5	6. The amount of money now spent on science in the elementary schools
1	2	3	4	5	7. The amount of time now devoted to science in the elementary schools
1	2	3	4	5	8. The average elementary teacher's knowledge of science
1	2	3	4	5	9. The school organization
1	2	3	4	5	10. The types of workshops which might be used in implementing the new curricula
1	2	3	4	5	11. Science facilities in the elementary school classroom
1	2	3	4	5	12. Grade levels at which new science curricula can be implemented

Please list others not mentioned above on the back of this sheet.

Number_____

Very Low				Very High	
1	2	3	4	5	13. Where scientific principles should first be introduced
1	2	3	4	5	14. How one gets materials for use in teacher workshops

DIRECTIONS: The following items deal with the question: What do you think that the school community expects of college teachers like yourself?

Please circle one of the five numbers to the left of each item, that most clearly represents the relative strength of this community feeling.

KEY: 1. very low 2. low 3. neutral 4. high 5. very high

Very Low				Very High	
1	2	3	4	5	15. Orientation programs
1	2	3	4	5	16. Talks to PTA, Board, Teachers, etc. about the program
1	2	3	4	5	17. Workshops
1	2	3	4	5	18. Visit classes
1	2	3	4	5	19. Demonstration teaching
1	2	3	4	5	20. Consultation on problems
1	2	3	4	5	21. Science content instruction
1	2	3	4	5	22. Help schools to select appropriate program
1	2	3	4	5	23. Help schools to find financial support for implementation
1	2	3	4	5	24. Help schools to locate materials which are not included in kit

Please list others not mentioned on the back of this sheet

Number_____

Very Low				Very High	
1	2	3	4	5	25. Possibility of offering regular college courses for credit in the new programs
1	2	3	4	5	26. On-going in-service work and help
1	2	3	4	5	27. Change agent in local schools
1	2	3	4	5	28. Know how to help implement new programs

Please list others not mentioned on the back of this sheet

Appendix E Number_____

(Posttest)

DIRECTIONS: The following items deal with the question: What did you get out of the Workshop concerning the new elementary science curricula?

Please circle one of the five numbers to the left of each item that most clearly represents the intensity of your feelings about that item.

KEY: 1. very low 2. low 3. neutral 4. high 5. very high

Very Low				Very High	
1	2	3	4	5	1. Philosophy of the programs
1	2	3	4	5	2. Knowledge of the written materials
1	2	3	4	5	3. Knowledge of the manipulative materials
1	2	3	4	5	4. How to present new programs to academic college community
1	2	3	4	5	5. Instructional pattern now prevalent in our schools
1	2	3	4	5	6. The amount of money now spent on science in the elementary schools
1	2	3	4	5	7. The amount of time now devoted to science in the elementary schools
1	2	3	4	5	8. The average elementary teacher's knowledge of science
1	2	3	4	5	9. The school organization
1	2	3	4	5	10. The types of workshops which might be used in implementing the new curricula
1	2	3	4	5	11. Science facilities in the elementary school classroom
1	2	3	4	5	12. Grade levels at which new science curricula can be implemented

Please list others not mentioned above on the back of this sheet.

Number_____

Very Low				Very High	
1	2	3	4	5	13. Where scientific principles should first be introduced
1	2	3	4	5	14. How one gets materials for use in teacher workshops

DIRECTIONS: The following items deal with the question: How did the Workshop satisfy what you think the school community expects of college teachers and coordinators like yourself?

Please circle one of the five numbers to the left of each item, that most clearly represents the relative strength of your feeling about that item.

KEY: 1. very low 2. low 3. neutral 4. high 5. very high

Very Low				Very High	
1	2	3	4	5	15. Orientation programs
1	2	3	4	5	16. Talks to PTA, Board, Teachers, etc. about the program
1	2	3	4	5	17. Workshops
1	2	3	4	5	18. Visit classes
1	2	3	4	5	19. Demonstration teaching
1	2	3	4	5	20. Consultation on problems
1	2	3	4	5	21. Science content instruction
1	2	3	4	5	22. Help schools to select appropriate program
1	2	3	4	5	23. Help schools to find financial support for implementation
1	2	3	4	5	24. Help schools to locate materials which are not included in kit

Please list others not mentioned on the back of this sheet

Number_____

Very Low				Very High	
1	2	3	4	5	25. Possibility of offering regular college courses for credit in the new programs
1	2	3	4	5	26. On-going in-service work and help
					27. Change agent in local schools
					28. Know how to help implement new programs

Please list others not mentioned on the back of this sheet

Appendix E.--Descriptive data for Instrument E.

	Perceived Needs Pretest Responses (%)					Satisfied Needs Posttest Responses (%)				
Item No.	1	2	3	4	5	1	2	3	4	5
1			10.3	34.5	48.3			13.3	50.0	36.7
2			6.9	31.0	62.1	3.3		26.7	46.7	20.0
3			3.4	37.9	55.2		13.3	20.0	43.3	23.3
4	20.7	13.8	17.2	20.7	27.6	10.0	20.0	20.0	30.0	16.7
5	20.7	13.8	41.4	13.8	10.3	16.7	33.3	30.0	16.7	3.3
6	24.1	27.6	31.0	13.8	3.4	26.7	40.0	30.0	3.3	
7	20.7	17.2	41.4	17.2	3.4	23.3	30.0	43.3	3.3	
8	13.8	24.1	20.7	31.0	10.3	23.3	23.3	26.7	23.3	3.3
9	24.1	37.9	31.0	6.9		33.3	26.7	40.0		
10			3.4	27.8	69.0		3.3		40.0	56.7
11	13.8	27.6	24.1	24.1	10.3	13.3	23.3	50.0	13.3	
12		10.3	10.3	51.7	27.6			13.3	53.3	33.3
13	3.4	10.3	20.7	34.5	24.1	6.7	10.0	33.3	43.3	6.7
14		6.9	13.8	41.4	37.9	3.3	10.0	36.7	23.3	26.7
15	3.4		6.9	48.3	34.5			6.7	66.7	23.3
16	3.4	6.9	13.8	51.7	24.1		3.3	13.3	46.7	33.3
17			10.3	24.1	65.5			6.7	43.3	50.0
18		3.4	44.8	34.5	17.2		20.0	40.0	26.7	13.3
19		17.2	27.6	31.0	20.7	3.3	16.7	26.7	33.3	16.7
20			6.9	31.0	62.1		10.0	10.0	43.3	36.7
21	6.9	10.3	34.5	27.6	17.2	13.3	16.7	46.7	20.0	3.3
22	10.3		20.7	31.0	34.5		6.7	20.0	40.0	33.0
23	37.9	13.8	31.0	13.8	3.4	20.0	40.0	30.0	6.7	3.3
24	13.8	10.3	37.9	24.1	10.3	16.7	26.7	40.0	13.3	3.3
25	6.9	3.4	24.1	31.0	27.6	10.0	30.0	26.7	26.7	6.7
26			3.4	41.4	55.2			10.0	53.3	36.7
27	10.3	13.8	27.6	24.1	20.7		3.3	30.0	40.0	26.7
28			3.4	37.9	58.6			6.7	50.0	43.3

Perceived as greatest needs: (75% or greater of responses at 4 and 5 level)

1, 2, 3, 10, 12, 14, 15, 16, 17, 26, 28

Perceived as needs: (50%-74% of responses at 4 and 5 level)

13, 18, 19, 22, 25

Greatest satisfaction of needs: (75% or greater of responses at the 4 and 5 level)

1, 10, 12, 15, 16, 17, 20, 26, 28

Satisfaction of needs: (50%-74% of responses at 4 and 5 level)

2, 3, 13, 14, 19, 22, 27

Perceived Needs		Satisfied Needs	
High	Greatest	High	Greatest
	1		1
	2	2	
	3	3	
	10		10
	12		12
13		13	
	14	14	
	15		15
	16		16
	17		17
18			
19		19	
	20		20
22		22	
25			
	26		26
		27	
	28		28

No. 25 was ranked by 60.1% of the participants at the 3, 4, and 5 levels on the posttest, satisfied needs.

No. 27 was ranked by 72.4% of the participants at the 3, 4, and 5 levels on the pretest, perceived needs.

Appendix E.--Descriptive data from Instrument E scores.

	Pretest	Posttest	Mid-winter Test
Mean	99.40	96.67	95.40
Standard Deviation	10.67	12.99	10.25

APPENDIX F

Appendix F Number_____

EVALUATION

DIRECTIONS: We are interested in a total workshop evaluation. We have arbitrarily divided the four-week College Teacher Workshop, now concluding, into five parts. They are:

A. Orientation to programs
   1 - lectures (McLeod, Arbanas, Kageyama, Irwin, Berger)
   2 - films of AAAS and SCIS
   3 - printed materials
   4 - discussions of programs.

B. Laboratory and micro-teaching activities using AAAS and SCIS materials
   1 - T.V. sessions with children and T_2's
   2 - involvement with kits, and other experiences with manipulative materials of SCIS and AAAS.

C. Group Process Skills sessions with Dr. Miller and Dr. Hurley

D. Change Agent Skills session with Dr. Rogers

E. Workshop conducted by participants at MEA Camp, August 19-21, 1968

We are interested in your opinions on the following statements as they pertain to each of the above outlined divisions of the workshop. Below each statement, the five divisions are listed; each is followed by seven blanks that correspond to various shades of agreement and disagreement. Check the blank that most closely corresponds to your own feeling about each division.

1. EACH DIVISION OF THE WORKSHOP SATISFIED NEEDS THAT I HAD WHEN THE INSTITUTE BEGAN.

A. Orientation to Programs

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

Number_____

B. Lab and Micro-teaching

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

C. Group Process Sessions

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

D. Change Agents Session

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

E. Workshop in MEA Camp

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

2. THE KNOWLEDGE GAINED IN EACH DIVISION OF THE WORKSHOP WILL BE HELPFUL TO ME IN BRINGING ABOUT CHANGES IN SCIENCE PROGRAMS IN MY SCHOOL AND/OR AREA.

A. Orientation to Programs

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

Number_____

B. Lab and Micro-teaching

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

C. Group-Process Sessions

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

D. Change-Agents Session

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

E. Workshop at MEA Camp

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

3. EACH DIVISION OF THE WORKSHOP HAD GREAT VALUE AND SHOULD BE INCLUDED IN SUBSEQUENT INSTITUTES OF THIS KIND.

A. Orientation to Programs

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

Number_____

B. Lab and Micro-teaching

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

C. Group-Process Sessions

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

D. Change-Agents Sessions

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

E. Workshop at MEA Camp

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

4. EACH DIVISION OF THE WORKSHOP IS LIKELY TO HAVE CONTRIBUTED TO A CHANGE IN MY BEHAVIOR, MAKING ME A MORE EFFECTIVE LEADER IN THE AREA OF SCIENCE TEACHING.

A. Orientation to Program

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

Number_____

B. Lab and Micro-teaching

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

C. Group Process Sessions

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

D. Change Agents Session

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

E. Workshop at MEA Camp

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

5. WHAT TWO THINGS DID YOU LIKE MOST? WHY?

A.

B.

Number_____

6. WHAT TWO THINGS DID YOU LIKE LEAST? WHY?

   A.

   B.

7. IF YOU WERE IN CHARGE OF ORGANIZING A WORKSHOP SUCH AS THIS ONE NOW CONCLUDING, WHAT EXPERIENCES WOULD YOU DELETE, AND WHAT EXPERIENCES WOULD YOU INCLUDE THAT WERE NOT INCLUDED?

   DELETE

   INCLUDE

8. ADDITIONAL COMMENTS:

Appendix F.--Final evaluation of five parts of workshop.

1					2					3					4					Participant I.D. No.
A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
6	6	6	5	7	6	5	6	5	7	5	5	5	5	7	6	5	5	5	7	0000
6	7	1	1	7	6	6	2	2	6	6	6	2	2	7	5	6	1	1	5	1079
7	7	2	4	7	7	7	2	2	7	7	7	1	1	7	5	6	2	2	7	1093
7	7	1	7	7	7	7	1	7	7	7	7	1	7	7	7	6	1	7	7	1097
6	6	3	6	7	6	6	4	6	7	7	6	3	7	7	5	5	2	5	6	1124
6	6	1	1	6	6	6	1	1	6	6	6	1	1	6	6	6	1	1	6	1200
6	5	5	6	7	7	5	5	6	7	6	5	5	6	7	6	5	5	6	7	1250
7	7	5	5	7	6	6	5	5	7	6	6	5	5	7	6	6	5	5	7	1727
5	5	2	5	5	6	6	1	5	5	6	5	1	5	5	5	5	1	5	5	1831
6	6	5	6	7	7	6	5	6	7	7	6	5	6	7	7	6	5	6	7	1911
6	6	3	5	7	6	6	3	5	7	7	7	3	6	7	6	6	5	6	7	2204
6	6	4	7	7	7	7	4	6	7	7	7	4	6	7	7	7	5	7	7	3188
7	7	1	2	7	7	6	3	3	6	7	7	1	1	7	7	7	3	2	7	3398
7	6	4	4	7	7	7	4	4	7	7	7	4	4	7	7	7	5	5	7	3459
5	3	5	5	7	5	3	5	5	7	6	5	5	5	7	5	5	5	5	7	3611
7	7	1	6	7	6	6	1	6	6	6	7	1	6	6	5	6	1	6	6	3671
7	6	5	6	5	6	5	5	5	5	7	6	6	7	6	6	5	5	5	5	3699
7	7	1	7	6	7	7	4	7	7	7	7	3	7	7	7	7	5	7	7	3854
6	7	6	6	7	6	6	6	5	7	7	7	7	7	7	6	6	6	6	6	4072
7	7	3	5	7	7	7	5	4	7	7	7	3	5	7	7	7	5	6	7	4554
7	6	3	1	7	7	6	5	1	7	7	7	5	1	7	6	6	5	1	7	5034
6	6	4	6	7	6	6	5	6	7	7	7	5	7	7	6	6	5	7	7	5068
7	7	1	5	5	7	7	2	5	5	7	7	1	5	5	7	7	5	6	5	5548
5	3	2	3	5	5	3	2	3	5	5	3	2	3	5	5	3	2	3	5	6567
5	5	2	4	6	5	4	2	5	6	5	5	2	6	7	5	5	3	4	5	6656
5	6	2	3	6	5	6	2	3	6	5	6	2	3	6	5	6	1	3	5	6858
5	6	3	2	7	6	5	2	2	6	6	6	2	2	7	6	6	2	2	7	7233
7	5	2	2	6	7	5	1	2	6	7	6	1	1	6	6	5	1	1	6	8143
2	6	1	2	7	7	7	1	1	7	7	7	1	1	7	6	6	1	1	7	8824
5	6	2	5	6	5	5	3	5	5	6	6	3	6	6	3	5	5	5	5	9365

Appendix F.--Final evaluation of five parts of workshop (Continued)

Question No.	Part of Workshop	Total	Mean	Rank
1	A	181	6.03	
	B	180	6.00	
	C	86	2.87	(lowest)
	D	132	4.40	
	E	196	6.53	
2	A	188	6.27	
	B	174	5.80	
	C	97	3.23	
	D	131	4.37	
	E	192	6.40	
3	A	193	6.43	
	B	186	6.20	
	C	90	3.00	
	D	134	4.47	
	E	198	6.60	(highest)
4	A	176	5.87	
	B	174	5.80	
	C	103	3.43	
	D	131	4.37	
	E	189	6.30	

Grand Total 3131 pts.

Grand Mean 5.22

Observations:

(E) The Workshop (at MEA Camp) scored consistently above 6.00

(1) 6.53 mean
(2) 6.40 "
(3) 6.60 "
(4) 6.30 "

(A) The orientation to programs scored high in all categories

(1) 6.03 mean
(2) 6.27 "
(3) 6.43 "
(4) 5.87 "

(B) The laboratory and micro teaching scored high in all categories

(1) 6.00 mean
(2) 5.80 "
(3) 6.20 "
(4) 5.80 "

(D) The Change Agent Session scored consistantly below average in rank

(1) 4.40 mean
(2) 4.37 "
(3) 4.47 "
(4) 4.37 "

(C) The Group-Process sessions scored lowest in every category of measure

(1) 2.87 mean
(2) 3.23 "
(3) 3.00 "
(4) 3.43 "

Instrument F.--Final evaluation comments.

Liked Most	Liked Least
1. MEA Workshop (18)*	1. Time consumer in group process skill sessions (24)
2. Orientation to programs (10)	2. Lecture at beginning of Workshop (orientation) (5)
3. Micro-teaching opportunity (10)	3. Conditions at MEA Camp (4)
4. Exchanges with other science educators (5)	4. More time working with programs (4)
5. Team planning for workshop (3)	5. Dr. Roger's talk (3)
6. Knowledge given by competent staff and resource persons (3)	6. Lack of structure to conference (3)
7. Berger--workshop design (2)	7. Not getting both programs equally (2)
8. Total staff cooperative (2)	8. Planning sessions (2)
9. Working with children (2)	9. Time spent packing and moving to MEA Camp (2)
10. Rogers session--need more	10. Non-authoritarian attempts to interpret Piaget and Bruner
11. Special people from AAAS and SCIS	11. Small amount of time given to micro-teaching
12. Discussion with Irwin on AAAS	12. Assumption at beginning of Workshop that we know the programs and their philosophies

*The number after each comment indicates the number of persons who made that comment, or similar remarks. No number indicates a single response.

Appendix F.--Descriptive data from Instrument F scores.

	Post-Workshop Test	Mid-Winter Test
AAAS Sub-Group		
Mean	106.40	109.80
Standard Deviation	13.21	14.00
SCIS Sub-Group		
Mean	102.62	107.54
Standard Deviation	14.12	17.91
Total Group Data		
Mean	104.64	108.75
Standard Deviation	15.38	13.27

APPENDIX G

Appendix G

1. How many formal class sessions, laboratory sessions, and assignments did you devote to AAAS and/or SCIS programs and materials?

Sept. to Dec. this year			Sept. to Dec. this year	
AAAS	SCIS		AAAS	SCIS
____	____	formal class sessions	____	____
____	____	laboratory sessions	____	____
____	____	assignments	____	____
____	____	other (explain)	____	____
		. . . . .		
		question not appropriate ☐		

2. When did you introduce AAAS and/or SCIS programs or materials to your classes?

question not appropriate ☐

	AAAS	SCIS
First few weeks of school	☐	☐
Near middle of term or semester	☐	☐
Near end of term or semester	☐	☐
Will introduce at later time	☐	☐

3. When did you have your first opportunity to use AAAS and/or SCIS in workshops, in-service training, or other similar circumstances?

question not appropriate ☐

☐ Aug. ☐ Sept. ☐ Oct. ☐ Nov. ☐ Dec. planned for _____ month

4. How many workshops which have included AAAS and/or SCIS in their format have you given or participated in since the summer Leadership Workshop?

_____

5. Have you included in your laboratory or regular classes, activities taken from the AAAS and/or SCIS programs, source books or instructor guides?

AAAS yes ☐ no ☐ SCIS yes ☐ no ☐

If yes, approximately how many _____ If yes, approximately how many _____

6. Which, if any, of the following materials have you purchased since the Leadership Workshop?

AAAS

a. Instructors Guide ☐ how many?_____
b. Teacher editions of units ☐ how many?_____
c. Student editions of units ☐ how many?_____
d. Laboratory materials ☐ please explain which ones were purchased and how many of each

_____
_____

SCIS

a. Instructors Guide ☐ how many?_____
b. Teacher editions of units ☐ how many?_____
c. Student editions of units ☐ how many?_____
d. Laboratory materials ☐ please explain which ones were purchased and how many of each

_____
_____

For what use were purchases intended?

self use only ☐
class use ☐
reference ☐
other ☐

if other, explain_____

_____

7. Have you acquired any of the above (question No. 6) materials by loan?

   yes ☐ no ☐

   if yes, which ones? _____

   _____

   _____

   _____

8. How much time did you devote to in-service training (workshops, etc.) in actual contact hours. . .

   (circle appropriate answer)

last year?	0-5	6-20	21-50	51-100	101-200	over 200
so far, this year?	0-5	6-20	21-50	51-100	101-200	over 200

9. How much of your current in-service work is in . . .

   (circle appropriate answer)

AAAS?	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
SCIS?	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Other?	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

   not appropriate ☐

10. How many other persons on your staff used AAAS and/or SCIS materials in their work . . .

    last year? _____
    this year? _____

11. How many contacts or inquiries about AAAS and/or SCIS have you had as a result of the MEA camp, 3 day workshop?

    No. for AAAS_____ No. for SCIS_____

12. How would you rate the cooperation you have had from the commercial representation?

AAAS	poor	fair	good	excellent
SCIS	poor	fair	good	excellent

13. How many talks or discussions about the new science programs have you had with . . .

School boards? _____
Parent-teacher Organizations? _____
Commercial Representatives
of AAAS? _____
SCIS? _____

14. How do the children and teachers feel as to the applicability and suitability of the AAAS and SCIS materials to the grade levels for which they were designed?

children				
AAAS	poor	fair	good	excellent
SCIS				
	poor	fair	good	excellent
teachers				
AAAS	poor	fair	good	excellent
SCIS				
	poor	fair	good	excellent

15. In attempting to use AAAS and SCIS materials in your work, what problems did you find?

In class		In-service
☐	lack of funds?	☐
☐	administrative hurdles?	☐
☐	student approval	☐

please comment on these or other problems: _____

_____

_____

16. What major things are you doing differently than you probably would have done if you had not attended the Leadership Workshop?

17. As you look back at the Leadership Workshop, five months later, how do you evaluate its effectiveness in preparing you as a resource people.

Instrument G (Totals of participant responses)

Question 1:

This Year		Not Appropriate	Last Year	
AAAS	SCIS		AAAS	SCIS
14	19	14	2	2
15	17-1/2		2-1/2	2
12	13		2	2
3	3		0	0

Question 2:

AAAS	SCIS	Not Appropriate
7	6	13
2	1	
2	3	
2	2	

Question 3:

August	September	October	November	December	Not Appropriate
3	8	4	3	1	4

Six planned for later dates.

Question 4:

Number of Workshops 61

Question 5:

AAAS			SCIS			Not Appropriate
Yes	No	How many?	Yes	No	How many?	
13	8	42	11	8	36	6

Question 6:

AAAS	SCIS
6	107
34	35
0	52
9	4

Question 7:

Yes	No
6	21

Question 8:

Last Year:

0-5	6-20	21-50	51-100	101-200	Over 200
15	0	1	2	0	1

So far, this year:

0-5	6-20	21-50	51-100	101-200	Over 200
14	7	2	3	0	0

Question 9:

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
AAAS	6	3	0	2	3	0	0	0	0	3	1
SCIS	7	3	1	3	1	0	0	0	0	0	1
Other	4	2	1	3	1	1	0	0	0	0	0

Not appropriate: 8

Question 10:

Last Year	This Year
9	44

Question 11:

Number for AAAS: 36

Number for SCIS: 27

APPENDIX H

Appendix H

Activity_____ Number_____

Date: A.M.
P.M.

DIRECTIONS: We are interested in your opinions on the following statements as they relate to the activity you have just completed. Below each statement are seven blanks that correspond to various shades of agreement and disagreement. Check the blank that most closely corresponds to your own feeling as you read that statement. There is a space below the items for writing additional comments if you desire.

1. The activity just completed has satisfied a need(s) that I had when the institute began.

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree
_____	_____	_____	_____	_____	_____	_____

2. The knowledge I have gained in the activity just completed (noted above) will be helpful to me in bringing about changes in science programs in my school and/or my area.

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree
_____	_____	_____	_____	_____	_____	_____

3. I will integrate all or part of the activity just completed into my subsequent work.

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree
_____	_____	_____	_____	_____	_____	_____

4. The activity just completed should be included in subsequent institutes of this kind.

Very Strongly Disagree	Strongly Disagree	Moderately Disagree	No Opinion	Moderately Agree	Strongly Agree	Very Strongly Agree

COMMENTS:

Can you name two things you liked? And why?

Can you name two things you did not like? And why?

Appendix H.--Activities evaluated with Instrument H.

1. Dr. M. Miller/ N.A.S.A. Test/ July 29
2. Mr. J. Arbanas/ AAAS Introduction/ July 30
3. Dr. G. Berkheimer/ Role of Observer in Micro-Teaching/ July 30
4. Dr. G. Berkheimer/ SCIS Objectives/ July 30
5. Dr. J. Arbanas/ AAAS Demonstration Teaching/ July 31
6. Mr. J. Arbanas/ AAAS General Discussion, Instruction Guides, Action Words/ July 31
7. Micro-teaching with children/ August 1
8. Dr. G. Berkheimer/ Implementation--Contacting and Working with Schools/ August 1
9. Dr. G. Berkheimer/ Workshop Plan--SCIS/ August 1
10. Mrs. C. Kageyama/ SCIS Demonstration Lesson/ August 2
11. Berkheimer and Kageyama/ SCIS/ August 2
12. Mrs. C. Kageyama/ SCIS/ August 5
13. Dr. R. McLeod/ AAAS/ August 5
14. College Teachers' Workshop/ Individual Activities/ August 6
15. Inquiry Laboratory/ August 6
16. Dr. Scott Irwin/ AAAS/ August 7, 8, and 9
17. Dr. Carl Berger/ SCIS/ August 7, 8, and 9
18. Micro-teaching Experience with T_1's/ August 15
19. Dr. E. Rogers/ Change-Agent Skills/ August 16
20. Dr. Miller and Dr. Hurley/ Group Process Skills/ August 16
21. M.E.A. Camp Workshop conducted by participants/ August 21

Appendix H.--Evaluations of activities at their conclusions.

Activity Number																					Participant I.D. No.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
22	-	-	22	20	20	10	18	4	24	20	-	-	-	17	24	-	21	23	27	28	0000
20	28	24	21	24	23	28	24	24	25	24	24	28	28	28	28	-	16	-	-	28	1079
20	-	-	26	28	19	28	28	27	27	28	25	20	28	28	-	28	-	22	20	28	1093
24	24	24	23	24	24	28	25	25	28	24	28	25	23	24	28	-	24	28	4	28	1097
18	23	19	19	18	18	19	22	21	-	-	26	24	13	18	19	-	24	25	15	27	1124
11	27	25	-	20	20	28	12	20	28	-	28	28	12	24	24	-	21	20	4	24	1200
20	21	20	19	18	19	24	24	21	24	24	20	24	19	23	-	24	21	27	20	28	1250
24	20	20	20	23	24	28	24	24	-	-	24	24	28	28	-	-	24	20	20	28	1727
17	28	24	19	24	24	25	19	18	28	28	28	22	24	21	-	28	23	21	12	24	1831
21	19	21	16	20	17	26	24	23	28	27	28	21	28	24	-	28	-	27	20	27	1911
22	21	22	20	23	24	24	23	21	26	28	28	28	21	25	21	-	21	21	18	28	2204
22	-	-	23	18	20	25	25	26	23	25	24	27	22	26	-	24	20	27	20	28	3188
22	19	24	26	17	9	26	22	22	28	25	26	28	24	28	21	-	25	13	6	28	3398
19	28	28	20	28	23	23	16	11	28	24	28	28	24	20	-	28	17	18	20	28	3459
21	-	-	-	-	-	23	23	19	25	25	26	27	24	24	26	-	-	20	20	26	3611
20	22	20	21	25	16	27	23	24	22	24	26	27	25	22	27	-	24	22	8	28	3671
20	25	22	25	26	17	26	21	23	27	28	25	28	24	24	-	28	22	26	21	22	3699
24	28	24	5	26	25	26	27	27	27	27	27	28	28	28	-	28	28	27	12	28	3854
26	22	25	22	22	22	27	25	24	24	24	24	23	24	23	20	-	24	7	24	26	4072
25	22	24	23	28	24	28	24	27	28	28	28	28	24	22	24	-	28	22	20	27	4554
22	26	26	20	23	14	28	20	22	24	-	16	28	25	12	-	28	22	7	12	27	5034
22	23	24	19	23	20	26	19	25	28	25	28	28	25	20	-	28	28	26	18	27	5068
20	21	20	25	19	24	23	25	18	21	28	27	28	23	22	24	-	22	19	11	17	5548
21	24	17	15	21	14	17	25	19	23	20	25	24	26	16	21	-	20	24	8	26	6567
18	23	19	18	25	21	26	20	20	24	19	24	20	17	19	20	-	21	15	14	24	6656
12	19	13	19	19	12	21	13	20	20	20	28	20	20	17	-	26	-	10	8	21	6858 (6378)
23	23	20	12	23	21	25	22	21	24	20	22	21	23	23	-	23	22	13	18	25	7233
20	18	17	-	19	16	20	14	21	23	22	22	-	22	19	-	25	-	7	7	25	8143
20	21	24	20	16	12	28	24	22	28	23	24	28	23	22	-	24	24	14	8	28	8824
22	21	22	I5	14	21	21	20	18	21	21	21	21	20	21	21	-	21	23	12	21	9365

Response Scores of Participants

Activity No.	Total Pt. Count	Total Number Persons	Mean	
1	618	30	20.60	
2	596	26	22.92	
3	568	26	21.85	
4	533	27	19.74	
5	634	29	21.86	
6	563	29	19.41	
7	734	30	24.47	
8	651	30	21.70	
9	637	30	21.23	
10	706	28	25.21	
11	631	26	24.27	
12	730	29	25.17	
13	706	28	25.21	
14	667	29	23.00	
15	668	30	22.27	
16	348	15	23.20	
17	370	14	26.43	High
18	563	25	22.52	
19	574	29	19.79	
20	427	29	14.72	Low
21	780	30	26.00	

High averages (above 25.00); 17, 21, 10, 13, 12

Low averages (below 20.00); 19, 4, 6, 20

Appendix H_a.--Pertinent comments on activities.

Activity Number	Suggestions	Positive Comments	Negative Comments
1	Needs follow-up	I will use this activity.	Not relevant
2	---	Very appropriate introduction.	What is expected of in-college science teacher?
3	---	---	---
4	More discussion	Good contrast of AAAS and SCIS	More involvement with children needed. Some were bored.
5	Needed a bigger and better blackboard	Movies quite helpful Demonstration lesson was an excellent supplement to movie Movie may replace child contact	More appropriate activity could have been chosen.
6	Would have liked a closer look at "operational definition"	---	He seemed indecisive at times. Hedged. Need more doing and less telling. Afternoon a waste of time. Too much argument over semantics. Turned some people away from AAAS.

Activity Number	Suggestions	Positive Comments	Negative Comments
7	Give more time to this	Greatest. Must do more.	Activity did not follow the model.
	Would have liked a choice of grade levels	Excellent part of workshop	Too many simultaneous activities in one room.
	Could have used more space	I will try this with my classes and in-service work	
	Should be included in future workshops		
8	---	Confirmed some ideas I previously felt intuitively.	I am not a salesman.
		This is the essence of implementing new materials into a school district	
		Most practical so far	
9	I need more information on Piaget	---	---
10	---	Any workshop will GO if she is there	I'm quite puzzled about what the children are learning.
		Best yet!	
		Practical	
		Undoubtedly one of the best sessions we have had.	
11	---	Gave me a much better understanding of SCIS and flexibility of program.	---

Activity Number	Suggestions	Positive Comments	Negative Comments
12	---	A rare flower! Quite down to earth. I'll use many of the suggestions.	---
13	---	Answered many questions left dangling from last week. Need more of this. You've recaptured a AAAS follower.	Directions not clear enough. Not enough time to complete the exercise.
14	---	Very helpful.	A little disorganized with picture taking.
15	---	---	---

The comment position of the instrument was changed at this point. The altered form requests two positive and two negative comments on each evaluation.

16	--	Interaction with consultant. Removed last doubts about this program. Role playing. Opportunity to plan workshop. Actual group activity of building in-service schedules.	Too much control by consultants. Not enough action. Seemed to be lack of communication between staff and Dr. Irwin. Not enough AAAS activity involvement. Too much talking. Lack of materials.
17	Wish we could have had equal time with AAAS (Dr. Irwin)	Chance to interact and contribute. Best days spent in long time.	Films could have been discussed more. The psychological bases of these programs seems essential.

Activity Number	Suggestions	Positive Comments	Negative Comments
17 (Cont.)		Discussion of workshop activities	Organisms not meaningfully related.
		Practice in using stop-action films.	Lack of time to pull things together.
		Dealt with significant concepts at adult level	
		Working with SCIS materials.	
		Sincerity. For two days I was part of SCIS	
18	Possibly a better location.	Opportunity for feedback.	Too much noise.
	Less crowded conditions.	Opportunity to work with children.	Disorganized.
		Interactions with other teachers.	Some children had same lesseon from two different teachers.
		Opportunity to try out materials with children.	Very artificial.
		Taping of session.	Out of context.
		Working with experienced teachers.	No pre-knowledge about children to be taught.
19	---	Great entertainer. Should consider television	Could have said it in ten minutes. (another fifteen minutes.
		Useful. Stimulating.	Earthy language
		Good approach to subject.	Wish he could have been here for both of his scheduled times.
		Informative.	Ran too fast.
		Patterns of dissemination.	I can waste my time in better ways.
		Locating change agents.	

Activity Number	Suggestions	Positive Comments	Negative Comments
19 (Cont.)		Understanding of our needs. Based on research	He was unprepared. He hadn't bothered to learn our aim here.
20	Should have come earlier in Workshop. Time could have been used to give us more background in both programs.	Excellent interpersonal approach. Comparison of programs. Informal. Organized. Help in designing feedback. Getting better acquainted.	Almost total waste of time. Time spent way out of proportion to value. Too much dialogue on group process skills. Already covered earlier. Treated as if we could not make decisions.
21	More information on people who come to meeting. Suggest campus location next year. Eliminate packing and unpacking. Not including schools already committed to one of programs.	Interaction with classroom teachers. Excellent opportunities to study the techniques of others. Attitudes. Demonstration room. Try-out activities. Opportunity to meet people interested in science. Meals. Opportunity to conduct a workshop on my own. Michigan State University team approach.	Need for AAAS materials. MEA Camp Facilities could have been improved. Lack of evening get-together. Too hot. Lack of audio-visual equipment. Prices. More information on people who come. Plans too rigid. Participants not fully aware of purpose of the program.

Activity Number	Suggestions	Positive Comments	Negative Comments
21 (Cont.)		Chance to work in a realistic situation. Relaxed atmosphere. Communication with new groups and new people. Length of workshop. Direct contact with teachers. Excellent job by Paul (workshop assistant) Both teachers and administrators involved.	Combining of persons already committed to one of the programs with others with no previous commitment.

APPENDIX I

Appendix I

AN IMPLEMENTATION MODEL

A four-week summer leadership workshop is proposed as one part of a larger model to meet the needs outlined. The primary purpose of the workshop will be to prepare selected college and school personnel for active involvement in a major effort to implement two science curriculum programs in elementary school classrooms. The conference itself will deal directly with the materials of both projects and provide experiences for the participants with children, teachers, and school administrators. The implementation model will involve colleges, state department personnel, and certain government agencies in addition. The model is intended for schools and colleges in Michigan, but some elements may be applicable to other situations.

The initial phase will consist of a series of communication efforts to inform schools and colleges of their opportunity to participate in subsequent phases. The first meeting is to be held in mid-December at Oakland University with a group of representatives from the colleges in Michigan which prepare teachers for certification. Since the majority of the participants are expected to come from these institutions, this early opportunity to discuss the model seems especially important.

Planning for evaluation procedures and suggested ways to carry out the remaining phases will also be conducted in this phase with school personnel and college representatives. A brochure describing the total program will be distributed throughout the state with the cooperation of the State Department. Formal selection of participants for the workshop will be made and orientation information distributed. Colleges may begin to invite schools to participate in direct relationships with specific resource trainees later in this first phase.

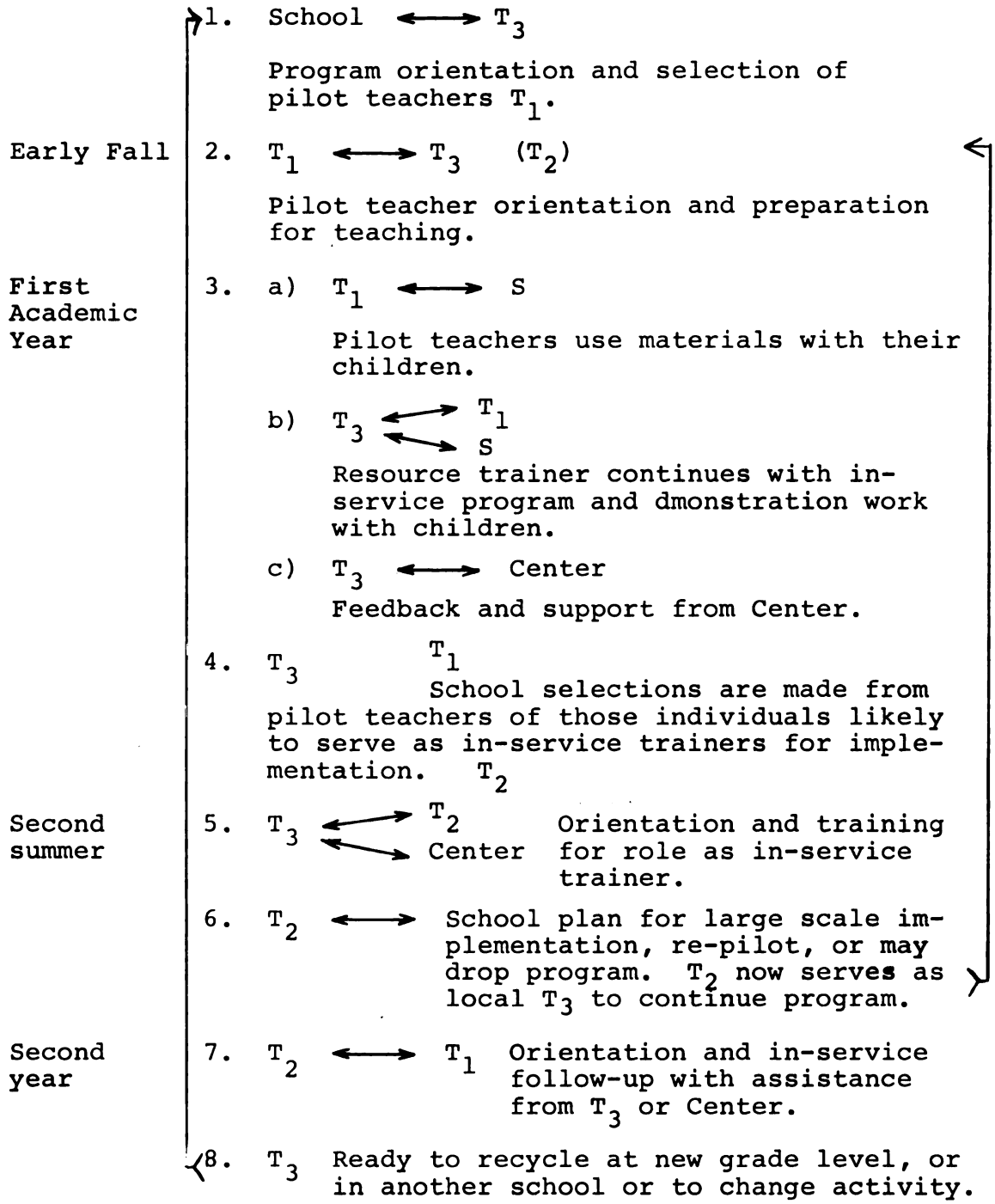
Phase two will be the workshop period itself and is examined separately as the central purpose of this proposal. The success of the three-day program for school teams depends upon the advance notice mentioned in phase one and will immediately bring considerably attention to the new curriculum materials in this state.

Phase three is the actual implementation model as it is intended to operate and to alter the teaching of elementary school science. The diagram, Figure 1, gives a skeletal picture of the order of events during the full two-year cycle the T_3 or resource-trainer has received his workshop preparation and, operating from his school or college position, makes initial contact with the school. This may also have been done prior to the workshop or have occurred during the work with school teams. The T_3 must next help the school group to decide whether or not to pilot a program. This orientation he may conduct himself or in conjunction with other resource-trainees. If the decision is favorable, he should help the school group select pilot teachers (T_1) and begin the planning for their orientation. The details of the in-service activities, consultative sessions and feedback activities are established with his college and the school. The intensive orientation period will be based on the project teacher education materials and procedures and those ideas developed during the workshop. The T_1 group continues to teach their children with the new materials and to gain in skills throughout the year. Near the end of the year, the T_3 in cooperation with the school administrators, pilot teachers, and other selects several of the first year pilot teachers to become leaders (T_2) for subsequent in-service programs. A second-summer experience is planned to give this group additional knowledge of the program and to provide them with leadership skills necessary for their work with new T_1's.

The second year begins with a decision by the school to expand the implementation, to re-pilot or to drop the program. Again the T_3 is involved, but now aided by the T_3 group. If expansion is the decision the T_2 can now be expected to carry forward the orientation and in-service work. The T_3 may occasionally be needed as a consultant, but he is largely free to work with another school or pursue other problems. (See: Implementation Cycle, next page.)

Phase four is directed at one of the other problems which a T_3 may find attractive. The selection of participants from teacher education colleges and their involvement in this implementation model should bring to their attention the needs of the pre-service teacher. At a mid-winter feedback session during the program this question will be examined. Specific proposals to modify pre-service courses have not yet been formulated, but it is anticipated that such ideas may come as a result of this program.

IMPLEMENTATION CYCLE



T_1 = Classroom Teacher

T_2 = Leader Teacher

T_3 = Resource Trainer

This appendix was taken from a Research Proposal submitted by Dr. J. R. Brandou, chairman of the Science and Mathematics Teaching Center at Michigan State University, to the National Science Foundation on December 19, 1967. It was given number 8/848-369 by the National Science Foundation.

APPENDIX J

Appendix J

N A S A

DECISION BY CONSENSUS

Instructions: This is an exercise in group decision-making. Your group is to employ the method of Group Consensus in reaching its decision. This means that the prediction for each of the 15 survival items must be agreed upon by each group member before it becomes a part of the group decision. Consensus is difficult to reach. Therefore, not every ranking will meet with everyone's complete approval. Try, as a group, to make each ranking one with which all group members can at least partially agree. Here are some guides to use in reaching consensus:

1. Avoid arguing for your own individual judgments. Approach the task on the basis of logic.
2. Avoid changing your mind only in order to reach agreement and avoid conflict. Support only solutions with which you are able to agree somewhat, at least.
3. Avoid "conflict-reducing" techniques such as majority vote, averaging or trading in reaching decisions.

4. View differences of opinion as helpful rather than as a hindrance in decision-making.

Take as much time as you need in reaching your group decision. Then enter the group rankings on each individual's DECISION FORM under Column D, "My Group's Scoring."

Name _____

Group _____

DECISION FORM

Instructions: You are a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip. Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance in allowing your crew to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important, in Column B.

	A Difference B & C	B My Scoring	C NASA Scoring	D My Group's Scoring	E Difference C & D
Box of matches	_____	_____	_____	_____	_____
Food concentrate	_____	_____	_____	_____	_____
50 feet of nylon rope	_____	_____	_____	_____	_____
Parachute silk	_____	_____	_____	_____	_____
Portable heating unit	_____	_____	_____	_____	_____
Two .45 calibre pistols	_____	_____	_____	_____	_____
One case dehydrated Pet milk	_____	_____	_____	_____	_____
Two 110 lb. tanks of oxygen	_____	_____	_____	_____	_____
Stellar map (of the moon's constellation)	_____	_____	_____	_____	_____
Life raft	_____	_____	_____	_____	_____
Magnetic compass	_____	_____	_____	_____	_____
Five gallons of water	_____	_____	_____	_____	_____

	A Difference B & C	B My Scoring	C NASA Scoring	D My Group's Scoring	E Difference C & D
Signal flares	_____	_____	_____	_____	_____
First aid kit containing injection needles	_____	_____	_____	_____	_____
Solar-powered FM receiver-transmitter	_____	_____	_____	_____	_____
Total of Column A	_____			Total of Column E	_____

N A S A

SCORING KEY

Little or no use on moon	15	Box of matches
Supply daily food required	4	Food concentrate
Useful in tying injured together, help in climbing	6	50 feet of nylon rope
Shelter against sun's rays	8	Parachute silk
Useful only if party landed on dark side	13	Portable heating unit
Self-propulsion devices could be made from them	11	Two .45 calibre pistols
Food, mixed with water for drinking	12	One case dehydrated Pet milk
Fills respiration requirement	1	Two 100 lb. tanks of oxygen
One of principal means of finding directions	3	Stellar map (of moon's constellations)
CO_2 bottles for self-propulsion across chasms, etc.	9	Life raft
Probably no magnetized poles: thus useless	14	Magnetic compass
Replenishes loss by sweating, etc.	2	5 gallons of water
Distress call when line of sight possible	10	Signal flares
Oral pills or injection medicine valuable	7	First aid kit containing injection needles
Distress signal transmitter, possible communication with mother ship	5	Solar-powered FM receiver-transmitter

APPENDIX K

Appendix K

COLLEGE TEACHER WORKSHOP

M.E.A. CAMP WORKSHOP FEEDBACK

Comments:

1 - Have three tracks: AAAS, SCIS and non-committed.

2 - Invite only non-committed.

3 - Those who already had purchased AAAS or SCIS needed as much help as the others.

4 - Procedure may not have been clear--some felt that when they were to leave they would then be ready to teach.

5 - Perhaps institute should direct itself to those coming in at different levels: Awareness, need philosophy, need in-service.

6 - Have comparable materials for each program. This time SCIS was 1-3, and AAAS was K-2.

7 - Team construction of scientists and educators together was good.

8 - What activities went over well? (McLeod)
    a - Those at teacher's grade level
    b - Sequence of activities at various grades
    c - (Lammel) took eight observation lessons through each grade (including space-time and how it coordinated)
    d - (Sweetser) showed sequence of SCIS and the interaction of some related divisions and activities
    e - Avoid showmanship-emphasis programs
    f - Include activities--involve participants to create
    g - Show how parts are connected by using the table of contents and pointing out interrelationships
    h - One thing that made W.S. go was that teams were well prepared. (dittoed)
    i - Outlines handed out were helpful
    j - Another strength of W.S. was that the teachers evaluated one team each day the solicited feedback was used to change format to meet needs

k - Showed film--got written reaction then showed film again and verbally analyzed the film and had group reactions and discussions
l - One group used AAAS film and teachers told them it was contrary to what W.S. proposed to do
m - Lighbulb experiment--good
n - Generated good discussions on "behavioral objective and action words" (another group felt they didn't generate enthusiasm)
o - AAAS classification--only so-so reaction. Button kit (SCIS) great enthusiasm (Another group--AAAS classification--just great) (One of best experiences) (Sandpaper classification--not so good)
p - Snails experience--very good (better than whirley-birds)(another reaction--not so good)
q - Whirley birds--good✓✓
fair✓
not so good✓
r - Sugar cubes - ?
s - Freon--lost one person completely but others were very interested; helped with graphing
t - One good thing was meeting (Ragy and Ron) people with whom we can continue to have contact
u - Good luck with solutions (SCIS)(Berger gave to group)

APPENDIX L

Appendix L.--Outlines of teams' activities at M.E.A. camp workshop

TEAM ONE SCHEDULE

Day 1	Introduction activity Goal setting Observation session (sugar cube) Break Overview of new sciences, ESS, SCIS, and AAAS Lunch SCIS Overview of SCIS Break Programs, AAAS & SCIS: Comparisons (poor group reaction) SCIS activity ($CuCl_2$) Dinner ESS materials demonstration and history and derdopment
Day 2	AAAS lesson planning experience AAAS demonstration lesson Symmetry Measuring Break Examination of Materials AAAS and SCIS Lunch SCIS training session (Whirlybirds) SCIS training session (Buhons) Break Booklets and teacher materials SCIS Dinner Movie "Science in Education"
Day 3	SCIS training session (Freon) Movie SCIS "Interaction and Air" Break AAAS training session (Classifying) Lunch Wrap up and panel discussion Where do we go from here Evaluation

TEAM TWO SCHEDULE

Monday Rooms 14-15

9:00-10:15	Introduction and Lab Activity
10:30-12:00	Why When and How
1:00-2:45	Lab. Activity and Film
3:00-4:00	Lab. Activity

Tuesday Team IIA Room 14

9:00-9:30	Development of the Science-A process Approach program
9:30-10:30	Behavioral objectives and Action words
10:45-12:00	Sample Lessons and Hierarchy Chart
1:00-2:20	Lab. Activity

Room 15

2:40-3:10	Development of the Science Curriculum Improvement Study Program
3:10-4:00	Lab. Activity

Tuesday Team IIB Room 15

9:00-9:30	Development of the Science Curriculum Improvement Study Program
9:30-10:00	Film
10:15-12:00	Lab. Activities
1:00-2:20	Film and Lab. Activities

Room 14

2:40-3:10	Development of the Science--A Process Approach Program
3:10-4:10	Behavioral Objectives and Action Words

Wednesday Team IIA Room 15

9:00-10:30	Film and Lab. Activity
10:45-11:15	Film
11:15-12:00	Lab. Activity

Wednesday Team IIB Room 14

9:00-10:15	Sample Lessons and Hierarchy Chart
10:30-12:00	Lab. Activity

Teams IIA and IIB Rooms 14-15

1:00-1:30	Implementation of a Program and Materials
1:30-End	Questions, Evaluation and Closing Remarks

TEAM THREE SCHEDULE

Monday, August 19

9:00 a.m.	Introduction and Orientation
10:00 a.m.	Film: Interaction
10:30 a.m.	Coffee Break
11.00 a.m.	Laboratory Activity
12:00 noon	Lunch
1:00 p.m.	Process skill involved in Lab Activity
1:30 p.m.	Laboratory Activity
2:30 p.m.	Coffee Break
3:00 p.m.	Film: Piaget's Developmental Theory

Tuesday, August 20

9:00 a.m.	Laboratory Activities
10:30 a.m.	Coffee Break
11:00 a.m.	Laboratory Activities Film: Science in the Classroom
12:00 noon	Lunch
1:00 p.m.	Overview of Science Curriculum Improvement Study (SCIS)
1:45 p.m.	Overview of Science--A Process Approach (AAAS)
2:30 p.m.	Coffee Break
3:00 p.m.	Division into AAAS and SCIS groups for more specific information on programs

Wednesday, August 21

9:00 a.m.	Film: Interaction
10:00 a.m.	Response to participant's concerns
10:30 a.m.	Coffee Break
11:00 a.m.	Film: Classroom Teaching of Science lesson
12:00 noon	Lunch
1:00 p.m.	Objectives of Elementary School Instruction
2:00 p.m.	Wrap-up

TEAM FOUR SCHEDULE

Monday

9:00	Small group orientation
9:30	Group session
10:30-11:00	Coffee Break
11:00	Background and Philosophy AAAS: Science a Process Approach SCIS Science Curriculum Improvement "Scientific Literary"
12:00-1:00	Lunch
1:00	SCIS Activity Adult concept to kits
2:00	AAAS Activity
3:00	Feedback
6:00-7:30	Dinner

Evening open--Individual Investigation, etc.

Tuesday

Film:	"Science in the classroom" SCIS film discussion
Implementation processes:	Discussion
Inservice guide lines:	Discussion
Activity:	NASA
Activity:	Classification 7 discussion--systems and sub-systems
Communicating and Classifying:	Independent activity and discussion multi-stage system
Activity:	AAAS Action Words and discussion
Film:	"Experiment with Air" SCIS film
Activity:	Interaction and discussion--Copper Chloride
Consultation:	Independent and small groups
Film:	Conservation (SCIS)--Piaget theory Feedback

Wednesday

Film:	Relativity (SCIS)
Activity:	Interaction Whirly Bird-System and Sub-System
Activity:	Ordering 0 ams
Demonstration:	Life cycles and Organisms SCIS e.g. daphnia model
Activity:	Lesson No. a--Level No. A AAAS

Question and answer session

Summary remarks

Evaluation

Materials passed out
SCIS chart
AAAS booklet by Gagne
AAAS outline

TEAM FIVE SCHEDULE

MONDAY, AUGUST 19

9:00 a.m.	Introduction To participants To conference
9:45 a.m.	Science and inquiry Lab
10:30 a.m.	Sciences and Inquiry Lab - continued
11:00 a.m.	Science and Children (Including Piaget Film)
12:00 noon	Lunch
1:00 p.m.	Introduction to AAAS Science--A Process Approach
1:15 p.m.	Processes of Science Lab
2:00 p.m.	AAAS Structure and Philosophy
2:45 p.m.	AAAS Process Lab--Space/Time
3:50 p.m.	VIBRATIONS
7:00 p.m.	AAAS Classroom Film Excerpts and Materials Kits (Optional)

TUESDAY, AUGUST 20

9:00 a.m.	AAAS Process Lab - Classifying
10:45 a.m.	AAAS Process Lab - Student Level Activity on Inferring Lesson Structure and Evaluation
12:00 noon	Lunch
1:00 p.m.	SCIS Exploration, Invention and Discovery Labs--Adult Level Concepts: Material Objects Lab on Classifying, Organisms Lab on Daphnia
2:30 p.m.	Break Overview of SCIS units: 16 mm. films on Material Objects and Interactions, slides on Organisms, Chronology with Materials Kits
3:50 p.m.	VIBRATIONS
7:00 p.m.	SCIS Classroom Film Excerpts and Exploration of Materials Kits (Optional)

WEDNESDAY, AUGUST 21

9:00 a.m.	SCIS Exploration, Invention, and Discovery Pupil Level Concepts: Interactions Lab
9:45 a.m.	Analysis of Classroom Activity utilizing 16 mm. film: Interaction Documentary
10:45 a.m.	Systems and Subsystems Lab--Adult Level Concepts
12:00 noon	Lunch
1:00 p.m.	Research on SCIS and AAAS
1:20 p.m.	After Awareness--What?
1:40 p.m.	FINAL VIBRATIONS

TEAM SIX SCHEDULE

Sunday	
5:00-6:00	Registration
6:30	Dinner
7:30	Opportunity to meet other participants
Monday	
9:00	Who are the participants in your group? Philosophy of the new science programs--Behavioral objectives Sequential Activity Oriented Pupil Involvement Questionnaire Approach Material available in "kit" form
10:30	Inferring exercise Classifying exercise
12:00	Lunch
1:00	Film showing teaching--Chris w/Air Discussion and review of film
3:00	Look at kits and material--free time to explore kits
Tuesday	
9:00	Film--Piaget: Conservation Discussion of film
9:45	What is the SCIS program?
10:30	Activities (experiments) from SCIS program--Freon II w/bags
12:00	Lunch
1:00	What is the AAAS program? AAAS activities--sugar cube More AAAS activities--Measurement, Equal arm balance, springs
3:15	Look at kits
Wednesday	
9:00	Film--Piaget: Classification AAAS circuit boards
10:30	Film--Science in the Classroom
12:00	Lunch
1:00	Advantages and disadvantages of these programs Questions and answers . . .
3:00	Homeward bound

TEAM SEVEN SCHEDULE

Monday	
9:00-10:15	Introduction of participants Goal setting Introduction to AAAS--Science A Process Approach
10:15-10:45	Coffee break
10:45-12:00	Observing session
1:00-2:15	Behavioral Objectives Action Words Examination of Exercises
2:15-2:45	Coffee break
2:45-4:00	Classifying Session
Tuesday	
9:00-9:45	Film--Science in Classroom and background of SCIS
9:45-10:45	Coffee break
10:45-11:30	Object Collections
11:30-12:00	Interaction Task film--Interaction Documentary
12:00-1:00	Lunch
1:00-1:45	Pulley Systems
1:45-2:15	Get into kits
2:15-2:45	Coffee break
2:45-3:45	Interaction--printed materials and copper chloride
3:45-4:00	Evaluation
Wednesday	
9:00-10:15	Inference boards AAAS
10:15-10:45	Coffee break
10:45-11:45	Whirlybirds SCIS
11:45-12:00	Description of Life Science Series SCIS
12:00-1:00	Lunch
1:00-1:30	Film--Experimenting with Air
1:30-2:00	Discussion of common elements of two programs
2:00-3:00	Questions of Implementation

TEAM EIGHT SCHEDULE

Monday	
9:00	Small groups: gp concern [sic] What are they doing in science [sic]
9:30	Gen. Session gps 3, 8, 9 - Grabber boxes [sic]
10:00	Film--"Interaction"
10:30	Discussion of film X "What Is Science?"
10:45	Coffee
11:00	Small groups--Sugar Cube AAAS (Inference, senses)--feedback
12:00	Lunch
1:00	SCIS Copper Chloride Interaction (Invention)
2:00	Introduce two programs: AAAS SCIS
2:30	Coffee
3:00	Snail SCIS, feedback
4:00	EXIT
Evening	Open-end/Leaders meet to rechart if necessary kit exploration films
Tuesday	
9:00	AAAS Observations (4-5) sequence, heirarchy
10:45	Coffee
11:00	AAAS Action Words/objectives Feedback
12:00	Lunch
1:00	SCIS--Interaction, Electrical Circuits
2:00	Talk about SCIS, Film, Piaget "Conservation"
2:45	Coffee
3:00	SCIS--Resource person--Field trip, Bird Sanctuary Feedback dev. design for classifying
5:00	EXIT
Evening	Open end--see Monday
Wednesday	
9:00	AAAS--Classifying and communicating
10:45	Coffee

11:00	SCIS, Film Feedback	"E&P in Classroom"
12:00	Lunch	
1:00	AAAS, Film Planned by group Reports of groups	What does it all mean? Where do we go from here? What can you use? How will it work in your classroom? Does it make sense? How to get consultant help?

TEAM NINE SCHEDULE

Monday		
	9:00-9:30	Introduction identification of participants; Goal setting
	9:30-10:30	Combined Group Session "Birthday Box"
	10:20-11:00	Introduction to AAAS--Science A Process Approach
	12:00-1:00	Lunch
	1:00-2:00	Activity on Observing from AAAS--The Sugar Cube
	2:00-2:30	AAAS film--Measurement
	2:30-3:00	Coffee break
	3:00-4:00	Discussion of Behavioral Objectives
Tuesday		
	9:00-10:30	Activity on Classification and Magnetism from AAAS
	10:30-11:00	Coffee break
	11:00-12:00	Overview of SCIS; film "Science in the Classroom"
	12:00-1:00	Lunch
	1:00-2:30	Material Effects Activity 6 "Grandma's Button Box" Activity 7 "Objects Grab Bag Game Activity 23 "Calico Clam Sheels" Interaction Chapter 12 "Making Copper Chloride Solution" Chapter 15 "Aluminum Foil and Copper Chloride Solution" Film "Interaction"
	2:30-3:00	Coffee
	3:00-4:00	Interaction Chapter 5 "Pulley System" Chapter 8 "Comparison of Pulley Systems"

	Organisms	
	Part One	"Natural Events in Aquaria"
	Part Three	"Diversity of Organisms"
	Part Six	"Daphnia"
	Part Seven	"Food Web"
	Film logs	"Daphnia"
Wednesday		
9:15-9:45	Completion of evaluation sheets	
9:45-10:00	Coffee and discussions	
10:00-10:30	Film "Material Objects--Exploration of Air"	
10:30-11:30	Life Cycles	
	Summary of booklet	
	Activity Part Six "Meal Worms"	
	Systems and Subsystems	
	Part Five	"Water, Ice, Freon"
	Part Four	"The Whirly Bird System
11:30-12:00	Summary--and comparison of AAAS and SCIS	

Appendix M

Activity: Mid-winter Conference
December 13-14, 1968

Identification
Number_____

DIRECTIONS: We are interested in your opinions on the following questions as they relate to the Mid-Winter Conference.

1. What two things did you like most about this conference? Why?

   a-_____

   _____

   b-_____

   _____

2. What two things did you like least about this conference? Why?

   a-_____

   _____

   b-_____

   _____

3. If you were in charge of organizing a follow-up conference such as this one now concluding, what experiences would you delete, and, what experiences would you include that were not included?

Delete	Include

4. Additional comments:

MERRY CHRISTMAS

M_a-Mid-winter Conference Comments

Liked Most	Liked Least
1. Sharing of experiences (17)	1. AAAS represented, but SCIS was not (2)
2. Problem discussion sessions (5)*	2. Cold Weather
3. Hearing about problems of Heath and Xerox (2)	3. Sitting too much
4. Dialogue with Marsten & Boone	4. Rather had it held later in school year. More time.
5. New insights into the conducting of workshops	5. Rather start at 9:00 A.M. than 8:00 A.M. and take shorter breaks
6. Facilities at Kellogg Center	6. Attitude of frustration
7. Dissemination ideas	7. Crowded conditions of conference room
8. Realization that it is the philosophy of the programs we are selling	8. Four cents a mile for travel
9. Clarification of status of programs	9. Starting hour
10. Informality. Exchange of ideas.	10. Talk with Xerox people
11. Opportunity to face up to real problems.	11. Marston & Xerox problem
12. Renew friendships and trade experiences.	12. AAAS and SCIS company representative not a sales person
13. Prepared agenda. Informative	13. Insufficient time. Longer.
14. Ideas of workshop for credit.	14. Evening with Marston
15. Information on preservice.	15. Unnecessary rehashing
	16. All comments not relevant

Liked Most	Liked Least
16. Follow-up of summer activities	
17. Re-build my confidence in programs	
18. Talk with Boone	
19. Suggestions given on Saturday morning most valuable	

*The number after each comment indicates the number of persons who made that comment, or similar remarks. No number indicates a single response.

Delete	Include
1. Salesmen present	1. Short and sweet. All was fine.
2. Talk to Xerox people	2. Analysis of other programs; such as ESS, COPES, etc., textbook programs.
3. Marston--we've heard that before	3. Invite teachers who have started using the programs, and get their point of view.
4. Problem of distribution of materials	4. More about what others have done and their problems.
	5. Presentation of new material of programs.
	6. Do it the same way. Very good.
	7. Do it the same.
	8. SCIS representative.
	9. Mimeo of data on activities of others.
	10. Make conference longer.

Additional Comments

1. Good conference. (3)*
2. Surprised at large return of participants and the fact that the participants have looked at their own situations and positions.
3. Would like copy of this study.
4. Enjoyable, useful. Can't think of how it could be improved.
5. Michigan State University staff have gone way beyond the call of duty.
6. Well worth attending.
7. I've completely changed by attitudes about elementary science as a result of the Workshop. Thank you.
8. It was great!

*The number after each comment indicates the number of persons who made that comment, or similar remarks. No number indicates a single response.

APPENDIX N

Appendix N

GENERAL INFORMATION CHECKLIST

DO NOT WRITE IN THESE SPACES

Name_____ 1 - 5

Age_____ Date_____ 6 - 7

Sex_____ 8

Marital Status_____ 9

1. Education

Major	Degree	Year	Institution	DO NOT WRITE IN THESE SPACES
				10
				11
				12 - 13
_____	_____	____	_____	14 - 15
				16
				17
				18 - 19
_____	_____	____	_____	20 - 21
				22
				23
				24 - 25
_____	_____	____	_____	26 - 27

2. Experience

	Years	Number of Locations	DO NOT WRITE IN THESE SPACES
			28
Public School - Elementary	_____	_____	29
			30
Public School - Jr. High	_____	_____	31
			32
Public School - Sr. High	_____	_____	33
			34
College	_____	_____	35
			36
Industry	_____	_____	37
Present position	_____		38

3. Your present position:

a. Teaching responsibility for 1967-68 (excluding summer) ____% of time 39

b. If college teacher, please name the course

credit hours	course	
_____	_____	40 - 41
_____	_____	42 - 43
_____	_____	44 - 45
_____	_____	46 - 47

c. If not college, which grade level did you teach? _____ 48 - 49

d. Research responsibility _____% of time 50

e. Administrative responsibility _____% of time 51

f. Other ____% of time

Specify_____ 52

4. Professional organizational memberships

AAAS_____ 53

AERA_____ 54

NARST_____ 55

ACS_____ 56

AAPT_____ 57

AGS_____ 58

AIBS_____ 59

Other (please specify)

_____ 60

_____ 61

5. What teacher education institutions are available in your area?

		how many?	
_____	a. state supported schools	_____	62
_____	b. private institutions	_____	63

6. Which school districts have indicated interest to you in improving their science instruction? (These are groups of teachers with whom you might work.)

District 64

_____

_____

_____

_____

_____

For each district you have indicated above please fill out Appendix A

Appendix N

Collected Data

Sex

Number of Males	25
Number of Females	5

Marital Status

Single	5
Married	23
Divorced	1
Widowed	--

Education

Degree Number 1

Major		Kind of Degree	
Natural Science, Biology	16	B.A.	11
Social Science, Sociology	1	B.S.	14
English	--	M.A., M.Ed.	1
History, Government	--	Ph.D., Ed.D.	4
Foreign Language	--	M.S.	--
Mathematics	3	B.B.A.	--
Elementary Education, Science Education	7		
Engineering	1		
Other	2		

Degree Number 2

Major		Kind of Degree	
Natural Science, Biology	11	B.A.	--
Social Science, Sociology	--	B.S.	2
English	1	M.A., M.Ed.	14
History, Government	--	Ph.D., Ed.D.	1
Foreign Language	--	M.S.	10
Mathematics	1	B.B.A.	2
Elementary Education, Science Education	8		
Engineering	--		
Other	8		

Degree Number 3

Major		Kind of Degree	
Natural Science, Biology	5	B.A.	--
Social Science, Sociology	--	B.S.	3
English	--	M.A., M.Ed.	1
History, Government	--	Ph.D., Ed.D.	10
Foreign Language	--	M.S.	--
Mathematics	--	B.B.A.	--
Elementary Education, Science Education	7		
Engineering	--		
Other	4		

Experience

Public School, Elementary

Number of Years	Number of Participants
0	0
1 - 2	4
3 - 5	6
6 - 10	3
11 - 15	--
16 - 20	--
21 - 25	--
26 and up	--

Public School, Junior High

Number of Years	Number of Participants
0	1
1 - 2	2
3 - 5	3
6 - 10	4
11 - 15	1
16 - 20	1
21 - 25	--
26 and up	--

Public School, Senior High

Number of Years	Number of Participants
0	1
1 - 2	2
3 - 5	5
6 - 10	4
11 - 15	--
16 - 20	2
21 - 25	--
26 and up	--

College

Number of Years	Number of Participants
0	1
1 - 2	5
3 - 5	2
6 - 10	4
11 - 15	3
16 - 20	3
21 - 25	--
26 and up	1

Industry

Number of Years	Number of Participants
0	--
1 - 2	3
3 - 5	--

Number of Years	Number of Participants
6 - 10	2
11 - 15	--
16 - 20	--
21 - 25	--
26 and up	--

Present Position

Number of Years	Number of Participants
0	3
1 - 2	3
3 - 5	--
6 - 10	2
11 - 15	6
16 - 20	--
21 - 25	1
26 and up	3

Information about Present Position

Per cent Teaching Time	Number of Participants
0 - 25%	5
26 - 50%	4
51 - 75%	2
76 - 100%	14

Per cent of Time Research Responsibility	Number of Participants
0 - 25%	5
26 - 50%	2
51 - 75%	--
76 - 100%	1

Per cent of Time Administrative Responsibility	Number of Participants
0 - 25%	6
26 - 50%	5
51 - 75%	1
76 - 100%	5

Professional Organizations

Organization	Number of Participants
American Association for the Advancement of Science	8
American Educational Research Association	1
National Association for Research in Science Teaching	6
American Chemical Society	2
American Association of Physics Teachers	3
American Geological Society	1
American Institute of Biological Sciences	4

Teacher Education Institutions Available in Participants' Areas

Number of State Supported Schools	29
Number of Private Institutions	20

Other answers varied and were not considered appropriate for collection in this study report.

APPENDIX O

Appendix O

Schedule of College Teacher Workshop Activities

Dates	Major Activities
July 29	Introductions Tour of Science and Mathematics Teaching Center Workshop format--Dr. McLeod Pretesting Group Process discussion--Dr. M. Miller
July 30	Process Skills--Mr. Arbanas Objectives of Science Education and Role of Observation in Micro-Teaching--Dr. Berkheimer
July 31	Role of Teacher, Psychological Basis of AAAS, and Demonstration Teaching--Mr. Arbanas
August 1	Micro-teaching with children--participants Contacting and Working with Schools--Dr. Berkheimer Workshop Plan--Dr. Berkheimer Introduction to SCIS--Dr. Berkheimer and Mrs. Kageyama
August 2	Demonstration Teaching with Children--Mrs. Kageyama SCIS as Viewed by Teachers--Dr. Berkheimer and Mrs. Kageyama SCIS Involvement and Materials--Dr. Berkheimer and Mrs. Kageyama
August 5	Demonstrations with children--Mrs. Kageyama SCIS--Mrs. Kageyama AAAS--Dr. McLeod
August 6	Individual Activities with Materials Workshop Planning Observation of SCIS Workshop for Elementary Teachers--An Inquiry Laboratory
August 7	Experiences with AAAS--Dr. S. Irwin Experiences with SCIS--Dr. C. Berger
August 8	Same
August 9	Same

August 12	Group Processes and Communication--Dr. M. Miller Work on Workshop Plans
August 13	One-half of Participants Micro-teaching with Elementary Teachers from SCIS Workshop One-half of Participants Continue with Work-shop Plans
August 14	MEA Camp Workshop Coordination--Dr. McLeod Plans for Workshop--Dr. Harley and Dr. Miller Teams set for Workshop One-half of Participants Micro-teaching with T_3's while one-half Continue with Work-shop Plans (reverse of August 13)
August 15	Workshop Planning Change-agent Strategies--Dr. E. Rogers
August 16	MEA Camp Final Details--Dr. McLeod National Science Foundation Consultant--Dr. Bender Workshop Planning
August 19	Workshop at MEA Camp--presented by participants
August 20	Same
August 21	Same
August 22	Evaluation Feedback of MEA Group Workshop Posttesting
August 23	Workshop Evaluation Discussion Planning of Follow-up Activities