DOCUMENT RESUME

ED 072 934 SE 014 938

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TITLE A Questionnaire Study Relative to Science Education Methods Courses in Teaching Science at the Elementary Level.
PUB DATE [72]
NOTE 35p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Educational Research; *Elementary School Science; Methods Courses; *Preservice Education; Questionnaires; *Science Education; Science Teachers; Surveys; *Teacher Education; Teacher Education Curriculum
IDENTIFIERS Research Reports

ABSTRACT

This study was conducted to secure information about various academic and organizational aspects of pre-service science methods courses for elementary school teachers. About 65 percent of all respondents to the questionnaire indicated a semester plan in existence as against 27 percent for a quarter system for preparing elementary teachers. Most colleges offered a course in Teaching Science in the Elementary School for one quarter or semester. Very few colleges offered such courses for more than two sequential terms. Many schools placed equal emphasis during science methods courses upon ways to teach science and upon the acquisition of scientific knowledge. Such courses were taken generally by prospective elementary school teachers during their junior or senior years. Most frequently the college of education controlled such courses but in some colleges it was controlled by division of science. Most science methods educators in colleges had participated in new science curriculum workshops or training sessions. These new curriculum projects had had a definite impact on the nature of the course in general and specifically on instructional procedures emphasizing the processes of science. (PS)

A Questionnaire Study Relative to Science Education Methods Courses in Teaching Science at the Elementary Level

by

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INTRODUCTION

This paper is a report of a questionnaire study relative to science education methods courses in Teaching Science in the Elementary School for prospective elementary teachers. The study was initiated by the authors in connection with their participation as post-doctoral fellows in the Training of Teacher Trainers (TTT) Project in Science and Mathematics Education at New York University during the school year 1970-71.

The study originated as a result of discussions in the TTT Project seminars and of interactions with other science education post-doctoral participants. Two of several recurring problems, which appeared to be of interest to some of the participants, were concerned with the nature of the methods courses in teaching science for prospective elementary teachers and with the impact which the new elementary science projects have had upon the methods courses in science at the colleges or universities where such courses are offered. Various opinions are to be heard relative to the latter problem. Some individuals are saying that the new science curriculum projects have had little, if any effect, on methods courses while the following quotation indicates that they have had and are having an impact.

> ... Now new science programs for elementary schools are available and are being introduced into schools. At the same time important changes are taking place in college science teaching and preservice teacher education programs are under constant study. Many innovations are being introduced. The support by the U. S. Office of Education of the development of Model Projects for the preservice education of elementary teachers may result in changes on a wide scale.[1]

While some evaluations nave been made of new elementary science curriculum workshops for elementary teachers, a review of the literature shows no comprehensive study as to what impact the new elementary science curriculum projects have had upon science education methods courses throughout the nation. This finding points to the need for the present study, not only to ascertain what has happened, but also to serve as a point of reference in decision making at institutional and national levels as to what should be the desired impact and as to how monies should be allocated to bring about the most efficacious means for achieving the desired influence.

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[1] AAAS Commission on Science Education. Preservice Science Education of Elementary School Teachers. Washington, D.C.: American Association for the Advancement of Science. 1969. p. 5.

Purposes of the study. The main purposes of the study were to secure information relative to the

1) administrative, organizational, and instructional patterns of science education for prospective elementary teachers at the college or university level;

2) professional background and professional experiences of individuals directly associated with science education instruction for prospective elementary teachers; and

3) impact which selected new science curriculum projects may have had upon the instructional materials and procedures employed in college or university programs designed to prepare prospective elementary teachers to teach science in the elementary school.

Collection of data. The data in this study were collected by means of a questionnaire which was prepared by the authors. The questionnaire was designed as an unsigned instrument. However, respondents were given an option to sign if they so desired. Preliminary drafts of the questionnaire were reviewed by science education post-doctoral colleagues in the TTT program and administrative personnel. Special credit and appreciation are due Dr. George Manolakes, Director, TTT Project and Dr. Darrell Barnard, Science Director TTT Project and Head of the Science and Mathematics Education, New York University, for their support, interest, and personal involvement in reviewing and in offering constructive suggestions in the preparation of the instrument.

The questionnaire contained 84 items and was intended to be completed by science educators who were directly concerned with instruction in a college or university methods course in Teaching Science in the Elementary School. In order to reach as many science educators as possible, it was decided to not only mail the questionnaire to the individuals who were members of a national science education association, but also to the deans of colleges of education throughout the United States with a request that the questionnaire be forwarded to the appropriate individual in their institution.

The mailing list was assembled from two sources. Printed mailing labels of the names and addresses of deans of colleges and of members of the Association for the Education of Teachers of Science (AETS) were obtained from the office of the National Science Teachers Association. A set of printed mailing labels were also secured of the membership of the National Association for Research in Science Teaching (NARST) through the office of the secretary of that organization. The deans list contained approximately 2500 names, the AETS list some 500 names and NARST list something over 400 names. The science educator lists were checked so that no duplicate mailings would occur and an effort was made to eliminate the names of deans of junior colleges, technical institutes, medical schools and other colleges whose titles suggested that they were not preparing elementary teachers from the list of deans which had been obtained for the office of NSTA.

The first mailing of 1,671 questionnaires was completed on April 23, 1971 and a second mailing of 450 questionnaires was completed on May 7, 1971. The two-week delay of the second mailing was due to an unforeseen situation which resulted in an insufficient number of mailing envelopes for the mailing to be completed on April 23. Each mailing envelope contained a descriptive letter, a questionnaire, and an addressed return envelope which showed a return Postage Permit.

Approximately 2000 questionnaires were mailed and 518 usable questionnaires were returned to the authors. The data from the returned questionnaires were transferred to IBM data cards and computer analyzed for the number of individuals responding to a given item and the percent of the total responses represented by that number.

Table I shows the number and percent of returned questionnaires from each of the twelve National Science Teachers Associations' designated Districts. Inspection of this table reveals that, with the exception of Districts II and VI, the percent of returned questionnaires from each District falls within a 4 percent to 9 percent range. However, since a significant larger percent of the returns were from District II than from, for example, District V, and due also to the fact that the items were not analyzed according to specific districts, the findings of this study cannot be generalized as representative of any specific District. The findings are descriptive only of the responses of the individuals regardless of their geographical locations. As would be expected, all respondents did not mark every item. Therefore, the total responses to some items are less than the reported number of returned questionnaires. It should be noted that no effort was made to isolate individuals as to specific colleges or universities. Therefore, the reported number of responses to given items on the questionnaire should not be interpreted as representative of the number of institutions since there may have been more than one individual responding to the questionnaire from a single institution. Further limitations of the study are that class sizes were not investigated and no attempt made to organize the data according to institutional enrollments, or to whether the institutions were public or private. It should also be noted that in developing items for the questionnaire, it was assumed that the training which was designed to prepare prospective elementary teachers for teaching science in the elementary school, whether a single course or a combined course with another area or experience pattern, could be designed as "the course in Teaching Science in the Elementary School." Thus, the reader should recognize that the course findings of this study rest upon this assumption.

General institutional findings. Fifty-nine (59) percent* of the respondents indicated that they were teaching in public institutions (college or universities). Analysis of the responses of all the respondents shows that the college or university in which they were teaching was organized most frequently on a semester (16-18 weeks) period of instruction. Sixty-five (65) percent indicated a semester plan and only twenty-seven (27) percent reported a term or quarter (10-12 weeks) instructional pattern. Approximately seven (7) percent said their institution was organized on a 13-14 weeks period.

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*All percents are expressed to the nearest whole number.

Table I. Questionnaires Received From NSTA Districts

NSTA District	States in the District	Number of Questionnaires Received from the District	Percent* of the Total Number of Questionnaires
I.	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	40	8%
II.	New Jersey, New York, Pennsylvania	97	19%
III.	Deleware, District of Columbia, Maryland, Virginia, West Virginia	28	5%
IV.	Kentucky, North Carolina, South Carolina, Tennessee	41	8%
V.	Alabama, Florida, Georgia, Mississippi	22	4%
VI.	Indiana, Michigan, Ohio	72	14%
VII.	Minnesota, North Dakota, South Dakota, Wisconsin	32	6%
VIII.	Illinois, Iowa, Missouri	45	9%
IX.	Arkansas, Louisiana, Oklahoma, Texas	31	6%
X.	Colorado, Kansas, Nebraska, New Mexico, Wyoming	36	7%
XI.	Alaska, Idaho, Montana, Oregon, Washington	31	6%
XII.	Arizona, California, Hawaii, Nevada Utah	43	8%
		518	100%

*Rounded to nearest whole number.

Approximately forty-one (41) percent indicated that the institution in which they were teaching offered both undergraduate and master degrees. Thirty-one (31) percent reported they taught in an institution which offered undergraduate, master, and doctor degrees, and twenty-eight (28) percent reported that their college or university offered only an undergraduate degree program. Less than one (1) percent of the respondents indicated that they were associated with an institution which was concerned only with graduate programs.

Thirty-three (33) percent of the individuals surveyed were teaching in institutions with an enrollment of between 1,000 and 5,000 students. One hundred and three individuals (20 percent) were at institutions with enrollments of between 5,000 and 10,000 students and approximately twenty-one (21) percent taught at an institution having an enrollment of 10,000 to 35,000 student. Eighteen (18) percent of the respondents were teaching in schools with enrollments of less than 1,000 students and only twenty-two (22) individuals were associated with colleges or universities with enrollments of over 35,000 students.

THE BASIC, UNDERGRADUATE, ON-CAMPUS COURSE OR EXPERIENCE IN TEACHING SCIENCE IN THE ELEMENTARY SCHOOL

Organizational features of the course. Three hundred (300) individuals indicated that the course in Teaching Science in the Elementary School was a one quarter or semester course. Thirty-two (32) reported that their institution offered two sequential courses or experiences designed to prepare students to teach science at the elementary level and seven (7) indicated that more than two sequential courses or experiences in science education were offered at their institution for prospective elementary teachers.

According to three hundred and thirty-six (336), the course at their institution was designed basically as a methods course in which the main emphasis was upon objectives, teaching procedures, evaluation, and the processes (skills) and attitudes of scientific endeavor. One hundred and forty-nine (149) individuals reported that the course placed about equal emphasis upon ways to teach science and the acquisition of scientific knowledge. Less than four (4) percent (18 individuals) indicated that the main emphasis of the course was the acquisition of scientific facts, concepts, and principles.

It is of interest to note that fifty-nine (59) respondents reported that at their institution the one quarter or semester offering in teaching science included training in teaching science and also teaching mathematics at the elementary level. Forty-five (45) indicated a one quarter or semester course which included coverage of some subject matter teaching other than mathematics in addition to science instruction. Also of interest is the finding that twenty-seven (27) respondents reported that the offering at their institution was a one quarter or semester experience, but not an academic course in the usual meaning of the term course.

An analysis of the data relative to type of instructional situations and clock hours per week revealed that at least one feature of the course was a large group situation in which there might be lectures, demonstration, discussion, and other types of instruction. Of the three-hundred and fifty-six (356) individuals who indicated such a feature, one hundred (100) reported such a one

hour session per week. Eighty-four (84) reported two hours were allocated for this type of learning situation per week and one hundred and twenty-four (124) indicated that the students were given three hours per week of large group instruction. An organization plan of four or more hours per week in the large group situation was noted by forty-eight (48) individuals.

While the data were not analyzed for combinations of instructional situation, one hundred and fifty-two (152) respondents reported that the schedule for the course called for small group discussion sessions. Of these respondents, seventy-eight (78) responded that such sessions were scheduled for one hour per week, thirty-nine (39) indicated two hours were spent in small group discussions, twenty-eight (28) reported three hours of discussion situations per week, and seven (7) indicated that more than three hours were allocated for this type of instruction.

Laboratory work was scheduled for the students in the course according to two hundred and twenty-one (221) individuals. The time spent in laboratory activities varied from one hour per week to four or more hours per week. Sixty-nine (69) individuals reported one hour per week, ninety-seven (97) two hours per week, thirty-three (33) three hours per week, and twenty-two (22) four or more hours per week in laboratory work.

Another feature of some course organization was an elementary classroom observation or teaching requirement. This was a requirement according to one hundred and thirty-two (132) of the respondents. Seventy-four (74) reported a requirement of one hour per week, twenty-eight (28) of two hours, fifteen (15) of three hours, and thirteen (13) of four or more hours per week. Fifty-five (55) persons marked other types of situations, but these responses were not tabulated as to specific situations.

Place in prospective elementary teacher's program-requirements. The responses indicated that the course in Teaching Science in the Elementary School was most frequently a part of a prospective elementary teacher's program during the students' junior or senior year. Twenty-two (22) percent or one hundred and twelve (112) of the respondents indicated the course was designed to be taken during the junior year, nineteen (19) percent indicated the senior year, and forty-three (43) percent signified either the junior or senior years. The data also revealed that the course could be taken in a few instances by freshmen, sophomores, or by a student with freshman, sophomore or higher status.

According to eighty (80) percent of the respondents (407 individuals), the course was a required part of the prospective teacher's program. Twenty-eight (28) percent (143 individuals) noted that the students were not required to have any previous college science courses before taking the course in Teaching Science in the Elementary School. However, fifty-five (55) percent (278 individuals) indicated that the students were required to have had certain specified college courses or a certain number of credit hours in science before taking the course and seventeen (17) percent (83 individuals) noted that the students were required to have had or to be taking concurrently certain specified college courses or a certain number of credit hours in science in order to enroll in the course in Teaching Science in the Elementary School. Of the individuals (361) who reported that some science was

required as a prerequisite for the course, one hundred and twenty-one (121) noted that the students in their institution had to fulfill a requirement of between five and ten semester hours and seventy-two (72) indicated the requirement to be between ten and fifteen quarter hours. These findings show that the science requirement in the institutions represented by one hundred and ninety-three (193) of the respondents was similar as far as credit hours were concerned. Fifty-seven (57) individuals reported that more than ten hours of science were required at their institution and twenty-six (26) noted a requirement of more than fifteen quarter hours. There were some eighty (80) respondents who were from institutions where the requirement was less than five quarter or five semester hours or between five and ten quarter hours.

Administrative control-staff-frequency of offering-enrollments. The data showed that the administrative control of the course was most frequently under the administration of the college or division of education. This was the case in the institutions where three hundred and seventy-nine (379) of the respondents were teaching. The course was administered by the college or division of science in the institutions represented by sixty (60) of the respondents. Forty-four (44) individuals reported that the administrative control rested jointly in the college or division of education and in the college or division of science. The data, according to some twenty individuals, showed administrative control to be in a Science and Mathematics Teaching Center or Science Teaching Center.

It is of interest to note that while three hundred and seventy-nine (379) individuals reported that administrative control of the course was under a college or division of education only three-hundred and forty-nine (349) indicated that the instructor in the course had an appointment in the college or division of education. Also of interest is the finding that although sixty (60) reported that such control rested in a college or division of science, the responses of eight-nine (89) showed the instructor to have any appointment in the college or division of science. Forty-nine (49) responses indicated dual appointments and some twenty (20) responses showed the instructor appointment to be in a Science and Mathematics Teaching Center or Science Teaching Center.

One hundred and sixty (160) respondents indicated that the number of regular staff members who could be assigned to teach the course was one individual. Approximately the same number (153) reported that two individuals were available for such an assignment. One hundred and six (106) reported a regular staff of three qualified individuals. Forty-two (42) reported staffs of four persons, nineteen (19) of five individuals, and twenty-seven (27) said there were more than five persons who could be assigned to teach the course.

The course, exclusive of summer session, in the institutions represented by the respondents, was regularly offered each quarter or semester during the academic year according to three hundred and seventy-nine (379) individuals. However, one hundred and twelve (112) respondents reported that the course was offered only once a year and twenty-three (23) indicated the course was available on alternate years. There was only one scheduled offering each

quarter or semester according to two hundred and forty-three (243) individuals. Sixty-six (66) individuals indicated they were teaching at institutions where two scheduled offerings were available each quarter or semester and one hundred and ninety-four (194) reported that more than two scheduled offerings were available each quarter or semester.

In addition to the course being offered on-campus, one hundred and thirty-two (132) of five hundred and fourteen (514) respondents noted that the course was offered both on-campus and also off-campus.

Total enrollment in the course during the academic year (including summer session where offered) was less than 100 students in the institutions represented by two hundred and twenty-eight (228) of the respondents. Seventy-five (75) respondents indicated that the enrollment in their institution ranged between one hundred and one hundred and fifty students. One hundred and three (103) reported total enrollment between one hundred and fifty and three hundred. Sixty-one (61) individuals were from institutions where the total enrollment ranged between three hundred and five hundred students while forty-two (42) indicated the enrollment at their institution was between five hundred and one thousand students each year.

Implementation of the course. The course in the institutions represented by three hundred and fifty-one (351) respondents is normally taught by the same instructor each quarter or semester the course is offered. Fifty-five (55) reported that the course is handled by one instructor one quarter or semester and by another instructor at a different time. The other one hundred and four (104) individuals responding to the item relative to handling the course indicated a variety of teacher combinations or assignments.

With respect to the content and methodology of the course, one hundred and forty-seven (147) felt the course was basically the same regardless of the individual teaching the course. In contrast, one hundred and forty-six (146) responded that they believed the course to be quite different when different individuals taught the course. The other two hundred and fifteen (215) of a total of five hundred and eight (508) who responded to this item reported that the course was their responsibility since they were the only person handling the course.

Of five hundred and seven (507) respondents, three hundred and sixteen (316) reported that the students in the course were expected to use a basic text or texts in the course. No attempt was made to calculate the frequency of the use of any text or texts.

Summary. The following descriptive statements relative to on-campus courses for teaching science at the elementary level appear to be justified in view of the data collected in this study. In general, prospective elementary teachers are required to take a course in teaching science at the elementary level as a part of their overall preparation toward becoming an elementary teacher. Such a course, in the majority of instances, was a one quarter or semester offering in which the main emphasis was placed upon the content and processes inherent in the methods of teaching science at the elementary level. A few schools offer two or more sequential courses or experiences, but this situation appears to be an exception to the general pattern.

The course was most frequently designed to implement methodological objectives. However, the course, according to over one hundred (100) respondents, stressed both methodology and science content and there was some evidence that the course in a few cases had as the main objective the acquisition of scientific knowledge per se. There was also some evidence that the course was designed to cover instruction in the teaching of science and also the teaching of mathematics or the teaching of some other academic discipline.

The course, according to the majority of the respondents, had one or more large group instructional situation per week. The time allocated for such group instruction varied from one hour per week to four or more hours per week with either one hour or three hours per week being the most frequent patterns. From the data, it appeared that a few courses were organized entirely as large group situations while others did not have any large group situations for instructional purposes. It also appeared that the instructional pattern in many cases included, in addition to large group situations, either small group discussions or laboratory periods. The time most frequently allocated for discussion sessions was one hour per week and for laboratory work two hours per week. Laboratory work was reported as a feature of the course by over two hundred (200) respondents.

The course was normally a part of the prospective elementary teacher's program at the junior or senior year. College science credit was a prerequisite or concurrent requirement for enrolling in the course in more than half of the courses described by the respondents. Five to ten semester hours of science was the most frequently reported science requirement and it appeared that in some institutions students could enroll in the course without taking any college science.

Administrative control of the course was generally under a division or college of education. Staff appointments were also largely in a division or college of education. However, there was evidence that a division or college of science administered the course in some instances and that appointments for staffing the course sometimes rested in a division or college of science even when the course was administered by a division or college of education. It is also to be noted that forty-nine (9) of the respondents reported that the instructor in the course had dual appointments in the division or college of education and the division or college of science. One could infer from the data that in schools with a small enrollment one person was available for teaching the course while in schools with larger enrollments two or more individuals were available for the assignment. Two hundred and fifty-nine (259) respondents indicated that they were teaching in institutions where two or three persons were available for assignment to teach the course.

The course was offered in most institutions each quarter or semester during the academic year and was usually taught by the same instructor. However, one could infer from the data that in the institutions with large enrollments and two or more instructors available for teaching the course that the number of course offerings and the teaching assignments would vary from one quarter or semester to another quarter or semester. It is of interest to note that approximately an equal number of respondents thought the content

and methodology of the course in their institutions was the same regardless of the person assigned to teach the course as those who considered the course to be different when handled by different instructors. A basic text (or texts) was used in the course according to more than three hundred (300) of the respondents.

PROFESSIONAL BACKGROUND AND TEACHING EXPERIENCES OF THE INDIVIDUALS COMPLETING THE QUESTIONNAIRE

The questionnaire was designed to be completed by a person who was directly involved with science education for prospective elementary teachers. This was done basically in order to furnish information relevant to the previously mentioned purpose of the study. This section presents the findings of the study relative to the academic background and teaching experiences of the respondents to the questionnaire.

Undergraduate degrees-majors. The B.S. degree was held by most of the respondents although one hundred and eighty (180) said they had an A.B. degree. Sixteen (16) individuals indicated they had earned both an A.B. and a B.S. degree and three (3) reported having a B.E. degree.

Five hundred and four (504) individuals gave information relative to their undergraduate preparation in education. Two hundred and thirty-four (234) indicated that their undergraduate program included a major in education and one hundred and twenty-three (123) reported a minor in this area. Sixty-six (66) indicated some education, but less than a minor and seventy-nine (79) reported that they had not taken any courses in education. One hundred and twenty-six (126) said their bachelor degree was in education.

With respect to undergraduate preparation in science, one hundred and seventy-six (176) had a major in the biological sciences, fifty-three (53) in general science, one hundred and eleven (111) in chemistry, thirty-eight (38) in physics, and eighteen (18) in earth science. Eight (8) persons reported majors in two of these areas. From the data secured, one could infer that many of these individuals also had a minor in science in academic areas other than their major. Fifty-seven (57) reported a minor in the biological sciences, sixty-five (65) a minor in general science, eight-four (84) a minor in chemistry, seventy-eight (78) a minor in physics and seventeen (17) a minor in earth science. The data also showed that many of the respondents had had some work in one or more of these science areas but not enough to constitute a minor. Six (6) respondents indicated that they had not taken any science courses as an undergraduate. There were one hundred and seven (107) with a bachelor degree in the biological sciences, fifty-five (55) in physical science, seventy (70) in science (not specified as to area), twenty-two (22) in science education, and twelve (12) in mathematics.

Graduate degrees-master. One hundred and eight-five (185) of the respondents held a M.S. degree, one hundred and seventy-one (171) an A.M., fifty-three (53) an Ed.M., and thirty-two (32) a M.A.T. degree. Fifty-six (56) individuals

held two master degrees. The number of individuals holding master degrees in specific areas was as follows: two hundred and seven (207) in education, ninety-four (94) in science education, forty-nine (49) in the biological sciences, thirty-eight (38) in science (not designed as to area), thirty-eight (38) in science and education, sixteen (16) in earth science or general science, sixteen (16) in non-specified areas, and three (3) in mathematics.

Four hundred and twenty-seven (427) individuals had master programs which included some work in the field of education. However, sixty-seven (67) persons reported that their programs did not include any credit hours in education.

Many of the individuals had completed a masters degree which included at least some graduate science credit. One hundred and ninety (190) reported some graduate credit in the biological sciences, eighty-one (81) some graduate credit in physical sciences, fifty-three (53) some course or courses in botany, forty-eight (48) some work in zoology, one hundred and forty-one (141) some credit in chemistry, one hundred (100) some credit in physics, and over one hundred (100) with some credit in geology or earth science.

Graduate degrees-doctor. Four hundred and twenty-five (425) responded to the item on the questionnaire relative to graduate work at the doctorate level. There were one hundred and ninety-three (193) with an Ed.D. degree and one hundred and fifty-two (152) holding a Ph.D. degree. Forty-eight (48) indicated they were working on an Ed.D. and twenty-nine (29) on a Ph.D. Three (3) individuals indicated they planned to begin work on the degree. The number of individuals holding a doctoral degree in specific areas or pursuing a degree in that area follows: one hundred and ninety-five (195) in science education, one hundred and eighty-eight (188) in education, thirteen (13) in science (not specified as to area), thirteen (13) in the biological sciences, five (5) in physical science, two (2) in earth science-general science, and six (6) in other areas (not specified).

Teaching experiences. Two hundred and ninety (290) respondents reported having taught in public elementary schools and seventy-two (72) in private elementary schools. With respect to length of service in elementary schools, over one half of the respondents had had five or more years of experience in teaching in elementary schools. As to teaching experience in private or public secondary schools, three hundred and sixty-seven (367) indicated that they had taught at this level. Over one half of the respondents with secondary experience in public schools reported that the experience was five or more years. However, in the private schools over half had had less than five years in such schools. At the college or university level, nearly three hundred (300) of the respondents had been teaching at this level for five or more years and, of these, approximately one hundred and twenty-five (125) had had eleven or more years of college or university teaching responsibility.

Regarding teaching assignments at the college or university level, over four hundred (400) said they had taught a course in teaching science at the elementary level for one or more years. Over one hundred (100) of these reported having taught such a course for five or more years. The data revealed that many of these respondents had also taught science courses at the college or university level. One hundred and twenty (120) reported having taught

biological sciences, one hundred and thirty-nine (139) physical sciences, sixty-seven (67) chemistry, and fifty-nine (59) earth science. Nearly two hundred (200) of the individuals reported that they had handled a course in teaching science in secondary school.

Present teaching assignments. The data showed that the teaching responsibility of one hundred and twenty-six (126) of the respondents included only science education courses. Approximately two hundred (200) of the respondents said they were teaching science education courses and other education courses and ninety (90) indicated that in addition to teaching the course in teaching science in the elementary school that they were also teaching a college science course. Nineteen individuals reported that they taught science courses in a laboratory school and also the course in teaching science at the elementary school. It is to be noted that three hundred and thirty-five (335) individuals reported that they taught the course in teaching science in the elementary school every time the course was offered in their respective institutions.

Summary. While no value judgments relative to the professional and/or academic preparation of science educators are intended in this study, the findings of the study support the following statements and notations. More than half of the persons (science educators) responding to the questionnaires had majors or minors in education as a feature of their undergraduate programs. With respect to science preparation, considerably more than half had a major in some science area and, one could infer that many of these individuals also had a minor in one or more science area. There were more individuals with majors in the biological science than any other area although over one hundred (100) had a major in chemistry and thirty-eight (38) had a major in physics. Approximately half of the undergraduate degrees had been earned in a science area and about thirty-three (33) percent in education or science education. There were seventy-nine (79) individuals who had not taken any education courses as an undergraduate and six (6) who had not scheduled for any science courses.

While about thirty-three (33) percent of the undergraduate degrees had been earned in education or science education, the data revealed that at the master's level approximately seventy (70) percent of the degrees had been awarded in education or science education. Only about fourteen (14) percent indicated that their master's degree did not included any credit hours in education. The master programs of approximately two hundred (200) respondents showed some graduate credit in the biological sciences. Science areas in which a hundred (100) or more persons indicated some graduate credit were chemistry and physics. Other areas in which forty (40) or more of the respondents had taken graduate work were physical sciences, earth science, botany, zoology, and geology. Approximately one hundred (100) of the respondents had received their master's degree in a science area.

The doctorate degree was held by three hundred and forty-five (345) of the individuals who provided information relative to the degree. Seventy-seven (77) indicated they were working on a program leading to the doctorate and three (3) planned to begin their doctoral studies. Thus, there were four hundred and twenty-two (422) of the individuals who had completed or were in the process of completing a doctor's degree. Ninety-one (91) percent of the

degrees were in education or science education and approximately eight (8) percent in a science area. Information was not collected relative to credit hours in education or in science as features of the doctoral degree programs.

The data revealed that more than half of the respondents had had teaching experience at the elementary school level and that more than half had taught in secondary schools. Most of the individuals reporting elementary or secondary teaching experience indicated that they had taught at these levels for five or more years.

Ninety-five (95) percent of the individuals who completed the questionnaire indicated they had taught the course in Teaching Science in the Elementary School. This finding adds validity to the general results of the study in that the questionnaire was to be completed by individuals who were directly involved with science education for prospective elementary teachers. Over two hundred of the respondents had taught such a course for five or more years, and one hundred and thirty-three (133) three or four years.

While the teaching assignments of practically all the respondents, at the time the questionnaire was completed, were in science education and/or other education areas, ninety (90) individuals reported that they were also teaching a college science course and nineteen (19) reported they were teaching science courses in a laboratory school in addition to science education. Fifty-five (55) respondents indicated that they had taught a course or courses at the college level in the biological sciences for five or more years. The number of individuals who reported teaching other specific college science courses for five or more years were: fifty-seven (57) physical science, thirty (30) chemistry, and seventeen (17) earth science.

FINDINGS RELEVANT TO IMPACT OF SELECTED SCIENCE CURRICULUM PROJECTS

While it was recognized that the publications of other study groups and of individuals may have had an impact on elementary science education at the college or university level, this study was limited to the three projects which were considered to be the most widely disseminated at the time that the study was undertaken. These were: Science--A Process Approach (SAPA); Elementary Science Study (ESS); and Science Curriculum Improvement Study (SCIS). In this study, the phrase "new science curriculum projects" refers specifically to the ESS, SAPA, and SCIS projects.

Participation in projects. One-third of the respondents (167) indicated that they had been associated either directly or indirectly with all three of the projects. However, nearly as many (31%) reported having had no association with any of the new science curriculum projects. Table II shows the number of respondents who had been associated with single projects or combinations of two or more of the projects.

Table II. Association With Projects

NAME OF PROJECT	RESPONDENTS NUMBER	RESPONDENTS PERCENT*
Science--A Process Approach (SAPA)	63	12%
Science Curriculum Improvement Study (SCIS)	28	6%
Elementary Science Study (ESS)	20	4%
SAPA and SCIS	32	6%
SAPA and ESS	23	5%
ESS and SCIS	14	3%
SAPA, ESS, and SCIS	167	33%

*Percent of individuals who responded to this part of the questionnaire.

From the data in Table II, one may conclude that the respondents had been associated most frequently with SAPA or with SAPA in combination with one or more of the other projects. With respect to having been a writer on one of the projects, seven (7) reported they had been a writer in the SAPA project, five (5) in the ESS project, and six (6) in the SCIS project. Less than five (5) percent had participated as writers on any of the projects. Table III presents data relative to the respondents' experiences as participants in workshops or training sessions concerned with the new curriculum projects or as persons conducting such workshops or sessions.

Table III shows that sixty-four (64) percent of the sampled science educators had participated in a workshop or training session designed to familiarize the participants in one or more of the new curriculum projects. Likewise, forty-one (41) percent had attended such meetings where leadership training had been provided for conducting trial centers for one or more of the projects. Of the three hundred and twenty-five (325) who had attended a workshop or session for gaining information regarding the project materials, two hundred and ten (210) reported experiences with two or more of the projects and one hundred and forty-three (143) indicated familiarity with all three of the projects as a result of workshops or training sessions. Due to these findings, one may infer that a majority of the workshops or training sessions for familiarizing participants with project materials were designed to cover two or more of the projects. However, it would appear that the majority of the leadership workshops or training sessions were designed for experiences relevant to only one project.

Table III. Participation in Workshops or Training Sessions

NAME OF PROJECT	Participation in a workshop or training session designed to: Familiarize participants with the project materials		Provide Leadership for Conducting trial centers		Conducted a workshop or training session with special emphasis on the project	
	Number	Percent*	Number	Percent*	Number	Percent*
Science A Process Approach (SAPA)	56	11%	43	9%	42	9%
Science Curriculum Improvement Study (SCIS)	37	7%	49	10%	16	3%
Elementary Science Study (ESS)	22	4%	24	5%	23	5%
SAPA, SCIS, and ESS**	143	29%	40	8%	98	19%
SAPA and ESS**	32	6%	12	2%	74	15%
SAPA and SCIS**	25	5%	20	4%	14	3%
SCIS and ESS**	10	2%	13	3%	10	2%
SAPA, SCIS, and ESS (Combined)	325	64%	201	41%	277	56%
None	173	35%	289	59%	213	44%
TOTALS	498	99%	490	100%	490	100%

* Percent of individuals who responded to this part of the questionnaire.
** Responses did not indicate whether the workshop or session was for each project or one designed to cover the projects in the same workshop or session.

Examination of Table III also shows more than half of the respondents had conducted workshops or sessions in one or more of the new curriculum projects. While there were ninety-eight (98) who indicated that they had conducted workshops or sessions in SAPA, ESS, and SCIS, it seems reasonable to infer that in a vast majority of cases, the sessions had been designed to emphasize one or more of the projects rather than all three.

Summary. While a third of the science educators in this study had been associated either directly or indirectly with all three of the new science curriculum projects, a like number had not been associated either directly or indirectly with

any of the new projects. Less than five (5) percent had been associated as a writer on any of the projects. Of the individuals who had been associated with the new curriculum projects, more had been connected in some manner with SAPA than any other of the projects.

More than half of the science educators had participated in new curriculum workshops or training sessions designed to familiar the participants with one or more of the projects. Two hundred and ten (210) had had such an experience whereby they became more familiar with two of the projects and one hundred and forty-three (143) had become more familiar with all three of the projects through participation in workshops or training sessions. Less than half of the science educators had attended workshops or training centers designed to provide leadership for conducting trial centers.

Some impact of the new science curriculum projects may be inferred from the number of science educators who have conducted workshops or training sessions which covered one or more of the projects. Over half of the respondents had conducted such sessions and, it is to be noted, that more of these sessions had been designed to implement SAPA or SAPA with another project than any of the other programs.

Impact on the course in teaching science at the elementary level. Table IV summarizes the respondents' markings relative to the influences the new curriculum projects had had upon certain aspects of the course in the college or university where they were teaching. From the data in Table IV, one may infer that the influence has been quite significant as approximately eighty (80) percent of the respondents reported that the projects have had a definite impact upon the nature of the course at their respective institutions. To the educators who

Table IV. Impact Upon Certain Aspects of Course

Aspect of Course	Little if any Impact or Influence		A Definite Impact or Influence	
	Number	Percent	Number	Percent
The nature of the course in Teaching Science in the Elementary School	101	20%	398	79%
The selection of the text or texts used in the course	190	39%	297	61%
The science content of the course	141*	29%	349	71%
The instructional procedures which emphasize the processes of science	80	16%	427	84%

* Number includes forty (40) individuals who indicated content influenced most by other projects which were not specified.

support the assumptions and objectives of the new curriculum projects, these findings may be very satisfying as they give evidence that many instructors were implementing new curriculum materials with respect to course content and instructional procedures. Attention could also be called to the finding that sixty-one (61) percent of the respondents reported that the new projects had influenced instructors with respect to the selection of a text for the course.

As to the ways whereby the new materials have been implemented, two hundred and twenty-four (224) reported that the students were exposed to the new science curriculum projects mainly through laboratory situations. Seventy (70) indicated the students were exposed to the materials mainly through large group situations, sixty (60) reported this was done in small group sessions, and forty-six (46) indicated the students might be exposed in either large groups, small groups, and/or laboratory situations. Only thirty-one (31) persons reported that the students received little, if any, exposure to the materials. It should also be of interest that three hundred and ninety-five (395) reported that the students received direct experiences through laboratory or small group activities with one or more of the new science curriculum projects.

Each of the projects was emphasized, according to three hundred and sixty-six (366) or seventy-two (72) percent of the science educators. Approximately eight (8) percent indicated that the course emphasized only SAPA, ESS, or SCIS and five (5) percent reported that only two of the projects were emphasized. About fifteen (15) percent reported little, if any emphasis, upon the new curriculum materials.

The greatest influence on the science content of the course appeared to be due to SAPA materials as one hundred and thirty-eight (138) respondents so indicated. Eighty-four (84) said ESS had influenced the course content the most and seventy-one (71) SCIS as the greatest influence upon course content. Ninety-six (96) of the respondents indicated that course content had been influenced most by combinations of the projects or by other projects which were not specified. Respondents who indicated little, if any influence upon course content numbered one hundred and one (101).

With respect to the use of activities designed to illustrate and to emphasize instructional procedures for the development in pupils of the processes of science, one hundred and fifty-eight (158) indicated that such activities were drawn about equally from each of the projects. The single curriculum project which influenced most the selection of such activities, according to those who had not said all three influenced the selection, was SAPA followed by ESS and SCIS respectively. One hundred and five (105) persons reported that other sources were used basically for the selection of the activities.

Summary. An analysis of the data, pertaining to the influences the new science curriculum projects have had upon the course, permits one to conclude that the projects have had a definite impact on the nature of the course in general and specifically to the science content and to the instructional procedures which emphasize the processes of science. The greatest impact appears to have been on the instructional procedures.

Student exposure to the new science curriculum projects occurred most frequently in laboratory situations. However, it appears that in some courses the main exposure was either in small group discussion situations or in large group situations. Almost all direct experience with the new curriculum projects, according to three hundred and ninety-five (395) respondents, was obtained in laboratory or small group discussion situations.

As a matter of record, it should be noted that thirty-one (31) respondents reported that the students in the course in their institutions have very little, if any, exposure to the new projects and that ninety-three (93) indicated that the students did not have direct experience with the new science curriculum projects.

In the courseswhere the new materials were emphasized, one could infer from the data that all three projects were covered in most of these courses. SAPA was the single project which had influenced most the science content covered in the courses and had been the project most frequently drawn upon for activities to illustrate and to emphasize the instructional procedures associated with the processes of science. However, seventeen (17) percent of the respondents indicated that ESS had influenced the science content most and fifteen (15) percent reported the greatest influence was due to SCIS. After SAPA, the project which most frequently had been drawn upon for process activities was ESS.

Patterns of class organization and teaching techniques. Large group situations (lectures, demonstrations, discussions, etc.), small group discussion sessions, laboratory situations, required elementary classroom observation or teaching, and other (not specified) were the class organization patterns reported by the respondents. The number of science educators reporting that one of these situations was a feature of the course in their institution was as follows: three hundred and fifty-six (356), large group; one hundred and fifty-two (152), small group discussion; two hundred and twenty-one (221), laboratory situations; one hundred and thirty-two (132) required elementary classroom observation or teaching; fifty-five (55) other. Data pertaining to the percent of time devoted to the specific teaching techniques which were employed by the science educators are presented in Table V. Since five hundred and one (501) individuals furnished responses relative to these situations, one may infer as to the general practices which were being followed at the time of the study.

From Table V, it appears that close to four hundred (400) instructors were devoting at least five (5) percent of class time to some form of lecturing while slightly over one hundred (100) were devoting little, if any, time to lecturing. Since only thirty (30) individuals reported using fifty (50) or more percent of the time for formal lecturing, one may infer that in most of the classes students were being instructed through a variety of techniques.

Seventy (70) of five hundred and ten (510) respondents, reported that the students were exposed in their course to the new science curriculum materials mainly through large group situations.

Table V. Percent of Time Devoted To Types of Instruction

	Percent																	
Instruction	None	Less than 5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	More than 75
Formal lecture	90*	21	64	120	25	46	39	39	2	23	2	16	1	9	0	0	0	4
Demonstration	137	10	63	118	24	64	31	29	4	9	2	8	0	1	0	0	0	1
Class discussion	93	6	29	120	34	90	41	46	6	14	3	12	0	3	2	2	0	0
Small group discussion	218	8	41	104	21	47	23	18	5	5	0	4	1	2	0	0	3	1
Laboratory	135	0	15	37	7	37	27	52	14	36	6	70	3	23	6	11	6	16
Microteaching	286	4	31	69	20	30	14	13	6	9	0	12	0	2	0	1	4	0
El. classroom observation or teaching	260	14	34	78	10	34	17	13	5	17	0	17	0	0	0	0	2	0

* Number of individuals indicating time devoted to the specific type of instruction or situation. Total number of respondents was five hundred and one (501).

While formal lectures and class discussions appear to have been the most frequently used techniques, laboratory instruction and demonstrations were used by many of the science educators. As previously noted, two hundred and twenty-four (224) (of 510 respondents) had reported that students were exposed to the new science materials mainly through laboratory experience.

The teaching procedure least used by the respondents was microteaching. About half of the respondents indicated that elementary classroom observation or teaching was a feature of their courses. To another item in the questionnaire, one hundred and thirty-two (132) had reported that observation or teaching was a required aspect of the course. Table V was included in the report mainly for the reader who may be interested in the percent of time which the respondents reported was given to the cited teaching techniques.

Implementation of new projects in large group situations. Three hundred and thirty-one (331) respondents indicated that some formal lecturing was done in a large group situation in the course in Teaching Science at the Elementary Level in the institution where they were teaching. In lecture situations, roughly ten (10) percent of these individuals reported that little, if any, time was given to familiarizing the students with the objectives and/or features of any of the new science curriculum projects. In contrast, approximately thirty-eight (38) percent (127 individuals) reported that an hour was devoted to familiarizing the students with SAPA, ESS, and SCIS and one hundred and eleven (111) or approximately thirty-four (34) percent said at least one hour was devoted to familiarizing the students with the general features of the new curriculum programs. Thus, seventy-two (72) percent of the respondents who were teaching in large group situations felt that the students were getting at least one hour of general exposure to these three curriculum projects. A few individuals reported instruction in only a specific project.

Another finding revealed by an analysis of the data was that eighty-six (86) percent of three hundred and thirty-five (335) respondents reported that they had used selected activities or modifications from the new science curriculum projects for demonstrating the processes of science in preparing for lecture situations. Approximately sixty (60) percent of these individuals indicated they had selected for demonstration purposes activities from each of the new curriculum projects. Nineteen (19) reported they had used only activities from SAPA and ten (10) indicated they had drawn from only ESS or SCIS. Forty-five (45) reported that they had selected activities from either SAPA and ESS or SAPA and SCIS. Fifteen (15) said they had used ESS and SCIS to select demonstrations for lecture situations.

Summary. While one hundred and sixty-two (162) of the five hundred and eighteen (518) science educators who turned in completed questionnaires did not indicate that large group situations were a feature of the course at their respective institutions, three hundred and thirty-one (331) reported that some formal lecturing was employed in such situations. Of these individuals, ten (10) percent reported that little, if any, time was given to familiarizing the students with the objectives and/or features of the new programs through lecturing. However, with the exception of some twenty (20) individuals, the data indicate that at least one hour of lecturing was used to familiarize the students with some or all of the new science curriculum projects and in some instances an hour to each of the projects. The data also support the conclusion that close to ninety (90) percent of the respondents who were teaching large group situations used selected activities or modifications of activities from the new programs for demonstrating the processes of science in their lecture presentations. While a majority of these respondents selected activities from each of the projects, SAPA was used most frequently as a single source or in combination with other new science curriculum projects as sources for selecting demonstration activities for lecture situations.

Implementation of new projects in small group discussion sessions. While only one hundred and fifty-two (152) respondents indicated that small group discussion sessions were characteristics of the course in their respective institutions, three hundred and seventy-six (376) reported information relevant to the implementation of the new science curriculum projects in such situations and two hundred and seventy-seven (277) reported five or more percent of class time was devoted to this type of discussion. Ninety-eight (98) of these three

hundred and seventy-six (376) individuals reported that at least one hour was utilized in discussing the projects and one hundred and thirty-two (132) said at least one hour was devoted to discussing each of the projects. Only thirty-five (35) reported that little time, if any, was utilized for the purpose of discussing the projects. Close to eighty (80) percent of these science educators reported that in such sessions considerable time was devoted to familiarizing the students with the objectives for teaching science as exemplified by the new science curriculum projects and to the teaching approaches of the various new materials.

As a requirement in the small group discussion sessions, one hundred and forty-eight (148) of three hundred and seventy (370) respondents reported that the students were required to review selected activities from each of the new science curriculum projects and one hundred and twenty-six (126) said the students in the courses in their respective institutions had to review selected activities from at least one of the new science curriculum projects. Thus, in situations where small group discussion groups were a feature of the instructional pattern, students were required in approximately seventy-five (75) percent of the courses to make some examination of the new science curriculum projects.

Summary. In view of the data, the following conclusions appear to be warranted relative to the course in which small group sessions were conducted. At least one hour was used for discussing the projects in most of the courses and in many of the courses an hour was used for discussing each of the projects. Considerable time was given in the sessions to familiarizing the students with the objectives and the teaching approaches inherent in the new science curriculum projects. Students were required, in most of the courses, to review selected activities from one or all of the projects.

Implementation of new projects in laboratory. Two hundred and twenty-one (221) respondents indicated that laboratory work was scheduled for students in the course in their institutions. With respect to the implementation of the science curriculum projects in laboratory instruction, approximately four hundred (400) individuals responded to the items designed to collect information regarding laboratory instruction. Fifty-seven (57) percent of these respondents reported that some of the exercises or activities used in laboratory instruction were taken directly from each of the new curriculum projects and twenty-seven (27) percent indicated that such exercises or activities were from one or two of the projects. Only sixty-three (63) respondents reported that few, if any, of the exercises or activities were taken from the new materials.

The exercises or activities drawn from the new curriculum projects were performed by small groups of individuals according to one hundred and sixty-nine (169) while one hundred and eight (108) reported that the activities or exercises were performed individually by the students. Less than four (4) percent of the respondents reported that the exercises were presented through teacher demonstrations.

Implementation of new projects through activities of the course which may or may not have been a required aspect of the course. Approximately five hundred (500) persons responded to the items regarding certain specified activities in the course. Seventy (70) percent of these respondents reported

that the students were required to examine some or all of the Teacher's Guides for the new science curriculum projects. About an equal number of the respondents said the students were required to critique one or more of the projects as those who indicated students were not required to critique any of the projects. With respect to using the new curriculum materials as models for lesson planning, the data showed that forty-five (45) percent of the respondents said students were not required to use them while forty (40) percent said the students were required to select one or more of the patterns followed in the new science curriculum projects as a model in lesson planning. Forty (40) persons reported that students were required to follow the SAPA format in preparing lesson plans and less than five (5) percent reported the exclusive use of the ESS approach or the pattern inherent in the SCIS materials.

Students were required to teach a microlesson using an activity or modification from one of the new science curriculum projects according to two hundred and ten (210) individuals. Two hundred and nineteen (219) respondents indicated that the students were required to make a classroom presentation showing how to implement an activity (lesson) from one of the new projects.

Influence of new science curriculum projects in relation to student grade determination. Approximately seventy (70) percent of the individuals who completed the questionnaire responded to the items relevent to the influence which the new science curriculum projects may or may not have had upon student grade determination. The number of respondents reporting the use of specific criteria were: one hundred and eighty-six (186), student competence in teaching a lesson or activity from one of the new science projects in a peer or microteaching situation; two hundred and sixty-five (265), either written or oral evidence of examination of at least one of the new curriculum projects; two hundred and fifteen (215), preparation of a lesson plan which used one of the projects as a resource or model; and, one hundred and sixty-seven (167), the collection of materials which could be used in teaching a lesson (or activity) from one of the the projects.

In evaluating student achievement in the course, one hundred and thirty-two (132) of three hundred and forty-two (342) who responded to an item regarding written tests reported that the students were not tested on their acquisition of knowledge or skills contained in the new science curriculum materials. Sixty-one (61) said students were tested on both knowledge and skills in the projects while one hundred and seventeen (117) reported testing of intellectual skills (processes of science) and twenty-five (25) indicated testing only their knowledge of specific information in the new curriculum projects.

Graduate work at master's level. Four items were included on the questionnaire relative to graduate courses in teaching elementary science. Approximately three hundred (300) individuals responded to these items. One hundred and sixty-nine (169) report that a single graduate course in Teaching Science in the Elementary was offered, ninety-four (94) reported more than one graduate course, and seventeen (17) signified that a regularly scheduled graduate seminar was offered in teaching elementary science.

Only twelve (12) respondents indicated that the new science curriculum projects were not covered in the course. One hundred and eighty-three (183) reported that the new materials were covered as an integral part of the course and the remainder said the students were provided with opportunities to do special assignments relevant to the projects. Two hundred and thirty-nine (239) reported that the students in the course were provided direct laboratory experiences with the new science curriculum materials.

AVAILABILITY AND USE OF PROJECT MATERIALS

Date were collected relative to the availability of curriculum materials and the use of such materials. The items on the questionnaire pertaining to the three projects were organized according to a specific project and the respondents were directed to answer the items if at least some of the materials were available and in use at their college or university. If none were available or in use, they were to omit the items in that section. Thus, it was assumed or inferred that an omission to a given section indicated that the materials were not available. Therefore, in the tables that follow, attention is called to the notations accompanying each table as to the number responding to specific items. It should also be noted that the items on the questionnaire had sub-parts and due to undedermined reasons, the total number of responses for a given item may not total the same as for the sub-parts. There are likewise differences in the total number of individuals marking associated items with respect to a given project. Therefore, slight inconsistencies are to be noted. However, it was assumed that the data were still valid for reporting purposes and for drawing tentative conclusions.

Availability and uses of new science curriculum projects. Table VI shows that sixty-four (64) percent of the science educators reported that the SAPA Commentary for Teachers was available for use in the courses at their institutions. Table VII reveals that this publication was being used by one hundred and twenty-one (121) of the instructors as required reading or as a reference for students and one hundred and forty-two (142) said they used the publication as a reference for their own preparation in teaching the course.

Two hundred and seventy-nine (279) respondents indicated that one or more of the Teacher's Guides (Parts A, B, C, D, E, F, and G) were available at their institutions and thirty-six (36) reported that none of these were available. All of the guides were available at the institutions where they were teaching according to eighty-six (86) individuals. Two hundred and seventy-five (275) (330 - 55) reported (Table VII) that the guides were used to give students direct experiences with the program and/or as resources for lesson planning.

Table VI shows that two hundred and twelve (212) individuals reported that one or more of the SAPA equipment and supply kits were available at their institutions. When compared to those who indicated such materials were not available and to the two hundred and thirty-four (234) who did not answer the items relating to SAPA equipment and supplies, one notices that fifty-nine (59) percent of the respondents were teaching at institutions where the materials were not available. Only thirty-eight (38) indicated that all the SAPA equipment and supply materials were available for their teaching. The kits were used basically

Table VI. Availability of New Curriculum Projects

	SAPA						ESS						SCIS					
	n_1	n_2	%*	n_3	n_4	%**	n_1	n_2	%*	n_3	n_4	%**	n_1	n_2	%*	n_3	n_4	%**
Commentary for Teachers	388	330	64	58	188	36												
El. Sci. Source-book Trial Ed. 1968													376	319	62	57	199	38
One or more of Teacher's Guides or Units	315	279	54	36	239	46	362	333	64	29	185	36	356	310	60	46	208	40
All of Teachers' Guides or Units	315	86	17		432	83	362	61	12		457	88	356	135	26		383	74
One or more of Equipment and Supply Kits or Materials Kits	284	212	41	72	306	59	355	287	55	68	231	45	336	208	40	128	310	60
Equipment, etc., for all parts or units which are available	284	38	7		480	93	355	20	4		499	96						
AAAS Behavioral Charts	385	385	74		133	26												
ESS Supplementary Science Readers							360	158	30	202	360	70						

n_1 Number responding to item.
n_2 Number indicating availability of material.
n_3 Number responding to item who indicated material was not available.
n_4 Number (actual and/or inferred) indicating material was not available.
* Percent of total sample (518) indicating material was available.
** Percent of total sample (518) indicating material was not available.

for giving students direct experiences with such equipment and supplies and for instructor use in presenting activities in the course. Ninety-nine (99) (64 + 35) reported (Table VII) they used the kits for making class presentations and a like number reported the kits were not used in teaching the course. It is significant to note that several of the respondents wrote comments to the effect that lack of money and price of the kits were factors in not having the equipment and supplies that are available for implementing SAPA.

Table VI reveals, with noted reservation on Table VII, that seventy-four (74) percent of the respondents indicated that at least one of the Behavioral Charts was available at their institutions. However, Table VII shows that one hundred and forty-five (145) or thirty-eight (38) percent of those who said such charts were available reported that they made no use of the charts. While the availability of the preliminary and experimental edi ons was not specifically asked for in the questionnaire, one hundred and ninety-nine (199) indicated that they used the editions for familiarizing the students with Science - A Process Approach.

As shown in Table VI, three-hundred and thirty-three (333) individuals reported that one or more of the ESS units were available and sixty-one (61) indicated that all units were available. Data not shown in the table, but available to the authors show that five or more ESS units were available to two hundred and eighty-five (285) of the science educators. The specific uses of these units are given in Table VIII. The questionnaire did not contain a question relative to the specific uses that instructors made in their own preparation, but the data show that three hundred and eight (308) of the science educators used the units as a regular part of classroom instruction and/or as resources for lesson planning or sources of ideas.

One or more of the ESS Equipment and Materials Kits were available according to two hundred and eighty-seven (287) respondents (Table VI). Five or more of the kits were available to one hundred and fifty-seven (157) of the respondents. Only twenty (20) indicated that all the kits were available. As with the units, the kits were used regularly in classroom activities and/or as resources for planning science lessons. Two hundred and sixty-nine (269) respondents (Table VIII) indicated such use of the kits.

Table VIII shows the responses of the science educators with respect to the opportunities that students had in the courses at their institutions to view ESS film loops. While one hundred and eighty-six (186) said this opportunity existed, an almost exact number reported that students did not have such an opportunity. No data were collected as to the use made of the E S S Supplementary Science Readers.

Table VI shows the number of respondents who furnished information relative to the availability of the various S C I S materials in the institutions where they taught. The number of individuals who indicated the availability of specific materials was: three hundred and nineteen (319), Elementary Science Sourcebook, Trial Edition, 1968; three hundred and ten (310), one or more of the Teacher's Guides; and, two hundred and eight (208), one or more of the materials kits. One hundred and thirty-five (135) indicated that all the

Teacher's Guides were available and two hundred and sixty-six (266) reported that four to all the guides were available for use. Only sixty-seven (67) reported the availability of five or more of the kits at their institutions. Student use of the Teacher's Guides and the materials kits in the institutions where the guides were available was similar to the use made of SAPA and ESS guides or units. Specific data relative to the uses made of the SCIS materials are presented in Table IX.

Table VI reveals that more individuals indicated the availability of one or more of ESS Teacher's Guides or units than either of the other two and SCIS materials in this category exceeded SAPA. However, when all the Teacher's Guides or units were considered, more reported complete sets of SCIS followed by SAPA and then ESS. Where available, all the guides or units appeared to be used rather extensively by the instructors in the course.

FINDINGS AND/OR CONCLUSIONS - SUMMARY

The findings and/or conclusions of this study are summarized according to the three main purposes of the study. Data were collected from five hundred and eighteen (518) science educators who were directly associated with science education at the college or university level by the questionnaire technique. The aspect of science education investigated was the course in Teaching Science at the Elementary Level for prospective elementary teachers.

Administrative, organizational, and instructional patterns of science education for prospective elementary teachers at the college or university level. The major findings and/or warranted conclusions relevant to the preceding heading are:

1. The course in Teaching Science at the Elementary Level in a majority of the institutions where the respondents were teaching was administered by a college or division of education. The administration of the course, according to eleven (11) percent of the respondents, was administrated by a college or division of science and about nine (9) percent report that the administrative control rested jointly in the college or division of education and in the college or division of science. Some four (4) percent of the individuals completing the questionnaire indicated that the control was under a Science and Mathematics Center or Science Teaching Center.

2. Instructors in the course in a majority of instances held appointments in a college or division of education. However, seventeen (17) percent of the instructors had appointments in a college or division of science and a few had dual appointments in these respective colleges or divisions.

3. The course in Teaching Science at the Elementary Level, at the institutions where the respondents were teaching, was

    a. a required part of the prospective elementary teacher's program according to eighty (80) percent of the respondents. The course was offered most frequently as a part of the students' program during the junior or senior year. Approximately seventy (70) percent of the respondents indicated that some work in college

Table VII. Use of SAPA Materials

	Commentary for Teachers		Teacher's Guides		Equipment and Supplies		Behavioral Charts		Preliminary & Experimental Editions	
	n*	%**	n*	%**	n*	%**	n*	%**	n*	%**
Student Use										
Direct experience with program			85	26%						
Direct experience and lesson planning			85	26%						
Direct experience with equipment					126	39%				
Become familiar with curriculum							240	62%		
Experience with Science--A Process Approach									199	57%
Required reading or reference	121	31%								
Research for lesson planning			105	32%						
Student-Instructor Use										
Required student reading or reference --Instructor preparation	39	10%								
Direct experience--presenting activities					64	20%				
Instructor Use										
Resource-preparation	142	37%								
Presenting activities					35	11%				
Not Used	28	7%	55	17%	99	31%	145	38%	148	43%
Not Available	58	15%								
Total Responding	388		330		324		385***		347	

* Number responding to the relevant item or items.
**Percent of total responding to the relevant items.
***Analysis of responses made with some reservation due to multiple marking of items.

Table VIII. Use of ESS Materials

	Teacher's Guide (Units)		Equipment and Materials Kits		Film Loops***	
	n*	%**	n*	%**	n*	%**
Student Use						
Regular part of class instruction	65	19%	97	31%		
Resources in lesson planning and/or source of ideas	167	48%	84	26%		
Regular part of class instruction or resource	76	22%	88	28%		
Film loops - opportunity to view***						
a) all					15	4%
b) 5 to 10					55	15%
c) 1 to 5					116	31%
Not Used	39	11%	49	15%	188	50%
Total Responses	347		318		374	

*Number responding to the relevant item or items.
**Percent responding to the relevant items.
***Collected information did not reveal source of availability.

Table IX. Use of SCIS Materials

	Elementary Science Sourcebook - Trial Edition 1968		Teacher's Guide		Materials Kits		Films	
	n*	%**	n*	%**	n*	%**	n*	%**
Student Use								
Required reading or reference	84	26%						
Direct experience in regular classroom			73	23%	59	20%		
Resources for lesson planning			119	38%	79	27%		
Direct experience in regular classroom and resources for lesson planning			86	28%	68	23%		
Films - opportunity to view***								
a) 5 or more							24	6%
b) 3 or 4							31	8%
c) 1 or 2							106	28%
Student - Instructor Use								
Student-required reading or reference--teacher-preparation	40	12%						
Instructor Use								
Resource for teacher preparation	141	44%						
Not Used	54	17%	35	11%	87	30%	213	57%
Total Responses	319		313		293		374	

*Number responding to the relevant item or items.
**Percent responding to the relevant items.
***Collected information did not reveal source of availability.

science was a prerequisite or concurrent requirement for taking the course. The most frequently reported prerequisite or concurrent requirement was five to ten semester hours of science.

b. in a large majority of instances, a one quarter or semester offering in which the main emphasis was placed upon the content and processes inherent in teaching science. Approximately thirty (30) percent of the respondents reported that the course placed about equal emphasis upon ways to teach science and scientific knowledge per se. Slightly more than twenty-five (25) percent reported that some elementary classroom observation or teaching experience was an integral part of the course.

c. scheduled most frequently as a large group situation in which lectures, discussions, demonstrations, and other types of activities might be carried on. Approximately twenty-five (25) percent of the respondents reported that three hours per week were allocated for large group instruction. From the data, one could infer that in addition to large group instruction, class organization also included either small group discussion sessions and/or laboratory periods. Approximately forty (40) percent of the science educators reported that the course included laboratory experiences.

d. normally taught by the same instructor each quarter or semester the course was offered. One half of the respondents reported that they were teaching in institutions where two or more individuals were available for teaching the course. The respondents had mixed feelings regarding the content and methodology of the course when taught by different instructors. The number that considered the course to be much the same regardless of the instructor was approximately the same as those who thought the course was quite different when handled by different individuals. A basic text was used in the course according to about sixty (60) percent of the respondents.

Professional background and teaching experiences of science educators surveyed in this study. About half of the bachelor's degrees of the respondents had been in a science area and approximately one-third in education or science education. More than half of the individuals had majors in science areas and one could infer from the data that many of these individuals also had one or more minors in science. Likewise, more than half had majors or minors in education. In the science areas, more individuals had majors in the biological sciences than any other science area. About twenty-five (25) percent of the respondents reported majors in chemistry. From the data, one could infer that the exposure of the respondents to science had been fairly extensive as only six (6) individuals reported that they had not taken any science as an undergraduate. Fifteen (15) percent of the respondents indicated that they had not taken any education courses as an undergraduate.

Analysis of the data with respect to master degrees showed that seventy (70) percent of the degrees had been awarded in education or science education. The data also showed that approximately forty (40) percent of the programs had included some graduate work in the biological sciences and twenty (20) percent

of the programs some graduate work in chemistry and a like percentage of programs with some graduate work in physics. About fourteen (14) percent of the respondents reported that their programs did not include any educational courses.

The collected data showed that over eighty (80) percent of the science educators in the study held the doctorate degree or were in the process of completing the degree. This finding was based on the responses of four hundred and twenty-five (425) individuals who answered the relevant item in the questionnaire. Of the doctoral degrees reported, approximately eight (8) percent were in science and the remainder in education or science education.

The teaching experiences of the science educators indicated that more than half had had elementary experiences and more than half secondary. Many of the respondents had had experiences at both levels. Practically all the respondents reported teaching the course in Teaching Science at the Elementary Level. At the time this study was undertaken, some seventeen (17) percent of the respondents, in addition to handling the methods course, were teaching a college science course. The data also showed that one hundred and twenty (120) had had experiences in teaching a college course in the biological sciences; one hundred and thirty-nine (139), physical science at the college level; sixty-seven (67), college chemistry; and approximately sixty (60) in the areas covered in earth science.

Impact of new science curriculum projects with respect to the instructional materials and procedures employed in college or university programs for prospective elementary teachers. The authors have restrained, at least in their own perceptions, from evaluating in this paper the degree of impact which the new science curriculum projects have had upon methods courses in teaching science at the elementary level for prospective elementary teachers. Thus, the report has attempted to be factual in nature and the significance and implications of the findings left to the reader. The findings and/or tentative conclusions are summarized under headings which were considered relevant to the effects which the new science curriculum projects may have had upon college of university courses in Teaching Science at the Elementary Level.

Respondents' associations with the projects. Thirty-two (32) percent or one hundred and sixty-seven (167) of the science educators survey in this study had been associated either directly or indirectly with all three of the new curriculum projects (ESS, SAPA, and SCIS). One hundred and eighty (180) had been associated either directly or indirectly with one or more of the projects. Thus, approximately two thirds of those surveyed had had some experiences with at least one of the projects. Only eighteen (18) responses indicated association as a writer on one of the projects and the data do not reveal whether some of the individuals marking the relevant items might not have been writers on more than one project. Whatever the case, it is evident that a comparatively small number had participated in the production of the curriculum materials.

With respect to respondents' experiences through attending workshops or training sessions designed to familiarize participants with project materials, approximately sixty-five (65) percent had had such an experience as a participant in one or more such workshops or training sessions. Approximately forty (40) percent had been participants in one or more workshops or training sessions designed to provide leadership training for conducting trial centers.

About fifty-four (54) percent of the science educators had conducted workshops or training sessions which covered one or more of the projects. From the data, one could infer that these workshops or training sessions had been designed to cover SAPA or SAPA with another project than any of the other programs.

New science curriculum projects - nature of course. Approximately eighty (80) percent of the sampled science educators reported that the new materials had had a definite impact on the nature of the course in Teaching Science at the Elementary Level. The greatest impact was upon instructional procedures. One may infer from this finding that the process skills were emphasized more than they had been previously stressed. As a matter of record, it seems appropriate to note that a few respondents made written comments or remarks that they had been emphasizing process skills prior to the availability of the new curriculum materials. The data also showed that the new materials had definitely influenced the science content of the course. This finding may have significance for institutions where science is a prerequisite for taking the course. It could indicate a need for the re-examination of the content of such science courses in order to provide the science background for implementing the facts, concepts, and principles covered in the new curriculum materials. The finding that some sixty (60) percent of the respondents reported that the new materials had been influencial in the selection of a text for the course adds confirmatory evidence that the new curriculum materials have had an impact on the nature of the course.

The new curriculum project which the respondents reported had the greatest influence upon the course science content and the number so indirecting were: SAPA, one hundred and thirty-eight (138); ESS, eighty-four (84); and SCIS, seventy-one (71). The science content according to ninety-six (96) persons was influenced most by a combination of the projects or by other curriculum sources.

One hundred and fifty-eight (158) individuals reported that the activities used in the course to illustrate and to emphasize the processes of science had been drawn about equally from all three projects. The project that had been used most frequently for these purposes, according to the respondents who had not indicated the use of all three equally, was SAPA, ESS, and SCIS respectively. Approximately twenty (20) percent indicated other sources were used to illustrate and to emphasize the processes of science.

New science curriculum projects - implementation situations. Some forty (40) percent of the respondents reported that the students were exposed to the new curriculum projects mainly through laboratory situations. Besides those that considered exposure to be mainly through laboratory, there were many who indicated that laboratory work was a feature of the course as about four hundred (400) responded to items relevant to laboratory work. Over half of these individuals said that at least some of the laboratory exercises were taken directly from each of the projects and about one-fourth indicated that some exercises were from one or more of the projects. As a point of interest, these exercises were performed most frequently by small groups although one hundred and eight (108) said they were done individually by students. From the data, it would appear that few of the exercises in laboratory situations were performed as demonstrations by the teacher.

Large group situations were reported by three hundred and fifty-six (356) respondents. Three hundred and thirty-one (331) indicated that some form of lecture was carried on in this situation. The data show that some seventy (70) percent of these individuals reported that the students were getting at least one hour of general exposure to the three new science curriculum projects. One may infer from the data that in at least one-fourth of the courses students were receiving that much instruction in each of the curriculum projects. Close to ninety (90) percent of the science educators who taught in large group situations said they used the new programs as sources of activities for preparing demonstrations for their lecture presentations.

In situations where small group discussions were held (152 indicated this type of situation existed), at least one hour was used for discussing the projects in most of the course and in many instances at least an hour was devoted to discussing each of the projects. In most of the courses having small group discussion, the students were required to review selected activities from one or more of the projects.

New science curriculum projects - required activities. The impact of the new science curriculum projects may be inferred from the activities required of students in the courses where these projects were being covered. The following findings were observed in the courses with which the respondents were familiar: 1) the students, in the majority of cases, were required to examine some or all of the Teacher's Guides or units for the projects; 2) the students, in approximately half the courses, had to critique one or more of the projects; 3) the students, in less than half the instances, were required to use the projects as models for lesson planning; and 4) in slightly less than half the cases students were required to teach a microlesson or make a class presentation based upon an activity from one of the projects.

New science curriculum projects - grade determination. The respondents reported that such criteria as competence in teaching a lesson or activity from one of the projects, written or oral evidence of examination of one or more of the projects, and preparation of a lesson plan or collection of materials for teaching a lesson from one of the projects were used in evaluating student achievement in the course. Each of the above criteria were cited by at least thirty (30) percent of the respondents. However, the reader should be reminded that this finding does not mean that all these criteria were necessarily used in all the courses. Tests were used by sixty-one (61) of the respondents to evaluate student achievement relative to the cognitve knowledge and skills contained in the new science curriculum materials. One hundred and seventeen (117) reported the testing for the processes of science inherent in the projects, and twenty-five (25) reported the testing was basically on the cognitive knowledge contained in the new science curriculum projects.

New science curriculum projects - graduate course. In instances where graduate courses were offered, it was evident that instructors covered the projects, to a degree at least, when it was evident that the students had not had previous experience with the projects.

Availability and use of new curriculum materials. The data indicated that sixty-four (64) percent of the respondents were teaching in institutions where one or more the ESS units were available and fifty-five (55) percent at institutions were one or more of the Equipment and Materials Kits were available. These

percents were slightly in excess of those for the corresponding SAPA and SCIS materials. More than half indicated that one or more of the Teacher's Guides were available for SAPA and more than half for SCIS. However, only forty-one (41) percent indicated that one or more of the equipment materials were available for SAPA and forty (40) percent reported availability of SCIS materials kits.

More than half of the respondents had access to the AAAS Commentary for Teachers and more than one-third of those having this publication said they used the commentary for their own preparation and/or as a resource for students.

Approximately sixty (60) percent of the respondents indicated that they used the ESS units for teaching purposes. Fifty-three (53) percent reported the use of AAAS Teacher's Guides and fifty-four (54) percent the SCIS guides for instructional purposes. Some thirty (30) percent of the respondents reported availability of some ESS film loops and slightly more the availability of some of the SCIS films. Preliminary editions of AAAS (SAPA) appeared to have been used by approximately forty (40) percent of the respondents. This finding could be interpreted as an early influence of this project upon the course by those having access to the materials.

If one assumes that the individuals who did not respond to the items regarding project materials, did not have them and if one also assumes that such materials are conducive to effective science instruction in a course in Teaching Science at the Elementary Level, there appears to be a need to find ways to make such materials available. None of the SAPA guides were available to forty-six (46) percent of the respondents, thirty-six (36) percent reported none of the ESS units were available, and forty (40) percent did not have any SCIS guides for instructional purposes. With respect to the availability of one or more of the equipment and supply kits, the percent of individuals reporting the complete lack of such kits was fifty-nine (59) percent for SAPA, forty-five (45) percent for ESS, and sixty (60) percent for SCIS.