AN EVALUATION OF NATIONAL SCIENCE FOUNDATION INSTITUTES BY THE PARTICIPANTS

By

DON QUENTIN MILLIKEN

Bachelor of Arts
Southwestern College
Winfield, Kansas
1936

Master of Science
Kansas State University
Manhattan, Kansas
1949

Submitted to the Faculty of the Graduate School of
the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
DOCTOR OF EDUCATION
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Thesis Approved:

Wilbur Marsden
Thesis Adviser

Kenneth E. Wiggins

Roy W. Jones

Geo. A. Moore

J. H. Boggs
Dean of the Graduate School

570255

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

History and Development of the National Science Foundation Institute Program

The National Science Foundation (NSF),[1] a unique cross between a federal agency and a private foundation, had its inception in 1944, when President Roosevelt asked Vannevar Bush how to muster the wartime initiative and inventiveness of the United States for more productive peacetime usage. Bush, head of the Office of Scientific Research and Development during World War II, recommended a federal agency with a dual function:

> (1) the support of research and education through grants, fellowships, and other means, and (2) the development of national science policy and the evaluation of correlation of the research activities of the federal government, as well as the correlation of its own program with those of other agencies, both public and private.[2]

In 1950, the recommendations of Bush became actualities when Congress approved the National Science Foundation Act, making the Foundation an independent agency within the executive branch of the federal government. The Foundation is governed by a Director and a 24-member National Science Board, appointed by the President for six-year terms. Alan T. Waterman, Yale University physicist and researcher in radar, was selected as Director by President Truman. Dr. Waterman served

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[1]Hereafter "NSF" refers to "National Science Foundation."

[2]Alan T. Waterman, "National Science Foundation: A Ten-Year Resume," Science, CXXXI (May 6, 1960), p. 1341.

continuously as Director of the NSF until 1963 when he was retired.

Initially, the NSF opened in an unused Washington school with a staff of forty and a budget of $3.5 million. In 1962, the Foundation occupied its own massive, marble building (overflowing into four other locations), had 673 employees, and a budget of $261.7 million.[3]

The initial functions, as defined by Congress, took on unforeseen aspects in the mid-1950's when the Foundation, in cooperation with private foundations, began assisting public education by financing experimental institute programs. Working through colleges and universities, the NSF played an indispensable part in reshaping public school science and mathematics and the sciences (natural and social) at all levels; it did little to strengthen the universities themselves until 1962.[4]

NSF has a remarkable record for dispensing federal funds without federal control. The reason for this, according to Dr. Waterman, is that "The foundation has had constantly before it the accepted American principle of local control of education and has observed this principle in its operations."[5]

Within the NSF, the Division of Scientific Personnel and Education is responsible for the Institute Programs. These programs have been directed toward the following four broad categories:

(1) support of students of science, mathematics, and engineering, including support of students at graduate levels and above, and support of programs for students at the undergraduate level and below;

(2) aid to teachers of science, mathematics, and engineering, including teachers of science and mathematics at the secondary school level and below and teachers of science, mathematics, and engineering at the college level and above;

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[3] "Aid Without Control," Time, LXXVIX (May 4, 1962), p. 67.

[4] Ibid.

[5] Waterman, op. cit., p. 1374.

(3) the content of science courses; and

(4) public understanding of science.[6]

The primary objective of the program activities in science education, is to insure an adequate supply of capable scientists and engineers by maintaining a high level of excellence in science and mathematics education in view of (1) tremendous and rapid changes in science, (2) expanding enrollments, and (3) increasing need for products of scientific research and development. The Foundation is concerned with content of science, mathematics, and engineering, and its programs are designed to encourage specialists in these fields to take an active part in arriving at solutions to problems which are related to the improvement of subject-matter instruction.

Summer Institute (SI)[7] Programs

The first SI programs supported by the NSF were held during the summer 1953: at the University of Colorado, Bernard W. Jones directed an institute for college teachers of mathematics; at the University of Minnesota, J. W. Buchta directed an institute for college teachers of physics.

These first SI programs probably arose from similar programs that had been sponsored earlier by other agencies. In 1945, General Electric initiated institutes for high school teachers. In 1950, the Division of Chemical Education of the American Chemical Society and Oklahoma State University (then Oklahoma A. and M. College), co-sponsored a ten-day

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[6] Ibid.

[7] Hereafter "SI" refers to "Summer Institute."

"workshop" for college chemistry teachers. This ten-day exchange of ideas, under the able leadership of Dr. Otto M. Smith, proved so effective that similar sessions were organized for the next two summers. This influence spread to California Institute of Technology and Pennsylvania State University that same year. In 1954, Kenyon College, North Carolina State College, and the University of Wyoming started comparable programs.

The NSF made $10,500 available to the University of Wyoming to lengthen the already-scheduled "workshop" to five weeks. The program was planned by the Division of Chemical Education Committee on Teaching. One lecturer agreed to "participate only if the name 'Workshop' was abandoned."[8] Thus, the first "institute" was born, co-sponsored by the NSF, the Division of Chemical Education of the American Chemical Society, and the University of Wyoming.

The Ford Foundation Fund for the Advancement of Education provided $15,000 for a simultaneous institute for 56 high school chemistry teachers. This institute was organized to operate in parallel with the college teachers' institute, with joint sessions whenever appropriate.

In that same summer, 1954, the NSF supported three other SI programs: two of these were for college teachers of mathematics, at the University of North Carolina and at the University of Oregon; the other institute, held at the University of Washington, was the first SI for high school mathematics teachers.

These early institutes, closely observed by the NSF personnel, exerted tremendous influence on later institute developments. Table I

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[8]William E. Morrell, "Review and Future Plans /for/ Summer Institutes," Journal of Chemical Education, XXXVIII (September, 1961), p. 448.

indicates the rapid growth and the increased support of the SI programs.

The objective of the SI programs is to give the participant-teachers courses that will:

1. Renew their knowledge of fundamentals.
2. Acquaint them with recent developments and advances in science, mathematics, and engineering.
3. Familiarize them with new approaches to presentation of their subject.[9]

TABLE I

ANNUAL SUMMER INSTITUTE SUPPORT BY THE NATIONAL SCIENCE FOUNDATION[10]

Year	Number	Year	Number
1953	2*	1959	350
1954	4	1960	481
1955	11	1961	398
1956	25	1962	481
1957	96	1963	517[11]
1958	126	1964	535[12]

*These figures are the totals for all types of NSF SI's: College, Secondary, Elementary, and Technical.

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[9]"Foundation Grants $24.2 Million for 415 Summer Institutes for Secondary School Teachers." (NSF 63-100. Washington, D. C.: National Science Foundation, January 13, 1963), p. 1.

[10]George G. Mallinson, "The Summer Institute Program of the National Science Foundation," School Science and Mathematics, LXIII (February, 1963), p. 97.

[11]Programs for Education in the Sciences. (NSF 63-20. Washington, D. C.: U. S. Government Printing Office, 1963), p. 17.

[12]Suggestions and Forms for Preparing a Proposal for a Summer Institute. (SPE 64-C-13. Washington, D. C.: National Science Foundation, 1964), p. 25.

A typical summer institute accepts about fifty applicants for sessions of six to eight weeks. The institute programs are planned and conducted by the host institutions, most of which are degree-granting colleges and universities. Instruction is given by the faculty of the host institution and sometimes by visiting scientists. Institutes are designed for teachers with varying backgrounds, for those weak in subject matter or for those with strong backgrounds in subject matter. Both staff and participants have indicated that courses are more effective when the participants have homogeneous backgrounds. Too, participants from varied geographical areas learn more from each other than those selected from a single region. Some institutes have emphasized the new curricula revisions of science and mathematics (e.g., School Mathematics Study Group, and Biological Science Curriculum Study); whereas, some present the traditional courses with the content modified according to recent research.

Group interaction constitutes one of the key advantages of institutes over ordinary summer sessions. The benefits that the participant-teachers gain from each other have been found to be comparable to that gained in the classroom. Many institute personnel induce group interaction by housing participants together, scheduling one meal a day together, providing lounges for impromptu discussions, and allowing an "open period" in the daily schedule for informal discussions with each other and with the institute staff.

The average grant from the Foundation for a SI is approximately $58,000. This amount provides financial assistance to the participants for tuition and fees, travel allowances, dependency allowances, and a weekly stipend for the duration of the institute. Applicants for each

SI are "selected without regard to race, creed, or color, solely on the basis of their ability to benefit from the program of the Institute and their capacity to develop as teachers of science and mathematics."[13] Selection of the participants is made by the institute staff, not by the Foundation.

Academic Year Institute (AYI)[14] Programs

In 1956, three years following the initiation of the SI programs, the supplemental education of science and mathematics teachers was extended to programs which occurred during the regular academic year. These institutes comprise two major groups: Academic Year Institutes and In-Service Institutes.

These institutes, like the SI programs, undoubtedly received their impetus from early activities supported by individual colleges and universities, and by private and corporate funds. Notable examples of earlier support of supplemental education for science and mathematics teachers were the General Electric and the Shell Merit Programs. Besides the current NSF support of the AYI programs, financial assistance has come from the National Defense Education Association Fellowships and the U. S. Office of Education Institutes.

The AYI programs were initiated in 1956-57 at Oklahoma State University, under the direction of Dr. James H. Zant, and at the University of Wisconsin, under the direction of Dr. C. Harvey Sorum.

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[13]"Foundation Grants $24.2 Million for 415 Summer Institutes for Secondary School Teachers," loc. cit.

[14]Hereafter "AYI" refers to "Academic Year Institute."

TABLE II

GROWTH OF ACADEMIC YEAR INSTITUTES[15]

Year	No. of proposals	No. of grants	No. of participants	Total amount of grants
1956-57	2	2	95	$ 504,700
1957-58	22	16	775	4,065,000
1958-59	33	19	925	4,906,500
1959-60	57	32	1508 HS 16 College	8,632,400
1960-61	65	33	1491 HS 43 College	9,210,600
1961-62	66	43	1494 HS 75 College	9,794,300
1962-63[16]	78*	55	1725 HS 105 College	10,300,000*
1963-64[17]	82*	58	1750 HS 110 College	10,850,000*
1964-65[18]	89*	61	1530 HS 120 College	11,300,000

*Estimated

Basically, the purposes of the AYI programs and the SI programs are identical (See pp. 5-6). In addition, the AYI programs complement the SI programs in several significant aspects: (1) the participant-teacher is able to make the necessary readjustments to college life and still have ample time remaining for effective course and degree accomplishments;

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[15]Lewis N. Pino and Robbin C. Anderson, "Review and Future Plans /of/ Institutes in the Academic Year," Journal of Chemical Education, XXXVIII (September, 1961), p. 452.

[16]National Science Foundation 12th Annual Report, 1962. (NSF 63-1. Washington, D. C.: U. S. Government Printing Office, 1963), p. 102.

[17]Programs for Education in the Sciences, op. cit., p. 18.

[18]"NSF Announces Academic Year Institutes; Reviews Success of Program," (NSF 63-151. Washington, D. C.: National Science Foundation, November 12, 1963), p. 1.

(2) there is more contact and interchange with the instructional staff; and (3) the participant-teacher is usually able to complete a master's degree in one year rather than in five summers--or to establish residence and to complete considerable coursework toward a doctoral program.

Quoted in a National Science Foundation press release, Dr. Bowen C. Dees, the Foundation's Associate Director of Scientific Personnel and Education, stated that the AYI program

> . . . has become a unique and potential instrument of the Foundation's broad charge to further knowledge of science in the U. S. . . . Contact with the scientist is during the period of intense teaching activity, the academic year, and is of sufficient duration to take the measure of the teacher's willingness to face up to hard work.[19]

A typical AYI accepts 20-30 participants, if in a single discipline, or 40-50 participants, if in several disciplines. Many of the institutes provide coordinated summer education in addition to the AYI program. In some instances the summer session precedes the year-long program; in others, institutes offer an optional related program during the following summer to assist selected participants in completing degree programs begun during the academic year.

Structurally and mechanically, the AYI programs are organized much as the SI programs are (See pp. 5-7). In addition to the financial support received by the SI participants, the AYI participants receive travel and book allowances each semester.

Again, selection of participants is the responsibility of the host institution, according to the student level specified by the institution upon making application to the Foundation for the institute.

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[19]"NSF Announces Academic Year Institutes; Reviews Success of Program," loc. cit.

In-Service Institute (ISI)[20] Programs

The In-Service Institutes, another NSF program within the academic year, are patterned after the familiar college extension courses. Special classes are scheduled "after school" or on Saturday mornings and are usually limited to one course or about six semester hours of credit in the academic year.

This program began in the spring of 1957 with two institutes: at Antioch College, Dr. James F. Corwin directed a chemistry institute; at Reed College, Mr. Gwen L. Taylor directed a chemistry-mathematics institute.

Table III contains summaries of data on the growth of the ISI programs.

TABLE III

GROWTH OF IN-SERVICE INSTITUTES[21]

Academic Year	Number of Institutes	Number of Participants	Total Grants (millions $)
1956-57	2	90	0.01
1957-58	21	635	0.16
1958-59	85	3,000	0.61
1959-60	184	8,725	1.89
1960-61	191	9,026	2.22
1961-62	253	11,633	2.90
1962-63	284	13,751	3.54
1963-64	267	13,423	3.51

The program projected for 1964-65 will support about 280 institutes and over 14,000 participants.

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[20] Hereafter "ISI" refers to "In-Service Institute."

[21] "Suggestions and Forms for Preparing a Proposal for an In-Service Institute for 1964-65." (SPE 3-C-5, Washington, D. C.: U. S. Government Printing Office, 1963), p. 2.

The ISI programs, in their turn, have certain unique aspects: (1) the time factor and the teaching load of the participant-teachers tend to reduce concern about quality of material covered and about credit hours; (2) the close juxtaposition with the teaching assignments of the participants encourages course work correlated with teaching problems; and (3) participant-teacher population is usually quite different from that of the SI programs and the AYI programs.

The ISI program has been continued by the Foundation because of "a recognition of the need for providing opportunities for teachers to improve their scientific knowledge while continuing regular classroom duties."[22]

The Growth of Support for Institutes

The tremendous growth of the institutes receiving financial support has been accompanied with changes in the type of support and in purposes of the institutes. The increase of opportunities in the different teaching levels in the institute programs is evident in Table IV.

Financial support for the early institutes appears to have been based largely on the assumption that there were many competent teachers in the colleges and secondary schools in the United States who could profit from programs designed to update their education in the different areas of science and mathematics. Too, it was assumed that the up-dating might be attained within a relatively short time. A follow-up program to provide fellowships for teachers of science and mathematics was intended

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[22]"NSF Announces $3.1 Million Program of In-Service Institutes in Science and Mathematics for Secondary School Teachers." (NSF 63-116, Washington, D. C.: National Science Foundation, April 7, 1963), p. 1

TABLE IV

STUDY OPPORTUNITIES IN INSTITUTE PROGRAMS, FISCAL YEARS 1953-63, INCLUSIVE[23]

Teaching Level of Stipend Holder	Stipends Granted Years 1953-63	Stipends Granted Year 1963
Summer Institutes:		
College	14,359*	3,100**
Secondary	106,214	21,000
Elementary	3,428	1,000
Sub-total	124,001	25,100
Academic Year Institutes:		
College	343	100
Secondary	9,812	1,750
Sub-total	10,155	1,850
In-Service Institutes:		
Secondary	60,129	13,550
Elementary	4,244	1,440
Sub-total	64,373	14,990
Total:	198,529	41,940

*Includes 3,774 opportunities in Summer Conferences for College Teachers.

**Includes 1,000 opportunities in Summer Conferences for College Teachers.

to raise the level of academic competence through traditional graduate courses.

Educators, professional and academic, praised this approach but began to seek support involving basic training in science and mathematics.

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[23]Mallinson, loc. cit.; National Science Foundation 12th Annual Report, 1962, op. cit., pp. 96-104; National Science Foundation 13th Annual Report, 1963. (NSF 64-1. Washington, D. C.: U. S. Government Printing Office, 1964), pp. 95-100.

These educators, closer to the problems of teacher education than the NSF staff, were more cognizant of the vast numbers of unqualified teachers of science and mathematics throughout the United States who could profit from NSF assistance. Until 1959, proposals for institutes for the "less able" teachers were not approved by the NSF. Briefly, the trend of NSF support may be summarized as follows:

1. 1953-57--support for Institutes designed for able teachers of science and mathematics who needed updating.
2. 1957-58--support for Institutes designed for able teachers of science and mathematics who needed additional subject matter to improve their competence.
3. 1959 to present--support for Institutes designed for the less able teachers of science and mathematics who need basic subject matter (some almost at the freshman college level) to achieve adequacy.[24]

Since 1953, NSF support for institutes has extended through the total educational system of the United States: first, for college science and mathematics teachers; second, for secondary school teachers of specialized sciences and mathematics; third, for junior high school teachers; and fourth, for elementary school personnel. Table V indicates that almost ninety per cent of these institutes have been for secondary school teachers, just over seven per cent for college teachers, and three per cent for elementary school personnel.

The Growth of Curricular Offerings in Institutes

The extension of course offerings in the institutes kept pace with the extension in both number of institutes and support of institutes: the initial SI programs offered mathematics and physics courses for college teachers;[25] the first AYI programs offered courses in biology,

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[24] Mallinson, loc. cit.

[25] Morrell, loc. cit.

chemistry, mathematics, physics, and seminars in teaching science and mathematics for secondary school teachers;[26] and the first ISI programs offered courses in chemistry and mathematics for secondary school teachers.[27]

Education opportunities for teachers of mathematics, science, and engineering provided by NSF-supported institutes in 1963 increased about 1,300 over 1962. While most of the 900 institutes were for secondary school teachers, there was an increase in the number of college/elementary school participants.[28]

In 1963 the Foundation provided "small-scale" support of these late developments in teacher education activities: (1) a pilot study of in-service institutes for college teachers; (2) increased opportunities for technical institute teachers; (3) an experiment to help ascertain how elementary school teachers can most effectively be educated through institutes; and (4) a slight increase in number of institutes in certain of the social sciences.

More attention was centered on testing the newer approaches in the special projects in the science education area in 1963. The Cooperative College-School Science Program, which provides a close relation between college-university scientists and secondary school teachers/students, was

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[26]"National Science Foundation Program at the University of Wisconsin for High School Science and Mathematics Teachers," American Journal of Physics, XXIV (February, 1956), p. 77; James H. Zant, "A Report on /an/ Academic Year Institute for High School Science and Mathematics Teachers /1956-57/," Director's Report to the National Science Foundation, Stillwater: Oklahoma State University, October, 1957, p. 7. (Mimeographed.)

[27]Pino and Anderson, op. cit., p. 451.

[28]National Science Foundation 13th Annual Report, 1963, op. cit., p. 88.

channeled in a new direction. Certain secondary school officials who wanted to introduce one or more of the NSF-supported science courses into their curricula, were given the assistance of nearby college/university scientists. New guidelines for the purchase of instructional scientific equipment was developed through the Undergraduate Instructional Scientific Equipment Program.[29]

Besides the curricular innovations and experimental programs just mentioned, Table V indicates the many fields of study that were available in the 1963 SI program.

TABLE V

DISTRIBUTION OF SUMMER INSTITUTES, BY FIELD OF STUDY, 1963[30]

Field	Elementary School Personnel	High School Teachers	High School and College Teachers	College Teachers
Anthropology	...	1	...	2
Astronomy	1	2	...	...
Biology	4	53	1	6
Chemistry	2	28	1	8
Earth science	4	22	...	2
Economics	...	1	...	...
Engineering	...	...	...	14
History and philosophy of science	...	1	...	2
Mathematics	11	117	2	10
Physics	...	24	...	4
Psychology	...	2	...	6
Radiation biology	...	12	3	6
Radiation in physical science	...	4	1	12
Multiple fields and general science	11	148	...	...
Total	33	415	8	67

[29] Ibid.

[30] National Science Foundation 13th Annual Report, 1963, op. cit., p. 99.

Definition of Terms

The terms used in the statement of the problem and in this study are defined as follows:

Course:

Institute. Upper division or graduate level courses that are component parts of institute curricula.

Non-Institute. Upper division or graduate level courses that are not component parts of institute curricula but are component parts of the curricula of an institution. Under certain conditions such courses may be taken by a participant.

Academic. Subject-matter courses, specifically science, mathematics, and engineering.

Professional. Non-science,-mathematics, and -engineering courses dealing with improved methods of presentation, teaching techniques, supervision, and philosophy. Such courses may be offered by departments of education, or by departments of science, mathematics, or engineering.

Host Institution. The college or university that furnishes the educational facilities and faculty for a National Science Foundation Institute (NSFI).[31] In this thesis, "host institution" and "sponsoring institution" are used synonymously.

Institute. The department(s) or school(s) within a college or university which, in cooperation with the National Science Foundation, offer certain upper level and/or graduate level courses to teachers of science, mathematics, and engineering to improve their subject-matter competence. These

[31] Hereafter "NSFI" refers to "National Science Foundation Institute."

courses usually may be applied toward advanced degrees. There are three major types of institutes conforming to the time patterns available to teachers:

Summer, which provides four to twelve weeks (usually eight or nine) of full-time study during the summer when most of the public schools are not in session.

Academic Year, which provides full-time study opportunities during the regular "academic year" for a relatively small number of teachers who take leaves of absence for a year.

In-Service, which provides part-time study opportunities for teachers who, simultaneously, hold full-time teaching positions.

Open Period. An unassigned period within a school day to allow teachers time for class and/or laboratory preparations, course planning, grading papers, etc.

Participant. A teacher of science, mathematics, or engineering who has been selected by the host institution to "participate" in an institute. In this thesis, "participant" and "participant-teacher" are used synonymously.

Stipend. A grant of money made by the National Science Foundation to a participant in an institute for financial assistance in securing additional education in the sciences, mathematics, and engineering, or in closely related disciplines. The participant's tuition and fees also are paid by the National Science Foundation, as well as certain allowances for dependencies, books, and travel expenses to the institute.

Hypotheses

This study poses the null hypothesis that the attainments of the participant-teachers in their renewal of knowledge of fundamentals, in their acquaintance with recent subject-matter advances, and in their familiarization with newer methodologies, were not altered as a result of their participation in the NSF-KSC institutes.

The alternative or research hypothesis and the methods of testing the hypotheses are treated in detail in Chapter IV, "Analysis and Interpretation of the Data."

Assumptions

The assumptions on which this study was based are:

1. The curricular/co-curricular activities of the institutes renewed the participant-teachers' knowledge of fundamentals.

2. The curricular/co-curricular activities of the institutes familiarized the participant-teachers with recent developments and advances in science and mathematics.

3. The curricular/co-curricular activities of the institutes acquainted the participant-teachers with newer approaches to presentations of their subjects.

4. Accomplishments of the participant-teachers in the above areas (Nos. 1-3) can be evaluated by the opinionaire designed for that purpose.

Purpose and Goals of the Study

The purpose of this study was to test the hypotheses as stated. The specific goals which were sought in order to accomplish the stated purpose are listed below:

1. To determine the significance of the institute courses and activities in renewing the participants' knowledge of fundamentals.

2. To determine the significance of the institute courses and activities in acquainting the participants with recent developments and advances in science and mathematics.

3. To determine the significance of the institute courses and activities in familiarizing the participants with newer approaches to the presentation of their subjects.

4. To seek inferences which may be of value to professional education and to its researchers and which may be of value to those who conduct future comparable programs in science/mathematics education.

Need for the Study

Since the initial NSF institutes in 1953, the Foundation has supported only those science education programs that have proved satisfactory.[32] In the eleven years since that time, there have been many evaluations of the several types of NSF institutes. In 1958, Schenberg[33] began a series of annual evaluations of the SI programs attended by New York City science and mathematics teachers. Examples of evaluations made by institute personnel and/or resource persons are those done by

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[32]Dael Wolfle, "National Science Foundation: The First Six Years," Science, CXXVI (August 23, 1957), p. 336.

[33]Samuel Schenberg, "An Evaluation of the 1958 Summer Institutes Attended by Science and Mathematics Teachers of New York City High Schools" (New York: Board of Education of New York City, 1959, Mimeographed.)

Ostlund[34] of Oklahoma State University, and Koelsche[35] of the University of Georgia. Examples of evaluations required of institute directors at the termination of each institute are those done by Zant[36] of Oklahoma State University and Smith[37] of Kansas State College, Pittsburg.

Various types of evaluations have been done by the NSF personnel, by their resource persons and/or organizations. Wolfe[38] did an evaluation of all NSF activities at the end of the first six years of the program. This appraisal included the institute activities. The President of the United States receives an annual report and evaluation of all NSF activities. An example of this major evaluation is the report on the 1962 activities of the Foundation by Dr. Alan T. Waterman.[39] An example of a large-scale, contractual evaluation is the 1960 report done by the

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[34]Leonard A. Ostlund, "Field Survey Academic Year Institute Participants for 1956-57, 1957-58" (Stillwater: Oklahoma State University, 1958, Mimeographed).

[35]Charles L. Koelsche, Characteristics of Persons Submitting Applications in 1962 for Participation in NSF Institute Programs at the University of Georgia: Part II, Secondary School Science Teachers (Athens: The University of Georgia, 1962).

[36]James H. Zant, "A Report on an Academic Year Institute for High School Science and Mathematics Teachers [1961-1962]" (Stillwater: Oklahoma State University, 1962, Mimeographed.)

[37]Kansas State College of Pittsburg (R. G. Smith, Director), "Final Report National Science Foundation Inservice Institute for Secondary School Teachers of Science and Mathematics, September 19, 1959 through May 28, 1960" (Pittsburg: Kansas State College of Pittsburg, 1960, Mimeographed.)

[38]Wolfe, op. cit., pp. 335-343.

[39]National Science Foundation 12th Annual Report, 1962, Alan T. Waterman, Director, NSF 63-1, (Washington, D. C.: National Science Foundation, 1963).

Bureau of Social Science Research.[40]

The above examples of the numerous and varied types of evaluations of the NSF institute programs indicate the wealth of information that is available in the offices of the NSF. It becomes apparent that the Foundation is aware of the strengths and the weaknesses of most aspects of its several institute programs. This does not imply that the sponsoring institutions are equally aware of their strengths and their weaknesses. Herein is the basis of this study.

Kansas State College of Pittsburg (KSC),[41] the sponsoring institution in this study, can exhibit some of the strengths and some of the weaknesses of institute programs that are evident from the above cited studies. Similarly, this institution can exhibit institute strengths and weaknesses that are uniquely her own. It becomes evident that such specific information can be of considerable value to KSC in her plans for future educational activities in the areas of science, mathematics, and engineering, and in related education curricula. Therefore, this study is needed to assist in:

1. Improving the quality and the content of existing curricula.

2. Securing the addition of significant curricular offerings.

3. Upgrading the graduate degree programs--Master and Education Specialist (Ed.S.).

4. Ascertaining the different curricular needs of the teacher in

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[40]Bureau of Social Science Research, "The NSF Summer Institute Program: A Follow-Up of 1957 Institute Participants" (Series of Summer Institute Evaluation Studies, Vol. IV, No. 338. Washington, D. C.: Bureau of Social Science Research, American University, 1960, Mimeographed.)

[41]Hereafter "KSC" refers to "Kansas State College of Pittsburg."

preparation, the recently graduated teacher, and the teacher who has been out of college a number of years.

5. Improving the guidance of teachers in their undergraduate, graduate, and continuing-education programs.

6. Stressing the need for interdepartmental curricular planning and the significance of improved interdepartmental relationships.

7. Encouraging professors to update and/or improve their teaching methodologies.

8. Encouraging the improvement of, and the addition to, the existing physical plant and facilities.

9. Encouraging the support of private, corporate, and federal agencies in financing the continuing education of teachers in other subject-matter areas, as well as in science and mathematics.

10. Ascertaining the advisability of continuing and/or modifying the institute programs in this sponsoring institution.

Statement of the Problem

To determine the significance of the National Science Foundation-Sponsored Science and Mathematics Institutes held at Kansas State College of Pittsburg (Kansas) between 1959-60 and 1962-63, as evaluated by the participant-teachers.

Scope and Limitations

This study sought to determine the significance of the NSF-KSC Science and Mathematics Institutes: (1) in renewing the participants' knowledge of fundamentals: (2) in acquainting the participants with recent developments and advances in science and mathematics; and (3) in

familiarizing the participants with new approaches to presentation of their subjects.

This study was limited to the NSF-Sponsored Science and Mathematics Institutes that were offered at KSC, beginning with the 1959-60 ISI (the first institute), and terminating with the 1962-63 ISI. (In the "Proposal for Study" this was to have included ten institutes. Developmental needs, evident immediately prior to the 1962-63 ISI, brought about an additional institute, raising the total to eleven institutes offered in the period indicated.)

These institutes were of two types: ISI and SI, and were offered to teachers in elementary schools, secondary schools (including junior high schools), and colleges (predominantly junior colleges).

This study was further limited to those institute participants who, through a preliminary survey, indicated that they would cooperate in an evaluation of the institutes they had attended.

Review of the Literature

A review of the literature indicated that there have been three types of studies made of the several NSF Institute Programs for Secondary School Teachers: (1) College and University Institutional Studies, (2) NSF Studies, and (3) Independent Studies.

The largest number of these studies have been made by the sponsoring institutions, the colleges and the universities offering the institutes. The studies involving the largest number of institute participants, per study, were those made by, or for, the NSF. The independent researchers have done the smallest number of studies on the smallest number of institute participants.

The Institutional Studies have been of three types: (1) studies made by members of the instructional staff or the institute directors of the sponsoring institutions; (2) studies made by students seeking a degree from the sponsoring institution; and (3) studies made by resource persons. The NSF Studies have been made by their own personnel or by organizations under contract to the Foundation. The Independent Studies have been made by individuals seeking to evaluate one or more of the institutes--or one or more of the different types of institutes.

College and University Institutional Studies

Koelsche studied the characteristics of institute applicants at the University of Georgia in 1962; this study included applicants for the 1962 SI and those for the 1962-63 AYI. Data came from two sources: (1) application forms submitted by the secondary school science teachers for participation in the institutes: 407 for the AYI, 339 for the SI; and (2) questionnaires completed by the 98 participants in the two institutes.[42]

Major divisions of each study of the two groups of applicants included:

1. Characteristics of the Sample
2. Certain Personal Characteristics
3. Collegiate Backgrounds
4. Teaching Backgrounds
5. Professionalism
6. Over-all View . . . Applicants[43]

The following observations are from the concluding statements by Koelsche: (1) Most college and/or university curricula do not distinguish between courses for students going into scientific positions and courses for students planning to be science teachers; (2) Few institutions offer

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[42]Koelsche, op. cit., p. 1.

[43]Ibid., p. iv.

graduate level science courses, organized particularly for teachers, excepting those which offer institute courses sponsored by the NSF.[44]

"The best science teacher education programs," Koelsche stated, "are found in institutions of higher learning where they were developed by committees composed of an equal number of science and education professors, selected because of their competence in each of their chosen fields of specialization as well as a demonstrated interest in improving teacher education."[45]

Applications for the ISI and SI programs at Indiana State College were selected largely on their teaching assignments in general science and their need for general science.[46] SI applicants were eliminated initially if they had attended a previous summer institute.[47]

The ISI programs were characterized by the integration of physics with other general science areas. Each weekly meeting of three hours was divided into three intervals that were both teacher-centered and learner-centered; the latter type was characterized by the small-group approach with considerable interaction between the instructor and the participants.[48]

Noteworthy aspects of the SI programs were (1) diagnostic testing for more homogeneous grouping of the participants, and (2) remedial mathematics in the laboratory periods for the first two weeks of the institute.[49]

Weber stated, "The survey of opinions of those who have participated

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[44] Ibid., p. 53.

[45] Ibid., p. iii.

[46] S. W. Suttle, "National Science Foundation Activities at Indiana State," The Teachers College Journal, XXXIII (March, 1962), p. 129.

[47] Ibid., p. 130.

[48] Ibid.

[49] Ibid., p. 139.

in Penn State's science institutes generally confirms the judgment of the faculty as to the value of the various features of these programs."[50]

Following are some of the significant aspects of the institutes as expressed by the participants: (1) Courses, while designed for the high school teachers, were considered to be of graduate caliber. (2) Institute facilities and mechanics of organization enabled the participants to exchange ideas with peers, faculty, and prominent visiting scientists. (3) Teaching and guidance problems were effectively discussed through group organization--seminars and colloquia. (4) There was ample access to up-to-date reference materials of diverse types. (5) Competent, considerate advisors plus both elective and core courses facilitated progress of students--course-wise and degree-wise.[51]

In his terminal paragraph, Weber recommended "that in subsidizing science institutes in the future, emphasis should be placed on summer 'refresher' programs designed to keep teachers up-to-date in recent developments in their sciences."[52]

Participants in the Physics Section of the 1961 SI at Yale University evaluated the several aspects of the program: (1) oral reports by the participants; (2) demonstrations; (3) visits to research laboratories; (4) special lecturers; (5) laboratory experiments; and (6) instructional films.[53]

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[50]Robert L. Weber, "Student Evaluation of the Science Institutes for Teachers Sponsored by the National Science Foundation at The Pennsylvania State University, 1955-1959" (University Park: The Pennsylvania State University, 1959), p. 14. (Mimeographed.)

[51]Ibid., p. 15.

[52]Ibid., p. 16.

[53]Robert L. Weber, "Opinions of Participants in the Physics Section of the NSF Science Institute /at/ Yale University, 1961," (Hartford: Yale University, 1961), p. 1. (Mimeographed.)

Just over ninety per cent of the participants evaluated the overall institute favorably; however, eighteen per cent indicated that while the institute was quite helpful to them, it did not meet their expectations. The most adverse criticism of the above-mentioned aspects of the institute came from the oral reports presented by the "teacher-students;" fifty per cent of the participants indicated that these oral reports "should be omitted from future programs."[54]

Reporting on an AYI, which included the adjacent SI programs, Zant stated: "An innovation, used for the first time in 1961-62 and only at the Oklahoma State University, was the inclusion of 12 participants without teaching experience, except practice teaching, but with standard teaching certificates in their own states."[55] (This NSF Pilot Study was extended in 1962-63 to six institutes providing fifth-year programs for pre-service teachers.)[56] To assist these participants with undergraduate deficiencies and to orient them to graduate study, they received NSF stipends the summer preceding the AYI. Six of these participants, fifty per cent, were granted stipends for graduate study the summer following the AYI. This enabled seven participants to complete requirements for a Master's degree and four others to complete course requirements--leaving only the Master's thesis to complete.[57]

A long-range objective of the AYI programs at Oklahoma State

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[54] Ibid.

[55] Zant, op. cit., p. 3.

[56] National Science Foundation 12th Annual Report, 1962, op. cit., p. 102.

[57] Zant, loc. cit.

University has been "to get content courses in science and mathematics established as an integral part of the graduate training of teachers of these subjects."[58]

In future AYI programs, Zant recommended the continuing education of supervisors to assist in the over-all improvement of science and mathematics teaching in the schools.[59] (In 1961-62, the University of Wisconsin conducted a NSF Pilot Study in Advanced Education for potential science and mathematics supervisors.)[60]

Parker investigated the National Science Foundation Summer Institutes conducted by eight colleges and universities of Louisiana in 1959. Just over ninety-three per cent of the participants thought that they could better motivate their students toward science careers because of their institute attendance. Almost one hundred per cent of the participants believed that they were better teachers as a result of their institute attendance. They cited increased knowledge of subject matter as the key reason for this improvement. Interestingly, just over ninety-one per cent of the participants' principals shared the same view. Besides improved knowledge of subject matter, the principals also indicated better usage of laboratory equipment by their "teacher-participants."[61]

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[58]Zant, op. cit., p. 1.

[59]Zant, op. cit., p. 14.

[60]National Science Foundation 12th Annual Report, 1962, loc. cit.

[61]Alwin Parker, "A Study of Certain Aspects of Eight N. S. F. Summer Institutes for High School Science Teachers Conducted in Louisiana, 1959" (unpublished Doctor's thesis, Louisiana State University, Baton Rouge, 1960), p. viii.

Suggested improvements for subsequent institutes in the study by Parker were secured from participants, principals, and institute directors. The following are significant items: (1) there should be discussions on secondary school methods and problems; (2) courses should be taught with the secondary school science teacher in mind; (3) laboratory classes should be improved and better supervised; and (4) classes should be composed of students with homogeneous backgrounds.[62]

The institute directors "were in agreement that presentation of course work in scientific subject-matter was the way to approach the objectives of the National Science Foundation summer institute program."[63]

In an investigation of the first three AYI programs at the University of Wisconsin, Heideman studied (1) the operational effects of the AYI education as evidenced one to three years later; (2) certain characteristics of the teachers involved in the program; (3) the validity of the undergraduate and the graduate curricula for the education of the science and the mathematics teachers; (4) the occupational potential and mobility of the participants; and (5) whether the AYI program at the University of Wisconsin accomplished its stated objectives.[64]

Some noteworthy aspects of this study included: (1) a research population large enough to give valid results; (2) a pilot study designed as a basis for further investigations of the AYI programs at the

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[62] Ibid., p. 43.

[63] Ibid., p. ix.

[64] Robert T. Heideman, "National Science Foundation Academic Year Institutes for Secondary School Teachers of Science and Mathematics Held at the University of Wisconsin 1956-57 through 1958-59. 'An Evaluation of the Background, Training, Placement, and Occupational Mobility of the Participants'" (unpublished Doctor's thesis, the University of Wisconsin, Madison, 1962).

University of Wisconsin--thereby setting the stage for continuing research of NSF institute programs; and (3) a recommendation by the author that the core courses of the AYI program, deemed most valuable of courses taken by the participants, be included in the graduate programs of the University of Wisconsin.[65]

Serving as a resource person for the evaluations of the first two AYI programs at Oklahoma State University, Ostlund published his initial studies in the Director's Reports for 1956-57[66] and 1957-58.[67] In the second evaluation, Ostlund stated that the evaluations of both institutes by the participants indicated that the 1957-58 institute had improved. The ratio of favorable to unfavorable comments was almost two to one.[68]

Commenting on the significance of the evaluations by the participants, Ostlund continued:

> The criticisms must not be ignored. A careful examination will reveal their factual validity. However, scrutiny of the bases for these statements will not be sufficient. Even if some are proved false, the fact that the students believe otherwise is important.
>
> Perhaps such faulty perceptions may be due to a misunderstanding of goals, purposes, rules, requirements, etc. of the University or of the National Science Foundation Institute. A consideration of these possibilities may lead to a more thorough orientation which should do much to correct such misconceptions.[69]

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[65] Ibid.

[66] Leonard A. Ostlund, "A Scientific Evaluation of a Scientific Program" in "A Report on [1956-57] Academic Year Institute for High School Science and Mathematics Teachers" (Stillwater: Oklahoma State University, 1957), pp. 22-37. (Mimeographed.)

[67] Ostlund, "The Evaluation Report of the 1957-58 Academic Year Institute for High School Science and Mathematics Teachers Sponsored by the National Science Foundation of Oklahoma State University, Stillwater" in "A Report on Academic Year Institute for High School Science and Mathematics Teachers" (Stillwater: Oklahoma State University, 1958), pp. 32-75. (Mimeographed.)

[68] Ibid., p. 65.

[69] Ibid.

National Science Foundation Studies

In March, 1957, the NSF asked Science Research Associates to evaluate the SI program. The Foundation wanted to know:

> How well did the Summer Institutes perform in terms of the five million dollars now being invested in them?
>
> How well did the host colleges and universities--as a whole--appear to be conducting the institutes?[70]

To secure necessary data, Science Research Associates (1) conducted personal interviews with forty per cent of the 627 secondary school science and mathematics participants of the 1956 summer institutes; (2) conducted personal interviews with approximately one-third of the secondary school principals and/or supervisors of the participants interviewed; and (3) secured 18 scientists and science education specialists to do "on-site" evaluations of thirty of the 1957 summer institutes.[71]

The most concrete, positive result of the SI programs was their stimulating effect on the participants; there was great interest in the acquisition of subject-matter and much enthusiasm was engendered in upgrading public school science. While the NSF Institutes were not established to improve teaching techniques and methodologies, such developmental improvement became an important value according to both participants and their administrators.[72]

Although sharpened teaching skills developed as concomitant values for the participants, the panel of scientists and educators, who made

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[70]Science Research Associates, "The National Science Foundation Summer Institutes Program--An Evaluation" (Chicago: Science Research Associates, 1957), p. 2. (Mimeographed)

[71]Ibid.

[72]Ibid., p. 4.

sixty-two visits to thirty of the 1957 summer institutes, felt that the improvement of teacher-education curricula was "considerably less positive and clear-cut."[73] Sixty-one per cent of the panelists felt that the institutes would have a long-range effect on teacher-education curricula. In answer to a more specific question, forty-eight per cent of the panelists agreed that improved courses resulting from institute influence, would actually be offered. Thirty per cent of the summer institutes that had been in operation more than a year indicated that previous institutes had brought about curricular changes.[74]

Administrators/supervisors reported that eighty-four per cent of the participant-teachers engendered more interest in science and/or mathematics among students in the post-institute periods. The participant-teachers themselves tended to be less positive than their administrators that their students were more active than previously, or more than the students of other teachers, in scientific activities. However, in the participants' judgment, "increasing student knowledge of and enthusiasm for scientific subjects was a prime benefit of the institutes."[75]

This study did not purport to assess the influence of the summer institutes upon non-participating teachers but seventy-eight per cent of the administrators indicated that the participants had favorable influence on their colleagues, whereas fifteen per cent observed some unfavorable influence.[76]

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[73] Ibid., p. 5.

[74] Ibid.

[75] Ibid., p. 6.

[76] Ibid., p. 7.

The following are brief excerpts from evaluations of participants, administrators, and panelists on how well the institutes were conducted:

> Both teachers and panelists had high regard for the facilities and accommodations of the various Institutes.
>
> As to content, teachers . . . found the course levels at about the right level of difficulty (leaning, if anything, toward the too-difficult).
>
> On the whole, Institute instructors were ranked high . . . but not so high in teaching skills.
>
> Panelists observed that in 55 per cent of the cases, Institute course offerings made some attempt to meet special needs of high school teachers . . . . Further, 62 per cent of panelists seemed to feel that course offerings were relevant to teachers' needs.
>
> /Course/ heterogeneity did indeed cause some difficulties . . . was attested to by 26 per cent of the panelists.
>
> There were indications that . . . interest in curriculum design was directed toward having courses in science teaching, as well as in science. There /was/ . . . enough dissatisfaction in this area to justify further inquiry into Institute course design.[77]

In summary, the Science Research Associates study indicated that the NSF Summer Institutes Program made worthwhile contributions in three areas: (1) updating participant-teachers in subject matter, (2) renewing enthusiasm for subjects taught by the participant-teachers, and (3) encouraging many of the host institutions to revise their teacher-education curricula.

In another contractual, large-scale evaluation of the 1957 summer institute participants, efforts were focused on long-range effects and data were obtained from a control group of approximately 500 teachers who had never attended a NSF institute. The basic framework of this

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[77] Ibid., pp. 7-8.

study involved findings obtained from interviews with teachers in the control group and their colleagues who had been participants in the 1957 summer institutes. The study began in the summer of 1959 with a mail survey to all the 4600 participants in the 1957 summer institutes.[78] By proper sampling techniques,

> the final field studies were made on 538 participants in the 1957 institutes, 202 institute participants in other years, 251 principals or supervisors, and 492 teachers in the control group . . . . The use of a geographic cluster technique provided for a highly satisfactory balanced sample from the qualified universe. Some 503 different schools were represented. The schools selected were in numbers proportional to the number of schools in the various census regions of the country.[79]

Administrators who evaluated the institutes gave credit to the participant-teachers for improvement in a large number of attributes associated with good teaching and expressed preference for "institute alumni;" the administrators found the participants "more alert in keeping abreast of new techniques and in maintaining progress with the new subject matter developments in their areas."[80]

Generally there was agreement among science teachers and their administrators that there was sound improvement in both course content

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[78]Bureau of Social Science Research, "The NSF Summer Institute Program: A Follow-Up of 1957 Institute Participants," Part I, Report and Interview Schedule (Series of Summer Institute Studies, Vol. IV, No. 338, Washington, D. C.: American University, 1960), p. 5. (Mimeographed.)

[79]Marsh W. White, "A Review of NSF Summer Institute Programs: A Follow-Up of 1957 Institute Participants," (University Park: The Pennsylvania State University, 1961), p. 1. (Mimeographed.)

[80]Ibid., p. 12.

and teaching techniques among teachers who had attended institutes. These factors were deemed influential in the following: (1) almost seventy-five per cent of the schools had increased the number of class sections in one or more of the science fields; (2) there was more participation in science clubs; (3) there were more students in the science-mathematics classes, in proportion to the overall enrollment increases; and (4) there were more science-prone students.[81]

A high proportion of the participant-teachers made favorable statements about new insights gained in improved teaching techniques, about important new subject-matter learned, and about the long-range benefits they had received from institute participation. Sequential attendance to institutes definitely increased the teaching effectiveness of the more fortunate participants--as contrasted with their "once-only colleagues."[82]

By using a control group, this study was able to point up some significant differences between the "institute alumni" and the non-participants. Generally, the alumni were superior in (1) subscribing to and reading of scientific and/or professional journals; (2) improvement in formal education and graduate study; (3) assignment to teach new courses; (4) using new teaching techniques; (5) overall teaching ability; (6) curricular modifications; (7) usage of supplementary materials in the classroom laboratory; (8) requirements of students; (9) inducing voluntary

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[81]Bureau of Social Science Research, op. cit., pp. 19-23.

[82]Ibid., pp. 27-30.

effort by students; (10) attaining higher student interest in classes; (11) securing above average students in elective classes; and (12) motivating students to greater accomplishments and higher grades.[83]

This research presents "convincing data that show qualitatively the long-range effects directly attributable to the National Science Foundation /Summer/ Institute Program."[84]

Reporting on the history and the future of the summer institutes, Morrell stated that most comments reaching the Foundation indicated the successfulness and the effectiveness of this type of institute; in fact, they had proved far more effective than was anticipated.[85] He continued:

> Many local studies have been undertaken, and in general they confirm the belief that the institutes have been successful. Studies have also been made on a national scale. The most thorough of these investigations was conducted by an independent private agency, the Bureau of Social Science Research, Inc. In earlier studies this organization sought to determine the /immediate/ effects of the 1957 institutes on high school teachers who participated. These same teachers were studied again in 1960, in an attempt to evaluate persistent effects of the institutes . . . . Efforts were made to identify changes in their teaching attributable to institute participation, and to compare the effectiveness of these teachers with that of similar teachers who had not attended institutes . . . . The conclusions . . . confirm earlier indications that the long-range, as well as the immediate, effects of the summer institutes are more than gratifying.[86]

Morrell enlarged upon some of the following problems of both the Foundation and the sponsoring institutions in the foreseeable future: (1) Should fellowship programs be substituted for the institute programs? (2) How can the evaluation and the selection of institute applicants be improved? (3) Should there be repeated participation in institutes? Or should teachers who have not yet received institute stipends be considered

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[83] Ibid., pp. 31-40.

[84] White, op. cit., p. 1.

[85] Morrell, op. cit., p. 450.

[86] Ibid.

preferentially? (4) How can we improve methods of evaluating and selecting institutes to receive or to retain financial support? (5) Should institutes be of the sequential type or of the unitary type? Or be combinations of both types? (6) Should the financial support now directed chiefly to science and to mathematics programs be channeled into other academic areas? (7) How can financial resources needed to improve the teaching of science and mathematics, as well as other areas, be secured from sources outside of the federal government?[87]

In reviewing the past AYI programs and ISI programs of the NSF, and projecting plans for these programs, Pino and Anderson stated: " . . . our major concern . . . /is/ to try to determine whether there is need for these programs and, if so, how they may be improved."[88] These members of the NSF staff (Dr. Robbin C. Anderson was on leave from The University of Texas) indicated the following as current critical problems in the several aspects of the above-mentioned institute programs:

> . . . first, the continuous strengthening of the training of new teachers; second, wider and more effective use of low cost programs such as in-service activities; third, new patterns which may reach more teachers; fourth, the development of really strong programs for college teachers; . . . fifth, eliminating undue overlapping and establishing clear-cut sequence and purposes in all the institute programs; /sixth/ . . . the continuing need for trying new ideas and new experimental programs such as those for elementary teachers; /seventh/ . . . to make even more extensive and effective use of the various patterns which have proved successful.[89]

These authors concur with Morrell in that there must be more cooperation and support of these programs from the federal agencies down through the local school systems.[90]

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[87] Ibid., p. 451.

[88] Pino and Anderson, op. cit., p. 453.

[89] Ibid., p. 454.

[90] Ibid.

Independent Studies

Speaking before the Midwest Conference on Graduate Study and Research, Mallinson[91] indicated that there are four thoroughly publicized problems associated with the NSF SI programs: (1) Courses do not have well-organized content--nor are these courses properly integrated or in their proper sequence; (2) Too often courses are repetitive from one institute to another; (3) Because it is difficult to place these courses in the customary graduate sequence, it is impossible to transfer credit from one institution to another; and (4) Frequently the institute graduate courses are of undergraduate caliber.[92]

"It would be difficult to refute any of these points just mentioned," Mallinson continued, "and their existence, without question, is real. They are, however, problems that are essentially institutional in origin, and are not those of the National Science Foundation."[93] Mallinson had discussed these problems with other graduate deans and came to the conclusion that such problems exist because most deans are not "directly concerned with the administration of Institute programs."[94]

A high-level administrator in the Office of Education was quoted by Mallinson as saying, "Without regard for the ultimate merit of these Institute programs, no other single activity has ever had a greater impact on American education."[95]

Since 1958, Samuel Schenberg, Director of Science of the New York City Schools, has done an annual evaluation of the summer institutes

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[91] Mallinson, op. cit., p. 95.

[92] Ibid.

[93] Ibid.

[94] Ibid.

[95] Ibid., p. 104.

attended by science and mathematics teachers of the New York City Secondary Schools.

In the three-year period, 1958-1961, twenty-four per cent of the secondary school teachers of science and mathematics of New York City have attended one or more summer institutes. Just under thirty-five per cent of the 1961 participants attended a summer institute for the first time; approximately the same per cent had attended one previous institute. Seventy per cent of the participants had to file better than five applications to secure an institute acceptance. (Figures were not available on the number of teachers who filed applications but failed to secure a single acceptance.) Nearly eighty per cent of the participants indicated that they would attend an institute the following summer (1962) if they were accepted; whereas, better than twenty-two per cent indicated that they would prefer industrial employment to summer institute participation.[96]

Generally, these New York City secondary school teachers of science and mathematics found the summer institutes stimulating: the professors and resource persons were capable; the institute courses brought them up to date in their own, and related teaching fields; the laboratories and field trips were worthwhile; and they enjoyed the contacts with teachers from other systems.[97]

There was much professional improvement and participation by these

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[96]Samuel Schenberg, "An Evaluation of the 1961 Summer Institutes Attended by the Science and Mathematics Teachers from the New York City High Schools" (New York: Board of Education of the City of New York, 1962), p. 3. (Mimeographed.)

[97]Ibid., p. 4.

teachers upon their return to the New York City Secondary Schools. Many teachers volunteered to assist in the national revision of the secondary school sciences (e.g., Biological Science Curriculum Studies Biology and Physical Science Study Committee Physics). Some teachers elected to offer advanced courses in the science and mathematics curricula. Generally, they were more qualified to motivate students in research projects. "Participation in an institute improved their status in the eyes of their principals, fellow teachers and students. They returned to their schools with greater confidence in their abilities as teachers.[98]

Schenberg had a number of constructive criticisms of the summer institutes, some having been indicated in his previous evaluations. Many of the participants would have "high school educators alongside of college educators in the planning and conduct of the institutes in order to secure better articulation, . . ."[99] In evaluating institute courses, many of the participants felt that too much material was covered in too little time, there was excessive homework, certain institute courses should have refresher courses, and the institute curricula were not integrated with the secondary school science and mathematics curricula. Seminars "designed to acquaint teachers with the best methods for presenting the latest advances in science and mathematics and for demonstrating new equipment in their own classrooms"[100] were considered necessary additions by many participants.

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[98] Ibid.

[99] Ibid., p. 21.

[100] Ibid.

CHAPTER II

METHOD AND PROCEDURE

The methodological pattern of this study included the following procedural steps:

1. Conceptualization of the problem.

2. Clarification of the objectives of the program.

3. Translation of these goals into specific hypotheses concerning the observable effect of the program upon a well defined population.

4. Design of the instrument to measure the effects studied.

5. Pretest of the pertinence of the hypotheses and the adequacy of the data-collection instrument.

6. Collection of the data--field phase.

7. Processing and analysis of the data.

8. Presentation of findings in report form.

Translation of Goals into Hypotheses

These objectives were translated into specific hypotheses concerning the observable effects of the institute programs on the participants. The hypotheses on which this study was based are:

1. The curricular/co-curricular activities of the institute renewed the participant-teachers' knowledge of fundamentals.

2. The curricular/co-curricular activities of the institutes familiarized the participant-teachers with recent developments and advances in science, mathematics, and engineering.

3. The curricular/co-curricular activities of the institutes

acquainted the participant-teachers with newer approaches to presentations of their subjects.

These hypotheses provided the basis for the construction of the data-gathering instrument.

Design of the Research Instrument

Rationale for the opinionaire. This research was accomplished through the use of transmitted opinionaires with a number of follow-up interviews. The opinionaire was formulated: (1) by comparison with comparable studies of three types as reviewed in Chapter I, and (2) according to psychological principles of opinion sampling as described in standard references:[1]

1. The study should be adequately sponsored.

2. The purpose of the study should be frankly stated.

3. The study should deal with matters worth investigating to both researcher and recipient.

4. The needed information is obtainable only through an opinionaire, or a comparable instrument.

5. The opinionaire items are within comprehension of the recipient.

6. The demands of the opinionaire are reasonable.

7. The opinionaire is well organized and in proper mechanical form.

8. Items are clearly and briefly stated.

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[1]Leon Festinger and Daniel Katz, Research Methods in the Behavioral Sciences (New York: The Dryden Press, 1953); W. J. Good and P. K. Hatt, Methods in Social Research (New York: McGraw-Hill Book Co., 1952); Marie Jahoda, et al., Research Methods in Social Relations (New York: The Dryden Press, 1953).

9. Items are directed primarily to matters of ascertainable facts and less often to matters of opinion.

10. Answers can be made briefly (e.g., with a check) and those requiring subjective replies can be kept to a minimum.

11. The respondent is to receive a copy of the study summary.

During recent years survey research has enjoyed increased usage in many areas of human endeavor and has been used in most countries of the world. Publications are available that contain detailed presentations of the stages of survey research and their interrelationship. There is practically no known limit to the information that can be gathered by survey research. Surveys enable responsible people to be informed of attitudes, behaviors, seriousness of problems, or other characteristics of a population that should be known to policy makers.[2]

"The value of surveys as catalysts for action and for progress is a question that has been settled beyond any reasonable doubt."[3]

This study was a partial survey in that it investigated two of the many aspects of the NSF institutes, the participant-teacher and the KSC-NSF institutes. It is further classified as an investigative-deliberative survey; investigative, in that it purported to evaluate existing conditions; deliberative, in that it purported to make proposals for development and improvement.

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[2]Stephen B. Withey, "Survey Research Methods," pp. 1447, 1450, in Encyclopedia of Educational Research. Edited by Chester W. Harris, (third edition; New York: The Macmillan Company, 1960).

[3]Dan A. Cooper, "School Surveys," p. 1214, in Encyclopedia of Educational Research. Edited by Chester W. Harris, (third edition; New York: The Macmillan Company, 1960).

Research methods are all subject to inherent faults and opinionaires are no exception. The noteworthy criticism of opinionaires is that they should not be used on groups having little interest or knowledge concerning the areas being investigated by the researcher. Rationale for usage of the opinionaire for these participant-teachers is quite evident in the following quotation:

> The questionnaire [opinionaire] can be most fruitfully used for highly selected respondents with a strong interest in the subject matter, greater education, and higher socioeconomic status.[4]

Another problematic area associated with transmitted opinionaires/questionnaires is nonresponse. In view of this possibility, several precautions were taken to insure adequate returns.

The initial correspondence to each participant was signed both by the Director of the Institutes and by the writer. Rather meticulous work was done to be certain that the address of each participant was accurate. This initial inquiry asked the recipient to assist the institute staff in improving subsequent institutes by cooperating in the survey. A stamped, addressed card was included with the inquiry to encourage a response.

Timing was used as another strategem. The correspondence was mailed to the participant-teachers in April, a month that usually allows teachers time for such considerations.

With these commitments at hand, timing again was employed when the opinionaires were mailed. The teacher-participants received their opinionaires early the first week of May. This served as a stimulus for many respondents for they realized the imperativeness of completing

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[4]Good and Hatt, op. cit., p. 182.

the opinionaires before the end-of-school activities materialized.

Both timing and the sample are essential in design considerations. In this research the "sample" was the population universe, hereafter referred to as the "universe."

In an economy gesture and, far more significantly, to make a more personal contact, participant-teachers of all seven ISI classes then in progress received their opinionaires from their instructors. To reduce the possibility of inducing bias into the responses, the instructors were asked not to pick up the opinionaires. At that and subsequent class meetings, the instructors reminded their participant-teachers to complete their opinionaires and to return them to the Office of the Institute Director in the stamped, addressed envelopes provided.

Such precautions and effort resulted in a seventy-eight per cent return of valid opinionaires from the participants who had expressed a desire to cooperate in the survey. Speaking of response rate, Withey stated:

> In practice, a 60 percent response to a mail questionnaire is a fairly good accomplishment, but it is insufficient to eliminate bias . . . . Callbacks can reduce the proportion of such individuals to less than 20 percent, however. With a non-response rate of 20 percent or less, although the unobtained respondents differ from the majority interviewed, they are sufficiently small to virtually guarantee that their inclusion would not significantly alter the results for any percentage figure.[5]

In view of this reference, and generally accepted ideas on percentage of response to a transmitted opinionaire, the near eighty per cent return was considered sufficient to substantiate findings.

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[5]Withey, op. cit., p. 1148.

Determination of Study Areas. Areas to be included in this research were ascertained through the assistance of the following people and the use of the following materials:

1. Comparable studies.
2. Proposals for the NSF-KSC Institutes.
3. Institute Summary Reports by the Director.
4. Select members of the KSC Institute Staff.
5. Select members of the Education-Psychology Staff.
6. Select NSFI participants (summer 1962).
7. Doctoral Committee Chairman and members.

Initially, the first three sources were studied intensively to secure a listing of possible areas for consideration. Subsequently a single-page check-list was prepared with two categories: (1) The Participant-Teachers, and (2) The Institutes.

This protocol was presented to select colleagues from five KSC Departments: Biology, Chemistry, Physics, Mathematics, and Education and Psychology. In the Science and Mathematics Departments, certain members of the NSFI Staff were consulted, including the Director, Dr. R. G. Smith, Head of the Mathematics Department. In the Education and Psychology Department, certain Science Education and Tests and Measurements personnel were consulted. Select NSFI participants were also consulted.

All individuals involved in assisting in the determination of study areas were asked to indicate topics that were pertinent, impertinent, ambiguous, redundant, or perplexing, and to list omissions. In most instances the writer was able to have a conference with each respondent after that person had submitted his revision of the listing

of suggested topics for inclusion in the study.

A composite revision of the protocol of potential study areas was presented to the writer's Doctoral Advisory Committee for approval before any items were constructed for the opinionaire.[6]

Pretesting the Instrument

After the study areas had been determined and catalogued into the two major areas, the construction of the opinionaire items was initiated. To encourage and to expedite responses to the opinionaires and to facilitate processing and analysis of the data, two types of items were constructed: (1) objective items with fixed categories, and (2) subjective, or "open," items which gave no clues as to the nature of the answer desired. The order and the sequence of both types of items was thoroughly analyzed to assure continuity, interrelationship, and completeness.

The initial version of the opinionaire items was pretested by various individuals and groups for readability, sequence, content, structure, and purpose. The following individuals and groups served in that capacity:

1. Select members of the NSF-KSC Institute Staff.
2. Select participant-teachers in the KSC area.
3. Select members of the Education-Psychology Staff.
4. One Education-Psychology class.

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[6]At that date the constituency of the Doctoral Advisory Committee was: Dr. James E. Frasier, Chairman; Dr. W. Ware Marsden; Dr. Roy W. Jones; and Dr. George A. Moore.

5. Science Education students associated with the writer.

6. Doctoral Committee Chairman.

The individuals indicated were given a copy of the initial version of the opinionaire and asked to examine the copy at their convenience. Subsequently, the writer had a conference with each respondent concerning the validity of the opinionaire items.

The classes indicated were studying test construction at the time of the opinionaire was being pretested. An opaque projector was used by the writer to unify attention and to direct discussion to problematic items and/or areas.

The developmental version of the opinionaire was presented to the Doctoral Advisory Committee. Suggested revisions of the data-gathering instrument were included in the final version that was now ready for the field phase. (A copy of the opinionaire is in the Appendix.)

Collection of the Data

Records secured from the Director of the NSF institutes held at KSC indicated that while there had been 621 institute participants, there were only 440 different persons involved. Many participants began graduate degree programs and secured subsequent institute grants.

The target population for this study, the universe, was the 440 teachers who qualified for inclusion by having met the following criteria:

1. They had attended one or more NSF-KSC institutes between 1959-60 and 1962-63.

2. They had been full-time teachers, college, high school (included junior high), and elementary before attending a NSF-KSC

institute.[7]

3. They were full-time teachers, college, high school (included junior high), and elementary for the academic year, 1962-63.[8]

In May, 1962, 440 form letters were sent to the individual members of the qualified universe asking them to participate in the survey. Table VI indicates the status of the responses:

TABLE VI

STATUS OF RESPONSES

Responses	N	%
Address unknown	6	1
No reply to inquiry	23	5
Would/Could not participate	24	6
Dropped institute	49	11
Would participate	338	77
Target population	440	100

In April, 1963, opinionaires were sent to the 338 individuals of the qualified universe who had indicated that they would cooperate in the survey. Table VII is a resume of the response to the opinionaires.

Slightly over three-fourths (77 per cent) of the universe elected to cooperate in the study; of this group, a slightly higher percentage of participants (78 per cent) responded with valid opinionaires.

[7]A relatively small number were either teaching administrators or administrators with science/mathematics majors.

[8]The small number of administrators were included in the target population because they were: (1) participant-teachers who had subsequently secured administrative assignments; (2) teaching administrator-participants; or (3) participant-administrators who had a science/mathematics major and had expressed a desire to be a participant to be better qualified to assist their teachers in these content areas.

TABLE VII

RESPONSES TO OPINIONAIRES

Responses	N	%
Opinionaire not returned	64	19
Non-valid opinionaires	10+	3
Valid opinionaires	264*	78
Study group	338	100

+This included three opinionaries that were returned too late for inclusion.

*This included eleven "dropouts" who had completed at least one semester of an ISI and who responded with valid opinionaires.

Processing and Analysis of the Data

The objective data were processed by translating responses into numerical codes, by transferring the coded information to IBM cards, and by using a card sorter and a computer to tabulate the information.

The subjective data, and certain short-answer items, were processed by coding and manual tabulation--by means of cards, charts, and a filing system.

The analysis of any opinionaire depends upon the type of response required by the items. In this opinionaire the items required two types of information, factual and judgmental. The factual information was required for the demographic and background items and those items seeking the what and the how. The judgmental information was dependent upon the attitude of the respondents toward the particular item under scrutiny. This type of response involved a subjective judgment on the part of the respondent.

Two types of analyses were deployed, depending upon the above types of responses. The short-answer, factual responses, usually referred to as "objective" responses, were reported in tables which indicated frequency and percentage of respondents for that attribute. This factual information, secured from the computer, was analyzed objectively.

The subjective or "open" responses, and certain short-answer items, required coding and manual tabulation. The resulting data, while being subjective, was analyzed as objectively as possible to increase validity.

CHAPTER III

THE REPORT

The Respondents

The data for this study was secured from a transmitted opinionaire composed of 419 forced-answer items and fifty open items. The opinionaires were printed by an off-set process and were "headed" to reduce the size of each opinionaire to eight sheets, or fifteen pages.

Demographic Information

There were 205 (78 per cent) male respondents and fifty-nine (22 per cent) female respondents in the study group.

TABLE VIII

AGES OF RESPONDENTS
(ITEMS 2-a, 2-b)

2-a. On Last Birthday			2-b. When First Accepted for a NSF Institute		
Age	Number of Respondents	Per Cent	Age	Number of Respondents	Per Cent
1. 20-24	17	6	1. 20-24	38	15
2. 25-29	49	19	2. 25-29	58	22
3. 30-34	56	21	3. 30-34	43	16
4. 35-39	38	15	4. 35-39	39	15
5. 40-44	31	12	5. 40-44	22	8
6. 45-49	16	6	6. 45-49	21	8
7. 50-54	26	10	7. 50 or +	42	16
8. 55-59	20	8			
9. 60 or +	9	3			
Total	262	100		263	100

Since attending an institute 202 respondents (77 per cent) were teaching in the same state and in the same school; thirty-seven (14 per cent) were teaching in the same state but in a different school, while twenty-two (8 per cent) were teaching in a different state. Institute attendance had not induced the majority of the respondents to change schools.

TABLE IX

GEOGRAPHICAL DISTRIBUTION OF SCHOOLS IN WHICH THE RESPONDENTS TAUGHT (ITEM 0)

State[a]	Number of Respondents	Per Cent	State	Number of Respondents	Per Cent
Alabama	1	*	Minnesota	1	*
Arizona	2	*	Missouri	59	22
Arkansas	2	*	Nebraska	1	*
California	2	*	New Mexico	2	*
Colorado	1	*	New York	3	1
Florida	2	*	North Carolina	1	*
Illinois	3	1	North Dakota	1	*
Indiana	2	*	Ohio	1	*
Iowa	1	*	Oklahoma	14	5
Kansas	161	61	Texas	1	*
Louisiana	1	*	Wisconsin	1	*
Michigan	1	*	Total	264	100

[a]There were respondents from twenty-three states.

*Less than one per cent

Teaching Experience

Less than five per cent of the respondents had taught all/most of the time in schools other than the public schools. Just over fifty per cent had taught all/most of the time at levels other than the secondary school level (Table XI).

The majority of the respondents, 154 (59 per cent) had taught in

their present schools less than five years (Table X); contributing factors were: (1) 71 respondents (27 per cent) had less than five years experience, and (2) normally there is a high degree of mobility within the first five to ten years of a teacher's career.

TABLE X

YEARS OF TEACHING EXPERIENCE OF THE RESPONDENTS (ITEMS 4, 5)

4. Total Experience			5. Years at Present School		
Years	Number of Respondents	Per Cent	Years	Number of Respondents	Per Cent
1. 1-4	71	27	1. 1-4	154	59
2. 5-9	72	27	2. 5-9	60	23
3. 10-14	42	16	3. 10-14	16	6
4. 15-19	28	11	4. 15-19	20	8
5. 20-24	15	6	5. 20-24	4	1
6. 25-29	16	6	6. 25-29	3	1
7. 30-34	11	4	7. 30-34	3	1
8. 35 or +	9	3	8. 35 or +	3	1
Total	264	100		263	100

TABLE XI

SCHOOL LEVELS AT WHICH THE RESPONDENTS HAD TAUGHT (ITEM 7)

School Levels	All/Most		Some		None	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. Elementary	23	9	47	18	194	73
b. Junior High	96	36	71	27	97	37
c. Senior High	124	47	58	22	82	31
d. Junior College	18	7	20	8	226	85
e. College	7	3	11	4	246	93
f. University	1	*	7	3	256	97

*Less than one per cent.

Slightly more than half of the respondents, 133 (51 per cent), had taught mathematics all/most of the time (Table XII). Besides mathematics, biological sciences, physical science, and general science, 113 respondents (43 per cent) reported that they had taught in one or more of thirteen "additional" areas.

TABLE XII

BROAD AREAS IN WHICH THE RESPONDENTS HAD TAUGHT (ITEM 8)

Area	All/Most		Some		None	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Mathematics	133	51	60	22	71	27
Biological Science	39	15	55	21	170	64
Physical Science	50	19	52	19	162	62
General Science	61	23	78	30	125	47

School Positions

The majority of the respondents were classroom teachers--the type of school personnel for which most of the NSF institutes were devised. There was a five per cent increase in administrative assignments in the post-institute period (Table XIII); this could be attributed to attainment of graduate degrees and better salaries in administrative positions.

Education

Semester hours in the majors of the respondents, at the undergraduate and the Master degree levels, ranged between the 20-24 hours bracket and the sixty-or-more hours bracket (Table XIV). This is

TABLE XIII

TYPE OF SCHOOL POSITION HELD BY THE RESPONDENTS (ITEM 9)

Position	Pre-Institute		Current	
	Number	Per Cent	Number	Per Cent
1. Teacher	244	93	210	88
2. Supervisor	3	1	6	3
3. Department Chairman	2	*	8	3
4. Principal	4	2	8	3
5. Superintendent	4	2	5	2
6. Other. Specify	4[a]	2	3[a]	1
Total	261	100	240	100

*Less than one per cent. [a]Too few open responses to tabulate.

TABLE XIV

SEMESTER HOURS IN RESPONDENTS' MAJORS (ITEM 13)

Hours in Major	Under-Graduate		Graduate					
			Master		Specialist		Doctorate	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. 20-24	27	11	63	37	7	78	0	0
b. 25-29	39	16	22	13	0	0	0	0
c. 30-34	77	32	45	26	1	11	0	0
d. 35-39	32	13	17	10	1	11	0	0
e. 40-44	32	13	7	4	0	0	1	50
f. 45-49	13	5	4	3	0	0	0	0
g. 50-54	9	4	1	1	0	0	0	0
h. 55-59	4	2	2	1	0	0	0	0
i. 60 or +	9	4	9	5	0	0	1	50
Total	242	100	170	100	9	100	2	100

indicative of the diverse requirements between academic areas within a college and between colleges/universities.

Of the total study group, forty-eight (18 per cent) had secured graduate professional education (Table XV) in institute programs.

TABLE XV

SEMESTER HOURS OF PROFESSIONAL EDUCATION SECURED BY THE RESPONDENTS IN INSTITUTE PROGRAMS (ITEM 14-a)

Category	Undergraduate		Graduate	
	Number	Per Cent	Number	Per Cent
1. Yes	7	11	48	18
2. No	56	89	216	82
Total	63	100	264	100

Fifty-six respondents (21 per cent) reported graduate degrees in progress. Institute financial assistance for graduate degrees either attained or in progress was reported by 133 respondents, fifty per cent of the study group (Table XVI).

Mathematics, education, and biology were the top three undergraduate majors of the respondents (Table XVII). Of significance here is the fact that fifty-one per cent of the respondents taught mathematics all/most of the time and (Table XII) and forty-five per cent of the respondents taught at the elementary/junior high levels (Table XI).

The same three areas listed in the preceding paragraph were involved in the graduate majors of the respondents but in a different placement: education, mathematics, and biology. Besides the majors and minors listed in Table XVII, the respondents had attained majors in twenty other areas and minors in twenty-one.

Just under fifty per cent of the respondents had been away from college/university only a year prior to their institute attendance (Table XVIII). While NSF recommends that participants have several years of teaching experience this decision is left to the sponsoring

TABLE XVI

ACADEMIC TRAINING OF THE RESPONDENTS (ITEM 10)

Degree	Attained		In Progress		Institute Help	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. B.A.	60	23	0	0	0	0
b. B.S.	192	73	3	1	4	2
	252	96	3	1	4	2
c. M.A.	24	9	25	9	19	7
d. M.S.	74	28	2	1	93	35
	98	37	27	10	112	42
e. Ed.S.	3	1	22	8	18	7
	3	1	22	8	18	7
f. Ed.D.	1	*	4	2	2	1
g. Ph.D.	0	0	3	1	1	*
	1	0	7	3	3	1
h. Other	9[a]	-	2[a]	-	4[a]	-

*Less than one per cent.

[a]Too few open responses to tabulate.

TABLE XVII

MAJOR AND MINOR AREAS IN THE UNDERGRADUATE AND GRADUATE STUDIES OF THE RESPONDENTS (ITEMS 11, 12)

Area	Major				Minor			
	Under-Graduate		Graduate		Under-Graduate		Graduate	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. Mathematics	93	35	77	29	85	32	20	8
b. Biology	46	17	30	11	25	10	7	3
c. Botany	5	2	3	1	4	2	2	1
d. Zoology	9	3	3	1	6	2	3	1
e. Chemistry	36	14	19	7	36	14	5	2
f. Physics	26	10	19	7	44	17	6	2
g. Gen'l Science	27	10	27	10	44	17	15	6
h. Education	87	33	79	30	52	20	36	14

TABLE XVIII

YEARS SINCE RESPONDENTS HAD RETURNED TO COLLEGE/UNIVERSITY PRIOR TO THEIR INSTITUTE ATTENDANCE (ITEM 16)

	Years	Number of Respondents	Per Cent
1.	1 yr.	125	49
2.	2 yrs.	39	15
3.	3 yrs.	23	9
4.	4 yrs.	14	6
5.	5-9 yrs.	28	11
6.	10 or +	26	10
	Total	255	100

institution. It is possible that a number of participants had already started additional course work before they applied for an institute.

Certification

Since the majority of the study group were teaching in elementary, junior high, or senior high schools they could be expected to be certified to teach. This is evident in Table XIX. Fifteen respondents (6 per

TABLE XIX

TYPE OF TEACHING CERTIFICATE HELD BY THE RESPONDENTS (ITEM 15)

	Type of Certificate	Number of Respondents	Per Cent
1.	Temporary	13	5
2.	Provisional	19	8
3.	Semi-permanent	71	29
4.	Permanent	146	59
	Total	249	100

cent) were college/university teachers and held no certification.

Eighty-four respondents (32 per cent) indicated that institute courses had enabled them to improve their certification.

Teaching Assignments

In comparing the pre-institute curricular assignments of the respondents with their post-institute assignments the following were evident: (1) there was a slight increase in student load (Table XX);

TABLE XX

APPROXIMATE NUMBER OF STUDENTS TAUGHT DAILY BY THE RESPONDENTS (ITEM 18)

Students	Pre-Institute		Current	
	Number	Per Cent	Number	Per Cent
a. Below 100	87	34	80	31
b. 100-149	86	33	94	36
c. 150-199	79	30	73	28
d. 200-249	7	3	9	4
e. 250 or +	1	*	2	1
Total	260	100	258	100

*Less than one per cent.

(2) there was a slight decrease in number of classes taught (Table XXI); and (3) the number of daily class preparations were comparable to that of the pre-institute period (Table XXII).

Since the respondents were not asked about class size, the slight decrease in number of classes versus the slight increase in number of students taught could indicate slightly larger classes in the post-institute periods. There was very little evidence to indicate that institute attendance had been a factor in these slight load modifications.

TABLE XXI

NUMBER OF CLASSES TAUGHT DAILY
BY THE RESPONDENTS (ITEM 19)

Classes Per Day	Pre-Institute		Current	
	Number	Per Cent	Number	Per Cent
1. Four or less	48	19	59	24
2. Five	118	47	109	43
3. Six	74	29	71	28
4. Seven or +	12	5	12	5
Total	252	100	251	100

(A few respondents indicated that their institute attendance was a factor in this respect.) Undoubtedly the increasing school enrollments was the more significant factor.

TABLE XXII

DAILY CLASS PREPARATIONS MADE BY THE RESPONDENTS
IN THEIR TEACHING (ITEM 20)

Preparations	Pre-Institute		Current	
	Number	Per Cent	Number	Per Cent
a. One	19	8	25	10
b. Two	68	26	63	25
c. Three	73	28	77	31
d. Four	44	17	42	17
e. Five or +	55	21	42	17
Total	259	100	249	100

In the consideration of "open" periods within the school day for preparations, planning, and related teacher activities, the following points were made: (1) 82 per cent stipulated that they had "open" periods; (2) 83 per cent indicated that both "laboratory" and "non-laboratory" teachers were accorded about the same amount of "open"

time; and (3) 11 per cent believed their institute attendance had influenced "open" period time for teachers of laboratory courses.

From the above it is evident that most of the school systems of the respondents did allow "open" time for their teachers--and were making no distinction between the needs of "laboratory" and "non-laboratory" teachers; too, the institutes had little influence on this aspect of their teaching.

One hundred fifty-nine respondents (64 per cent of 232) believed that teachers handling laboratory classes should be given more "open" time than that given teachers of non-laboratory classes (Table XXIII). This was confirmed by those who elected to defend their position with a subjective statement: 73 per cent made positive statements.

TABLE XXIII

RESPONDENTS WHO BELIEVED THAT TEACHERS HANDLING LABORATORY CLASSES SHOULD BE GIVEN MORE "OPEN" PERIODS THAN THAT GIVEN TEACHERS OF NON-LABORATORY COURSES (ITEM 22)

Objective Item			Subjective Item		
Category	Number	Per Cent	Category	Number	Per Cent
1. Yes	149	64	1. Positive	140	73
2. No	83	36	2. Negative	44	23
			3. Non-commital	7	4
Total	232	100		191[a]	100

[a]This number is eighty-three per cent of the respondents to the objective item. Forty-one respondents (18 per cent) did not elect to defend their position.

While the majority of the respondents believed that teachers handling laboratory classes should be given more "open" time than that

given teachers of non-laboratory classes, they had not yet convinced their non-laboratory colleagues, their administrators, and their school boards on this point.

Income

The salaries of the respondents moved from a median within the $4500-$4999 bracket just prior to their institute attendance to a median within the $5000-$5449 bracket at the time of their response (Table XXIV). Only five per cent of the study group indicated that their institute participation was influential in the salary increase. Forty-eight respondents (16 per cent) had received additional job offers by virtue of their institute attendance--these were largely school and/or school related job opportunities.

TABLE XXIV

NINE-MONTHS TEACHING INCOME OF THE RESPONDENTS (ITEM 26)

	Salary	Pre-Institute[a]		Current	
		Respondents	Per Cent	Respondents	Per Cent
1.	Below $4000	46	18	11	4
2.	$4000-$4499	52	20	18	7
3.	$4500-$4999	60	23	45	18
4.	$5000-$5499	49	19	73	29
5.	$5500-$5999	27	11	45	18
6.	$6000-$6499	10	4	32	13
7.	$6500-$6999	4	2	14	6
8.	$7000-$7499	6	2	11	4
9.	$7500-$7999	2	1	3	1
10.	$8000 or over	0	0	0	0
	Total	257	100	252	100

[a]The school year in which the respondent received his first NSF institute grant.

Teaching Methods and Techniques

A close examination of Table XXV reveals that the institute

TABLE XXV

THE EXTENT OF INSTITUTE INFLUENCE UPON THE INSTRUCTIONAL TECHNIQUES AND METHODS OF THE RESPONDENTS (ITEM 28)

	Instructional Techniques and Methods	Much		Some		Little		None	
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
1.	Multiple-purpose classrooms	6	2	40	15	22	8	195	74
2.	Flexible furniture arrangements	8	3	41	16	37	14	177	67
3.	Usage of student assistance	15	6	64	24	40	15	144	55
4.	Usage of multiple-texts/references	79	30	99	38	24	9	61	23
5.	Depth of coverage of selected areas	137	52	77	29	21	8	28	11
6.	Student involvement in curriculum	31	12	76	29	55	21	101	38
7.	Usage of outside agencies/persons	24	9	78	30	49	19	112	42
8.	Usage of A-V equipment/materials	40	15	82	31	38	15	103	39
9.	"Up-dating" reading materials	94	36	83	31	34	13	52	20
10.	Supplementary reading materials	90	34	94	36	29	11	50	19
11.	Extra-class student assignments	49	19	99	37	45	17	70	27
12.	Learner-centered class presentations	33	13	90	34	47	18	93	35
13.	Student involvement in research	40	15	38	14	62	24	93	35
14.	Open-ended experiments	28	11	54	20	56	21	125	48
15.	Essay/semi-structured lab write-ups	22	9	45	17	64	24	132	50
16.	Extra-class student projects	37	14	84	32	62	24	80	30
17.	Variation in testing procedures	43	16	84	32	54	21	82	31
18.	Cooperative evaluations	12	5	64	24	59	22	128	49
19.	Standardized tests (e.g., SMSG, ACS)	20	8	46	18	45	17	152	58
20.	Expanding your guidance role	36	14	93	35	52	20	82	31
21.	Varying methods of presentation	100	38	118	44	20	8	26	10
22.	Usage of newer subject-matter concepts	148	46	80	30	11	4	25	10
23.	Usage of generalizations	55	21	90	34	55	21	63	24
24.	Intensifying elective courses	44	17	54	20	47	18	118	45
25.	Challenging the brighter student	127	48	84	32	24	9	28	11
26.	Motivating the creative student	107	41	95	36	29	11	32	12
27.	Encouraging student initiative	110	42	92	35	27	10	34	13
28.	Setting higher student goals	126	48	85	32	24	9	28	11

TABLE XXVI

ACTIVITIES AND METHODS IN PREDOMINANT USAGE IN THE COURSE WORK OF THE RESPONDENTS (ITEM 29)

Activities and Methods	Number of Respondents		Per Cent	
a. Furniture arrangement				
1. Set	121		48	
2. Flexible	131		52	
Total		252		100
b. Usage of equipment/material				
1. Teacher controlled (only)	75		30	
2. Student assistants' help	99		39	
3. By any student	77		31	
Total		251		100
c. Text(s)				
1. Single (No other reference)	23		9	
2. Single (With other references)	181		70	
3. Multiple-texts (several used)	55		21	
Total		259		100
d. References				
1. From school library	145		64	
2. From classroom library	80		35	
3. From city library	3		1	
Total		228		100
e. Course coverage				
1. Breadth (All of text)	95		37	
2. Depth (Of selected text areas)	164		63	
Total		259		100
f. Unit preparations				
1. By teacher (Self)	177		70	
2. From text "teacher's manual"	45		18	
3. In cooperation with students	31		13	
Total		253		100
g. Planning class/course work				
1. Student/Learner-centered	133		53	
2. Teacher-centered	118		47	
Total		251		100
h. Assignments				
1. Specific text pages	161		64	
2. "Open" assignment	91		36	
Total		252		100

TABLE XXVI (Continued)

Activities and Methods	Number of Respondents		Per Cent	
i. Class presentations				
1. Teacher-centered	117		47	
2. Student/Learner-centered	134		53	
Total		251		100
j. Laboratory				
1. Exercises	65		34	
2. Experiments	114		59	
3. Research	13		7	
Total		192		100
k. Experiments				
1. Standard ("closed")	116		60	
2. Open-ended	78		40	
Total		194		100
l. Student projects (time)				
1. On class time	69		31	
2. Extra-class	151		69	
Total		220		100
m. Student projects (type)				
1. Largely exhibits	90		45	
2. Research with paper	112		55	
Total		202		100
n. Test questions				
1. Recall	69		31	
2. Problem-solving	142		65	
3. Essay	8		4	
Total		219		100
o. Grading/Evaluating (source)				
1. Largely from tests	86		35	
2. With items besides tests	161		65	
Total		247		100
p. Grading/Evaluating (evaluator)				
1. By teacher only	206		84	
2. With student assistance	38		16	
Total		244		100
q. Grade cards/Progress reports				
1. With letter/numerical grades only	151		63	
2. With both grade and constructive comments to parents	90		37	
Total		241		100

experiences of the respondents had only moderate influence upon their teaching methods/techniques except in the areas of varying methods of presentation, usage of newer subject-matter concepts, and in student motivation. Table XXVI adds insight to this modest influence of the institutes in that the respondents were already using many of the newer methods/techniques before their institute attendance.

When asked about the extent of their course content changes since attending an institute, eighty-two per cent of the respondents indicated they had modified their courses from "some" to "a great deal"(Table XXVII).

TABLE XXVII

EXTENT OF COURSE CONTENT CHANGE BY RESPONDENTS IN THEIR CLASSES SINCE ATTENDING AN INSTITUTE (ITEMS 30, 30-a)

30. Extent of Change	Number	Per Cent	30-a. Subjective Responses	Number	Per Cent
1. A great deal	63	25	Responses	191	94
2. Some	140	57	Non-responses	12	0
3. Very little	41	17			
4. None	3	1			
Total	247	100		203[a]	100

[a]This number is the total of Categories 1 and 2 under Item 30; these objective responses should have had accompanying subjective responses in Item 30-a.

Table XXVIII indicates the curriculum revisions in usage by the respondents in their teaching. Mathematics was the only area where the majority of the respondents were using the newer curriculum revisions. This can be explained in that fifty-one per cent of the respondents were teaching mathematics and eighteen of twenty-two institute courses in this area included varying aspects/amounts of SMSG mathematics.

TABLE XXVIII

CURRICULUM REVISIONS IN USAGE BY THE RESPONDENTS IN THEIR CLASSROOM TEACHING (ITEM 50)

Curricula	Yes		No		Some		N
	Number	Per Cent	Number	Per Cent	Number	Per Cent	
1. SMSG (Mathematics)	40	30	58	43	36	27	134
2. BSCS (Biology)	6	8	60	80	9	12	75
3. CHEM (Chemistry)	5	8	51	77	10	15	66
4. Chem-Bonds (Chem.)	4	7	50	88	3	5	57
5. PSSC (Physics)	15	21	49	67	9	12	73
6. Other. Specify	5[a]				4[a]		

[a]Too few open responses to tabulate.

While the majority of the respondents (89 per cent of 150) indicated that curriculum revision information gained in the institutes had been of value to them, only in mathematics had the majority of the respondents secured information about the newer curricula in their institutes (Table XXIX).

TABLE XXIX

RESPONDENTS WHOSE INSTITUTE EXPERIENCE HAD INCLUDED A STUDY OF SECONDARY SCHOOL MATHEMATICS AND SCIENCE CURRICULUM REVISIONS (ITEM 52)

Curricula	Yes		No		Some		N
	Number	Per Cent	Number	Per Cent	Number	Per Cent	
1. SMSG (Mathematics)	69	42	67	41	27	17	163
2. BSCS (Biology)	17	15	78	71	15	14	110
3. CHEM (Chemistry)	14	16	71	81	3	3	88
4. Chem-Bonds (Chemistry)	10	11	72	84	4	5	86
5. PSSC (Physics)	23	24	65	68	8	8	98
6. Other. Specify	9[a]				1[a]		

[a]Too few open responses to tabulate.

In a comparison of their teaching competence before and after institute attendance, the respondents thought they were more competent in

handling most students excepting the slow-learner (Table XXXI). They may have been of the opinion that increased knowledge of subject-matter was the sole criterion for improved handling of the gifted, creative, and average student.

Professional Activities

The majority of the respondents (74 per cent) stated that their institute attendance had assisted them, from "some" to "a great deal," in the selection of science/mathematics materials, equipment, and supplies; Table XXX confirms this percentage except in the selection of periodicals, films/stripfilms, and furniture.

A possible explanation for the reduced percentage of respondents in the selection of periodicals, films/stripfilms, and furniture is that fifty-one per cent of the respondents were mathematics teachers--who use conventional classroom furniture, and few, if any, periodicals and films/stripfilms in their classroom teaching.

TABLE XXX

ASSISTANCE IN THE SELECTION OF SCIENCE AND MATHEMATICS MATERIALS BY RESPONDENTS SINCE THEIR INSTITUTE ATTENDANCE (ITEM 42)

Materials	Yes		No	
	Number	Per Cent	Number	Per Cent
1. Textbooks	201	76	63	24
2. Reference Books	137	52	127	48
3. Library Books (Not "2")	141	53	123	47
4. Periodicals	96	36	168	64
5. Films/Stripfilms	115	44	149	56
6. Equipment/Apparatus	157	60	107	40
7. Supplies	146	55	118	45
8. Furniture	58	22	206	78

TABLE XXXI

COMPARISON OF RESPONDENTS' TEACHING COMPETENCE BEFORE AND AFTER INSTITUTE ATTENDANCE IN HANDLING CERTAIN TYPES OF STUDENTS (ITEM 32)

Type of Student	Much Better		Some Better		Little Better		About the Same		N
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	
1. Gifted	121	46	103	40	12	5	24	9	260
2. Creative	82	32	121	46	34	13	23	9	260
3. Average	60	23	117	45	47	18	35	14	259
4. Slow-learner	36	14	80	31	51	19	93	36	260

Just under half of the respondents (46 per cent) had served on science/mathematics curriculum revision committees at all levels, excepting the national, during/since their institute participation (Table XXXII).

TABLE XXXII

LEVEL AT WHICH RESPONDENTS HAD SERVED ON MATHEMATICS OR SCIENCE CURRICULUM REVISION COMMITTEES (ITEM 43)

Level of Committee	Number of Respondents	Per Cent
1. Local	111	91
2. County	7	6
3. State	4	3
4. National	0	0
Total	122*	100

*46 per cent of the study group

Just over half of the respondents (57 per cent) stated that their participation in an institute had been effective, from "some" extent to a "definite" extent, in enabling them to be of greater service in supporting their mathematics/science programs; however, Table XXXIII indicates that a minority were actually engaged in any one activity listed in the table.

The respondents had informed others about their institute experience and the NSF programs for teachers and students in a variety of ways (Table XXXIV). There were two key methods employed by the majority of the respondents: "Talked with individual students," and "Talked with individual teachers."

Most interest in the NSF programs for teachers and students was expressed to the respondents by those very individuals, plus administrators

TABLE XXXIII

ACTIVITIES OF RESPONDENTS IN SUPPORT OF THEIR SCHOOL MATHEMATICS AND SCIENCE PROGRAMS (ITEM 44)

	Activities	Much		Some		Little		None	
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
1.	Sponsor Mathematics/Science Club	42	16	32	12	16	6	174	70
2.	Wrote article for newspaper	7	3	10	4	12	4	235	89
3.	Gave talk(s) to students	25	9	66	25	21	8	152	58
4.	Gave talk(s) to teachers	12	4	35	13	21	8	196	74
5.	Gave address(es) to the public	2	*	13	5	13	5	236	89
6.	Appeared on TV	0	0	1	*	1	*	262	99
7.	Spoke on radio	0	0	5	2	2	*	257	97
8.	Mathematics/Science Fair Judge	11	4	31	12	6	2	216	82
9.	Helped secure scholarship fund	5	2	13	5	3	1	243	92
10.	Other. Please specify	8[a]	3	3[a]	1				

*Less than one per cent.

[a]Too few open responses to tabulate.

TABLE XXXIV

HOW RESPONDENTS INFORMED OTHERS ABOUT THEIR INSTITUTE EXPERIENCES AND THE NSF PROGRAMS FOR TEACHERS AND STUDENTS (ITEM 33)

Methods and Media	Yes		No	
	Number	Per Cent	Number	Per Cent
a. Talked with individual students	205	78	59	22
b. Spoke to student groups	64	24	200	76
c. Talked with individual teachers	242	92	22	8
d. Addressed teacher groups	33	12	231	88
e. Spoke to PTA	20	8	244	92
f. Spoke to service club(s)	9	3	255	97
g. Talked with parent groups (not e)	25	9	239	91
h. Appeared on TV	0	0	264	100
i. Made radio presentation(s)	3	1	261	99
j. Press release(s)	25	9	239	91
k. Wrote newspaper article(s)	7	3	257	97
l. Wrote magazine article(s)	1	*	263	99
m. Other. Please specify	13[a]	5	251	95

*Less than one per cent.

[a]Too few open responses to tabulate.

(Table XXXV). The majority of the respondents found teachers interested in all aspects of institutes listed in Table XXXVI excepting "Extra-class activities," and "Housing and meals."

In their pre-institute periods the respondents subscribed to more professional journals than special field (academic) journals (Table XXXVII). Their institute experiences and associations induced them to subscribe to more special field journals in the post-institute periods.

In their pre-institute periods the respondents belonged to more professional organizations, by twenty-seven per cent, than special field

TABLE XXXV

INTEREST EXPRESSED TO RESPONDENTS IN THEIR INSTITUTE EXPERIENCES AND THE NSF PROGRAMS FOR TEACHERS AND STUDENTS (ITEM 34)

Respondents	Much		Some		Little		None		Don't Know		N
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	
a. Students	48	18	119	47	49	20	8	3	31	12	251
b. Teachers	83	32	127	49	37	14	2	1	9	4	258
c. Administrators	83	33	103	41	36	14	14	5	18	7	254
d. PTA	4	2	21	10	23	12	57	28	95	48	200
e. Parent groups (not d)	6	3	22	11	24	12	47	24	99	50	198
f. Lay organizations	0	0	20	9	28	13	44	21	121	57	213
g. Public generally	10	4	50	22	37	16	27	12	103	46	227

TABLE XXXVI

ASPECTS OF THE INSTITUTES THAT WERE MOST INTERESTING TO OTHER TEACHERS (ITEM 35)

	Aspects of Institutes	Great Deal		Some		Very Little		None		N
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	
a.	Sources of information	70	32	90	41	43	20	16	7	219
b.	Locations, purposes, types	52	22	153	66	19	8	10	4	234
c.	When offered and dates	52	22	149	60	25	11	16	7	233
d.	Participant selection	78	34	116	51	19	8	15	7	228
e.	Stipend ("pay")	89	38	115	49	22	9	10	4	236
f.	Course offered	111	46	111	46	10	4	10	4	242
g.	Degree programs	66	29	99	44	40	18	20	9	225
h.	Professor (e.g., "methods")	38	17	105	47	54	24	28	12	225
i.	Extra-class activities	6	3	91	42	68	32	50	23	215
j.	Classrooms, labs, etc.	20	9	90	42	61	28	44	21	215
k.	Housing and meals	21	11	69	36	48	26	50	27	188
l.	Other. Please specify	3[a]		2[a]		0		0		5[a]

[a]Too few open responses to tabulate.

TABLE XXXVII

JOURNALS READ OR SUBSCRIBED TO BY THE RESPONDENTS
(ITEMS 36, 37, 38)

Item	Special Field		Professional	
	Number	Per Cent	Number	Per Cent
36. Pre-Institute subscriptions				
Response	189	72	220	83
Non-response	75	28	44	17
	264	100	264	100
37. Post-Institute subscriptions*				
Response	81	31	19	7
Non-response	183	89	245	93
	264	100	264	100
38. Additional journals read				
Response	96	36	33	12
Non-response	168	64	231	88
	264	100	264	100

*In addition to the pre-institute subscriptions.

(academic) organizations (Table XXXVIII). During and since their institute participation, the respondents joined more special field organizations, by ten per cent, and were elected to more special field honorary organizations, by one per cent, than professional organizations.

Professional Status

Over sixty per cent of the respondents indicated that institute attendance had raised their academic prestige in the eyes of their students, colleagues, and administrators (Table XXXIX); just under half

TABLE XXXVIII

ACADEMIC AND PROFESSIONAL ORGANIZATION MEMBERSHIPS OF THE RESPONDENTS[a] (ITEMS 39, 40, 41)

	Item	Special Field		Professional	
		Number	Per Cent	Number	Per Cent
39.	Pre-Institute memberships				
	Response	132	50	202	77
	Non-response	132	50	62	23
		264	100	264	100
40.	Memberships during and since institutes				
	Response	42	16	116	6
	Non-response	222	84	248	94
		264	100	264	100
41.	Honorary organization memberships during/since institute				
	Response	7	3	4	2
	Non-response	257	97	260	98
		264	100	264	100

[a]Item 39 included honorary academic and professional organizations.

(45 per cent) believed their prestige was raised in the eyes of school parents/patrons.

The Institutes

Purposes

Of the three purposes of institutes specified by the NSF, the majority of the respondents selected two (Table XL); only thirty-five per cent selected "Renew their [participants'] knowledge of fundamentals."

TABLE XXXIX

ACADEMIC PRESTIGE OF RESPONDENTS RESULTING FROM INSTITUTE ATTENDANCE (ITEM 45)

Evaluator	Higher		Lower		About Same		Don't Know	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
1. Students	169	64	1	*	53	20	41	15
2. Colleagues	164	62	1	*	69	26	30	11
3. Administrators	169	64	2	*	48	18	45	17
4. School parents/patrons	119	45	1	*	44	17	100	38

*Less than one per cent.

TABLE XL

THE CHIEF PURPOSES OF THE NSF INSTITUTES AS INDICATED BY THE RESPONDENTS (ITEM 53)

Institute Purposes	Number of Respondents[a]	Per Cent
1. Renew their knowledge of fundamentals.	92	35
2. Acquaint them with recent developments and advances in science, mathematics, and engineering.	207	78
3. Familiarize them with new approaches to presentation of their subjects.	167	63

[a] N = 264

Ninety-four per cent of the respondents believed the NSF institute objectives had been attained "Fairly well"/"Very well" in the KSC institutes.

Participant Selection and Their Reasons for Acceptance

When the respondents selected bases on which they believed participants were chosen for the KSC-NSF institutes, the majority selected bases that corresponded to the NSF institute objectives (Table XLI).

Again, when the respondents indicated their reasons for wanting to attend the KSC-NSF institutes, the majority selected reasons that corresponded to the NSF institute objectives--they also included two other reasons that were related to those basic objectives. (These reasons are shown in Table XLII.)

TABLE XLI

BASES ON WHICH RESPONDENTS BELIEVED PARTICIPANTS WERE CHOSEN FOR NSF INSTITUTES AT KANSAS STATE COLLEGE (ITEM 54)

Bases for Selection	Yes		No	
	Number	Per Cent	Number	Per Cent
a. Their need for financial assistance	30	11	234	89
b. Their teaching competence	116	44	148	56
c. They are promising, inexperienced teachers	101	38	163	62
d. Their scholarship	122	46	142	54
e. Previous institute attendance/acceptance	83	31	181	69
f. No previous institute attendance/acceptance	75	28	189	72
g. Baccalaureate degree from KSC	25	9	239	91
h. Their need for graduate courses/degree	111	42	153	58
i. They are already in KSC's graduate program	46	17	218	83
j. Their need for improved certification	85	32	179	68
k. Their need for refresher courses (fundamentals)	183	69	81	31
l. Their need for recent subject matter concepts	230	87	34	13
m. Their need for improved methodology	168	64	96	36

TABLE XLII

REASONS FOR WANTING TO ATTEND KANSAS STATE COLLEGE-NSF INSTITUTES AS INDICATED BY THE RESPONDENTS (ITEM 55)

Reasons	Strength of Motive							
	Strong		Average		Weak		Not considered	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. Needed courses for additional degree.	80	30	52	20	17	6	115	44
b. Needed courses for certification requirements.	19	7	25	10	22	8	198	75
c. Needed refresher courses (fundamentals).	106	40	64	24	26	10	68	26
d. Needed courses covering new fields/areas.	194	74	34	13	8	3	28	11
e. Needed new techniques of presentation.	139	53	67	25	24	9	34	13
f. Needed courses offered in this institute.	124	47	54	20	20	8	66	25
g. This institute was closest to my home.	79	30	53	16	24	9	118	45
h. This was the only institute to accept me.	23	9	20	7	15	6	206	78
i. Wanted salary increment for additional hours.	10	4	17	6	18	7	219	83
j. Wanted prestige associated with an institute.	16	6	37	14	28	11	183	69
k. Wanted contact with other math./science teachers.	113	43	79	30	24	9	48	18
l. Wanted campus cultural associations.	15	6	23	9	32	12	194	73
m. Wanted to "get paid" for going to school.	28	11	50	19	40	15	146	55
n. Wanted to prepare for a better position.	86	33	51	19	20	8	106	40
o. Wanted to improve school science programs.	148	56	59	23	10	4	45	17

Significance to the Respondents

Expectations realized by the respondents in their institute participation at KSC (Table XLIII) again high-lighted the basic NSF institute objectives. Also selected by the majority of the respondents were two concomitant values expressed by most participants in NSF institutes: "Sharing experiences," and "Association with professors and scientists."

Two effects of institute attendance upon the thinking of approximately half of the respondents were: (1) to increase their enthusiasm for teaching mathematics/science, and (2) to enhance their desire to continue graduate work (Table XLIV).

Institutes Attended by the Respondents

The respondents to this study were representative of all eleven NSF institutes held at KSC between September, 1959, and May, 1963 (Table XLV). Of the fifty-one classes given in these institutes only one was not represented in the survey (physics, summer, 1962).

Of the 264 respondents, 162 (61 per cent) had attended institutes only at KSC; 102 (39 per cent) had attended 164 institutes at sixty-nine other colleges/universities.

Applications for the 1963-64 institutes made by 134 respondents (51 per cent of the study group) resulted in acceptance by seventy-six (57 per cent of the applicants) and rejection by fifty-eight (43 per cent).

TABLE XLIII

EXPECTATIONS REALIZED BY THE RESPONDENTS IN THEIR INSTITUTE PARTICIPATION AT KANSAS STATE COLLEGE (ITEM 56)

Expectations Realized	Many		Some		Few		None	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. Sharing experiences	168	64	66	25	11	4	19	7
b. Growth through extra-class events	48	18	84	32	62	24	70	26
c. Association with professors and scientists	132	50	80	30	23	9	29	11
d. Expansion of cultural background	62	24	101	38	45	17	56	21
e. Learning new laboratory techniques	82	31	65	25	38	14	72	30
f. Renewing knowledge of fundamentals	119	45	98	37	19	7	28	11
g. Learning new teaching techniques	126	48	85	32	21	8	32	12
h. Study of newer subject matter concepts	201	76	45	17	4	2	14	5
i. Expansion of general math. and/or science background	151	57	70	27	11	4	32	12
j. Solution of personal teaching problems	30	11	78	30	83	31	73	28
k. Rejuvenated your enthusiasm for teaching	96	36	74	28	36	14	58	22
l. Other. Specify	4[a]							

[a]Too few write-ins to tabulate.

TABLE XLIV

EFFECTS OF INSTITUTE ATTENDANCE UPON THINKING OF THE RESPONDENTS (ITEM 57)

Institute Effects	Much		Some		Little		None	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
a. Enhanced your desire to continue graduate work.	126	48	78	29	18	7	42	16
b. Encouraged you to remain in present position.	44	17	54	20	46	17	120	46
c. Created a desire to teach at a higher level.	47	18	59	22	46	17	112	42
d. Encouraged you to leave teaching.	1	*	3	1	11	4	249	94
e. Fostered a desire to go into business/industry.	2	1	7	3	16	6	239	60
f. Increased enthusiasm for teaching math./sciences.	145	55	79	30	14	5	26	10
g. Encouraged transfer to other teaching areas.	6	2	10	4	19	7	229	87
h. Encouraged you to demand more of your students.	98	37	106	40	24	9	36	14
i. Other. Specify	4[a]							

[a]Too few open responses to tabulate.

TABLE XLV

KANSAS STATE COLLEGE INSTITUTES ATTENDED BY THE RESPONDENTS (ITEM 58)

	Date		Level	Respondents	
a.	1959-60	In-Service	Jr./Sr. High		
		1. Biology		15	
		2. Mathematics		16	
					31
b.	1960	Summer	Jr. College		
		1. Chemistry		11	
		2. Physics		13	
					24
c.	1960	Summer	Jr./Sr. High		
		1. Biology		12	
		2. Chemistry		7	
		3. Mathematics		22	
					41
d.	1960-61	In-Service	Jr./Sr. High		
		1. Biology		11	
		2. Chemistry		6	
		3. Mathematics		17	
					34
e.	1961	Summer	Jr./Sr. High		
		1. Biology		13	
		2. Mathematics		17	
		3. Physics		13	
					43
f.	1961	Summer	Junior High		
		1. Biol. science		16	
		2. Phys. science		22	
					38
g.	1961-62	In-Service	Elementary		
		1. Biol. science		16	
		2. Physical science		16	
					32
h.	1961-62	In-Service	Jr./Sr. High		
		1. Biology		9	
		2. Mathematics		26	
					35
i.	1962	Summer	Jr./Sr. High		
		1. Biology		13	
		2. Chemistry		19	
		3. Mathematics		36	
		4. Physics		0	
					68
j.	1962-63	In-Service	Jr./Sr. High[a]		
		1. Biology		9	
		2. Mathematics		34	
		3. Mathematics (SMSG)		32	
		4. Physics (PSSC)		10	
					85
		Total			431

[a]There were two institutes in this academic year.

Suggestions for Future Institutes

The respondents were asked to make first and second choices of study areas desired in subsequent institutes (Table XLVI). In making their first choice, mathematics was first and physical sciences was second; their second choice placed mathematics education first and physical sciences again second. Mathematics being in top position in both choices can be accounted for in that just over half of the respondents were mathematics teachers.

TABLE XLVI

SUBJECT AREAS DESIRED BY RESPONDENTS IN SUBSEQUENT INSTITUTES (ITEM 63)

Area Desired	1st Choice		2nd Choice	
	Number	Per Cent	Number	Per Cent
a. Mathematics	115	44	37	15
b. Mathematics education	20	8	84	35
c. Biological sciences	48	18	26	11
d. Physical sciences	51	20	57	24
e. Science education	20	8	32	13
f. Other. Specify	5[a]	2	5[a]	2
Total	259	100	241	100

[a]Too few open responses to tabulate.

When selecting methods by which they planned to keep up-to-date during the next five years, the majority of the respondents selected institutes ("academic") first (Table XLVIII), and more specifically, summer institutes (Table XLVII). The predominant reason given in their subjective responses was "For financial reasons."

TABLE XLVII

TYPES OF INSTITUTES SELECTED BY THE RESPONDENTS TO KEEP THEM UP-TO-DATE DURING THE NEXT FIVE YEARS (ITEM 66)

	Type of Institute(s) Selected	Number of Respondents		Per Cent	
1.	Summer Institute	156		59	
2.	In-Service Institute	60		23	
3.	Academic Year Institute	14		5	
4.	Combination:	34		13	
	Summer/In-Service		28		10
	Summer/Academic Year		4		1
	In-Service/Academic Year		1		1
	All three types		1		1
	Total	264		100	

Tables XLIX and L indicate preferences of in-service and summer institute respondents, respectively, with respect to certain aspects of those institutes.

Both ISI and SI respondents indicated that institute dates and lengths were satisfactory; the majority of both groups of respondents had spent four to five hours of preparation time for each class session--and did not deem the preparation time excessive.

The majority of the ISI respondents stated preference for Saturday classes instead of evening classes. In their subjective evaluation of this item, many ISI respondents indicated that their school obligations prevented evening class commitments.

TABLE XLVIII

ADDITIONAL METHODS BY WHICH THE RESPONDENTS PLAN TO KEEP UP-TO-DATE IN THE NEXT FIVE YEARS (ITEM 66-a)

Method	Much		Some		Little		None	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
1. Independent study	103	39	104	39	12	5	45	17
2. Institute: Academic	133	51	64	24	8	3	59	22
3. Institute: Research	54	20	61	23	34	13	115	44
4. Industry	9	3	46	17	36	14	173	66
5. Industry: Research	9	3	36	14	34	13	185	70
6. Other. Please specify	4[a]	1	4[a]	1				

[a]Too few open responses to tabulate.

TABLE XLIX

PREFERENCES OF IN-SERVICE INSTITUTE RESPONDENTS WITH RESPECT TO CERTAIN ASPECTS OF THE INSTITUTES (ITEM 61)

In-Service Institute Aspects	Number of Respondents	Per Cent
a. When were your class sessions?		
1. Evenings	56	33
2. Saturdays	116	67
	172	100
b. Which class time do you prefer?		
1. Evenings	63	38
2. Saturdays	74	44
3. No preference	29	18
	166	100
c. On an average, how many hours of preparation was necessary for each class session?		
1. 2 hrs. or less	17	10
2. 3 hrs.	43	25
3. 4 hrs.	55	33
4. 5 hrs. or more	54	32
	169	100
d. Did this number of hours of class preparation seem excessive to you?		
1. Yes	26	15
2. No	143	85
	169	100
e. Do you think that the dates on which the institute(s) began and terminated were satisfactory?		
1. Yes	164	65
2. No	89	35
	253	100
f. Do you think that the length (in weeks) of the institute(s) was satisfactory?		
1. Yes	168	64
2. No	85	37
	253	100

TABLE L

PREFERENCES OF SUMMER INSTITUTE RESPONDENTS WITH RESPECT TO CERTAIN ASPECTS OF THE INSTITUTES (ITEM 62)

Summer Institute Aspects	Number of Respondents		Per Cent
a. On an average, how many hours per day did you spend in class attendance?			
1. 3 hours or less	6		4
2. 4 hours	27		18
3. 5 hours	67		43
4. 6 hours or more	54		35
		154	100
b. Did this number of hours of daily class attendance meet with your approval?			
1. Yes	144		93
2. No	10		7
		154	100
c. On an average, how many hours per day did you spend on class preparation?			
1. 2 hours or less	20		13
2. 3 hours	32		21
3. 4 hours	38		25
4. 5 hours or more	63		41
		153	100
d. Did this number of hours of class preparations seem excessive to you?			
1. Yes	23		15
2. No	130		85
		153	100
e. Do you think that the dates on which the Summer Institutes began and terminated were satisfactory?			
1. Yes	155		60
2. No	105		40
		260	100
f. Do you think that the length (in weeks) of the Summer Institute(s) was satisfactory?			
1. Yes	146		56
2. No	114		44
		260	100

Evaluations by the Respondents

The respondents were given an opportunity to constructively critize the institutes they had attended through semi-structured questions (Table LI). The majority of the respondents (between 55 and 87 per cents) participated in this subjective evaluation. Chapter IV contains interpretations of these comments and suggestions.

TABLE LI

OPEN RESPONSES BY THE RESPONDENTS ON CONSTRUCTIVE CRITICISM OF THE INSTITUTES (ITEM 67)

Item	Response		Non-Response	
	Number	Per Cent	Number	Per Cent
a. The highlight of your Institute(s) experiences at KSC	231	87	33	13
b. Your most adverse criticism of KSC's NSF Institute(s)	191	72	73	28
c. Your suggestion for correcting the situation expressed in "b" above	146	55	118	45

A check-list, with a five-point rating scale, was used to facilitate objective evaluation of the institutes by the respondents (Table LII). Sixty or more per cent of the respondents rated twenty of the twenty-two aspects either No. 1 or No. 2. "Non-institute activities" and "Research facilities" fell just short of the sixty per cent response. Eighty-five per cent of the respondents made the "Composite rating" of the institutes either No. 1 or No. 2; fifty-four per cent evaluated the institutes at No. 2.

TABLE LII

RATING OF INSTITUTE ASPECTS BY THE RESPONDENTS

	Aspects	1		2		3		4		5		N
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	
a.	Director	163	71	55	24	11	5	0	0	1	*	230
b.	Visiting lecturers	50	28	90	50	28	16	7	4	3	2	178
c.	College administrators	73	41	74	42	29	16	2	1	0	0	178
d.	Professors: institute	129	54	82	35	18	8	7	3	1	*	237
e.	Professors: non-institute	37	29	60	46	26	20	3	2	4	3	130
f.	Graduate degree programs	47	29	76	47	31	19	5	3	3	2	162
g.	Advisement/Guidance	46	28	54	32	47	28	12	8	6	4	166
h.	Courses: institute	103	47	83	38	28	13	5	2	0	0	219
i.	Courses: non-institute	29	28	46	44	24	23	4	4	1	1	104
j.	Activities: institute	52	28	83	45	42	23	5	3	2	1	184
k.	Activities: non-institute	27	21	46	36	48	37	6	5	2	1	129
l.	Library: general	45	26	85	48	39	22	5	3	1	1	175
m.	Library: specific	35	21	72	43	46	28	12	7	2	1	167
n.	Classwork	74	35	101	47	37	17	2	1	1	*	215
o.	Laboratory work	32	23	61	44	32	23	9	6	5	4	139
p.	Laboratory facilities	30	23	60	47	31	24	8	6	0	0	129
q.	Research facilities	14	12	54	47	37	32	9	8	1	1	115
r.	Gratis materials	43	26	70	43	38	23	11	7	1	1	163
s.	Handling routine items	71	40	66	37	36	20	4	2	1	1	178
t.	Gab-sessions, time/place	60	33	76	42	40	22	5	2	1	1	182
u.	Housing	73	49	49	33	23	16	2	1	2	1	149
v.	Meals (S.C.Cafeteria)	58	35	58	35	38	23	6	4	4	3	164
w.	COMPOSITE RATING	65	31	111	54	28	14	3	1	0	0	207

*Less than one per cent.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF THE DATA

Introduction

The stated purpose of this study was to determine the significance of the NSF-KSC institutes in renewing the participants' knowledge of fundamentals, in acquainting them with recent developments and advances in science and mathematics, and in familiarizing them with newer approaches to the presentation of their subject matter.

In order to make this determination, a pre-tested opinionaire was sent to the individual members of the study group. Data were processed by two methods: (1) Objective data were processed by the IBM computer at Oklahoma State University. (2) Subjective data, and certain short-answer items, were processed by coding and manual tabulation.

Analysis depends upon the type of response required by the items. The objective responses, securing factual information, were reported in tables which indicated frequency and percentage of respondents for that item; this information was secured from the computer and analyzed objectively. Certain short-answer items and the subjective responses, securing judgmental information, were analyzed as objectively as possible to increase validity.

Respondents quoted in this chapter have been identified only by school level at which they taught and type of institute(s) attended (e.g., senior high respondent, two ISI's, one SI). Similarly, the specific names of courses and/or professors have been given only departmental designations (e.g., "Probability and Statistics for Teachers,"

designated as a "mathematics" course. Professor Elton Cline, designated as a "physical science" professor).

The Director[1]

The over-all evaluation of "the Director" was definitely above average. In the objective evaluation (Table LII) ninety-five per cent of the respondents placed the director in the top two categories--with seventy-one per cent giving him a top rating.

In the subjective responses by the respondents the appraisal of the director was equally as complimentary. Following are some exemplary quotations in response to Item 67-a, "The highlight of your Institute(s) experience at KSC."

> The genuine sincere effort on the part of the . . . director to make the program worthwhile.
>
> /The director/ is an outstanding chairman of the institutional program.
>
> I'd like to give much credit to the director for his great efforts in getting these people /visiting lecturers/ to the institute.
>
> The fine organization by the director . . . .
>
> /The director/ is wonderful.

Considering both objective and subjective evaluations "the Director" was given an outstanding rating.

The Visiting Lecturers

In the objective evaluation of the visiting lecturers, seventy-eight per cent of the respondents placed these resource persons in the

---

[1]Dr. L. C. Heckert was director of the 1960 SI for junior college teachers. Prof. Margaret Parker was director of the 1961 SI for junior high school teachers. Prof. Elton Cline was director of the 1961-62 ISI for elementary school teachers. Dr. R. G. Smith was director of the other eight institutes.

top two categories--fifty per cent placed them in the second category (Table LII).

The subjective evaluations of the visiting lecturers confirmed the objective evaluations in such factors as high caliber of the lecturers, their association with the participants and the institute professors, and the number and type of resource persons used. The following quotations are typical responses by the respondents when indicating institute highlights:

> The visiting lecturers of the Institute were very good and the informal get togethers with them were very rewarding.
>
> /My highlight was/ Getting to know and to hear the lectures of . . . visiting scientists.
>
> /The visiting lecturers/ secured for those 2 wk. courses were most excellent.
>
> Coming in contact with and studying with the visiting professors in Astronomy and Meteorology.

Constructive criticism of the visiting lecturer aspect of the institutes is evident in the following statements by the respondents:

> . . . was caustic and very hard to follow in his lectures.
>
> I have had two visiting professors in summer institutes at Pittsburg. I felt they had their salary at heart more than their teaching.
>
> The lectures by . . . were beyond our understanding.
>
> /We/ need more visiting lecturers. (Respondent was in one ISI and two SI's.)
>
> . . . spoiled the short time he was an instructor.
>
> . . . attack on PSSC should have been made by some one who had used PSSC at least once.

Generally the respondents considered the visiting lecturers to be worthwhile additions to the institute programs. Many of them expressed

appreciation for the opportunity to talk with these resource persons in the informal sessions.

Constructive criticism pointed up the need for coordination of effort; e.g., indicating to the lecturer the type and level of students hearing/seeing the presentation, having presentations made that are both in the field of specialization of the speaker and also topical for the participant-students; possibly requiring only certain participants to hear certain lecturers (e.g., members of the mathematics classes to hear a mathematics specialist).

The Professors

The objective evaluation of the institute professors by the respondents was high: almost ninety per cent of the respondents rated the professors in the top two categories with fifty-four per cent giving them a "1" rating (Table LII). The subjective evaluation supported the objective appraisal, as indicated by the respondents in the following general quotations excerpted from "institute highlights:"

> The highlight of the Math (modern) course I took was the material along with the way it was presented. As far as I'm concerned . . . was the best mathematics instructor I have ever had . . . .
>
> Meeting and working with and for master teachers. You have a couple of the "best" mathematics teachers I've seen.
>
> Being able to study under/with qualified professors . . . .
>
> The instructors!
>
> . . . is a very fine teacher and makes any course seem easy and worthwhile.

Knowledge of Content. While most respondents were complimentary about the professors' "knowledge of content," the following typical

criticisms and suggested solutions need consideration:

Constructive Criticism	Possible Solution
Too much time was spent "covering" obsolete descriptive information . . . . (Senior high respondent had two ISI's.)	Courses along the lines of the NSF BSCS would certainly be desirable. . . .
The courses were too generalized, not enough depth. (Senior high respondent had three SI's.)	Cut down on the quantity of material covered and increase the amount of time spent on specific areas.
I would like to have had a little more of instruction in the fundamentals of physical science rather than as much in methods of teaching.	If the instructor could have given some more work in the basic facts of science. (Elementary school ISI respondent)
The /physical science/ course I took didn't have enough "teeth" in it. (Junior college SI respondent)	Choose professors of a higher teaching caliber, like you did in the math. section, and treat the participants like any other graduate students, as far as amount of work required.
One . . . criticism was that neither instructor in our course had any background or enthusiasm for the course before we started. (this changed as we went along.)	Have a teacher that has used the materials. (High school SI respondent)

Method of Presentation. Through "institute highlights" the respondents were complimentary to the institute professors when considering "Method of presentation." Following are some typical responses:

> Since this was my first introduction to the newer line of mathematical thought, it was most enlightening. I particularly liked the way the class materials were presented.
>
> . . . Course material was presented in a very understandable manner by an excellent professor.
>
> Association with instructors in the Institute. Knowledge of subject matter and presentation were very impressive.
>
> The highlight of the Summer Institute (1962) was the course in /mathematics/ taught by . . . . The method of presentation and the class participation made it so.

The enthusiasm, skill and excellence of the presentations of material by the Professor.

This same area, "Method of presentation" by the institute professors, elicited an equal number of constructive statements by the respondents. Following are some representative criticisms with companion suggested solutions:

Constructive Criticism	Suggested Solution
Too often the fresh steam gets away so the later sessions lag, after the class is turned over to individual class members who just can't put across the material. (High school SI respondent)	Keep the instructor in the driver's seat all the way through. After all we need to get his view point & method on all the topics all the way through the course.
Sometimes I felt we spent too much time on just talking about experiences that were not too biological. (High school ISI respondent)	The professor being more conscious of the fact that students are getting him off the track. Giving a broad outline of material to be covered at the beginning of course and sticking to it.
The In Service Institute I attended was over the head of most of the members in the class. As a result about 1/2 of the participants dropped out the second semester. (High school respondent)	Bring the instruction down to a more basic fundamental level.
Classroom lectures too long. (Junior High SI respondent)	More lab or field work.
The instructors do not use the new methods of teaching which we are exposed to. The classes are too much teacher dominated. Don't deal enough with science education.	Education of the instructors in education as well as in their specific fields. (High school respondent had attended two SI's.)
Many /professors/ used teacher-centered, "lockstep" presentations, had little lab work and that was usually uncoordinated with classwork. (Senior high respondent, one ISI and one SI)	Up-date archaic teaching methods of professors by incorporating research proved techniques (individual, small/large group approaches).

Usage of Various Teaching Methods. The respondents made approximately the same number of pro and con subjective statements concerning the usage of various teaching methods by the professors. The following quotations are illustrative of positive statements made by the respondents when speaking of their "institute highlights:"

> The afternoon seminars.
>
> . . . student participation.
>
> Evening problem sessions. Doing the homework in groups.
>
> Seeing various demonstrations presented by class members and having the material to use in the form of . . . mimeographed sheets.
>
> Seeing and participating in the laboratory demonstrations each Saturday; . . . we were given copies of the lecture demonstrations to take back to our schools . . . also the display and discussion of the various elementary textbooks on science.
>
> The actual participation & discussion of problems and questions that arise in the classroom.

The representative "adverse criticisms" with companion suggestions for correction tend to refute the above complimentary comments:

Constructive Criticism	Suggested Solution
Too /many/ student reports. (Junior college SI respondent)	Most of the lecture time used by regular instructor or /by/ the guest lecturer.
The lack of prepared & supervised group discussion periods on the subjects themselves and methods of teaching them. (Junior high SI respondent)	Plan for periods when this can be done, using various ones from the group each time to initiate various courses of discussion.
Covering too much material and not enough time to discuss and apply.	..... (Senior high ISI respondent)
The afternoon seminars--very tiring. (Junior college SI respondent)	I would suggest that the Guest lecturers speak an hour /or/ two in the mornings leaving the afternoons open for diversification, i.e., laboratory periods, trips, special lectures, library research, etc.

Sometimes "open" discussions are dominated by some one person.	. . . . . (High school respondent, one SI, two ISI's)
More smaller group sessions. (High school SI respondent)	Because of the nature and purpose of the institute and my inexperience with a curriculum of this kind I would not feel qualified to make specific suggestions.

Usage of Supplementary Materials and Teaching Aids. In continued subjective evaluation of "Methods of presentation" the respondents were very complimentary about usage of teaching aids and supplementary materials by the institute professors. Representative quotations came from "institute highlights:"

> I certainly enjoyed the sharing of ideas, the vast amount of materials received . . . . (Elementary school respondent had two ISI's.)
>
> The showing of the P.S.S.C. Physics films. (High school respondent with three ISI's)
>
> Seeing various demonstrations presented by class members and having the material to use in the form of typewritten mimeographed sheets. (Elementary school respondent with two ISI's)

In contrast to the above praises concerning the usage of teaching aids and supplementary materials by the professors, the following constructive criticisms and companion solutions are added:

Constructive Criticism	Suggested Solution
Could perhaps be more exposed to new materials and teaching aids that pertain to field of study.	Devote part of institute time to study of new materials and teaching aids. (Senior high ISI respondent)
Lacked current publications for inspection & evaluation with respect to junior high & senior high classroom . . . . (Senior high respondent, two SI's, three ISI's)	Just as paper backs were available, perhaps between laboratory school & NSF a scheme could be worked out to have the latest /books and texts/ available at <u>institute center</u> . . . .
Need more gratis material & material for classroom teaching. (High school respondent, one ISI)	Institute bring in more usable ideas.

Testing and Evaluating. An aspect of teaching that generally presents problems is that of testing and evaluating. This was confirmed by the subjective comments of the respondents--all such comments were "adverse criticisms." The following are companion criticisms and possible solutions:

Constructive Criticism	Suggested Solution
The poor quality of evaluation by the non-math . . . personnel. (High school respondent, one ISI, one SI)	Do not make mandatory that math students take science courses . . . .
The papers should all be graded by the instructor giving the course lectures and not by an assistant.	Smaller classes for the instructors. Only one instructor for each group. (Senior high ISI respondent)
I strongly feel that we had too much material to be held responsible for in our tests. More than one question on a final exam might be desirable also. (Junior high ISI respondent)	Give more tests, instead of being held responsible for so much at one time. As to finals, I think they should cover what has been done during the semester. I see little value in asking one question.
. . . I also felt that evaluation of work done by the participants was far too lax. (Elementary school respondent, two ISI's)	. . . I would also suggest that a more careful evaluation record be kept by the instructor just the same as in regular college classes.
There was no use of . . . tests to help in the motivation of effort . . . . (Junior college SI respondent)	. . . Tests are painful to some but are nevertheless beneficial to all. (Tests should separate the B's from the A's and in cases of sloth or real incompetence should serve as the basis of a few C's and D's.)
Grading was not a true picture of achievement. Students with 10 years of experience were graded in their field against students with no previous experience in the field.	Background of student be considered in awarding grade to each student. (Junior high SI respondent)

The grading system. I have never worked harder to receive a C grade. My grades are above B average on 165 hrs. of work before the /mathematics/ course.	Perhaps more consideration could be given those who have not had the opportunity of previous Institute work . . . . (High school ISI respondent)
More thought and planning should have been given to the matter of grades . . . . (Junior college SI respondent)	Some criteria for the evaluating of the participants should have been set up and the participants should have been informed of the method of evaluation during first meeting.
. . . was about the poorest instructor I've had. No personality, No association, No ideas presented to students. (High school respondent, two SI's)	. . . Why should a student who applied himself and came to institute for help and new ideas receive a "C" grade. This doesn't make sense to me!!
In the in-service Institute I attended I was able to "get by" with too little work. With such a long time between classes it was easy to slip into the habit of neglecting my work.	A short quiz each week. (High school respondent, two ISI's)
The visiting institute professor that tried to teach /physical science/ & tried to fail everyone-- I wanted him to teach me, not find out how much I did not know	Screen them /professors/ according to their desires in wanting to teach an institute class. (High school respondent, one SI, one ISI)

Knowledge of Elementary/Secondary School Teaching Problems. Cognizance of elementary/secondary school teaching problems by the institute professors drew mostly adverse criticism by the respondents, as attested to by the following representative, companion responses:

Constructive Criticism	Suggested Solution
Too much time was used "covering" obsolete . . . information . . . . that has very little value in the modern high school biology course. (Respondent had two ISI's.)	. . . We high school biology teachers need help in understanding the biochemical concepts and also help in planning and setting up laboratory research projects . . . .
. . . Subject matter not always keyed to high school students' interest or capacities. (Junior high respondent had two ISI's.)	Simplification and screening of materials to fit H.S. or Jr. High curriculum.

I felt that our instructors having taught only on the college level had very little sympathy with the elementary level or very little idea of how to go about helping the elementary teacher with his problems. . . . (Elementary school respondent had two ISI's.)	I would suggest that if elementary teachers are to participate and if they are to receive any real help in methods of approach, creating interest, etc., that they be grouped together and that the instructor be one who has knowledge of and is in sympathy with their problems. . . .
There seemed to be . . . an attempt to cover too great an area of subject matter. (High school respondent had one SI.)	More practical instruction that can be used in high school biology courses. . . .
Lack of enthusiasm and capability for understanding new materials in certain professors. Failure of these men to be aware of us as High School Teachers. Their college curricula and their boring methods have no place in HIGH School. (Respondent had two ISI's and two SI's.)	Require attendance of these unwilling professors at high-level institutes, with great emphasis on methods of teaching . . . . Deliver me from professors who have utter faith in current "knowledge."
I feel that some of the material is much too advanced for H.S. teachers. Emphasis too much on higher mathematics. (Respondent had two SI's.)	. . . I do not plan on teaching in College only in H.S. . . . if fundamentals were stressed more . . . I am interested mainly in H.S. students giving them the best I can, and then let the Colleges take them from there.
Felt that sometimes we spent time on problems and theoretical matters not applicable to our individual teaching positions. (Junior high respondent had one SI.)	Situation could be helped by a close study of problems of the participants in the teaching of the subject matter for their particular class level, and instructing each participant on techniques of presenting this material.

Both objective and subjective evaluations supported each other in the "above average" appraisal of the institute professors by the respondents. Constructive criticism indicated that (1) the professors should be more knowledgeable and more effective in their usage of different teaching methods; (2) their course contents should continue to be updated, keeping in mind the institute objectives for the class; (3) course work

should be supported with topical, coordinated supplementary materials and teaching aids; (4) testing/evaluating techniques should be greatly improved; (5) presentations should be student-centered; and (5) the professors should become more cognizant of the unique teaching problems of both elementary and secondary school teachers.

Institute Courses

The subjective responses covering institute courses generally concurred with the objective responses; in the latter instance eighty-five per cent of the respondents rated the courses in the top two categories (Table LII). Some respondents made constructive comments aimed at improving these courses.

Content/Coverage. In the area of course content/coverage the following are typical quotations from "Your most adverse criticism of KSC's NSF Institutes," and "suggestions for correction."

Constructive Criticism	Suggested Solution
It seemed to me that there is an attempt to cover too much material too fast. There is not time to absorb what you have covered. (High school SI respondent)	I don't think this suggestion is practical but it seemed that there was too great a range in the backgrounds of students participating. Some had been there several times before, for others this was their first experience with the new approach.
Course work was too general. (Junior college respondent)	Needed more specific reading assignments. Lectures needed more specific content--less general.
The course could proceed at a more rapid pace.	Just cover more material. (High school ISI respondent)
Covering too much material and not enough time to discuss and apply the methods.	..... (High school SI respondent)
I felt more time should have been spent on how to present materials in class.	..... (College respondent)

Course Offerings and Degree Programs. Exemplary constructive evaluations and suggested solutions covering "Course offerings" and "Degree programs" follow:

Constructive Criticism	Suggested Solution
The inability to secure more courses in mathematics and science in the evening school on an off campus basis. (High school ISI respondent)	That similar courses be offered next year in connection with the Coffeyville and Independence College evening school programs for teachers in this area to improve themselves professionally.
Teachers are reluctant to give graduate credit for the courses. . . . (High school respondent, three ISI's)	I do not know.
..... (Junior college SI respondent)	I would like to see an institute curriculum set up leading to an Ed.S. in teaching Physical Science in Junior Colleges.
Need a continuing program in physical science.	..... (High school respondent, one SI, one ISI)
I would like to see more than one [mathematics] course offered at Shawnee Mission District next year.	I would like to see a repeat of the [mathematics] course . . . next year. (High school ISI respondent)
Should allow for a wider selection of courses.	..... (High school respondent, one ISI, one SI)

Coordination of Courses. A few respondents offered constructive criticism concerning the coordination of institute courses. Following is one such response:

> There was a great lack of coordination and planning of the courses. This included a great variation in the quality of talks given by guest lecturers.

Offering a possible solution to this situation the same respondent said,

I would suggest a much more thorough preparation of the courses of study at the institute, and include a better briefing of the instructional staff and the guest lecturers.

Textbooks. Another aspect of the institute courses that drew some constructive criticism was "textbooks." The following are representative companion criticisms and solutions:

Constructive Criticism	Suggested Solution
There was no use of textbooks along with the lecture material. . . . (Junior college respondent)	Choose a good text, or perhaps two, to accompany the lectures. . . .
Lack of text book. (High school ISI respondent)	Better organization of class material.
Would have preferred a text rather than method used. (High school ISI respondent)	Choose a text on . . . involving newer concepts.
In the particular institute I attended, we had no textbook or other study guide. . . . (Junior college SI respondent)	Better organization of class material.
The text--if we hadn't had excellent explanations by our instructor /we/ would have never passed the course--as the reading certainly didn't clarify what the course was trying to put across. (High school ISI respondent)	. . . . .

The two topics drawing the most constructive criticism in the area of institute courses were coverage and text books.

In the area of course coverage two points appeared, one implied and one stated. The point implied: all students covered all material in any one class--irrespective of background or need. The point stated: breadth of coverage was stressed more than depth of coverage.

Considering the number and type of criticisms of course textbooks, the writer asked, "Were these institute courses taught from a single or multiple-text approach?" "Were ample numbers of sound references

available to the participants?"

Classwork, Laboratory Work, and Field Trips

Classwork. Despite the fact that eighty-two per cent of the respondents evaluated institute classwork in the top two categories of the objective rating (forty-seven per cent rated it "2") their subjective responses had much constructive criticism in three aspects of classwork: enrollments, preparations, and presentations by the professors--the latter topic was considered under the previous heading, "Professors."

A. Class Enrollments. Many respondents were quite outspoken in their constructive criticism of the heterogeneity of students within the institute classes. The following companion responses are indicative of that criticism and the possible solutions:

Constructive Criticism	Suggested Solution
I believe I was in too advanced a class when I was enrolled in . . . my first introduction to modern mathematics.	I would suggest that first institute participants be guided into the most elementary courses first.
I feel that I would have been better off in a course where the rest of the people were about equal in background. My background was very inferior in comparison to the rest of the class.	Either eliminate the squareheads like me or be a little more careful in placing of participants in various courses. Many people in my class claimed to have had almost identical training in a previous institute.
Too wide of a range of abilities and background.	Offer basic science courses as institute courses so that the teachers with weak backgrounds can catch up.
Class too heterogeneous. Lecture above level of several.	. . . Students with weak backgrounds should not compete with those working on advance degrees.
After being out of mathematics teaching for a number of years, it was a terrific struggle in trying to get material to learn the new terminology, basic concepts, etc. as well as preparing lessons without feeling "mired" down.	A basic course should be offered for those teachers who have had no modern math so they could proceed with the other courses with at least a knowledge of better understanding /of/ basic procedures.

Seemed too "easy" for some, and too difficult for other participants.	Some sort of division of participants, by pre-testing, perhaps, into at least two levels . . . . Perhaps classwork could be concurrent, but problem-sessions and tests separate.
Terrible pressure to do the graduate work with no means of bringing forgotten fundamentals up-to-date.	Supply some guide sheet on what to review in undergraduate work.
I don't think it is so good for the program when teachers who have had the course before are allowed to retake it on N.S.F. funds. It's difficult to study with some in the class who have already been through the book. Careful thought should be given to some of the choices of participants.	It seems college teachers are grouped with high school teachers--those with Master's degrees in the field are with those without any graduate hours. I'm certain it's difficult to get a course that is satisfactory for such a varied ability group. I find it difficult to compete with someone who has taught the course themselves and they are a little bored with my slow step of learning.
I would have appreciated grouping according to past institute and In-Service training or experience.	A plan may be devised whereby those with limited experience can be allowed association with more experienced people but allow groups /with/ similar limitations to work on different levels from more advanced students.
Pressure from instructor in one case due to his knowledge of material & pressure from another due to lack of knowledge of material.	More tutors would help. Ability grouping if possible would also help.

B. Classwork Preparations. In their constructive criticism of classwork preparations most respondents offered possible solutions to the problem stated. The following are illustrative, companion responses:

Constructive Criticism	Suggested Solution
Too much preparation time was required.	We should study to learn the general ideas--not to pass a "pop test" on specific details.
Some instructors think because we got paid our time was completely theirs. (Respondent had been in four institutes, SI's and ISI's.)	. . . . .

The summer institute of 1962 required so much time preparing for class that an understanding of the material presented could not be appreciated. Too much time was spent dealing with library "busy work."	More time discussing materials presented. Some of the materials were covered so rapidly that only a state of confusion resulted.
Too much work.	I'm afraid any correction would diminish the value of the institute, but perhaps the homework could be reduced some.
I guess I'm not smart enough to absorb as much as I'd like to in such a short time.	My only suggestion is to have 36 hours in a day during Institute! I expect an academic year Institute would be the answer.
Poor balance of outside work required in various courses.	Suggestions obvious.
My main trouble was finding enough time to study between /ISI/ classes.	This is a local school problem, teachers should have one free period . . . and more time in evenings /should/ be available for teacher's own advancement and enrichment in study such as given by K.S.C. in extension programs.

Laboratory Work. The objective rating (Table LII) of "laboratory work" by the science respondents was not a strong rating: twenty-three per cent of the respondents rated it "1" and forty-four per cent rated it "2". The subjective ratings were comparable in that the positive statements were somewhat general and weak whereas the constructive evaluations were definitive.

Below are some typical responses to "institute highlights" with respect to "laboratory work:"

Use of laboratory materials with explanations by professors (both visiting and regular).

Laboratory experience and demonstrations prove most memorable.

New laboratory methods.

I enjoyed our "lab" sessions very much.

Methods for presenting experiments and the nominal cost of the material.

Study and use of equipment not available in high school lab.

The laboratory work under . . . , procedures, material, experiments.

Constructive evalution of "laboratory work" by the respondents is evidenced in the following representative, companion responses:

Constructive Criticism	Suggested Solution
. . . The small amount of laboratory time was mostly "wasted" on "nature study" that has very little value in the modern high school biology course. (Senior high respondent, two ISI's)	. . . We high school biology teachers need help . . . in planning and setting up laboratory research projects. We do not need to spend our time memorizing names and structural details of all the . . . phyla.
Confusion in laboratory . . . . (Junior high respondent, two SI's)	Smaller labs or improved planning.
Too much busy work (lab writeups for graduate students). (Senior high respondent, one ISI)	Don't require them.
The course as an extension course in Kansas City was unable to offer good laboratory facilities. (Senior high ISI respondent)	Although more teachers may have enrolled due to location in Kansas City I feel the extension course is limited and more could be achieved in a summer institute.
I feel the laboratory periods should be revised to fit the needs of teachers /participants/. (Junior high ISI respondent)	Instead of doing experiments in the conventional way, change them to be teacher /participant/ centered, with emphasis on the values of the experiment, variations of technique(s) and the data that are important to the high school student.
Not enough lab exercises. (Senior high respondent, two SI's, one ISI)	. . . . .
Little lab & poorly coordinated. (College respondent, one SI, one ISI)	Update lab activities and coordinate with classwork.

Field Trips. With very few exceptions the subjective responses on "Field trips" were very complimentary. The several "constructive criticisms"

of this aspect of the institute classes pertained to insufficient time spent on the field trip; e.g., ". . . [biological] fieldtrips--done so rapidly that only the instructor knew what was happening." The following typical responses were excerpted from "institute highlights" of the respondents:

> One such highlight was the observation of the Computer at KSC.
>
> Field Trips & the study of the Spencer ammonia plant.
>
> Aside from my regular course work, I enjoyed our trip to Midwest Research & the Science Library in Kansas City.
>
> The chance to study geology in the field. . . .
>
> Application of theory on field trips.
>
> . . . The field trip is unforgetable.

The most adverse criticism of classwork dealt with heterogeneous class membership. This criticism came from both sophisticated and unsophisticated respondents, thereby indicating the seriousness of this problem.

Sound criticism of laboratory work centered around an insufficient amount of such work, and that in existence was poorly coordinated and comparably supervised. In this light, one respondent made an apropos statement, "I feel the laboratory periods should be revised to fit the needs of the teachers [participants]."

The institute field trips were valuable teaching adjuncts as evidenced by the subjective responses to this point.

Extra-Class Activities

Almost all of the subjective evaluation of the extra-class activities centered around the informal meetings often referred to as "gab

sessions." The following quotations are indicative of the sentiment of most of the respondents with respect to these informal sessions:

> [My institute highlight] Discussing mutual problems with other teachers.
>
> The overall fellowship of the institute participants and the professors [was my highlight].
>
> . . . afternoons with teachers and deans of engineering schools and from industry had a marked effect upon my thinking regarding the field of engineering.
>
> The visiting lecturers of the Institute were very good and the informal get togethers with them were very rewarding.
>
> [My highlight--] The inspiration given to me in the classroom and "gab" sessions we would have about our teaching experiences. I felt so much was learned inside and outside class as well.
>
> [My highlight--] Meeting other teachers and learning what they were doing in their Mathematics Classes. Exchanging ideas and viewpoints.

Some respondents had constructive criticism of the "gab sessions," e.g.:

> Not enough general sessions for teachers to exchange ideas. (This respondent had attended three SI's.)
>
> The lack of time officially set aside for "bull sessions" in which teachers can compare their common teaching problems and solutions to these problems.

The former criticism was followed by this suggested solution, "Short seminars with subsequent discussion among teachers & Profs." The latter offered this solution, "Provide an hour every two weeks . . . for a teacher's session."

Recreational, social, and cultural activities were listed by a few respondents. Following are examples:

> [Some of my highlights] . . . the many cultural & recreational activities, such as the crafts program for families, concerts, lectures, swim pool.
>
> I enjoyed the social get togethers.
>
> Outside activities adequate.

The informal "gab sessions" were considered an "institute highlight" by many respondents. They provided many participants with a relaxed fellowship and a high degree of functional information concerning many aspects of science/mathematics education. Such sessions generated much morale through the associations and the mutual exchange of ideas.

The Institute Participants

In their subjective expression on "institute highlights" many respondents alluded to personal gains accrued during their institute participation. Most of these complimentary statements were placed in four general categories: Up-dated/Strengthened subject matter, Improved teaching competence, Shared experiences, and Appreciation.

Up-dated/Strengthened Subject Matter. Many respondents believed that their institute participation had up-dated and/or strengthened their academic background (science, mathematics). Representative "highlights" are quoted:

> . . . An opporutnity to learn more basic and background information in biological science.
>
> . . . the new look I got at mathematics. . . . the logical approach to developing math rather than the conventional method or type approach.
>
> . . . The exact experience that I sought, namely a working knowledge of S.M.S.G.
>
> The exciting new curricula (PSSC, BSCS, Chem Study, SMSG).
>
> . . . my institute experience . . . making me more conscious of the recent curriculum revisions necessary for better understanding of this modern science world.
>
> A view of PSSC ('61) and a view of CHEM ('62) as new approaches to my field. The varying enthusiasm for these materials between their sponsors and their opponents.

Improved Teaching Competence. Personal gains through institute participation in the area of improved teaching competence were indicated by a number of respondents. Following are exemplary highlights:

> The acquiring of information & skills needed to improve the course I'm teaching.
>
> The fact that I became more interested in mathematics and have tried to become a better teacher.
>
> I have used equipment more effectively and taught more of the material (subject matter) that I learned in summer institute than I actually thought I would. . . .
>
> . . . the bringing home to my classes the exciting mathematics we were learning in class.
>
> . . . Had it not been for the institutes I probably would never have known of, or how to teach, some of the newer concepts in the field of math instruction.

Shared Experiences/Association with Other Teachers. One of the personal gains most frequently mentioned by the respondents pertained to various aspects of "shared experiences" and/or "association with other teachers." A few of the "institute highlight" quotations follow:

> Association with other math teachers who are teaching the same new approaches in mathematics. Comparing what I learned in class with the material I am teaching.
>
> Close association with other interested in same field--plus concentrated effort together. . . .
>
> Meeting with and living close to other teachers in my field and sharing ideas and experiences at lunch, during breaks, and at Trout Hall. . . .
>
> . . . Not the least important was the opportunity to meet & talk with teachers from wide geographical areas. This opportunity to talk with good teachers as well as some I felt were not so good led me to draw conclusions as to what makes a competent teacher. . . .

Appreciation. Appreciation for personal gains through the institute programs was expressed in many ways by many respondents. Following are some of the more straight-forward quotations from "institute highlights:"

> It was a wonderful experience that opened the doors for me to do much study and modernize myself in my chosen field, and to become a more adequate teacher.
>
> Being selected and only an average student.
>
> The opportunity of learning new subject matter from some of the best in the field, plus the opportunity to meet and talk with others of the same profession about methods concerning the whole field of teaching. . . .
>
> . . . I appreciated the opportunity to study with your excellent staff!
>
> I received my M.S. degree!

Many respondents expressed personal gain from their institute participation. Only one respondent of the study group specifically expressed himself otherwise. These respondents indicated that their institute participation had improved their academic background (science/mathematics), both basic and current, through class and extra-class activities; had improved their teaching competence through acquired information and skills; and had brought them professional friendships and much practical information through shared experiences.

The Institutes

When asked to make a subjective statement concerning their "institute highlight" many respondents made complimentary remarks about the institutes generally. The following are examples of such statements made by the respondents:

> . . . The whole experience was the most enlightening and enjoyable summer I ever spent in school. . . .
>
> . . . When you have an interesting subject, good teachers and other members of class who are interested you have a good learning situation and in my opinion all these elements were present. . . .
>
> I have never been more at home in any of the 12 colleges and universities I have been to. . . .

> One of the best organized & planned summers I have ever had the privilege of attending. I have attended 10 straight summers & it was by far the best. If I could afford it I would come to KSC every summer.
>
> The association with dedicated professors who exhibited great love of their subject matter and an even greater love for education, as indicated by their total involvement in the institute and their keen insights into our problems.
>
> The highlight of my institute experiences was the bringing home to my classes the exciting mathematics we were learning in class.

Constructive criticisms by the respondents elicited many remarks about several aspects of the institutes.

Participant Selection. The area of selection of participants for the institutes elicited no complimentary statements under "institute highlights" and brought a considerable number of "adverse criticisms." Following are some typical constructive criticisms and companion "suggested solutions:"

Constructive Criticism	Suggested Solution
Some people attending who really had no business doing so. (Junior college SI respondent)	Avoid accepting those with too low a level of previous training and those who are not likely to be able to teach the subject even with the institute training.
The fact that I was never accepted for summer institute.	Enlarged programs? (High school ISI respondent)
Give too much consideration to people [who] do not intend to stay in the math field and only go to the institute for the money they make during the summer.	Be more selective of participants as to what they want out of the course. (Senior high ISI respondent)
Would not accept you in any course in which you were not teaching, e.g., I teach biology but am very weak in physical science. In order to improve in biology, I need chemistry.	Allow each participant to take regular offered courses in any field of math or science in order to make up deficiencies. (High school respondent, one ISI, two SI's)

The criticism I have /is/ . . . in the selection of participants. Some were not going to teach in the field being offered. This was probably due to job changes after acceptance was made.	Require verification by the administrator on or about May 1st. (Senior high SI respondent)
To be able to receive a summer institute . . . to better myself in the field of math. (High school respondent, two ISI's)	. . . I have applied three times /for SI/ and never have received it, and I think I need it just as bad as the next fellow.
After having attended "one" institute and maintaining an "A" average, I was rejected attendance of institutes the 2 following years and given no specific reasons as to why I was not accepted. (Junior high Si respondent)	Offering additional institutes to those who have previously attended "if their work was of graduate caliber" so they may be able to continue work toward a graduate degree.

Length, Types, and Levels of Institutes. The length, type, and levels of institutes induced constructive criticisms by certain respondents.

Following are exemplary responses with suggested solutions:

Constructive Criticism	Suggested Solution
I would like to see the program made into a 12 week program. Have the same pay as for 8 weeks.	Change the length of the institute to 12 weeks. (High school SI respondent)
The only thing I really didn't care for was the evening course. (High school ISI respondent)	I think it's /all right/ if time allows, & I believe for many settled married people it would be fine. I would vote to continue it, it was a great help.
Hated to give up so many Saturdays. It certainly curbed week-end activities. That is my reason for not applying for In-service /institutes/ this school year.	Would prefer evening institute. (High school ISI respondent)
I could not recommend an inservice /institute/ to any one unless they would have plenty of spare time to study.	. . . . . (High school ISI respondent)
Not being on campus limited all other phases of your program.	. . . . . (Junior college respondent, two ISI's, one SI)

Time involved in teaching & family does not permit one to study and prepare as should in an In service institute. (High school respondent, two ISI's)	Attend a summer institute with a stipend to remove the worry of finances for the family while attending.

The above respondent wrote a lengthy solution to the financial aspect of summer institute programs that is worthy of inclusion:

> It is my /opinion/ that . . .industries in conjunction with State Colleges /could/ give jobs to selected teachers . . . to hire & pay the teachers /for/ a program /pertaining to/ how the Science & Mathematics teachers could better prepare their students. This could be supervised by the College & the financial part could be written off /by/ the Employer as a tax /deduction/ as an inducement this might help the following areas
>
> 1. Job needs for teachers in the summer
>
> 2. A better understanding of how that which the teacher is teaching is used in real life
>
> 3. By alternating classroom and job on an every other summer bases /there would be/ more opportunity /and/ more training with less cost to the government.

(Writer's comment: The respondent needs a "grammar grant.")

Constructive Criticism	Suggested Solution
To be able to receive . . . an academic year program, in which to better myself in the field of math.	. . . . . (High school respondent, two ISI's)
Not enough /elementary/ teachers had the opportunity to attend. (Elementary school ISI respondent)	More such institutes for elementary teachers. More recognition of the importance of the elementary teacher and the elementary school in the teaching of science and mathematics.
None--just wished you had continued some more for college people. (College SI respondent)	Just hurry and set up some more institutes for college teachers.
My greatest problem was the distance to travel and the limited time I could devote to study aside from my regular duties. (High school ISI respondent)	Either to have the In-Service program as . . . an extension course in various localities or to reduce the radius within which applicants would be accepted.

Mechanics of the Institutes. A number of respondents had constructive criticism to offer on items that are usually included under the heading "mechanics;" e.g., housing, meals, scheduling. Most criticisms were accompanied by remedial suggestions.

Constructive Criticism	Suggested Solution
I don't feel that an institute member should have to rent a study room in the dorm if he lives in Pittsburg. (High school respondent, three SI's)	Don't make a charge to students for a study room. (Most of the studying is done in the basement and reception room)
. . . The housing policy which requires a participant whose family is with him to also have a study room in one of the dorms. (Junior high respondent, one ISI, two SI's)	The library is available . . . as well as the lounge in the dorm. A person whose family is with /him/ has a hard enough time making ends meet during the summer.
Afternoon devoted almost entirely to lectures . . . Little opportunity to specifically "get at" the materials in which you felt inadequate. (Junior high respondent, two SI's)	Keep morning schedule as is. Organize laboratory classes sometime in afternoon & evening on the basis of student needs . . . . This to be done after arrival of institute members. . . .
Time for proper study was hard to obtain. (Senior high respondent, two ISI's)	More group work--experiments--research.
Lack of time. (Senior high respondent, three SI's)	Shorten morning classes--Probably impossible.
Housing for families could be with kitchenette facilities for younger children.	Already expressed. (Senior high respondent, one SI)
Housing for larger families. (Junior high respondent, one SI)	. . . I had a lot of /college/ assistance in trying to acquire adequate housing. It is just difficult to find rental property for a large number of small children for 3 months.
. . . also I have felt that having to eat together was perhaps too much togetherness.	..... (Senior high respondent, three SI's, three ISI's)

The compulsory noon lectures. After spending [4 hrs. in classwork, the cutting out of the 1½ hr. lunch break was somewhat tiresome.

Use classtime for these people [visiting lecturers]. (Junior high respondent, one SI)

Atmosphere. When making comments about the institute atmosphere the majority of respondents were quite complimentary, as evidenced by the following remarks:

> Friendly college atmosphere with plenty of time & opportunity to study . . . .
>
> . . . The opportunity to live and work with people I respect is very rewarding.
>
> Having the opportunity of studying under excellent professors with a matured group of students, being pushed to the limit with the new ideas.
>
> The highlights of my institute experiences at KSC were the association with the professors and fellow teachers under ideal learning conditions.
>
> Director & Teachers excellent, Good facilities, Atmosphere for study good, Outside Activities Adequate.

In the composite objective ranking of the "institutes" (Table LII), fifty-four per cent of the respondents ranked the item "2" and thirty-one per cent ranked it "1". The subjective evaluation tended to refute this for almost all such statements were constructive criticisms of the institutes.

"Participant selection" drew much criticism largely because certain participants had been unable to secure additional institutes, and partially because they had not understood the mechanics and the bases for selections.

"Length, types, and level of institutes" brought constructive criticism aimed largely at assuring teachers of all teaching levels an institute berth by augmenting both number and type of institutes offered.

Institute "atmosphere" was mentioned in a complimentary manner by many respondents. Apparently certain aspects of the institutes induced criticisms but viewed in toto the impression was highly satisfactory.

Institute Physical Facilities

Not too many respondents made subjective comments concerning the physical facilities of the institutes. One respondent stated, "Good facilities." Comparable short statements were sometimes incorporated within listings of "highlights of the institutes."

In making constructive criticisms of physical facilities the following are examples of the very few "adverse criticisms" in this area:

> . . . lab work would have been improved considerably by air conditioning.
>
> Hot dorms. (with the suggestion to "condition dorms.")
>
> Food. (with the suggestion, "improve cafeteria meals.")

Physical facilities items listed in the objective evaluation (Table LII) averaged a "2" rating by any one group of respondents--various numbers of respondents rated different items. This rating appears to be comparable to the subjective rating in that there were very few adverse criticisms of these facilities.

Miscellaneous Items

Very few respondents made subjective comments on "miscellaneous" aspects of the institutes. One respondent with four institutes to his credit, one SI and three ISI's, said, "Too little contact with the 'College.'"

Two respondents made contrasting comments about "graduate

assistants."

> . . . and concern of [the assistant] was heart warming and instructive.
>
> [My most adverse criticism--] Student assistant who evidently was unqualified grading papers.

Summary

In the area of renewing participants' knowledge of fundamentals, both curricular and co-curricular institute activities were effective. The institute professors and their courses were rated very favorably in the attainment of this institute objective in both objective and subjective evaluations by the respondents. Field trips received near superior acclaim in advancing knowledge of fundamentals while effective, coordinated laboratory activities drew considerable adverse criticism from the respondents.

Co-curricular activities, particularly the informal "gab sessions" and the afternoon/evening group study sessions received superior ratings by the respondents in renewing their knowledge of fundamentals.

Curricular and co-curricular institute activities were both equally effective in acquainting participants with recent developments in science and mathematics. Institute professors and visiting lecturers received equal acclaim (percentage-wise) in this area, through formal presentation in the institute classrooms and through the informal sessions where ideas were shared. Here again the "gab sessions" were given a high rating by the respondents who learned much from their peers through sharing recent developments in their fields.

The institute objective of familiarizing participants with newer approaches to presentation of their subjects was attained more effectively

through institute co-curricular activities than through the structured curricular programs. While many respondents were complimentary when considering improved methods of presentation learned within the institute classrooms/laboratories, others felt that the institute professors were deficient in this area and in their usage of varied and effective methods of presentation.

The co-curricular activities, especially the "gab sessions," were the outstanding source of information for the respondents in improving their teaching competence. A quotation from one of the respondents illustrates this point, ". . . This opportunity to talk with good teachers as well as some I felt were not so good led me to draw conclusions as to what makes a competent teacher. . . ." Many respondents believed that their teaching competence was improved through their individual evaluations of what, to them, was sound or unsound methodology in their observations of the curricular/co-curricular aspects of the institute(s).

This study posed the null hypothesis that: The attainments of the participant-teachers in their renewal of knowledge of fundamentals, in their acquaintance with recent subject-matter advances, and in their familiarization with newer methodologies, were not altered as a result of their participation in the NSF-KSC institutes. The alternative or research hypothesis is, therefore, that: The attainments of the participant-teachers in their renewal of knowledge of fundamentals, in their acquaintance with recent subject-matter advances, and in their familiarization with newer methodologies, were altered as a result of their participation in the NSF-KSC institutes.

This study tends to refute the null hypothesis and tends to support the research hypothesis.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of the Study

The Respondents

Demographic Information. The majority of the respondents were married, male, and were Kansans teaching in the same state and the same schools where they taught at the time of their first acceptance for an institute; their median age on their last birthdays was within the 35-39 age bracket, while their median age when first accepted for a NSF institute was within the 30-34 age bracket.

Teaching Experience. The median for the total years of teaching experience of the respondents was within the 5-9 year bracket; the median for the years at their present schools was within the 1-4 year bracket.

School Position. Nearly all of the respondents were classroom teachers who had not been influenced to change type of school position by virtue of their institute attendance. With few exceptions they had done most/all of their teaching in the public schools and nearly fifty per cent had taught all/most of the time at the senior high school level. Institute attendance had not influenced them to change teaching levels. Just over fifty per cent of the respondents were mathematics teachers while social studies was the area, other than the sciences and mathematics, in which the largest number of respondents had done additional teaching.

Education. The largest percentage of respondents held B. S. degrees at the Bachelor degree level and M. S. degrees at the Master degree level.

The largest percentage of respondents with degrees in progress were working on M. A. degrees at the Master degree level. Eight per cent of the study group had Education Specialist (Ed. S.) degrees in progress. Of the respondents with Doctorate degrees in progress the greater percentage (2 per cent) were working on Ed. D. degrees.

The M. S. degree was designated by the largest percentage of respondents who had secured institute assistance on Master's degrees. Seven per cent of the respondents with Ed. S. degrees in progress had secured institute assistance while half those with Ed. D. degrees in progress had secured this assistance.

Major and minor areas in the undergraduate/graduate studies of the respondents found mathematics first in percentage in both undergraduate major and minor and education first in both graduate major and minor. Other major and minor areas in the undergraduate/graduate studies of the respondents found two areas tied for top number of respondents in the major area: physical education and social science; social science was also first in the minor area.

Semester hours in the respondents' majors found the 30-34 hour bracket with the largest percentage of respondents at the baccalaureate degree level; the same bracket at the specialist degree level; and there was a tie at the doctorate degree level between the 40-44 hour bracket and the sixty or more hour bracket.

Semester hours of professional education secured in the undergraduate/graduate programs of the respondents found a tie in maximum percentage between the 15-19 hour bracket and the 20-24 hour bracket. At the graduate level the greatest percentage of respondents had less than ten hours of professional education.

Professional education secured in institute programs found the largest percentage having secured no hours in either their undergraduate or graduate studies.

The largest percentage of respondents had been away from college/university only a year prior to their institute attendance.

Certification. The largest percentage of respondents held permanent type certification and had not improved their certification by virtue of their institute courses.

Teaching Assignments. Approximate number of students taught daily by the respondents in their pre-institute teaching found the largest percentage teaching below 100 students; in their current (post-institute) teaching, the largest percentage was teaching 100-149 students daily.

Number of classes taught daily by the respondents was five in both their pre-institute and their current teaching assignments. Number of classes taught by the respondents as compared with the number taught by the other teachers of those schools was indicated as "about the same" number. The largest percentage of respondents indicated that there was no institute influence on change in number of classes taught daily.

Daily class preparations made by the respondents were indicated as "three" by the largest percentage in both their pre-institute and their current teaching assignments.

The largest percentage of respondents indicated that all teachers in their respective school systems had daily "open" periods; the institutes had no influence on "open" period assignments; both laboratory and non-laboratory teachers were given "about the same" allowance for "open" periods.

When asked if they believed that teachers handling laboratory

classes should be given more "open" periods than those given non-laboratory teachers, the largest percentage of respondents answered in the affirmative and supported their replies with subjective statements.

Estimated number of hours per week spent on extracurricular activities found the largest percentage of respondents spending five hours or less.

The majority of the respondents had not sponsored or were not sponsoring a mathematics/science club in their respective schools. Of those respondents who were sponsoring clubs, the largest number had affiliated their clubs only at the local level, and comparable student enrollments in both pre-institute and current clubs, and their clubs were largely for exploration (subject areas).

Income. The largest percentage of respondents reported pre-institute nine-months teaching incomes in the $4500-$4999 bracket; current (post-institute) incomes in the $5000-$5499 bracket; no additional incomes resulting from attending an institute ("not pertaining to annual salary increase"); and no additional job offers by virtue of their institute attendance.

Teaching Methods and Techniques. In the over-all expression of the extent of change in their teaching methods since attending an institute the largest percentage of respondents indicated "some" change. In the detailed indication of changes in their instructional techniques and methods, the largest percentage of respondents indicated "much" institute influence in the following: "'Up-dating' reading materials," "Usage of newer subject-matter concepts," "Challenging the brighter student," "Motivating the creative student," "Encouraging student initiative," and "Setting higher student goals."

In comparing their teaching competence before and after institute attendance in handling certain types of students, the largest percentage of respondents indicated they were much better in handling gifted students, some better in handling both creative and average students, and about the same in handling slow-learning students.

In the selection of activities and methods in predominant usage in their teaching-the largest percentage of the respondents indicated activities and methods that are usually conceded to be most effective in classroom/laboratory situations.

The institute experience of the majority of the respondents had included a study of the new mathematics curriculum and had not included a study of the new biology, chemistry, and physics curricula. Of the respondents who had studied the new curricula revisions in the institute programs, the majority indicated that the information had been valuable to them and had "definitely" influenced them to make curriculum revisions in their respective programs. While the majority of the respondents did not have any of the new curriculum revisions in usage in their classrooms, they had made "some" change in the content of their courses since attending an institute.

"Some" information about N.D.E.A. assistance to schools had been gained by the majority of the respondents through their institute experiences; however, the majority indicated that their schools had received "much" equipment as a result of the N.D.E.A.

Professional Activities. Institute experience was valuable to the largest percentage of the respondents in assisting them in the selection of mathematics/science materials. Fifty or more per cent of them found their institute experience valuable in the selection of textbooks,

library/reference books, equipment and/or apparatus, and supplies.

The largest percentage of the respondents had served at the local level on mathematics/science curriculum revision committees and believed that their institute attendance had been "somewhat" influential in their selection for these committees.

While the largest percentage of respondents indicated that their institute experiences had enabled them to be of greater service in supporting their mathematics/science program activities, they had not been involved in such activities except in sponsoring clubs and giving talks to students.

The majority of the respondents had informed others about their institute experiences and the several NSF programs by talking with individual students/teachers. Administrators, teachers, and students were the groups that had expressed "some" interest in the NSF programs according to the largest percentages of respondents. Teachers had expressed "some" interest in all aspects of institutes listed in the opinionaire except "Housing and meals."

Pre-institute subscriptions to professional journals were indicated by the largest percentage of the respondents when compared with their subscriptions to special field journals. Special field journals were specified by the largest percentage of respondents in post-institute subscriptions and in additional journals read.

While membership in professional organizations rated the greatest percentage of respondents in the pre-institute period, memberships in special field organizations was indicated "during and since the institute." Election to special field honorary organization memberships was indicated over professional honorary organization memberships.

Professional Status. Over sixty per cent of the respondents indicated that their academic prestige gained from institute attendance was higher according to their administrators, colleagues, and students. The majority had encountered no "differences and jealousies" resulting from NSF financial assistance with additional schooling/degrees. Those who had encountered such attitudes said it existed to "some" extent.

The majority of the respondents stated that it was "very likely" that they would remain in the teaching profession.

The Institutes

Purposes. Of the three institute objectives listed in the opinionaire, over sixty per cent of the respondents selected two as important:

> 2. To acquaint [participants] with recent developments and advances in science, mathematics, and engineering.
>
> 3. To familiarize [participants] with new approaches to presentation of subject-matter.[1]

Interestingly, the objective selected by only thirty-five per cent of the respondents was a NSF institute objective:

> 1. To renew [participants'] knowledge of fundamentals.[2]

Just over sixty per cent of the respondents believed the NSF institute objectives were attained "Very well" by the KSC institutes.

Participant Selection and Their Reasons for Acceptance. The majority of the respondents selected the three following bases on which they believed participants were chosen for NSF institutes at Kansas State College:

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[1]"Foundation Grants $24.2 Million for 415 Summer Institutes for Secondary School Teachers," NSF 63-100, Washington, D. C.: National Science Foundation, January 13, 1963, p. 1.

[2]Ibid.

(1) "Their need for refresher courses (fundamentals)," (2) "Their need for recent subject matter concepts," and (3) "Their need for improved methodology."[3]

The following reasons for wanting to attend the KSC-NSF institutes were indicated as "strong" motives by over fifty per cent of the respondents: "Needed courses covering new field/areas." "Needed new techniques of presentations." "Wanted to improve school science programs." Another reason selected by almost fifty per cent of the respondents is pertinent: "Needed courses offered in this institute."

Significance of Institutes in Realization of Expectations and Modification of Thought. Fifty per cent or more of the respondents had "many" of their expectations realized in their institute participation in the following: "Sharing experiences," "Association with professors and scientists," "Study of newer subject matter concepts," and "Expansion of general mathematics and/or science background."

Nearly fifty per cent, or over, of the respondents indicated that institute attendance had "much" effect upon their thinking with respect to: "Enhanced your desire to continue graduate work," "Increased enthusiasm for teaching mathematics/science."

Institutes Attended. The respondents to this study were representative of all eleven NSF institutes held at Kansas State College of Pittsburg between September, 1959, and May, 1963. There were six in-service institutes and five summer institutes; one summer institute was for junior college teachers and one was for elementary school teachers;

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[3]The reader will note the parallelism with the NSF institute objectives.

one in-service institute was for junior high school teachers--the remaining eight institutes were for both junior high and senior high teachers.

Biology classes were offered in seven institutes and biological science in two; chemistry was offered in four institutes; mathematics was offered in eight; physics was offered in four institutes and physical science in two.

The majority of the respondents, sixty-one per cent, had not attended institutes at other colleges. The remaining thirty-nine per cent of the respondents had attended 164 institutes at sixty-nine other colleges/universities; eighty per cent were SI's, ten per cent were ISI's, and the same per cent were AYI's.

Slightly more than fifty per cent of the respondents made application for 1963-64 institutes, at KSC and elsewhere. Fifty-seven per cent of the applicants were accepted.

Suggestions for Future Institutes. In making first and second choices of subject areas they desired in subsequent institutes, mathematics, physical science, and biological science rated the first three positions in the respondents' first choice; mathematical education, physical science, and mathematics rated the first three positions in their second choice. Over sixty per cent of the respondents selected summer institutes to further their study of the above subjects.

To keep them up-to-date during the next five years the respondents selected the following types of institutes: summer institutes first, in-service institutes second, and combinations of institutes third--with the summer/in-service combination considered most frequently.

The ISI respondents stated preferences with respect to certain

aspects of their institutes: (1) the beginning and terminating dates were satisfactory; (2) the length (in weeks) was satisfactory; (3) Saturday classes were given preference over evening classes; and (4) the hours necessary for class preparations did not seem excessive--four hours per class session were considered necessary by the largest percentage of the respondents.

The SI respondents stated preferences with respect to comparable aspects of their institutes: (1) dates and length of institutes were satisfactory; (2) hours of daily class attendance met with their approval--five hours daily was indicated by the largest percentage; and (3) hours necessary for class preparations did not seem excessive--four hours daily were considered necessary by the largest percentage.

Institute Evaluation. The objective evaluation of the institute was done on a graduated basis; ratings were made by the respondents on a "1" through "5" basis with "1" being the top rating. The following aspects of the institutes were given a "1" rating by forty-seven (or more) per cent of the respondents: "The director," "Institute professors," "Institute courses," and "Housing." A "2" rating was made by the same percentage of respondents on the following: "Visiting lecturers," "Graduate degree programs," "General library," "Classwork," "Laboratory/Research facilities," and the "Composite" institute rating.

The subjective evaluation of the several aspects of the institutes confirmed the objective evaluation except in the following:

1. Presentations by the visiting lecturers should exhibit better coordination with the institute programs and objectives.

2. Professors should continue to improve methodology, course contents, usage of supplementary materials and teaching aids, knowledge of

elementary/secondary school teachers' problems, testing/evaluating techniques.

3. Course work should move toward depth of coverage rather than breadth of coverage and should be more student-centered. Sound text(s) should be used and ample numbers of worthwhile references should be available to the participants.

4. Student make-up of classes should be more homogeneous or classwork should be handled on a student-centered basis.

5. There should be more laboratory work that is better coordinated, comparably supervised, and "revised to fit the needs of the teachers [participants]."

6. Acquaint institute applicants with criteria for the selection of participants.

7. Devise methods by which more applicants, of all teaching levels, will be able to secure institute grants.

Conclusions Drawn from the Study

In the light of the findings of this study, it was concluded that the NSF institutes held at Kansas State College of Pittsburg were worthwhile for the participants in renewing their knowledge of fundamentals, acquainting them with recent developments and advances in science and mathematics, and familiarizing them with newer approaches to the presentation of their subject matter.

It was further concluded that both curricular and co-curricular institute activities were effective in renewing the participants' knowledge of fundamentals and in acquainting them with recent developments

and advances in science and mathematics. It is possible that certain institute co-curricular activities contributed more concomitant information for the participants on improved methodologies than that secured in the structured curricular activities.

Recommendations Drawn from the Study

Recommendations for Improvement of the KSC Institute Programs

In considering evidence obtained from this study, the following recommendations for the improvement of the institute programs at Kansas State College of Pittsburg need consideration:

1. The institute programs at Kansas State College of Pittsburg be continued. Type and number of institutes offered should meet the needs of the mathematics/science teachers of the several school levels in the service area of the college.

2. Presentation methods of the institute professors be modified in view of research-proved concepts of methodology for higher education institutions.

3. Course offerings to include newer curriculum revision materials pertinent to secondary and elementary education.

Recommendations for Further Study

Because of the nature of this study it has become evident that further research on certain factors should be investigated. The following areas are presented which appeared most able to yield pertinent data which would be useful in science education.

1. The characteristics of the mathematics/science teachers who have not applied for an institute and the need to involve these

non-participating teachers in institute experiences.

2. A comparison between the teaching/professional accomplishments of institute participants versus non-participants.

3. A follow-up study of the NSF-KSC institute participants who were not involved in this study, including an analysis of stated reasons for not becoming involved in the initial study.

4. The influence of the institutes upon (a) elementary/secondary school curricula, (b) elementary/secondary school student attainments in mathematics/science, and (c) academic/professional organizations.

5. The development of institute (institutional) curricula for the several types of mathematics/science teachers: (a) the recent graduate, (b) the experienced teacher seeking an advanced degree, and (c) the teacher who has not returned to school for ten to fifteen years following his undergraduate education.

6. The feasability of including academic year institutes in the existing pattern of in-service and summer institutes at Kansas State College of Pittsburg.

7. The reasons for drop-outs in the in-service institutes with possible solutions to help alleviate the situation.

8. The financial support of institutes from sources outside the federal government (e.g., state and local governments, business, industry).

9. A comparative study of sequential institute programs for single groups of participants (approximately fifty per group) versus unitary (non-sequential) institute programs for several groups of participants.

10. The need for financial support for institute programs in areas other than mathematics/science.

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The 1963 edition of The Foundation's description of its educational programs in the sciences.

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A proposal to the NSF for the only KSC science institute held specifically for junior high school teachers to date (1964). Director, Margaret B. Parker.

"A Proposal for an In-Service Institute /1959-60/ for Secondary School Teachers of Science and Mathematics." Kansas State Teachers College, Pittsburg, Kansas, 1959. (Mimeographed.)
The proposal made to NSF for the first ISI held at Kansas State Teachers College (now Kansas State College of Pittsburg); this was for both junior/senior high school teachers of science and mathematics. Director, R. G. Smith; Assistant Director, J. C. Johnson, Jr.

"A Proposal for an In-Service Institute /1960-61/ in Biology, Chemistry, Mathematics for Teachers of High School Science and Mathematics." Kansas State College of Pittsburg, 1960. (Mimeographed.)
A proposal to NSF for an ISI for secondary school teachers of biology, chemistry, and mathematics. Director, R. G. Smith; Assistant Director, J. C. Johnson, Jr.

"A Proposal to the National Science Foundation for Support of a Summer Institute [1962] for Teachers of Science and Mathematics." Kansas State College of Pittsburg, 1961. (Mimeographed.)
A proposal to NSF for a SI for secondary school teachers of biology, chemistry, mathematics, and physics. R. G. Smith, Director.

"A Proposal to the National Science Foundation for Support of a Summer Institute [1960] for Teachers of Science or Mathematics." Kansas State College of Pittsburg, 1959. (Mimeographed.)
The first proposal to NSF by KSC for a SI for secondary school teachers of mathematics/science. R. G. Smith, Director.

"A Proposal to the National Science Foundation for Support of a Summer Institute [1961] for Teachers of Science, Mathematics, or Engineering." Kansas State College of Pittsburg, 1960. (Mimeographed.)
A proposal for a SI in biology, mathematics, and physics for secondary school teachers of science and mathematics. R. G. Smith, Director.

"A Proposal to the National Science Foundation for Support of a Summer Institute [1960] for Teachers of Technical Curricula." Kansas State College of Pittsburg, 1959. (Mimeographed.)
A proposal for the only institute, to this date (1964), held at KSC for instructors of chemistry and physics in pre-engineering curricula. Director, Leon C. Heckert.

"A Proposal to the National Science Foundation for Support of an In-Service Institute [1961-62] for Elementary School Teachers and Supervisors of Science." Kansas State College of Pittsburg, 1960. (Mimeographed.)
A proposal for the only institute, to this date (1964), held at KSC specifically for elementary school teachers/supervisors of science. Director, Elton W. Cline.

"A Proposal to the National Science Foundation for Support of an In-Service Institute [1961-62] for Secondary School Teachers of Science and Mathematics." Kansas State College of Pittsburg, 1960. (Mimeographed.)
A proposal to NSF for an ISI for secondary school teachers of science and mathematics (biology and mathematics). Director, R. G. Smith.

"A Proposal to the National Science Foundation for Support of an In-Service Institute [1962-63] for Secondary School Teachers of Science and Mathematics." Kansas State College of Pittsburg, 1961. (Mimeographed.)
A proposal to the NSF for an ISI for secondary school teachers of biology, mathematics, and physics. Director, R. G. Smith.

Report of the Conference of 1956 NSF Summer Institute Directors. Washington, D. C.: National Science Foundation, 1956.
A resume of the reports and recommendations of the directors of the 1956 summer institutes.

"A Report on [the 1956-57] Academic Year Institute for High School Science and Mathematics Teachers." Stillwater: Oklahoma State University, 1957. (Mimeographed.)

The director's report to the NSF on one of the two pilot AYI programs. Director, Dr. James H. Zant. This includes "A Scientific Evaluation of a Scientific Program," by Leonard A. Ostlund.

"A Report on [the 1957-58] Academic Year Institute for High School Science and Mathematics Teachers." Stillwater: Oklahoma State University, 1958. (Mimeographed.)
The director's report to the NSF on the second AYI held at Oklahoma State University. (Copies of subsequent reports, through 1962, were also used in this study. Director, James H. Zant.

"Research Opportunities Offered for High School and College Teachers," NSF Bulletin, No. 62-156, November 12, 1962.
Announcement of research opportunities for 700 science teachers in certain colleges/universities throughout the U. S. during the summer of 1963; financed by the NSF.

Schenberg, Samuel. "An Evaluation of the 1958 Summer Institutes Attended by Science and Mathematics Teachers of the New York City High Schools." Board of Education of New York City, January, 1959. (Mimeographed.)
An appraisal of the 1958 summer institutes (NSF and other sponsors) attended by the secondary school mathematics/science teachers of New York City. Recommendations for future institutes are included. Subsequent annual evaluations have been made and were used in this study.

_____. "1958 Summer Institutes," The Science Teacher, XXVI (May, 1959), 228-231.
An evaluation of the 1958 summer institutes (NSF and other sponsors) by the science supervisor of New York City. Questions presented to the mathematics/science teachers of that system are included along with tabulated results and recommendations for future institutes.

_____. "Science Supervisor Views Summer Institutes," High Points, XLIV (October, 1962), 29-38.
The science supervisor of New York City secondary schools evaluates the summer institutes of 1958 through 1962 from information secured by the mathematics/science teachers who attended institutes during that period.

"Science and Mathematics In-Service Institutes," Higher Education, XVII (May, 1961), 14-15.
NSF is expanding its in-service institute program in recognition of the need for additional opportunities for teachers to improve their scientific knowledge while continuing their regular classroom duties.

Science Research Associates. "Evaluation of the NSF Summer Institutes Program of 1957: Final Report." Chicago: Science Research Associates, 1957. (Mimeographed.)
A contractual, large-scale, follow-up study of the 1957 summer institute participants. The study indicated that, in addition to previous findings concerning the immediate benefits of the institutes, there was carryover into the subsequent academic year. A companion study was done by the Bureau of Social Science Research, No. 301B.

"Science Teaching in Elementary and Junior High Schools," Science, CXXXIII (June 23, 1961), 2019-2022.

A study of science teaching in the elementary/junior high schools made by the American Association for the Advancement of Science, with the aid of a grant from NSF, is reviewed by the steering committee.

Secondary School Science and Mathematics Teachers, Characteristics and Service Loads. NSF-63-10. Washington, D. C.: U. S. Government Printing Office, 1963.

Report of a study made by the National Science Foundation on the "characteristics and service loads of secondary school science and mathematics teachers."

Selser, Will Lindsey. "An Evaluation of an In-Service Institute for Improving Science and Mathematics Instruction in the Hillsborough County Junior High Schools." Unpublished Doctor's thesis, University of Florida, Gainesville, 1962.

This study assesses the effectiveness of an in-service institute in increasing knowledge of content and the ability to understand and use broad concepts in mathematics and science. Experimental and control groups were used--students and teachers.

Smart, James R. "Follow-Up Evaluation for NSF Summer 1960 Institute for Teachers and Supervisors of Arithmetic." San Jose (California) State College, May, 1961. (Mimeographed.)

A short evaluating instrument, with tabulations by the author, for the institute mentioned.

Sorum, C. H. "Annual Report of the 1956-57 High School Science and Mathematics Teachers Supplementary Training Program." Madison: University of Wisconsin, December, 1957. (Mimeographed.)

The Director's report on one of the first two NSF-sponsored in-service institutes. (The other was at Oklahoma State University.)

Stevenson, Everett Earl. "A Follow-Up Study of the Participants of the Academic Year Institutes Held at The Ohio State University, 1957-1961." Columbus: The Ohio State University, 1962.

This study is concerned with the NSF AYI program carried on at The Ohio State University from 1957-1961. It attempts to measure the changes brought about by the participants in such a program after they return to teaching: changes made in the teachers themselves, changes in the mathematics programs of the schools, the extent to which the changes can be attributed to the AYI, and over-all changes in the professional growth of the teacher in the field of leadership in mathematics education.

Suggestions and Forms for Preparing a Proposal for a Summer Institute. SPE 64-C-13. Washington, D. C.: National Science Foundation, 1964.

Directives and blank forms issued to persons making proposals for summer institutes.

"Suggestions and Forms for Preparing a Proposal for an In-Service Institute for 1964-65." SPE 63-C-5. Washington, D. C.: U. S. Government Printing Office, 1963.
Materials prepared for usage by persons making proposals for 1964-65 academic year institutes.

"Summer and Academic Year Institutes," The Science Teacher, XXIV (December, 1957), 395.
Announcements and information on the second ISI's and the fourth SI's sponsored by the NSF.

"Summer Institutes for Elementary School Supervisors and Teachers," The American Biology Teacher, XXII (March, 1960), 167.
Announcements and information concerning the first regularly scheduled NSF SI's for elementary school teachers/supervisors. (Pilot institutes were held during the 1959 summer.)

"Summer Institutes in Mathematics and Mathematics-Science," The Arithmetic Teacher, IX(February, 1962), 106.
Announcements and information concerning the SI programs for elementary school teachers of science and mathematics for the third year of the program--following the pilot institutes in 1959.

Summer Institutes for Secondary School and College Teachers of Science and Mathematics. Washington, D. C.: U. S. Government Printing Office, 1962.
A brochure covering the indicated institutes and levels that was presented to directors in their early briefings for the institutes for that summer (1962).

"Summer Institutes in Science and Mathematics for Elementary School Supervisors and Teachers," California Journal of Elementary Education, XXVI (February, 1959), 131-133.
Information concerning the pilot institutes in elementary science/mathematics held during the summer of 1959.

"Summer Institutes for Science and Mathematics Teachers," The Mathematics Teacher, LI (February, 1958), 149-151.
Information and announcements concerning the 126 SI's offered in the fifth year of the NSF program.

Thesis Writing Manual--A Guide for Graduate Students. The Graduate School. Stillwater: The Oklahoma State University, 1962 (rev.).
Latest revision of the manual for thesis writing used by the Graduate School of O.S.U.

Thomas, Della. This Is Your Library. Stillwater: Oklahoma State University, 1959.
"A handbook prepared for use in OSU's Library Science III, 'The Use of Books and Libraries.'"

"Trends in the Secondary School Curriculum," Unesco World Survey of Education III Secondary Education. New York: International Document Service (A Division of Columbia University Press), 1961. VII:128-148.
An educational clearing house for the exchange of information related to the educational needs of Member States of Unesco. The chapter cited deals with the secondary school curriculum.

Turabian, Kate L. A Manual for Writers of Disserations. Chicago: The University of Chicago Press, 1937 (May, 1954 reprint).
Outstanding source of information for writers of theses/dissertations.

Turner, Joseph. "Plums for the Teacher: Summer Fellowships," Science, CXXIX (February 27, 1959), 535.
An explanation of the initial NSF fellowship program offering, purposes, and differences from the institute programs.

United States Department of Commerce, Bureau of Census. A Statistical Abstract Supplement--Historical Statistics of the United States. Washington, D. C.: U. S. Government Printing Office, 1960.
A necessary reference for historical data.

United States Government Organization Manual, 1959-60. Office of the Federal Register, National Archives and Records Service, General Services Administration. Washington, D. C.: U. S. Government Printing Office, 1960.
Contains descriptive materials on U. S. Government Organizations, including the National Science Foundation.

Waterman, Alan T. "National Science Foundation: Its Organization and Purposes," American Journal of Physics, XX (February, 1952), 73-77.
An explanation, by the NSF director, of the "organization and purposes" of the Foundation according to the 1950 enactment of the U. S. Congress.

_____. "National Science Foundation: A Ten Year Resume," Science, CXXXI (May 6, 1960), 1341-1354.
The history, organization, accomplishments, and plans of the Foundation by the director.

_____. "Role of the National Science Foundation," Annals American Academy of Political and Social Sciences, CCCXXVII (January, 1960), 123-131.
The director of the NSF explains the role of the organization to the U. S. on the tenth anniversary of its inception.

Weber, Robert L. "Opinions of Participants in the Physics Section of the NSF Science Institute, Yale University, 1961," New Haven, Connecticut: Yale University, 1961. (Mimeographed.)
The original questionnaires were submitted to the participants at the close of the 1961 summer institute by Prof. Stuart R. Brinkley, Director, Hall of Graduate Studies, Yale University. The summary was prepared by Robert L. Weber, Osmund Physics Laboratory, Pennsylvania State University. There is a summary of responses by the participants.

_____. "Student Evaluation of the Science Institutes for Teachers Sponsored by the National Science Foundation at The Pennsylvania State University, 1955-59." University Park: Pennsylvania State University, 1959. (Mimeographed.)

A summary of student evaluations of the secondary school in-service and academic year institutes held at The Pennsylvania State University for the years indicated.

White, Marsh W. "A Review of NSF Summer Institute Program: A Follow-Up of 1957 Institute Participants." University Park: The Pennsylvania State University, 1961. (Mimeographed.)

An evaluation of the National Science Foundation Summer Institute Program conducted by the Bureau of Social Science Research, June, 1960 (NSF-C124). Research that provides convincing data that show qualitatively the long-range effects that are directly attributable to the National Science Foundation Institute Program.

Whitney, Frederich Lawson. The Elements of Research. New York: Prentice-Hall, Inc., 1950 (3d).

An introductory source of educational research concepts. It is intended for use in the graduate departments of institutions of higher education.

Wiersma, William, Jr. "A Study of National Science Foundation Institutes: Mathematics Teacher's Reaction to Institute Programs and Effects of These Programs on High School Mathematics Courses." Unpublished Doctor's thesis, The University of Wisconsin, 1962.

The objectives of this study were (1) to ascertain the effects of NSF SI's in mathematics upon the high school mathematics programs of the 11 largest cities of Wisconsin, and (2) to ascertain why mathematics teachers do not apply for NSFI's--this included both SI's and AYI's.

Wolfle, Dael. "National Science Foundation: the First Six Years," Science, CXXVI (August 23, 1957), 335-343.

The history, organization, accomplishments, and future plans/possibilities of the Foundation.

Yon, John F. "The Academic Year Institute for High School Teachers of Science and Mathematics at The Pennsylvania State University during the 1957-58 Term." Evaluation Report No. 11. Unpublished Doctor's thesis, The Pennsylvania State University, University Park, 1959.

An appraisal of the 1957-58 AYI at The Pennsylvania State University through information secured from the participants.

Zant, James H. "The Implications of Present Developments in Mathematics and the Sciences for Teachers in the Schools," Proceedings of the First Conference, Recent Developments in Mathematics and Science, February, 1960. Bulletin of the College of Arts and Sciences, Oklahoma State University, Stillwater.

Current developments in mathematics/science and their significance for teachers.

_____. "The National Science Foundation and the Improvement of High School Science and Mathematics Teachers," Proceedings, Oklahoma Academy of Science, XXXVIII, 1958, 119-120.

Indicates how the NSF is improving the teaching competence of secondary school science/mathematics teachers.

APPENDIX

(Opinionaire)

Name_____
Last First Middle

School_____
School Address

1. Your sex: 1__Male
2__Female

2. In what age bracket were you:
a. On your last birthday?

1__20-24
2__25-29
3__30-34
4__35-39
5__40-44
6__45-49
7__50-54
8__55-59
9__60 or over

b. When you were first accepted for a NSF Institute?

1__20-24
2__25-29
3__30-34
5__40-44
6__45-49
7__50 or over

3. What is your marital status?
1__Married
2__Single (GO TO Q. 4)

a. Do you have any children?
1__Yes. How many?_____
2__No.

b. When you attended the Institute were you accompanied by:

	Yes	No
1. Your spouse?	1__	2__
2. Your child/ren	1__	2__

(IF "YES" TO EITHER, ANSWER "c")

c. Did you have difficulty finding accommodations?
1__Yes
2__No

d. Did any College Office/Official assist you in finding accommodations?
1__Yes
2__No

4. Counting this school year, how many years have you been teaching?

1__1-4
2__5-9
3__10-14
4__15-19
5__20-24
6__25-29
7__30-34
8__35 or more

5. How many years have you been teaching in your current school, counting this year?

1__1-4
2__5-9
3__10-14
4__15-19
5__20-24
6__25-29
7__30-34
8__35 or more

6. Indicate the types of schools in which you have taught all/most of the time, some of the time, or none.

	All or most	Some	None
a. Public	1__	2__	3__
b. Parochial	1__	2__	3__
c. Private	1__	2__	3__
d. Vocational	1__	2__	3__
e. Laboratory	1__	2__	3__
f. Government	1__	2__	3__
g. Other.Specify _____	1__	2__	3__

7. At what level(s) have you taught all/most of the time, some of the time, or none?

	All or most	Some	None
a. Elementary	1__	2__	3__
b. Junior High	1__	2__	3__
c. Senior High	1__	2__	3__
d. Junior College	1__	2__	3__
e. College	1__	2__	3__
f. University	1__	2__	3__

(IF THERE HAS BEEN A CHANGE IN LEVEL SINCE YOUR INSTITUTE ATTENDANCE, ANSWER "g".)

g. Do you think your Institute attendance influenced this change?
1__Definitely
2__Some
3__Very little
4__None
5__Do not know

8. In which of these broad areas have you taught all/most of the time, some of the time, or none?

	All or most	Some	None
1. Mathematics	1__	2__	3__
2. Biol. Science	1__	2__	3__
3. Phys. Science	1__	2__	3__
4. Gen'l Science	1__	2__	3__

8. Continued -
   a. Have you taught in areas besides the previously indicated broad areas?
   1___ Yes. Specify_____
   2___ No. _____

9. Indicate the type of school position you had, immediately before your Institute attendance, and/or now have.

	Pre-Institute	Current
1. Teacher	1___	2___
2. Supervisor	1___	2___
3. Dept. Chmn.	1___	2___
4. Principal	1___	2___
5. Supt.	1___	2___
6. Other. Specify _____	1___	2___

(IF THERE HAS BEEN A CHANGE IN TYPE OF POSITION, ANSWER "a".)
   a. Do you think your Institute participation influenced this change?
   1___ Definitely
   2___ Very little
   3___ Some
   4___ None
   5___ Do not know

10. What academic training have you had? (CHECK ALL ITEMS THAT APPLY)

	Attained	In progress	Institute help
a. B.A.	1___	2___	3___
b. B.S.	1___	2___	3___
c. M.A.	1___	2___	3___
d. M.S.	1___	2___	3___
e.Ed.S.	1___	2___	3___
f.Ed.D.	1___	2___	3___
g.Ph.D.	1___	2___	3___
h.Other: _____	1___	2___	3___

11. What were your major areas in your undergraduate (UG)/graduate (G) studies? (CHECK ITEMS THAT APPLY)

	UG	G
a. Mathematics	1___	2___
b. Biology	1___	2___
c. Botany	1___	2___
d. Zoology	1___	2___
e. Chemistry	1___	2___
f. Physics	1___	2___
g. Gen'l Sci.	1___	2___
h. Education	1___	2___
i. Other. Specify: 1_____ 2_____		

12. What were your minor areas in your undergraduate (UG)/graduate (G) studies? (CHECK ITEMS THAT APPLY)

	UG	G
a. Mathematics	1___	2___
b. Biology	1___	2___
c. Botany	1___	2___
d. Zoology	1___	2___
e. Chemistry	1___	2___
f. Physics	1___	2___
g. Gen'l Science	1___	2___
h. Education	1___	2___
i. Other. Specify: 1_____ 2_____		

13. How many semester hours in your undergraduate (UG)/graduate (G) majors?

	UG	Graduate M.S.	Ed.S.	Ph.D.
a. 20-24	1___	2___	3___	4___
b. 25-29	1___	2___	3___	4___
c. 30-34	1___	2___	3___	4___
d. 35-39	1___	2___	3___	4___
e. 40-44	1___	2___	3___	4___
f. 45-49	1___	2___	3___	4___
g. 50-54	1___	2___	3___	4___
h. 55-59	1___	2___	3___	4___
i. 60/more	1___	2___	3___	4___

14. How many hours of professional education UG/G, do you have?

	UG	G
1. Below 10	1___	2___
2. 10-14	1___	2___
3. 15-19	1___	2___
4. 20-24	1___	2___
5. 25-29	1___	2___
6. 30-34	1___	2___
7. 35/more	1___	2___

   a. Were any of these professional education hours secured in an Institute program?

	Yes	No
1. Undergraduate	1___	2___
2. Graduate	1___	2___

15. What type of teaching certificate do you have?
   1___ Temporary
   2___ Provisional
   3___ Semi-permanent
   4___ Permanent

15. Continued -
    a. Did course work you completed while attending an Institute assist you in improving your certification? 1__Yes 2__No

16. Prior to your institute attendance, how many years had it been since you went back to college/university?
    1__1 yr. 4__4 yrs.
    2__2 yrs. 5__5-9 yrs.
    3__3 yrs. 6__10 or more years

17. Since attending an Institute, where are you now teaching?
    a__Same state, same school
    b__Same state, different school
    c__Different state
    d__Other. Specify:

    _____

18. Approximately how many students do you teach daily?

	Pre-Institute	Current
a. Below 100	1__	2__
b. 100-149	1__	2__
c. 150-199	1__	2__
d. 200-249	1__	2__
e. 250/over	1__	2__

19. Indicate the number of classes you teach per day.

	Pre-Institute	Current
1. 4 or less	1__	2__
2. 5	1__	2__
3. 6	1__	2__
4. 7 or more	1__	2__

    a. Is the number of classes now taught by you comparable with the number taught by the other teachers of your school?
    1__More taught by you
    2__Less taught by you
    3__Same number (GO TO Q. 20)
    b. Do you think your Institute participation influenced this change in number of classes taught by you?
    1__Definitely 4__None
    2__Some 5__Do not know
    3__Very little

20. How many class preparations do you make daily?

	Pre-Institute	Current
a. One	1__	2__
b. Two	1__	2__
c. Three	1__	2__
d. Four	1__	2__
e. Five/more	1__	2__

21. Do you and the other teachers in your school have an "open" period daily for preparations, grading, conferences, etc.?
    1__All have
    2__Most have
    3__Some have
    4__None have (GO TO Q. 22)
    a. In your school do "laboratory" teachers have more "open" time than "non-laboratory" teachers?
    1__More "open" time
    2__Less "open" time
    3__About same
    b. Do you think your Institute attendance has had a positive influence on "open" periods for teachers of laboratory courses in your school?
    1__A great deal 4__None
    2__Some 5__Do not know.
    3__Very little

22. Do you believe that teachers handling laboratory classes should be given more "open" periods than that given teachers of non-laboratory courses?
    a__Yes) -- Why do you think this?
    b__No)

    _____

    _____

23. Estimate the average number of hours per week you spend on extra-curricular activities. (e.g., noon duty, class sponsor, committees)
    1__Less than 5 hours
    2__5-9 hours
    3__10-14 hours
    4__15 or more hours

24. Did you sponsor a mathematics or science club before your Institute attendance?

1 ___ Yes
2 ___ No

a. Are you currently a sponsor of a mathematics/science club?

1 ___ Yes (ANSWER "b-d")
2 ___ No (GO TO Q. 25)

b. How is your club affiliated?

1 ___ Local only
2 ___ State
3 ___ National
4 ___ Other: _____

c. What are the purposes of your mathematics/science club(s)? (CHECK ALL ITEMS THAT APPLY)

1 ___ Entertainment
2 ___ Exploration (subject areas)
3 ___ Service
4 ___ Research
5 ___ Other: _____

d. Are you doing more with your club since your Institute attendance?

1 ___ More now
2 ___ Less now
3 ___ About the same

25. By virtue of your Institute attendance did/have you receive(d) offers for additional jobs?

1 ___ Yes
2 ___ No (GO TO Q. 26)

a. Indicate general type of job and the approximate salary. (IN COMPARISON WITH YOUR SALARY AT TIME OF OFFER)

	Approximate salary			
	Higher	Lower	Same	Unknown
1. School/School-related	1___	2___	3___	4___
2. Industry/Business	1___	2___	3___	4___
3. Government	1___	2___	3___	4___
4. Salesman	1___	2___	3___	4___
5. Other. Specify: _____	1___	2___	3___	4___

26. Indicate the category for your nine-months teaching income. ("Pre-Institute" indicates the school year in which you received your first NSF Institute grant.)

	Pre-Institute	Current
1. Below $4000	1___	2___
2. $4000-$4499	1___	2___
3. $4500-$4999	1___	2___
4. $5000-$5499	1___	2___
5. $5500-$5999	1___	2___
6. $6000-$6499	1___	2___
7. $6500-$6999	1___	2___
8. $7000-$7499	1___	2___
9. $7500-$7999	1___	2___
10. $8000/over	1___	2___

27. Have you earned additional income as a result of attending an Institute? (DOES NOT PERTAIN TO INCREASE IN ANNUAL SALARY)

1 ___ Yes
2 ___ No (GO TO Q. 28)

a. Indicate sources of this income. (CHECK ALL ITEMS THAT APPLY)

1 ___ Summer school teaching
2 ___ Tutoring
3 ___ Summer school work (Not #1)
4 ___ Camp counselor/Director
5 ___ Judging Math/Science Fairs
6 ___ Writing/Publishing
7 ___ Speaking
8 ___ Research (Industry, etc.)
9 ___ Other. Please specify:

_____

28. To what extent did your Institute attendance influence you in using the following?

	Much	Some	Little	None
1. Multiple-purpose classrooms	1	2	3	4
2. Flexible furniture arrangements	1	2	3	4
3. Usage of student assistants	1	2	3	4
4. Usage of multiple-texts/references	1	2	3	4
5. Depth of coverage of selected areas	1	2	3	4
6. Student involvement in curriculum	1	2	3	4
7. Usage of outside agencies/persons	1	2	3	4
8. Usage of A-V equipment/materials	1	2	3	4
9. "Up-dating" reading materials	1	2	3	4
10. Supplementary reading materials	1	2	3	4
11. Extra-class student assignments	1	2	3	4
12. Learner-centered class presentations	1	2	3	4
13. Student involvement in research	1	2	3	4
14. Open-ended experiments	1	2	3	4
15. Essay/Semi-structured lab write-ups	1	2	3	4
16. Extra-class student projects	1	2	3	4
17. Variation in testing procedures	1	2	3	4
18. Cooperative evaluations	1	2	3	4
19. Standardized tests (e.g., SMSG, ACS)	1	2	3	4
20. Expanding your guidance role	1	2	3	4
21. Varying methods of presentation	1	2	3	4
22. Usage of newer subject-matter concepts	1	2	3	4
23. Usage of generalizations	1	2	3	4
24. Intensifying elective courses	1	2	3	4
25. Challenging the brighter student	1	2	3	4
26. Motivating the creative student	1	2	3	4
27. Encouraging student initiative	1	2	3	4
28. Setting higher student goals	1	2	3	4

29. Select one item from each group of activities/methods to indicate the predominant usage in your course work.

a. Furniture arrangement
   1 Set
   2 Flexible

b. Usage of equipment/materials
   1 Teacher controlled (only)
   2 Student assistants' help
   3 By any student

c. Text(s)
   1 Single (No other reference)
   2 Single (With other references)
   3 Multiple-texts (several used)

d. References
   1 From school library
   2 From classroom library
   3 From city library

e. Course coverage
   1 Breadth (All of text)
   2 Depth (Of selected areas in text)

f. Unit preparations
   1 By teacher (Self)
   2 From text "teacher's manual"
   3 In cooperation with students

g. Planning class/course work
   1 Student/Learner-centered
   2 Teacher-centered

h. Assignments
   1 Specific text pages
   2 "Open" assignment

29. Continued -

i. Class presentations

1___Teacher-centered
2___Student/Learner-centered

j. Laboratory

1___Exercises
2___Experiments
3___Research

k. Experiments

1___Standard ("closed")
2___Open-ended

l. Student projects

1___On class time
2___Extra-class

m. Student projects

1___Largely exhibits
2___Research with paper

n. Test questions

1___Recall
2___Problem-solving
3___Essay

o. Grading/Evaluating

1___Largely from tests
2___With other items besides tests

p. Grading/Evaluating

1___By teacher only
2___With student assistance

q. Grade cards/Progress reports

1___With letter/numerical grade only
2___With both grade and constructive comments to parents/guardians

30. How much would you say you have changed the content of your courses since returning from the Institute(s)?

1___A great deal) --ANSWER "a"
2___Some)
3___Very little) --(GO TO Q. 31)
4___None)

a. In what way(s) have you changed your course content? _____

_____

_____

_____

31. How much would you say you have changed your teaching methods since returning from the Institute(s)?

1___A great deal) --ANSWER "a"
2___Some)
3___Very little) --(GO TO Q. 32)
4___None)

a. In what way(s) have you changed your teaching methods? _____

_____

_____

_____

32. Comparing your current teaching competence with that before your Institute attendance, how effective do you think your present classwork is for the following types of students?

	Much better	Some better	Little better	About the same
a. The gifted student	1___	2___	3___	4___
b. The creative student	1___	2___	3___	4___
c. The average student	1___	2___	3___	4___
d. The slow-learning student	1___	2___	3___	4___

33. How have you informed others about your Institute experiences and the NSF Program for Teachers and Students? (CHECK ALL ITEMS THAT APPLY)

a ___ Talked with individual students
b ___ Spoke to student groups
c ___ Talked with individual teachers
d ___ Addressed teacher groups
e ___ Spoke to PTA
f ___ Spoke to service club(s)
g ___ Talked with parent groups, not PTA ("e")
h ___ Appeared on TV
i ___ Made radio presentation(s)
j ___ Press release(s)
k ___ Wrote newspaper article(s)
l ___ Wrote magazine article(s)
m ___ Other. Please specify:

_____

34. In general, how much interest has been expressed in your Institute experiences and the NSF Program for Teachers and Students?

	Much	Some	Little	None	Do not know
a. Students	1	2	3	4	5
b. Teachers	1	2	3	4	5
c. Administrators	1	2	3	4	5
d. PTA	1	2	3	4	5
e. Parent groups (not PTA)	1	2	3	4	5
f. Lay organizations	1	2	3	4	5
g. Public generally	1	2	3	4	5

35. In what kinds of things about the institute(s) have other teachers seemed to be most interested?

	Great Deal	Some	Very little	None
a. Sources of information	1	2	3	4
b. Locations, purposes, types	1	2	3	4
c. When offered and dates	1	2	3	4
d. Participant selection	1	2	3	4
e. Stipend ("pay")	1	2	3	4
f. Courses offered	1	2	3	4
g. Degree programs	1	2	3	4
h. Professors (e.g., "methods")	1	2	3	4
i. Extra-class activities	1	2	3	4
j. Classrooms, labs, etc.	1	2	3	4
k. Housing and meals	1	2	3	4
l. Other. Please specify.	1	2	3	4
_____	1	2	3	XXXX

36. To what professional journals do you subscribe? (Use standard abbreviations)

a. Special Field
1 _____
2 _____
3 _____
4 _____

b. Professional Education
1 _____
2 _____
3 _____
4 _____

37. Which of the above journals did you start to take since you attended an Institute?

a. Special Field
1 _____
2 _____

b. Professional Education
1 _____
2 _____

38. Besides the journals to which you subscribe, please list the additional mathematics/science/education publications you read regularly.

a. Special Field	b. Professional Education
1_____	1_____
2_____	2_____
3_____	3_____
4_____	4_____

39. To what academic/professional organizations do you belong? (INCLUDE HONORARY)

a. Special Field	b. Professional Education
1_____	1_____
2_____	2_____
3_____	3_____
4_____	4_____
5_____	5_____

40. Which of these organizations did you join during/since your Institute attendance? (IF "NONE", GO TO Q. 41)

a. Special Field	b. Professional Education
1_____	1_____

41. To what honorary organization were you elected during/following your Institute attendance? (IF "NONE", GO TO Q. 42)

a. Special Field	b. Professional Education
1_____	1_____

42. Since your Institute attendance have you been called on to assist in the selection of the following mathematics/science materials?

	Yes	No
1. Textbooks	1	2
2. Reference books	1	2
3. Library books (Not "2")	1	2
4. Periodicals	1	2
5. Films/Stripfilms	1	2
6. Equipment/Apparatus	1	2
7. Supplies	1	2
8. Furniture	1	2

(IF "YES" TO ANY ITEMS, ANSWER "a")

a. Do you think your Institute experience enabled you to be of more help in these selections?
1__ A great deal
2__ Some
3__ Very little
4__ None
5__ Do not know

43. Have you served on any mathematics or science curriculum revision committee(s) since your Institute attendance? (IF "NONE", GO TO Q. 44)
1__ Local
2__ County
3__ State
4__ National

a. To what extent do you feel that serving on the curriculum revision committee was brought about by your Institute attendance? 1__ A great deal
2__ Some
3__ Very little
4__ None
5__ Do not know

44. Have you been engaged in any of the following activities in support of your school mathematics/science program?

	Much	Some	Little	None
1. Sponsor Mathematics/Science Club	1	2	3	4
2. Wrote article for newspaper	1	2	3	4
3. Gave talk(s) to students	1	2	3	4
4. Gave talk(s) to teachers	1	2	3	4
5. Gave address(es) to the public	1	2	3	4
6. Appeared on TV	1	2	3	4
7. Spoke on radio	1	2	3	4
8. Was Mathematics/Science Fair Judge	1	2	3	4
9. Helped secure scholarship fund	1	2	3	4
10. Other. Please specify: _____	1	2	3	XXXX

a. Do you think your Institute experience enables you to be of greater service in supporting the above activities?

1 Definitely; 2 Some; 3 Very little; 4 None; 5 Do not know.

45. How would you rate your academic prestige because of your Institute attendance?

	Higher	Lower	About same	Don't know
a. With your students	1	2	3	4
b. With your colleagues	1	2	3	4
c. With your administrators	1	2	3	4
d. With school parents/patrons	1	2	3	4

46. Have you encountered jealousies and differences among your colleagues because you secured NSF financial assistance for your advanced studies?

1 Yes (ANSWER "a")
2 No (GO TO Q. 47)

a. How predominant has this been among your colleagues?

1 A great deal
2 Some
3 Very little

47. Do you think that you will remain in the teaching profession until retirement?

1 Very likely
2 Fairly likely
3 Not likely at all
4 Do not know
) --(ANSWER "a")

a. Why do you say this? _____

_____

_____

_____

48. How much equipment has your school received as a result of the National Defense Education Act (NDEA)?

1 Much
2 Some
3 Little
4 None
5 We didn't make application

a. Did you gain information about NDEA assistance to schools through the Institute(s) you attended?

1 Much
2 Some
3 Little
4 None

49. Did you learn anything about "Programmed Instruction" in your Institute course work?
1___Yes
2___No

a. Are you using "Programmed Instruction" in any of your mathematics/science courses?
1___Yes (ANSWER "b")
2___No (GO TO Q. 50)

b. Please indicate, briefly, the course and the "Programmed Instruction" material being used:

_____

_____

_____

_____

HIGH SCHOOL TEACHERS PLEASE ANSWER:

50. Since attending an Institute have you included any of these curriculum revisions in your teaching? (IF "NONE", GO TO Q. 52)

	Yes	No	Some
1. SMSG (Math)	1	2	3
2. BSCS (Biology)	1	2	3
3. CHEM (Chemistry)	1	2	3
4. Chem-Bonds (")	1	2	3
5. PSSC (Physics)	1	2	3
6. Other. Specify: _____	1	XXX	3

a. Did your Institute experiences influence you in your decision to include a curriculum revision in your school's mathematics/science program?
1___Definitely
2___Somewhat
3___Very little
4___None
5___Do not know

COLLEGE TEACHERS PLEASE ANSWER:

51. Have the secondary school mathematics/science curriculum revisions (e.g., CHEM, SMSG, BSCS, PSSC) influenced your departmental offerings: courses and/or contents?
1___Definitely; 2___Some; 3___Very little; 4___None; 5___Do not know

a. Do you find that high school students who have had the new course revisions in math/science are better qualified to handle college math/science courses?

	Great deal	Some	Very little	None	Don't know
1. General education courses	1	2	3	4	5
2. Specialized area courses	1	2	3	4	5

BOTH HIGH SCHOOL AND COLLEGE TEACHERS PLEASE ANSWER:

52. Did your Institute experience include a study of any of the secondary school math/science curriculum revisions?

	Yes	No	Some
1. SMSG (Math)	1	2	3
2. BSCS (Bio.)	1	2	3
3. CHEM (Chem.)	1	2	3
4. Chem-Bonds (Chemistry)	1	2	3
5. PSSC (Phys.)	1	2	3
6. Other. Specify: ___	1	XXXX	3

a. Do you feel that such knowledge of curriculum revisions has value for you?
1___Yes)
2___No) --Explain your answer:

_____

_____

_____

_____

_____

53. To your knowledge, the chief purposes of NSF Institutes are to give teachers courses that will:

1___ Renew their knowledge of fundamentals.
2___ Acquaint them with recent developments and advances in science, mathematics, and engineering.
3___ Familiarize them with new approaches to presentation of their subjects.

a. As an Institute participant do you feel that the purposes you checked were attained in KSC's NSF Institute(s)?

1___ Very well
2___ Fairly well
3___ Hardly at all
4___ Do not know

54. On what bases do you think participants are chosen for KSC's NSF Institutes?

	Yes	No
a. Their need for financial assistance	1___	2___
b. Their teaching competence	1___	2___
c. They are promising inexperienced teachers	1___	2___
d. Their scholarship	1___	2___
e. Previous Institute attendance/acceptance	1___	2___
f. No previous Institute attendance/acceptance	1___	2___
g. Baccalaureate degree from KSC	1___	2___
h. Their need for graduate courses/degree	1___	2___
i. They are already in KSC's graduate program	1___	2___
j. Their need for improved certification	1___	2___
k. Their need for refresher courses (fundamentals)	1___	2___
l. Their need for recent subject matter concepts	1___	2___
m. Their need for improved methodology	1___	2___

55. Indicate your reasons for wanting to attend KSC's NSF Institute(s).

	Strength of Motive			
	Strong	Average	Weak	Not Cons'd
a. Needed courses for additional degree	1___	2___	3___	4___
b. Needed courses for certification requirement	1___	2___	3___	4___
c. Needed refresher courses (fundamentals)	1___	2___	3___	4___
d. Needed courses covering new fields/areas	1___	2___	3___	4___
e. Needed new techniques of presentation	1___	2___	3___	4___
f. Needed courses offered in this Institute	1___	2___	3___	4___
g. This Institute was closest to my home	1___	2___	3___	4___
h. This was the only Institute to accept me	1___	2___	3___	4___
i. Wanted salary increment for additional hrs.	1___	2___	3___	4___
j. Wanted prestige associated with an Institute	1___	2___	3___	4___
k. Wanted contact with other math/science teachers	1___	2___	3___	4___
l. Wanted campus cultural associations	1___	2___	3___	4___
m. Wanted to "get paid" for going to school	1___	2___	3___	4___
n. Wanted to prepare for a better position	1___	2___	3___	4___
o. Wanted to improve school science programs	1___	2___	3___	4___

56. Which of the following expectations were realized by you in your Institute participation at KSC?

	Much	Some	Little	None
a. Sharing experiences	1___	2___	3___	4___
b. Growth through extra-class events	1___	2___	3___	4___
c. Association with professors/scientists	1___	2___	3___	4___
d. Expansion of cultural background	1___	2___	3___	4___
e. Learning new laboratory techniques	1___	2___	3___	4___

56. Continued -

	Much	Some	Little	None
f. Renewing knowledge of fundamentals	1	2	3	4
g. Learning new teaching techniques	1	2	3	4
h. Study of newer subject matter concepts	1	2	3	4
i. Expansion of general math/science background	1	2	3	4
j. Solution of personal teaching problems	1	2	3	4
k. Rejuvenated your enthusiasm for teaching	1	2	3	4
l. Other. Specify:_____	1	2	3	XXXX

57. What effects have your Institute attendance had upon your thinking with respect to the following?

	Much	Some	Little	None
a. Enhanced your desire to continue graduate work	1	2	3	4
b. Encouraged you to remain in present position	1	2	3	4
c. Created a desire to teach at higher grade level	1	2	3	4
d. Encouraged you to leave teaching	1	2	3	4
e. Fostered a desire to go into business/ industry	1	2	3	4
f. Increased enthusiasm for teaching math/ science	1	2	3	4
g. Encouraged transfer to other teaching areas	1	2	3	4
h. Encouraged you to demand more of your students	1	2	3	4
i. Other. Specify:_____	1	2	3	XXXX

58. Indicate the KSC NSF institute(s) you have attended by checking the major area studied for the date(s) of attendance.

	Date	Type	Level
a.	1959-60	In-Service	Jr./Sr.High
	1 Biology		
	2 Mathematics		
b.	1960	Summer	Jr. College
	1 Chemistry		
	2 Physics		
c.	1960	Summer	Jr./Sr.High
	1 Biology		
	2 Chemistry		
	3 Mathematics		
d.	1960-61	In-Service	Jr./Sr.High
	1 Biology		
	2 Chemistry		
	3 Mathematics		
e.	1961	Summer	Jr./Sr.High
	1 Biology		
	2 Mathematics		
	3 Physics		
f.	1961	Summer	Junior High
	1 Biological Science		
	2 Physical Science		
g.	1961-62	In-Service	Elementary
	1 Biological Science		
	2 Physical Science		
h.	1961-62	In-Service	Jr/Sr. High
	1 Biology		
	2 Mathematics		
i.	1962	Summer	Jr./Sr. High
	1 Biology		
	2 Chemistry		
	3 Mathematics		
	4 Physics		
j.	1962-63	In-Service	Jr./Sr.High
	1 Biology		
	2 Mathematics		
	3 Mathematics (SMSG)		
	4 Physics (PSSC)		

59. State the following about other Institutes (not KSC) that you have attended:

Date(Sum. 1961, etc.)	Type(Acad.Yr., Summer, etc.)	Level(Elem., Sr.H., etc.)	Area(Math., Phy.Sci., etc.)	Sponsor(GE, NSF, etc.)	School(Coll. Univ.)

60. Rate these aspects of the KSC Institute(s) you attended. (CIRCLE ANY NUMBER OF EACH ITEM, e.g., No. 1, "SUPERIOR", No. 2, "EXCELLENT", etc.)

a. Director	1	2	3	4	5	n. Classwork	1	2	3	4	5
b. Visiting lecturers	1	2	3	4	5	o. Laboratory work	1	2	3	4	5
c. College administrators	1	2	3	4	5	p. Laboratory facilities	1	2	3	4	5
d. Professors: Institute	1	2	3	4	5	q. Research facilities	1	2	3	4	5
e. Professors: Non-Inst.	1	2	3	4	5	r. Gratis materials	1	2	3	4	5
f. Grad. degree programs	1	2	3	4	5	s. Handling routine items	1	2	3	4	5
g. Advisement/Guidance	1	2	3	4	5	t. Gab-sessions, time/place	1	2	3	4	5
h. Courses: Institute	1	2	3	4	5	u. Housing	1	2	3	4	5
i. Courses: Non-Institute	1	2	3	4	5	v. Meals (S.C.Cafeteria)	1	2	3	4	5
j. Activities: Institute	1	2	3	4	5	w. COMPOSITE RATING	1	2	3	4	5
k. Activities: Non-Inst.	1	2	3	4	5						
l. Library: General	1	2	3	4	5						
m. Library: Specific	1	2	3	4	5						

61. In-Service Institute participants please answer the following:

a. When were your class sessions?
1__ Evenings
2__ Saturdays

b. Which class time do you prefer?
1__ Evenings 3__ No preference
2__ Saturdays

c. On an average, how many hours of preparation were necessary for each class session?
1__ 2 hrs/less 3__ 4 hrs
2__ 3 hrs 4__ 5 hrs/more

d. Did this number of hours of class preparations seem excessive to you?
1__ Yes. Explain: _____
_____
2__ No. (GO TO "e")

e. Do you think that the dates on which the Institute(s) began and terminated were satisfactory?
1__ Yes
2__ No. Explain: _____
_____

f. Do you think that the length (in weeks) of the Institute(s) was satisfactory?
1__ Yes
2__ No. Explain: _____
_____

62. Summer Institute participants please answer the following:

a. On an average, how many hours per day did you spend in class attendance?
1__ 3 hrs/less 3__ 5 hrs
2__ 4 hrs 4__ 6 hrs/more

b. Did this number of hrs of daily class attendance meet with your approval? 1__ Yes
2__ No. Explain _____

c. On an average, how many hours per day did you spend on class preparations?
1__ 2 hrs/less 3__ 4 hrs
2__ 3 hrs 4__ 5 hrs/more

d. Did this number of hrs of class preparations seem excessive to you?
1__ Yes. Explain: _____
2__ No. (GO TO "e", ON NEXT PAGE)

62. Continued -

e. Do you think that the dates on which the Summer Institutes began and terminated were satisfactory?
1__Yes
2__No. Explain_____

f. Do you think that the length (in weeks) of the Summer Institute(s) was satisfactory?
1__Yes
2__No. Explain_____

63. If you had another opportunity to attend an Institute, what subject areas would constitute your first two choices? (MAKE ONLY TWO CHECKS)

	1st Choice	2nd Choice
a. Mathematics	1__	2__
b. Mathematics Education	1__	2__
c. Biological Sciences	1__	2__
d. Physical Sciences	1__	2__
e. Science Education	1__	2__
f. Other. Please specify:_____	1__	2__

64. Which one of these three types of NSF Institutes would you prefer as a means to study the areas you selected in the above question?

1__Summer Institute
2__In-Service Institute (Evenings/Weekends)
3__Academic Year Institute (School year)

a. State the reason for your choice:_____

65. Did you apply for one of the above Institutes for 1963-64:

Institute	At KSC?	Elsewhere?	Please specify where	Accepted? Yes	No
a. Summer	1__	2__	_____	1__	2__
b. In-Service	1__	2__	_____	1__	2__
c. Academic Yr.	1__	2__	_____	1__	2__

66. In general, which of these three types of Institutes will provide the best opportunity for you to keep up-to-date in your field during the next five years?

1__Summer Institute
2__In-Service Institute
3__Academic Year Institute
4__Combination. Please specify:_____

66. Continued -

a. Which of the following would you consider as additional methods of keeping up-to-date in your field in the next five years?

	Much	Some	Little	None
1. Independent study	1	2	3	4
2. Institute: Academic	1	2	3	4
3. Institute: Research	1	2	3	4
4. Industry	1	2	3	4
5. Industry: Research	1	2	3	4
6. Other. Please specify: _____	1	2	3	XXXX

67. With a semester or more of time to give you perspective that removes the "halo" effect, modifies the "pressures," and matures your adverse criticism, please comment on the following (For additional space, use the back of the page):

a. The highlight of your Institute(s) experiences at KSC: _____

b. Your most adverse criticism of KSC's NSF Institute(s): _____

c. Your suggestion for correcting the situation expressed in "b" above:

VITA

Don Quentin Milliken

Candidate for the Degree of

Doctor of Education

Thesis: AN EVALUATION OF NATIONAL SCIENCE FOUNDATION INSTITUTES BY THE PARTICIPANTS

Major Field: Higher Education

Biographical:

Personal Data: Born in Carl Junction (Jackson) Missouri, May 29, 1909, the son of Albert Luce and Edith Fern Milliken.

Education: Attended grade school in Altamont and Leon, Kansas; graduated from Labette County Community High School (Altamont, Kansas) in 1927; received the Bachelor of Arts degree from Southwestern College (Winfield, Kansas), with a major in Zoology, in July, 1936; received the Master of Science degree from Kansas State College (University), with a major in Zoology, in August, 1949; attended five NSF Institutes: Oak Ridge Institute of Nuclear Studies (1), Kansas State College of Pittsburg (2), Oklahoma State University (2); graduate work at the University of Wichita (Ks.) and the University of Colorado; completed requirements for the Doctor of Education in August, 1964.

Professional Experience: Fifteen years experience in Kansas secondary schools as science teacher, biology teacher, and audio-visual director; one summer as zoology instructor at Southwestern College (Winfield, Kansas); twelve years experience at Kansas State College of Pittsburg as science supervisor and audio-visual coordinator in the College Laboratory High School (Associate Professor, Department of Education and Psychology).

Professional Organizations: American Association of University Professors, Association of Higher Education, Association of Student Teaching, National Education Association (Life), Kansas State Teachers Association, National Science Teachers Association (Life), National Association of Biology Teachers, Kansas Academy of Science, Phi Delta Kappa, Beta Beta Beta, American Institute of Biological Sciences.