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IMPACTS OF THE NATIONAL SCIENCE FOUNDATIONS SUMMER SCIENCE PROGRAM FOR HIGH ABILITY SECONDARY SCHOOL STUDENTS.

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EXAMINED ARE THE EFFECTS OF SUMMER SCIENCE PROGRAMS ON PARTICIPANTS, THEIR HIGH SCHOOLS, THEIR FUTURE EDUCATIONAL PLANS AND CAREERS, AND THE HOST INSTITUTION. ESTABLISHED CRITERIA WERE USED TO SELECT 18 OF 147 PROGRAMS SPONSORED BY THE NATIONAL SCIENCE FOUNDATION IN 1960. ORIENTATION, CLASSROOM, AND RESEARCH PROGRAMS WERE INCLUDED IN THE SAMPLE. CONTROL GROUPS WERE COMPOSED OF GIFTED HIGH SCHOOL STUDENTS WITH APPROXIMATELY EQUAL SCHOLASTIC ABILITIES, INTEREST RANGES, AND MOTIVATION INTENSITIES TO THOSE OF THE EXPERIMENTAL GROUPS. INVENTORY FORMS AND OBSERVATIONS WERE USED TO OBTAIN DATA FROM PARTICIPANTS, SECONDARY SCHOOL TEACHERS, AND ADMINISTRATORS PRIOR TO, DURING, AND FOLLOWING THE PROGRAM. PARTICIPANTS WERE COMPARED WITH CONTROL GROUPS IN TERMS OF--(1) PERSONAL DATA, SCIENCE BACKGROUNDS, AND GENERAL ACADEMIC RECORD, (2) BELIEFS AND ATTITUDES CONCERNING SCIENCE, SCHOOL, AND CAREERS, (3) PERFORMANCE IN SCIENCE ACTIVITIES, AND (4) EDUCATIONAL PLANS. OPINIONS OF PARTICIPANTS AND THEIR HIGH SCHOOL SCIENCE TEACHERS CONCERNING THE PROGRAMS ARE INCLUDED. (AG)

IMPACTS

of

The National Science Foundation's Summer Science Program

for

High Ability Secondary School Students

A RESEARCH UNDER CONTRACT NO. NSF–C–150

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TABLE OF CONTENTS

I	SUMMARY	1
II	INTRODUCTION	6
III	PLAN OF STUDY	7
IV	FIRST HAND EVIDENCES	13
	Summary of Observers Reports	13
	As Seen By Participating Students	27
	The Teachers Viewpoint	43
V	THE STUDENTS	50
VI	HIGH SCHOOL SCIENCE BACKGROUND	62
VII	BEFORE AND AFTER	74
VIII	FURTHER EDUCATIONAL PLANS	128
APPENDIX A		141

FOREWORD

The Summer Science Training Program for High-Ability Secondary School Students, sponsored and supported by the National Science Foundation, first appeared on the U. S. educational scene in the summer of 1959. These programs are intended "to provide the superior high-school student with educational experience in science and mathematics beyond that normally available in high school courses." Some 117 programs were offered in 37 of the fifty states, the District of Columbia and Puerto Rico in the summer of 1959. During the summer of 1960 the program was continued on an expanded basis, with 147 programs held in forty-three states, the District of Columbia and Puerto Rico. Present plans of the National Science Foundation call for a continuation of this program over the next few years at least. In addition to its impressive scope, Summer Science Programs are quite diverse. Changes have been made in the 1961 and 1962 programs based on the experiences of the Foundation with the SSP's. These programs, operated largely by colleges and universities, have been designed to give selected high school students more intensive training and more significant research experience than they could obtain in their high schools. It is believed that such experiences will intensify interest in and understanding of sciences, and give greater momentum to valid career planning.

A program of such scope obviously represents a tremendous amount of time and energy expended by the scientist-educators who designed the individual programs and put them into effect. It also signifies a substantial outlay of federal funds in the form of grants from the National Science Foundation. Interest in the utility of the program and its effectiveness in meeting its several goals, therefore, has been marked - both on the part of the Foundation and educational circles in general.

Since its inception in 1959 the general feeling on the part of persons who have come into contact with the summer science program is that it is a "useful" one. Most persons, however, have difficulty in putting their fingers on just what it is that makes the program "useful" and, for this reason, their judgments are more subjective than objective. The National Science Foundation, in keeping with its special interests and responsibilities, has encouraged Directors and others associated with the program to do as much in the way of objective evaluation as is feasible. At the same time the staff of the Foundation has implemented a continuing evaluation study of its own and has contracted with outside consulting organizations to provide further follow-up and evaluation of the program as a whole.

The present study is an attempt to measure the impact of the 1960 Summer Science Programs on the student participants and on their high schools.

Its research design makes use of pre-and-post-program measurement of the performance, attitudes and plans of the participants, comparing these evidences with parallel data from comparison groups of students who did not participate in the Summer Science Programs.

A brief overview of the results are given in I SUMMARY, and in greater detail in the body of the report.

A study of this magnitude and scope could be accomplished only with the full cooperation of many people:

- The high school students, in both the Experimental and Comparison groups who reported before and again after the Summer Science Programs on their backgrounds, interests and performance as students.
- The high school science and mathematics teachers who completed forms describing the performance patterns of their students who were included in this study.
- The high school principals who afforded and organized the cooperation of their teachers and students, and filled out questionnaires.
- The Observers, who visited each of the 18 Summer Science Programs included in this study.
- The Program Directors of the 18 programs.

The vision of Dr. Howard J. Hausman of the National Science Foundation made the study a reality and his guidance as contract monitor enabled the investigators to direct the study toward those questions which were of greatest pertinence to the Foundation.

Harold A. Edgerton, Ph. D.

I

SUMMARY

This report sums up a study of the impact 147 Summer Science Programs supported by the National Science Foundation in 1960 made upon the participants and their schools.

Data were collected before, during and after participation from a carefully selected sample of 18 of the programs diversified as to program type and geographic location. Student samples included an Experimental group of actual participants and 2 comparison groups of non-participants of similar age, ability and interest. The High School sample comprised the schools from which the student samples came.

Both students and high school teachers completed comprehensive questionnaires before and after the program and experienced Observers visited and reported upon the during phase.

I Chief Objectives of the program, as reported by the host institutions included:

A. For the Students

- Motivation toward and guidance in science careers
- Orientation toward science and research plus provision of some realistic experiences
- Supplementation of high school programs

B. For High Schools to which students return

- Increased science interest in entire student body, school administrators and parents with possible improvement in curricula
- Improvement in science teaching
- Strengthened ties between high schools and colleges

C. For Colleges anticipated benefits

- SSP students enter college with considerable orientation and clarification of college goals
- SSP contributes to raising freshman level of student ability
- Host institutions profit from opportunity to recruit high level future students, strengthen ties with area high schools and gain in prestige
- Host facilities gain understanding of secondary schools, enrich regular teaching as result of stimulation by these superior students, some gain in summer salary supplementation
- SSP helps close the gap between college and high schools with under par science programs--Negro institutions noted this objective especially.

II The Programs fell into these general categories:

A. Orientation programs characteristically were of 2 or 3 weeks' duration with larger enrollments of students exposed to a wide range of scientific material through lectures, laboratory and other methods. They were highly organized and directed, the teaching level generally sophisticated, with little or no homework required of students. Observers raised some question as to whether the impact on science education from this type of program can justify its cost in dollars and in faculty time as compared with programs which require more student performance. However, some in this category have operated for several years with apparently good results. Students were resident on campus.

B. Course (or classroom) programs of 4 to 6 weeks duration offered course material introducing the student to modern concepts unlikely to be met in high school or early college, depending heavily on lectures supplemented by text book study, homework, laboratory and other methods. They were almost as highly organized as the orientation programs but afforded students some opportunity for research and individual activity. Some were resident and some commuter programs with no essential differences except that the former allotted more time to laboratories.

C. Research Programs were from 6 to 13 weeks duration with generally smaller numbers of students participating in "science in the making" at varying levels from that of laboratory technicians to designing and carrying out their own experiments. There was less formal instruction but greater dependence on individual attention, laboratory work, casual advice and recommended reading. Students were resident on campus in some and commuted to others. Where there was a minimum of direction students were inclined to feel at loose ends.

D. Negro -- these programs were included because they were working toward some special goals including that of closing the gap between the level at which their students complete high school science and the level at which they are expected to function in college. Two such programs were included in the sample 18, both in the Course category, one residential, the other mainly commuter.

Features common to all the above types included some pattern of recreational program, mostly casual and unscheduled--where too highly organized students resented the necessity of leaving their work to participate. Co-ed programs had less problem in maintaining a happy balance of work and recreation than those which were all male. In every category "Bull sessions" were one of the most popular and most rewarding activities between classes, at meals and after hours. Students in residence had an advantage in this respect over the more limited opportunities available to commuters.

The staff in all programs characteristically had tremendous enthusiasm for working with young people. They gave generously of themselves, frequently without special reimbursement. Some Observers warned that top level staff could not be expected to go on indefinitely and that planning for the future must not "ride a willing horse too hard." Where high school teachers were utilized along with college staff, the Observers noted a drop in teaching level. They agreed generally that college atmosphere and of instruction were prime ingredients of the successful program. They noted a need for more counseling with the SSP students on how to choose a college, where to look for financial aid and the philosophical approach to science as a way of life. Girls are concerned with woman's role in home versus a career in science. Students too were critical of high school teachers. Student responses recorded six months later, however, seem to indicate that SSP counseling may have been stronger and of better quality than was evident to the Observers.

Student performance was generally high. There were no serious problems of discipline, no loafing or horseplay. In the opinion of the Directors, practically 100% of the participating students were benefiting though the degree might vary from those few who seemed in waters a little too deep for comfort on up to those who rode the highest waves with ease. Instructors judged the work these students did as superior to that of regular undergraduate classes.

Follow up, in the Observers' opinions, was the least developed facet of the entire program. Some institutions make an effort to keep in touch with students through circular letters, alumni days which bring the students back to the host campus, or informal personal contacts. Observers deplored that no one seemed to be making any serious, organized study of the behavior of these students while right at hand and available for testing and observation. High School Teachers expressed a desire for a direct report on their own SSP students. Some schools try to do this, but not all.

III Recruitment and selection: Those who should attend SSP's were typically described as:

> "Students of superior ability who are highly motivated, with keen curiosity and imagination, with a serious vocational interest in science, and who are socially mature for their age."

Printed brochures supplemented with news releases to local papers were the most usual recruitment techniques. Teachers generally felt that mailings sent to them directly were more effective in actually getting to students than were those sifted down through channels of school administrators and counselors. This was strengthened by reports from both the Experimental and Control students showing teachers who were not counselors as first source of information. About 10% indicated the counselor. A variety of approaches and media seems indicated to reach the most students.

Selection procedures varied. Host faculty or program directors made selections in some cases and in others, it was entirely in the hands of the high schools. Some more cooperative plan would seem advantageous.

Factors considered in selection included scholastic records, some use of tests and IQ's, teacher's recommendations and students' written statements. There was some use of personal interviews. No clear cut pattern emerged from the 18 programs in the sample.

Students were influenced to apply for admission chiefly through encouragement of Science and Math teachers. Cost was mentioned by very few but this is information only from those who were in the program. We do not know how many would-be participants were ruled out by this factor.

Teachers suggestions on how to improve selection varied from adding tests to eliminating all tests, but generally they felt that the right students were selected.

IV Financing: Some schools lamented NSF cuts in what had been submitted as absolutely minimal budgets. More financial support for faculties, for lunches, guidance and needy students were reported needs for some.

Division of cost varied from those in which board, room and transportation were all provided to others in which only some portion was provided. Arguments were advanced that a student's willingness to bear some of his own cost was evidence of sincerity on one hand and on the other that costs should be borne by the grant and stipends paid to equal what students might otherwise have earned.

Student replies in the "after" phase indicate their belief that the financial aid given was fair. Two out of five say they would attend SSP even if they had to pay tuition plus expenses, 1/4 would pay either tuition or expenses, but 1/4 would not attend if they had to meet either of these costs. Clearly more information is needed as to students who were recommended to SSP but did not go because of finances.

Another possibility to further science interest and knowledge without depriving students of summer earnings would be to promote science connected jobs for students with interest and ability.

V Does the Program measure up to its aims? Observers said "Yes, and then some" with suggestions noted to give students still more opportunity to "get their hands dirty", strengthen follow-up, refine selection, strengthen guidance.

Teachers' opinions expressed:

1. satisfaction with the manner in which the students were selected

2. a conviction that students learned more about mathematics and science than they would without SSP, and that student interest in same was increased

3. a prediction that SSP's would force high schools to expand and upgrade their science curricula

4. a belief that high school-college relationships were improved by SSP, that transition to college life would be made easier for the participating student and that more students were encouraged to go on to college.

5. a prediction that high schools will have to use some form of ability grouping.

6. a belief that SSP's increased motivation toward intellectual achievement and that enrichment of high school science courses will be a result of SSP's.

However, teachers also noted:

1. recognition of dangers to both high school and students from over-emphasis on science at the high school level.

2. a feeling that pressures on high school science teachers are being increased by SSP's

3. a belief that financial problems eliminate the best qualified SSP prospects (11%)

4. objection to SSP because it is contrary to their philosophy of education

5. those of superior but not exceptional ability should also be included.

Students generally felt that the Program had achieved its goals. Those reservations held by some were of a minor nature.

VI Impact on Students During SSP:

- The courses and lectures themselves, active laboratory and research work, contact with stimulating personalities, working in a college environment, field trips and skills gained in scientific writing made deep impressions on the students. College level lectures especially with summaries and bibliographies were highly rated and appreciated.

- Where background was not too strong there was some complaint of going "too fast", where it was strong, the criticism was "repetitious" another indication of the need for refining student selection and for rating high school backgrounds.

To discuss mutual problems, attitudes and ideas with equally able young people was of greatest importance and mentioned again and again as one of the most valuable assets of SSP.

VII Index of Quality of High School Science Background

This index was developed because "the kind of school the student comes from" was believed to affect the level of performance, the range of skill, interest and understanding expected of a student and exhibited by him.

The index was based on:

1. The per cent of parents of students in PTA

2. The per cent of high school graduates who go on to college

3. Annual salary after five years of service for teachers with Bachelor's degree as their highest degree

4. Per cent of teachers in the high school whose highest degree is the Bachelor's

5. Per cent of science or mathematics teachers holding Master's degree or higher

6. Per cent of science or mathematics teachers with six or more years of experience

7. Per cent of science and mathematics teachers who teach no other subject except science or mathematics

8. Is there a guidance counselor in the high school

9. The kinds of organizations sponsored by the school

10. The number of the key science courses for which the high school has a laboratory

11. The number of advanced mathematics courses regularly taught in the high school

12. The number of science courses regularly taught in the high school

Above evidences were collected from the high schools which had students included in this study. Each of the above evidences discriminated between two groups of schools; one group nominated by the Observers and identified by the evidence as being known for their strong background in science teaching, the second group made up of high schools from the same states as the first group but without the science reputation.

The index made it possible to compare students from superior science background schools with those from schools rated not superior. The evidence suggests a relationship between the kind of high school background and the type of SSP selected by the student. More study on this seems warranted.

VIII Facts about the Student Groups

- Both Experimental and Comparison groups were all bright, high ability, science interested students.
- Most were 17 years old at end of junior year in high school, a normal age for this educational level.
- 27% had received at least one award for scholarship, about half had science or mathematic awards. Almost none ranked lower than top fourth of their class.
- About 1/4 had been editors of school publications. 2 out of 5 had held student government offices, all indicative of a superior group in terms of ability, achievement and willingness to carry their load in the social system.
- Nine out of ten had never skipped grades in school.
- As children, more boys than girls had been given toys of a scientific nature, reflecting the commonly held notion that science is masculine.
- Absenteeism from school was low.
- Chief extra-curricular activities include in order of frequency: religious groups, science or math clubs, athletics, music, school publications.
- The person most influential in development of science or mathematics insterest is most often identified as a teacher of that subject, less frequently a parent.
- Most of the students have science libraries of their own. Many have home laboratories.

IX Before and After S. S. P.

Measurement of interests, beliefs, plans, and patterns of performance of the students were made both prior to SSP and again in January following the SSP. These measurements included questionnaires and performance descriptions completed by the students themselves and reports on how their teachers saw them as well.

Some of the changes could be anticipated as a result of maturity so Comparison groups were utilized. Such changes as occurred only in the Experimental group and not in the Comparison group were assumed to be due to SSP attendance. They included:

An increased number of students

- recognized importance of interrelated science areas as chemistry-biology, physics-chemistry
- believed that adding to the sum total of man's knowledge was more important than making a discovery directly applicable to a problem
- developed greater ability to express scientific ideas clearly
- felt they had gained knowledge of methods and philosophy of scientific research
- were following through with advanced mathematics courses in special or outside programs
- accepted experimentation as a method verifying conclusions reached by logic
- strengthened work habits, though not necessarily those characterized by conformance to schedule or programmed procedures
- increased their breadth of interest
- increased their self reliance, confidence in independent thought and action
- started or developed further personal science libraries
- (girls) increased in technical interest and all general activity related to science
- developed near professional skill in some laboratory specialty
- increased their academic load and habit of checking fact against theory

By and large the boys show greater objectivity than do the girls. Girls adhere to a greater extent to a pattern of belief which one might call "fundamentalism." No significant change was effected for either boys or girls in their beliefs in certain superstitions as a result of attendance at SSP. It appears that the SSP's have been oriented to presentation of the structure, facts and procedures of science rather than implications or generalization of attitudes of science and scientific method to everyday living.

Both boys and girls apparently had stabilized their interest areas in science before SSP. No significant changes developed.

Boys in a more marked degree than girls in post SSP behavior showed lessened interest in amount of laboratory work, tended to be less attentive in class, antagonized fellow students more with a "know it all attitude" and were more critical of authority. This is not unexpected since the SSP purposes are not to encourage conformity to a high school performance norm but rather to stretch the thinking of able students interested in science both quantitatively and qualitatively.

Post SSP showed more boys who thought they had overspecialized in science and others who thought they lacked sufficient drive for science. There was a general increase in those who now felt they lacked a real science interest.

X Study of Further Educational Plans of these highly able students shows that:

- Courses planned for senior year lean heavily to mathematics and science. There is a decrease in the Experimental group of those taking solid geometry possibly reflecting a shift from engineering as a career goal to the sciences.
- Practically all students in the 3 groups plan to go on to college.

- Physical sciences, engineering (male), mathematics, biological sciences (female) in that order, are the most frequently listed majors.

- 83% of boys, 61% of girls plan to study beyond the Bachelor's degree.

Plans for financing college education are not clearly drawn.

- Boys have earned more than girls, 44% between \$300 and \$1000, 24% of girls have no earnings at all.

- Boys feel more secure about going into debt for education. 61% of girls say they haven't thought about it.

- 2 out of 5 will need to borrow for college.

- As of January their senior year over 2/3 of these students had no information about the National Defense Student Loan Program.

- Almost all these students intend to apply for scholarships rather than loans.

- There is need for more planned college financing and a study of same. It appears that too many students and their parents just hope to "muddle through."

This study points distinctly to certain areas needing further study.

1. There needs to be further study of these same boys and girls, reporting their developing careers in college, graduate study and into careers. The real impact of the Summer Science Programs is in terms of the careers of those exposed to them.

2. Selection of students for SSP needs to be examined carefully. There are questions regarding making the selections appropriate for the type of Program, so as to bring in those upon whom the Programs are most likely to have optimum impact.

3. The concept of kind of high school from which the student comes" needs much more study, both in terms of its selection and training implications as well as "educational pressure."

4. As yet there has been no adequate study of financing of college education. A follow up type of study in this area is needed.

5. More might be done to promote and evaluate the possibilities of summer science employment in serving the same purposes as the Summer Science Programs.

II

INTRODUCTION

For more than two decades the United States has been deeply concerned with the supply of individuals trained in science and engineering in sufficient numbers to meet the needs of the country. These needs are two-fold:

- the increasing demands of the military for scientists and engineers. The attention to this problem was sharply intensified with the orbiting of Sputnik.
- the normal demands of industry, business and government for scientists and mathematicians.

Early in this era scattered efforts were made to interest more students in science careers, but these efforts were relatively small and in most cases of only local significance. This need to give the superior high school science student "something more" has been long recognized. Prior to 1959, substantial progress in this direction had been slight. Although experimentation with procedures such as ability grouping, acceleration and classroom enrichment has been going on at an increasing rate over the last several decades, these methods for providing for the talented student have often been restricted to large schools in metropolitan, urban or suburban areas. The concentration of students of this caliber in the smaller high schools has generally been insufficient to warrant installation of such relatively costly special procedures.

For many years superior students have used summer school as a means for getting unpopular required courses "out of the way" and for obtaining special skills such as typing and shorthand. In this way, however, a few have taken additional or advanced science or mathematics courses either in their home high schools or, by special arrangement, in nearby institutions of higher learning. With a few outstanding exceptions, summer schools have not been used directly in meeting the special problems of the high-ability science student.

As early as 1949 one of the most interesting concepts for dealing with the high-ability science student was born: the summer science camp or program. In these summer experiences a restricted number of highly selected high school science students were given the opportunity to work and study under top-flight scientists. Often these summer camps or programs were held at a university or professional research facility and staffed by university professors or professional researchers. Participation in actual on-going research frequently was at least a part of the summer experience. Privately sponsored, these early science camps were few and far between. As "the word" spread, however, more and more schools and research institutions set up pilot summer programs. By 1959, therefore, the summer science program was already quite well established in several institutions in various parts of the United States.

More or less paralleling the development of the summer science program concept was the emergence of a variety of other techniques for dealing with the gifted high school science student. The Westinghouse Science Talent Search has been active for more than 20 years. Academic year programs to strengthen teachers qualifications, including those supported by the National Science Foundation, have been on the increase in institutions of higher learning throughout the country. Various programs designed to orient and inspire outstanding students towards careers in science have been backed by private foundations and, to a lesser degree, by public agencies.

In 1959 the National Science Foundation embarked on a program of Summer Science Institutes.

The basic objective was, "To conserve scientific interest at a high level in those gifted high school students who have shown marked ability and interest in the past, so as to increase the probability that this type of student continue and make science his career."

The rationale supporting this objective is:

1. Future scientific manpower requirements will emphasize quality rather than quantity. The need will be to produce better scientists, though not necessarily more of them. Thus the goal of the National Science Foundation is not the recruitment of talent in the form of increased science enrollments.

2. There exists in the high schools a pool of scientific talent. As the students who constitute this pool progress through high school to college and beyond, certain proportions of them change their career aspirations from scientific occupations to non-scientific ones. Anything that can be done to reduce this loss of high-ability science talent by natural attrition could, therefore, serve to increase the numbers of high-quality science graduates at the A.B., M.A., and Ph.D. levels without requiring an increase in the initial pool of science talent. The basic objective of the National Science Foundation program, then, should be to cut down the drop-out of scientific talent from the high school pool.

3. Several methods are available for identifying the students who make up the pool of scientific talent. The act of applying for admission to such a program as that sponsored by the NSF serves as one excellent indication of scientific or mathematical interest. Assuming that proper identification can be made, therefore, the objective is to provide those students with a stimulating summer experience which will increase, or at least conserve or maintain, their interest in science and fix more strongly their motivations to elect science as a career. Stated in a different way, the objective is to give these students a realistic look at science so that reality can be separated from glamor and a correct career decision made. Or, again, the summer experience should be designed to postpone insofar as possible the student's making a negative or default decision regarding a career in science.

The Summer Science Programs for high ability secondary Students, supported by the National Science Foundation, were sponsored and conducted for the most part, by colleges and universities with a few conducted in established research agencies. There were 117 of these institutes in the summer of 1959 and about 147 during the summer of 1960. Since this represents a major program and substantial expenditure of public monies, the Foundation sought to assess the impact of such programs on the participants and on their high schools. The present study is an effort to make and report such measurement.

III

PLAN OF STUDY

The National Science Foundation's "Summer Science Training Program for High-Ability Secondary Students" was organized to provide opportunities for superior secondary school students to study and work with experienced scientists and mathematicians. The programs, offered under the auspices of various colleges, universities and non-profit research organizations, were varied in their approach, but had the same purposes of encouraging or motivating bright high school students in their scientific efforts and in setting their feet more firmly and securely upon the paths towards careers in science.

For those concerned with the support, development and growth of such a program the question of its total effect or impact is of great importance. The study reported here is concerned with the measurement and description of the effect or impact of the Summer Science Program.

The study has the following objectives:

1. To investigate the immediate and long-range impacts which attendance at a Summer Science Program has on the participating secondary school students.

2. To study the impact of the Summer Science Program on the home high schools of the participants, on their teachers and on their peers.

3. To examine the impact of the Summer Science Program on the host institutions and their staffs.

4. To make plans for a longer study reaching into the colleges attended by participants in order to examine the effects of the Summer Science Programs over a longer period of time and specifically on college science programs.

The study was designed to compare the performance, attitudes, interests and activities of program participants before they attended a Summer Science Program with similar measurements and observations obtained after such attendance. In addition a second set of comparisons contrasts these before and after observations of the program participants with comparison or control students who had similar abilities, attitudes, interests and opportunity for developing these but who were not Summer Science Program participants.

The data of this investigation can be divided into three phases: before, during and after the 1960 Summer Science Programs.

1. The "Before" phase was completed before high schools had ended their 1959-60 academic year, and included the following:

   a. A detailed plan of study.
   b. Selection of sample of Science Summer Programs to be studied.
   c. Development of data collection forms and organization of the procedures for their utilization.
   d. Identification of students for the Experimental and Comparison student samples.
   e. Collection of all required pre-program or "before" data on:

      Experimental Sample
      Comparison Samples
      Home High Schools and Staffs.

2. The "During" phase included:

   a. Observation of the programs of the schools included in the Program Sample through Observer visits. This is similar to the corresponding facet of the 1959 study.
   b. Collection of data concerning student reaction to the on-going programs through use of a special questionnaire. (Form G)

3. The "After" phase was conducted as late in the following school year as feasible and the date for such data collection was set for January, 1961. The "after" phase involved:

   a. Collection of all required post-program data on:

      Experimental Sample
      Comparison Samples
      Home High Schools and Staffs

   b. Processing of all data and preparation of reports.

Three kinds of sampling were involved in the study, these included the sample of Summer Science Programs, the sample of students and the sample of High Schools attended by these students.

1. Summer Science Programs Sample. Eighteen of the 147 in operation in the Summer of 1960 were chosen as representative on the basis of:

   a. the kind of program offered (research, course, or orientation), and the living arrangements for students (resident on campus or commuting).
   b. the length of the program
   c. the geographic area in which located
   d. the subject matter offered
   e. other factors.

As a guide in the selection, the pertinent characteristics of the 147 programs were tabulated. In each of the tables presented the occurrence of the characteristic is shown in terms of the 147 programs and the "18" selected for that study. Actually the column under the "18" includes three programs in the Prairie View Agricultural Mechanical College (Texas) which had been tabulated separately because each one is a unit in itself and was operated with a different faculty and different subject matter than the others in that same college.

Table 1 shows the kinds of programs offered. Thirteen schools offered an orientation program, with students resident on the campus. Fifty-seven schools offered a course program, resident on the campus, and so on. Observer's reports in the 1959 program noted that the students had better opportunity for bull sessions among themselves, and with their teachers, if they were in residence rather than in a day-school set up so it seemed important to consider this factor in the sampling.

Table 2 shows the length of the programs in weeks. Two programs were scheduled for 13 weeks each, 4 were 10 weeks long, but 54 out of the 147 programs were 6 weeks in length. In choosing the

Table 1

Kinds of Programs Offered

Kinds	1960	"18"
Orientation - resident	13	3
Course - resident	57	5
Course and Research - resident	25	3
Research - resident	17	4
Course - commuter	16	4
Course and Research - commuter	5	-
Research - commuter	12	1
Research - resident and commuter	2	-
Total	147	20

sample the 6 weeks programs were selected as far as possible, so as to rule out or minimize length of term as a factor. Howerver, to include orientation programs in the sample it was necessary to take some shorter programs than 6 weeks, and to include research programs,required some longer than 6 weeks. The median length of program was 6.0 weeks.

Table 2

Duration of Programs - 1960

Duration	1960	"18"
2 weeks	5	-
3 weeks	9	4
4 weeks	17	1
5 weeks	18	1
6 weeks	54	10
7 weeks	7	1
8 weeks	16	1
9 weeks	15	1
10 weeks	4	-
11 weeks	-	-
12 weeks	2	2
Totals	147	20

Table 3 shows the geographic distribution of the programs. In reviewing the data for these it was noted, however, that geographic location and kind of program were not independent. Hence, this interaction was taken into consideration in the selection. The orientation programs chosen were from Mississippi, Oklahoma and Kansas. There were no orientation programs in the Middle Atlantic or the Northeast. Course programs as such were common in the south, while research programs were more common in the northeast area. Only 7 states had no program.

Table 3

Geographic Distribution of Summer Science Programs - 1960

Area	1960	"18"
New England	8	1
Middle Atlantic	23	4
South Atlantic	21	2
East South Central	8	1
West South Central	24	5
East North Central	21	1
West North Central	16	2
Mountain	10	2
Pacific	12	2
Other	4	-
Total	147	20

Table 4 shows the subject matter undertaken in the various programs. The group "multiple sciences" was the most popular combination. This generally meant a review of materials and concepts of most of the sciences but not presentation as separate courses. In the group "mathematics, chemistry, physics and biology", offered by 14 of the schools, the four subject matter areas were presented as independent courses in the summer science program. The Summer Science Programs did attempt to use basic science and mathematics as a vehicle for increasing the interest of the students as well as for giving them more intensive training and understanding in an area of science.

Table 4

Fields of Study - 1960

Field of Study	1960	"18"
Physical Sciences	20	2
Biological Sciences	22	3
Multiple Sciences (1)	30	6
Mixed Sciences & Mathematics	24	2
Mathematics	17	3
Mixed Sciences (2)	9	1
Physical Sciences & Mathematics	16	2
Applied Sciences (3)	8	1
Biological Sciences & Mathematics	1	-
Multiple Sciences & Mathematics	--	-
Totals	147	20

(1) Listed only as "Multiple." Specific components unknown.

(2) "Mixed" Sciences refer to cases where Physical and Biological Sciences are included in the same program.

(3) Meteorology, Agricultural Science, Electronics, Engineering, Forestry and the like.

Table 5 lists some other characteristics considered in the selection of the programs for inclusion in the study sample. Eight of the programs were offered in non-college institutions. For the most part these were research organizations offering opportunity to the students to participate in their on-going research programs. Ten programs were available to boys only, thirteen were listed as being in a negro institution and open only to negroes. Three of the 13 are considered as one program among the 18. Most of the schools had no particular feature in this area which had any bearing on the selection of the sample.

Table 5

Other Characteristics Covered in Sampling

Characteristic	1960	"18"
Non-college Institution	8	1
Boys only	10	1
Girls only	1	1
Negro Institution	13	4
No special feature	115	14
Total	147	20

Table 6 gives a list of the programs selected. The data, however, are not shown for any one program by itself. The purposes of the study were to investigate the impact of summer science programs in general on the participating students and not to evaluate individual programs.

Table 6

Summer Science Programs Selected for Participation

Brooklyn College
California State Polytechnic College
Colgate University
Colorado College
Cooper Union
University of Georgia
Indiana University
Kansas University
University of Mississippi
The University of Missouri, School of Mines & Metallurgy
Oklahoma State University
Prairie View Agricultural & Mechanical College
Southern Methodist University
University of Utah
Virginia State College (Norfolk Division)
Worcester Foundation for Experimental Biology
University of Pittsburgh
University of Santa Clara

2. Student Samples:

Three groups of students were included in this study, the Experimental group and two groups of comparison or control students.

a. The Experimental group (E) were students who participated in one of the selected 1960 Summer Programs. They had just completed the eleventh grade in high school and expected to return to complete the twelfth grade during the academic year 1960-61. (The 1960 Summer Program participants were the first group for which adequate "before the fact" data could be obtained to compare with similar evidence gathered "after the fact.") It is recognized that there is an increasing science sophistication developing in the schools and, as time goes on, the impact on the students and on the schools associated with the Summer Science Programs will become more diffuse and hard to isolate or identify.

b. Control Groups. The matter of setting up comparison or control samples for such a study as this presented some serious problems. These problems included finding students of approximately equal ability, of the same range of interests and intensity of motivation as the Experimentals and doing it economically. That such a study as this must have comparison or control samples was not questioned.

Two sources of such control groups seemed available and both were used. They were identified as the C-1 and the C-2 groups. It might be noted that the use of two control groups, rather than one, makes it possible to check the observed changes more adequately than could be done with only one. It also permitted a judgment as to which of the control groups might prove more effective or efficient as a comparison or control.

(1) C-1: Comparison or control sample were boys and girls who had applied for admission to the 18 selected Summer Science Programs but who were chosen as alternates instead of acceptances. All of the schools reported positive selection based on a variety of factors such as school record, teachers recommendation, interviews, tests, and students' statement of plans. Hence, it might be assumed that the C-1 Comparison group were not quite as able, or quite as strongly motivated, or perhaps not as articulate as the experimental group.

(2) C-2: The members of the second comparison or control sample, were obtained from the same high schools from which the students in the experimental sample came. In asking each high school for cooperation in this study, a list of names of the students from that high school who had been accepted in one of the 18 Summer Science programs was included. The high school was asked to supply the name of one other student for each name listed, the other student to be of the same age, sex, ability, interest in science and motivation as his opposite

number in the Summer Science Program. This left the matter of identifying control samples to the schools themselves rather than attempting the use of psychometric data. The merit of this control sample is shown in the comparison of the data from these boys and girls with those of the experimental group and with those of the first control sample. Data on aptitude scores, which might be expected to offer a basis for comparison of the experimental and control groups was too scattered to make any sensible comparison. It may be assumed that differences in response or behavior of the members of the experimental group before as compared with after the Summer Science program must be associated with the effect of the science program as part of its impact, providing that same change is not observed among those boys and girls who were not privileged to attend such a program.

3. The High School Sample consisted of the high schools from which the Experimental and Control samples of students had been drawn. The immediate and long-range effects or impacts of the Summer Science Program could be many and varied. In order that optimum success for the study be achieved, therefore, it was important that efforts be concentrated in those areas in which accurate, objective measurement seemed most feasible and in which significant results would most likely to be forthcoming.

Nine forms or schedules were developed for the actual collection of data in this study. Table 7 shows the name, the form designation and title, and the sample or subsample for which the form was used.

The kinds of data to be collected were, of course, those believed to have some possible bearing on the question of impact of summer science programs on participants and their high schools. The forms are described briefly below. The questions in the various forms are shown in the tables showing the tabulations of answers to each of the questions.

Form A: STUDENT INVENTORY filled out by students before the beginning of the Summer Science Program. Forms A and B were mailed directly to the contractor, so as to minimize contamination related to the student's expectation that his high school teacher or principal would see his answers.

Part I is basically a biographical inventory covering home background, interests, college plans, awards, honors, activities, attitudes toward courses and school work, outside reading, outside work, and the like.

Part II consists of 87 questions, covering attitudes and beliefs in regard to school and in particular toward science as a career.

Part III is concerned with current school work and with the Summer Science Program.

Form B: STUDENT DESCRIPTION was designed to enable the student to describe himself, his performance pattern and work habits as precisely as he could.

Table 7

Outline of Use of Forms

Form	Pre-SSP Student	Pre-SSP Teacher	Pre-SSP Principal	During Observer	During Student	Post-SSP Student	Post-SSP Teacher
A. Student Inventory	X						
B. Student Description	X					X	
C. Student Academic Record			X				
D. School Inventory			X				
E. Student Description		X					X
G. Student Reaction					X		
H. Student Inventory						X	
I. Teachers Summary							X
Observers Schedule				X			

Part I is a series of 35 sets of 4 descriptive phrases used to describe the on-the-job performance of the student as a science student. Part I encompasses 7 factors as follows:

S: Scientific Attitude
C: Creativity, Inventiveness, Ingenuity
B: Breadth of Interest, Curiosity, Inquisitiveness
W: Work Habits, Goal Orientation, Dependability, Responsibility, Attention to Detail.
SS: Social and Communication Skills in Scientific Setting, Helpfulness, Cooperativeness, Teamwork, Leadership in Science, Communication
T: Technical Interests, Activity for Activity's Sake, Cookbook Scientist, Equipment Builder
I: Independence of Thought and Action, Disregard of Authority, Insistance on Checking Errors in Other's Work.

Part II contains 27 questions regarding attitudes and behavior. These use a five step scale; "Definitely "Yes" to "Definitely No" to answer each of the questions.

Part III asks the student to indicate his own characteristics, attributes and kinds of performance which he thinks will help him be a good scientist, and also those which he thinks will hinder him in developing and following a scientific career.

Form B was completed by all students, both Experimental and Comparison, before the SSP (May 1960) and again after the SSP during their senior year in high school (January 1961).

Form E: STUDENT DESCRIPTION is essentially a duplicate of Form B. It was designed for the teacher to answer, describing the performance and attitudes of pupils as the teacher sees them in the same terms as those used by the student. In addition to duplicating the questions asked in Parts I, II and III of Form B, Part IV asks for information regarding the teacher's knowledge of and attitude toward the Summer Science Program.

This form was completed by a high school science or mathematics teacher of each student both at the Pre-SSP (May 1960) stage and again in January 1961. It was not required that the same teacher report on a student both times.

Form C: STUDENT ACADEMIC RECORD is a brief form asking for the relative standing of the student in his high school courses and a record of courses taken and grades earned. This record was obtained only in May 1960, and not repeated in January 1961.since such a record could show no essential change within that period.

Form D: SCHOOL INVENTORY is a questionnaire to be filled out by the high school prinicpal, describing in some detail the high school and particularly those aspects of a high school which might influence or contribute to the student's understanding of science insofar as the high school as an environment is concerned. It covers description of the school, of the teaching staff, the offerings in science and mathematics, and information regarding the selection of students to attend the Summer Science Programs by the high school. This form was filled out in May 1960 only.

Form H: STUDENT INVENTORY is a revision of Form A, deleting from it questions to which answers would not change within the period of May 1960 to January 1961. A few other questions were added to cover topics bearing on financial need and the student's attitude toward the Summer Science Program. It was also necessary to use a question in Form H to check up on which students in the Comparison Groups had attended Summer Science Programs other than the 18 included in this study. This form was administered only in January 1961.

Form I: TEACHER'S SUMMARY is a series of open-end questions addressed to the teachers to be filled out by at least one teacher from each high school. The questions ask for the teachers' impressions of the benefits and detriments of the Summer Science Program as they see them in terms of their students and as they see them in terms of the reactions of other teachers.

Form G: STUDENT REACTION is a brief questionnaire filled out by the students (Experimental group only) during the last week of their Summer Science Program, to describe their summer experience as they saw it at that time.

The OBSERVERS' SCHEDULE is a list of 69 questions for which the observers sought answers from the program directors, faculty and students of each of the selected SSP's during a two day visit to the program while it was in progress.

The numbers of students by sex and by group for whom data were received are shown in Table 8. The numbers of students shown in the table for each group and form are the numbers for whom the forms were received in time to be coded and included in the study. A total of 1325 Form A's were returned. Of these, 957 were for males and 368 for females. By groups, there were 620 in Group E, 322 in C-1 and 383 in C-2.

Of the 705 possible members of the Experimental group, 88% returned a Form A, while Form A's were returned by only 51% of the possible C-1's and 54% of the C-2's.

The shrinkage from the numbers of students who filled out the forms in the pre-SSP period as compared with the post-SSP period is shown in Table 9. Eighty-four per cent as many boys in the Experimental group returned Form H as had filled out Form A. Eighty-five per cent as many boys in the post-SSP period filled out and returned a Form B as did during the pre-SSP period. The shrinkage picture for Form E for boys Experimental group is 87%. It has been suggested that there might be a relationship between the percentage of returns in the post-SSP as compared with the pre-SSP in the interest in science or mathematics as a career. If this is true then the boys in the Experimental group have the greatest or most intense interest, followed fairly closely by the boys in the C-2 group and the rather distinct drop in returns from the C-1 group. It could be argued, however, that the boys in the C-1 group, those who applied for admission to a SSP but were not accepted, might be less likely to cooperate in such a study than either those who were accepted (Group E) or those who were nominated by their schools as most similar in ability and interest (C-2).

Table 8

Numbers of Students for Whom Data Were Received

Form	Male				Female				Grand
	E	C1	C2	Total	E	C1	C2	Total	Total
A (Pre-SSP)	445	232	280	957	175	90	103	368	1,325
B (Pre-SSP)	444	231	284	959	173	90	103	366	1,325
C (Pre-SSP)	438	238	308	984	169	93	112	329	1,358
E (Pre-SSP)	429	236	288	953	157	80	92	329	1,282
B (Post-SSP)	377	166	253	996	137	74	78	289	1,085
E (Post-SSP)	365	160	242	767	121	64	80	265	1,032
H (Post-SSP)	375	143	219	737	136	67	69	272	1,009

The same pattern does not hold for the girls. The largest percentage of returns of post-SSP as compared with pre-SSP were for the girls in experimental group, followed in order by the C-1 and then the C-2 groups. It is not proper to include the returns on Form E from this point of view, since these forms were filled out by the teachers who may not be influenced by the same motivations as the students.

Table 9

Returns of Post-SSP Questionnaires as a Per Cent of the Corresponding Pre-SSP Questionnaire Returns

		Male			Female		
Pre	Post	E	C1	C2	E	C1	C2
A	H	84%	62%	78%	78%	74%	67%
B	B	85%	72%	89%	79%	82%	75%
E	E	87%	68%	84%	77%	80%	87%

IV

FIRST HAND EVIDENCES

The Summer Science Programs have been seen from several different viewpoints but with each having pertinence to the understanding and evaluation of these programs.

1. An "Observer" visited each of the 18 programs included in this study, making a 2 day visit to the program to see it in action, to talk with the program director and staff, and to interview some of the students. The Observers* were men trained and experienced in science and concerned about the encouragement and training of future scientists. On their visits they followed a prepared schedule of 69 questions covering every aspect of the program. These questions were answered with the cooperation of the program directors and others involved.

2. The students who participated saw their programs from a distinctly different angle. Toward the end of their summer program, each participant completed a brief questionnaire covering his attitude toward his experiences. In addition some questions were included in the pre - and post-SSP questionnaires asking about expectations for the program and about the realization of these expectations.

3. The science and mathematics teachers in the high schools attended by the students who participated in the selected SSP's answered questions about SSP and its effect on these students (January 1961) following the attendance at a 1960 SSP by one or more of their students. (January 1961)

Summary Of Observers' Reports

I. Objectives

Setting of program objectives had been left largely to the discretion of the host institution and so varied considerably from campus to campus. The proposals submitted to the NSF were also examined and are included in this summary of objectives.

Directors were asked what the host institution expected its program to accomplish from the point of view of:

1. The students and the high schools to which they would return as well as the colleges they would soon enter.

2. The host institution itself, and its faculty.

They were also asked why their institution had selected the particular areas of study covered in its program.

The objectives reported are listed in the following paragraphs with those which occurred most frequently appearing first in the list.

A. Objectives: For the Participating Students

1. To motivate toward and offer guidance in the selection of a science career: Encompassed in this objective was the thought that students would have an opportunity to see science as a possible and desirable career, but in a more realistic light than they had known heretofore. They would have the experience and stimulation of knowing and working with men who had achieved in science and at the same time see at first hand that such achievement rests more on patient routine than on glamorous drama. From their own performance in competition with others equally able they would also gain some valid measure of their own aptitude, competence and interest.

2. To orient and stimulate student interest in science: This was recognized as an objective particularly in the Orientation programs which were expressly set up to give students a brief but highly charged exposure to a wide variety of science areas. It was also so recognized by many of the Course programs and at least two of the Research programs. It was considered as important for a student to discover that he did not want a career in science as to confirm his feeling that he did.

3. To stimulate individual study and/or research and provide some realistic experience in it: This was widely accepted as an objective by both Course and Research types of programs. In the former the emphasis tended to be on the introduction of modern ideas, as in mathematics, with the hope that they would thus develop an appreciation of the subject as a living, growing discipline. In the Research programs "reality testing" was generally the key word with the greater amount of time spent actually in the laboratories. The degree in which individual creativity and research design was encouraged or made possible varied very widely.

4. To supplement the high school program: In the Course programs effort was generally made to convey course content on a level more advanced and different than the student would encounter in high school or in early college. The Research Programs aimed at exposing students to the basic characteristics of research work, refinement of laboratory skills and better understanding of the experimental approach. It was evident that great care had been taken to avoid actual duplication of high school work.

Other objectives mentioned by a few included:

5. To encourage these students to education beyond high school: It was hoped that some who had not seriously considered this, or who - as was true with some of the girls - had thought in terms of secretarial or business courses - would be so stimulated and impressed with the possibilities in science that they would go on to obtain degrees and perhaps do graduate work. The actual experience of a summer in a college atmosphere was seen as a strong factor in this.

6. To give the student some understanding of the interdependence of the sciences:

7. To impress the student with the importance of learning thoroughly the basic mathematics and

* See Appendix A for list of Observers. The views of these groups are summarized in this section of the report.

science available in high school:

8. To stress the importance of developing competence in communication skills in science and engineering.

Another objective just noted in passing would seem to be a rather important one. That is the stimulation and inspiration that seems to "explode into being" when good minds strike sparks with other good minds. This opportunity to work and compete with students who are really their peers in ability, to discuss past experiences, present problems and future ambitions appears in other areas of the report as one of the most influential and memorable results students carried home with them. However, this seemed to come about all on its own. It was not recognized in the early planning as a real objective.

B. Objectives: For the High Schools to Which the Student Will Return: These objectives were less clear-cut than those seen for the student himself. One Director stated quite flatly that his program's concern was for the student and for no one else. For the most part, however, Directors saw objectives for the high schools falling into four categories:

1. To exert positive influence on the student body body as a whole: More interest in and enthusiasm for science and its career possibilities would be generated in the whole school as a result of talks, special projects and the general contagious high science-temperature of the returnee. It was anticipated that he would also spread the notion that academic achievement does have rewards and thus influence a more positive attitude toward intellectualism.

2. To improve science teaching methods: This could result, the Directors felt, in those schools in which returnees were encouraged:

   a. to serve as laboratory assistants and/or class resource persons

   b. to share new techniques and ideas

   c. to organize Science Clubs

   d. to enrich school libraries through use of lists of references compiled during summer

   e. to teach classes (the institutions which included this did not elaborate)

   f. to give high school teachers a better idea of the possibilities for student activity at a high level

   g. to bring back to their schools the strong imprint of the science faculties. (This in a state where the School of Education had been more influential on high school teaching than had science departments.)

3. To influence school administrators and parents toward improvement of science curricula: One school was reported to have added a course in physics as a result of such influence. Improvement in quality as well as quantity of courses offered would also be expected.

3. To strengthen the tie between the high schools and the colleges through better mutual understanding: Many resources are available at the higher institutions of which teachers may be unaware, or which at least they are not utilizing.

C. Objectives For the Colleges Which these Students Will Enter: The Directors agreed some or all of the following could be expected:

1. These students would arrive in college with less need for orienting: They would have some familiarity with the college approach and with the seriousness of getting off to a good start. They would have a better appreciation of real intellectual achievement. In short, it was hoped that this summer experience would prove to have been a helpful transition mechanism for later college entrance.

2. Early clarification of goals through these programs would save time for the students and headaches for the colleges: in that there would be less fumbling and fewer program changes.

3. As the influence of these programs filter down it could mean a general raising of student ability at the freshman level: As a corollary to this a more mature attitude on the part of entering freshmen could stimulate better teaching as faculty responded to their challenge.

D. Objectives For the Host Institutions:

1. The recruitment of future students: These would return, it was hoped, as permanent students who would provide the host not just with more numbers but with better quality.

2. A closer alliance with high school teachers in the area: Many pointed out the gains made in better understanding of secondary school problems on the part of the host institution and faculty. And conversely they noted aid and facilities they could make available to teachers as they became better known in secondary school circles.

3. A general improvement of the educational level of the area high schools: Would in turn result in higher quality college students.

4. A gain in prestige as a leader in the science field: It is interesting to note that one host institution disclaimed any objectives for self gain, feeling that this was purely a public service.

E. Objectives For the Participating Faculty:

There was almost unanimous expression of the personal satisfaction which the participating faculty had derived. Many gave long hours without any recompense other than this. Observers reported the high sense of dedication with which the faculty approached these special programs and their sincere desire to give their very best.

Other benefits included:

1. A better understanding of the problems and activities

of secondary schools, plus a better acquaintance with their teachers, students and their science programs.

2. The stimulation of these superior high school groups lead many of the faculty to enrich their college courses for the regular year. As they saw what students of this age could really do they came to believe that they had not sufficiently challenged their usual classes and took steps to remedy this.

3. Two institutions noted that these programs benefited their faculty materially in supplementing the nine month salary on which they regularly operate.

4. In one instance the Director himself was collecting data on the ability, motivation, temperament, etc., of this superior group for further study and possible publication.

5. One reports using this program as a field for trying out new teaching methods.

F. Objectives Reasons host institutions selected particular areas of study:

Selection of area of study to be offered was determined largely by three elements:

1. Availability of staff and of on-going research.

2. The faculty's interest and feeling of what was most important for students. Several, for instance, felt very strongly that mathematics was the most important basic essential.

3. The administration's interest: For example, one which hoped to arouse its faculty to more interest in high school programs included as many of its science departments as possible, thus exposing more faculty members in its broad coverage. In another, the biology department was holding an NSF summer program for teachers, so to equalize this the student program was set up in the mathematics department.

A unique reason occurred in one program which felt that engineers were especially weak in communication skills so they looked for an opportunity in all their science courses to correlate report writing, public speaking, writing for publications, etc.

Negro institutions cited as a special objective the desire to promote better science programs in negro high schools. Generally, they felt, these are under par which results in a considerable gap when students do enter college. It was their hope that these programs would help to reduce this gap. They also hoped to encourage more of the able negro students to plan seriously on continuing in college. Many with ability would have considered this impossible because of the expense involved. With encouragement and information on where and how to seek financial aid many who would otherwise discontinue college entirely might go on.

II. The Program

The programs can be best presented in terms of the factors used in their selection. These factors were believed to have pertinence in identifying a sample of programs representative of the 147 listed by NSF for the summer of 1960. Type of program was perhaps the most important selector along with subject matter offered.

There were three major types of programs: Orientation, Course and Research.

The Observers' reports regarding program are summarized in terms of these and other pertinent factors.

A. Orientation Programs: Characteristically the orientation programs were of short duration, two or three weeks long. They covered a very wide range of subjects. Their purpose generally was to expose students to a large number of scientific fields. Students had completed 11th grade, except in one program which admitted some from 10th.

The method of approach differed in each program. In one school students were divided into three groups which rotated so that in the three weeks they were on campus they had had one week's exposure to physics and mathematics, one to geology and astronomy and one to chemistry and biology. Lectures, laboratory and field trips were employed. The Observers rated the level of teaching as generally sophisticated.

In another the day-time program was a presentation by faculty members in each of the fields of mathematics, physics, chemistry and engineering. The presentations covered a general picture of the content of the field, the nature of its professional application and the need for personnel in that area. In the evening there were informal meetings with guest representatives from local industrial fields of engineering with opportunities for questions and answers. There were field trips once a week but no formal courses, no exams, and no homework.

In a third school, students as a group attended demonstration lectures illustrating recent developments in methods of approach to unsolved problems in some 16 different branches of science. They then broke up into four smaller units and proceeded to laboratory or field work in which the students did their own experiments. Areas of science examined included anatomy, anthropology, astronomy, bacteriology, bio-chemistry, botany, chemistry, entomology, geography, geology, mathematics, physics, physiology, psychology, radiation bio-physics and zoology.

At least two of these are programs of several years standing and the sponsoring institutions are apparently happy about them. However, one Observer questioned whether the impact of the Orientation type of program on science education justified the cost in terms of faculty time and effort and financial expenditure, in comparison with other types which require more student performance and actual experience in science activities.

B. Course (or classroom) Programs: Characteristically these were of four to six weeks duration with subject matter designed to introduce the student to modern concepts not met in high school and unlikely to be met in early college.

Mathematics, physics, biology, chemistry and engineering were included in courses offered but as a rule only two or three of these would be available on one campus.

Course material was usually covered in lecture-discussions with the faculty in the morning. In some, text books were used as well as reference books of both the high school and the college level. Afternoons were usually given to laboratory, seminars, problem solving, student reports, conferences or homework. In one the approach was that of a team. In physics, for example, attention was focused on the nature of the atom. Lectures and laboratory were closely correlated.

Another unique approach was to put special emphasis on the use of communication skills, admittedly weak in engineers. Correlated with the other courses was one in scientific communications which involved public speaking, report writing and the reading of scientific papers.

No essential differences in program were discernible between those in which the students commuted or were in residence except that there were no evening or week-end activities for the commuter programs. However, a greater feeling of unity was reported among the residential students with more informal give and take in after hours "bull sessions" (which many Observers considered one of the most valuable parts of these programs.)

C. Research Programs: The research programs varied from six to thirteen weeks in duration. The number of students involved in each varied from twenty to forty-two, generally smaller than in the other types of programs. The emphasis was on giving students opportunity to see and to participate in real, live "science in the making". Actual student participation varied from those in which they observed and assisted faculty members in on-going research, more nearly at the level of laboratory technicians, to those in which students designed their own experiments with written protocols required and checked before any research operation began.

In one instance students would ultimately be paid for their six weeks of service. They were in the laboratories daily from 8 to 5. There were no organized groups for instruction but each was expected to read widely in reference books and journals and to gain from questions and answers of the researcher with whom he worked.

A more common variation was to attend formal lectures and classes for part of each day, with the remainder spent in the laboratories where they either worked with faculty on on-going research or on their own. In one case students audited one regular college science class of their choice daily and while not required to take the examinations were allowed to if they chose.

A special feature in another was the presence of four or five outstanding students from the last year's program. They had been invited back to work on specific problems under staff sponsorship. They also served a very important function as stabilizers and pace setters for the first year students to whom they were assigned as advisors. The Observer rated the level of work going on to be about that of 3rd year in college.

A third variation was that of a program which started with an interest in cancer research in the high school biology department and grew to involve the medical school of a nearby university. There were no formal texts or courses but students spent 2 weeks at the university visiting laboratories, getting instructions in how to use the library and attending various introductory lectures. Following this, the program revolved about individual projects designed by the students with written protocols required before work could begin.

Actual animal experiments were a special feature of this program with most of the work going on in the high school laboratories under the direction of high school teachers but with all the resources of the University, Medical School library, specialized equipment, and chemical supplies available. Most important was the dynamic direction emanating from the Medical School with daily visits by the members of its staff.

Where students were commuting they came in by bus from the surrounding area and were busy with their science activities from about 8 o'clock to 12 noon when they were returned to their homes.

D. Negro: Two programs from negro campuses were included in the sample. Both were course programs, though they made considerable use of laboratories too. Students at one were mainly commuters though they had a few non-local students for whom they arranged housing. The other was a residential program. These were considered separately because it seemed likely their problems would be somewhat specialized. One problem was the gap which they feel exists between the somewhat under par level at which their students complete high school science and the level at which they are expected to function when they enter college. Both programs put considerable emphasis on Mathematics, with Chemistry, Biology and Physics also available. A special feature in both the programs was some form of organized study hall or mathemtics drill several times weekly. Guest speakers, discussion groups, conferences and time in the laboratories completed their daily schedule.

E. Extracurricular Aspects of the Program: Recreational and extracurricular facilities were generally reported to be more than adequate. All the campus facilities for outdoor sports, swimming, tennis, golf, baseball, etc., were available. In addition many programs made available two or three movies weekly, concerts, picnics, campfires or dancing. In two instances ball teams were developed and challenged other teams in the area. For the most part such activities were unorganized and entirely voluntary. In one program entirely for boys, however, there were organized athletics four times a week in the late afternnon. All types of sports were included and many passed their Red Cross Lifesaving and water safety tests while here.

In the commuter programs there was naturally less opportunity for the extracurricular programs. Facilities of the host institution were usually available but beyond a little tennis or some use of the swimming facilities they were generally not utilized. Most popular apparently in these programs, were the pool tournaments which were developed during the lunch hour.

Bull sessions continued to be a popular sport in all programs, at meals, between classes and after hours.

III. The Staff

While the staff involved in these programs varied widely in types of training and experience, one characteristic stood out as common to all and that was a tremendous enthusiasm for working with youngsters. Many had volunteered for the summer without any special reimbursement.

A. Training and Qualifications: Program directors typically were men with doctorates. Frequently they were department heads. They were usually men with many years of school and administrtion experience. Instructors and research supervisors were also largely persons with advanced degrees in their areas of science. However, as secondary teachers worked alongside the university professors, the students seemed to consult one as frequently as the other. It appeared that the students did not respond to the advanced degree but to that person's apparent grasp of the problem at hand. In general, instructors were known as the better teachers of the host institution's staff.

The counselors less frequently had Ph.D's but were carefully chosen persons of experience and wisdom in dealing with high school student problems. On one campus counselors were of two groups. There were older, experienced high school teachers plus a second group of university undergraduates who had special ability in dealing with young people. Students appeared to like this age diversity, feeling that the younger counselors had a better understanding of some of their problems.

B. Experience: Few of the directors had had actual high school teaching experience but many had been school administrators. Instruction varied from those with only college teaching experience to those with fifteen to twenty years of high school teaching. The researchers were least likely to have had secondary teaching experience, but many of them had worked with college freshmen.

Non-academic work experiences at all levels included numerous instances of association with the Junior Academy of Science, Science Fairs, camp directing and counseling, scouting, Y.M.C.A., Sunday School, and other activities involving young people. Beyond this many had worked in industry, directly or as consultants, in the Armed Forces, in government service such as the Geological Survey or Park Service or had varied other experiences in libraries, banks, hotels or laboratories.

The dedication and enthusiasm with which these staffs approached their summer tasks was noted by almost every Observer. However, some raised a warning about riding a willing horse too hard.

In the 1959 report* it was noted that "staffing and general administrative difficulties were fewer in institutions where similar programs had been offered in the past." From this it was inferred that staffing would be easier as experience and faculty acceptance accumulated through the seasons.

Observers for '60 seem to see this in a different light. Several detected a growing uneasiness that, however willing to give of themselves for one or two seasons, men who are really operating on the frontiers of research have too many other pressing professional obligations to be expected to give attention to these secondary school programs year after year. They strongly urge that attention be given to this matter in the hope of finding a solution before the problem becomes really acute.

IV. Teaching Methods And Procedures

A. Teaching Load: The number of students in classes ran as high as 100, but 30 or 40 was more often the case. Orientation programs had the largest enrollment. Groups for laboratory work were broken down into smaller units of one to three, the largest reported being 25.

In no case did the Observers report any obvious overload on the teachers, although those in the Orientation programs were commonly carrying full summer school loads and their responsibilities to the science students were above and beyond this. In the residential programs, two noted that faculty members who lived on campus with the students were on duty practically 24 hours a day hough they might be scheduled for only 5 or 6. Many teachers were free to give all their time to the high school program.

B. Methods of Instruction: Just about every possible method was used here or there. Particularly was this wide variety true in orientation programs. Course programs depended more heavily on didactic lectures with questions and discussion periods and some use of laboratories or problem solving. In this category, those programs where the students were in residence allotted a greater portion of time to laboratories than did the commuting programs, probably because the commuters put in a shorter day on the campus.

* A Look at the 1959 National Science Foundation's "Summer Science Training Program for High-Ability Secondary School Students" A Report Prepared for The National Science Foundation By Richardson, Bellows, Henry & Co., Inc. December 31, 1959

In the Research programs there was less formal instruction or lecturing and a greater dependence on individual attention in laboratory work, casual advice, recommended reading and laboratory demonstrations.

The Negro programs utilized lecture, discussion and laboratory methods. One of them held weekly drills in mathematics.

A tabulation of this proportioning of time for each kind of program is shown in Table 10. These data are essentially the estimates of the program Directors, and are not the result of observation. Not all were able to provide this information saying all methods overlapped. In no case was any previously and formally designed experimental approach to teaching reported. Individual teachers were trying out methods here and there which were new for them. One Research program was using high school students as research assistants on a paid basis, which was an innovation.

Table 10

Time Distribution of Instructional Methods
In Summer Science Programs

Type of Program	Lecture	Laboratory	Other*
Orientation	50%	50%	
	33 1/3%	33 1/3%	33 1/3%
Course Programs			
Commuter	80%		20%
	70%		30%
	60%		40%
Residential	50%		50%
	33%	52%	15%
	33 1/3%	66 2/3%	
	33 1/3%	33 1/3%	33 1/3%
Research Programs			
Commuter		85%	15%
Residential	33 1/3%	33 1/3%	33 1/3%

* "Other" includes activities such as discussion, demonstrations, problem solving, seminars, consultations, etc.

C. Course Coverage and Direction: No one aimed at complete course coverage in the traditional sense. In one Research program students were actually enrolled in college courses, mostly as auditors, but some were meeting all the course requirements and taking the examinations. Orientation programs were highly organized and highly directed. Course programs were almost equally so but with some research studies in which students had opportunity to initiate some activity.

Even in Research programs, there was considerable direction and organization in some. Comments here varied from one extreme such as "90% organized, 10% student initiated" and "problem is set, student takes over" to the other in which the comment was "self initiation is expected."

D. Homework and Texts: There was homework of some sort in almost all but the Orientation program, and even there students did a fair amount of their own volition. References included some of high school level, mostly college and some even beyond. Half of the programs made use of texts or syllabi, mostly at college level.

In connection with references there were varying attitudes toward these young students using library facilities. For the most part, the students seem to have been accepted, or even especially welcomed with an effort made to instruct them on how to use everything the library could offer. However, one Observer reported a situation in which university librarians did not wish to have undergraduates consulting the technical periodical literature. This closed off opportunity to become acquainted with much of this and, although research advisors gave them some reprints, this did not really make up the deficit.

E. Other Methods: Field trips were commonly utilized, and varied in frequency from 1 or 2 for the entire session to once a week. They included visits to laboratories, to engineering and industrial situations where science was in use or research going on, to hospitals, to IBM data processing center, etc. At least one was an extended trip to collect geology specimens.

Guest speakers were an integral part of the plan in all but three of the programs. Once or twice a week was the usual thing. Subjects were sometimes related to courses, sometimes not. Reception varied but was usually enthusiastic.

Round-tables of some sort apparently went on most enthusiastically, and almost universally at lunch time. Observers were inclined to feel that these "bull sessions" among students, and give and take sessions between teachers and students were among the strengths of the program. There was a built in advantage for this where the students were in residence and little opportunity, except at lunch hour, where students commuted. In Research programs, this sort of exchange went on almost continuously in the Laboratories. Two Orientation programs had periods specifically scheduled for round-table conferences.

V. Recruitment and Selection

A. Who should attend these Programs: A general summary of opinion resulted in the following description:

"A student of superior ability, who is

highly motivated, with keen curiosity and imagination. He should have a serious vocational interest in science and be socially mature for his age."

The point on maturity was made particularly in the Research programs.

On the matter of how many times any one student should attend, most schools indicated a preference for one time only. Some added that if there was a second summer, it should be in a different science area or because of a very special interest to further research, but one pointed out that a policy of no repeaters makes the program available for that many more students. Others felt the student who wanted to return shouldn't be barred, but agreed that twice should be about maximum.

B. Recruitment Procedure: Brochures were the most commonly used method of publicizing the programs, and most schools relied on them as their main recruitment tool. They were sent to principals, mathematics and science teachers and to counselors.

Both brochures and an application form were sent on inquiries directly from students.

Commuter programs recruited only in nearby areas. Most others limited mailings to their own county or state. One college admissions office handled the brochure mailing, sending them to every high school in the state.

Other techniques included news releases to state newspapers. Several inquiries came from out of state as a result of NSF publicity, both printed and radioed.

Although commuter programs seemed to limit active recruitment to the local area, some students from greater distances were admitted and enabled to participate in the program by arranging to live within the community. In at least one case, students were housed with families in the area. These students came not only from surrounding states but, in a few instances, from the other side of the country.

Length of time allotted to the recruitment period was influenced by several factors. Not the least of these was the necessity on the part of any individual school to be officially assured of the NSF grant before going all out for recruiting.

Where the summer programs had come to be expected, some schools report that applications were arriving from all over the country before the brochures were in the mail. The earliest report date for beginning recruiting was that of late January, but most mailings were made in March and April with final selections from mid-April to mid-May.

C. Applications Received: The total number of applications reported (for the 18 programs in this study) was 3,756. Of these, 948 or about one-fourth were accepted. This differs rather markedly from the 4,000 applications made in 1959 for admission to the 11 programs studied that year. Roughly 12% of those were accepted.

Information as to the quality of 1960 applicants was not available from all schools, but three report it was difficult to make any final choice because of the general high quality of all. Seven others rated the top 1/2 to 2/3 of acceptable quality. Only one reported that 50% were generally unacceptable.

D. Selection:

1. Boys versus girls: of the 948 selected, 303, a little less than 1/3 were girls, 645 were boys, in other words, a ratio of about 2 to 1 in favor of the boys. Three of the 18 schools had no girls enrolled. This was either because the program had been geared to boys specifically, or because there were no dormitory facilities for girls, or because there was a hesitancy to have boys and girls the first time a program for high school students was tried. In the latter case, however, the report is that if repeated next year, the program here will be co-ed.

Boy to girl ratios on individual campuses differed rather widely. In only three cases was there a preset ratio. In the remaining schools the eventual acceptances were largely male. Two report that they might have had entirely boys except that they gave the girls a "little edge" in order to encourage some enrollment on their part at all. In these cases, girls constituted 1/4 to 1/3 of the total.

In the negro schools, the situation was reversed. Girls were in the majority and it was the boys who were given a little edge for encouragement. In this group the economic factor was especially evident. Many boys who would otherwise have been interested and eligible found it necessary to earn money in the summer months in order to continue in school.

2. Selection Procedures: There was no uniform pattern of selection. A need to improve and refine the process was generally recognized. In about one-third of the programs, selection rested in the hands of the faculty with each member reading and evaluating each application. In other cases, it was the director and/or assistant working independently, or perhaps with a faculty member who made the selection. In the commuter-research programs, selection was made entirely in the high schools and the university had little or no knowledge of the background of individual students. In the Observer's opinion, some more cooperative arrangement would have been profitable.

Evidence which was weighted in making the selection included:

a. Tests-Half reported some use of tests; mathematics tests being most frequently employed. Generally they do not seem to have been given great importance. Four reported considerable consideration given IQ's but one research program made a special point of not looking at IQ's.

b. Scholastic Records - High school academic records were relied on rather heavily.

c. Teachers' Recommendations - Ten weighted these heavily, especially those from English, mathematics and science teachers. Two considered them of little value, largely because they were all so good and did not differentiate among the applicants.

d. Students' Written Statements - These were required by eight, in some cases a letter, in others, an essay on a scientific topic. Such written statements were useful in tipping the balance one way or the other in doubtful cases. One research program which considered student interest of prime importance required students to submit a protocol of a research they thought they might profitably undertake. If this were found acceptable, a personal interview followed.

e. Personal Interviews were utilized by three. Others thought they might be desirable but that distance and time made them generally impractical.

f. Other Factors Considered included leadership, intellectual ability, original thinking, community standing, and similar general terms without elaboration on how these were measured.

E. Factors Which Influenced Application

1. Encouragement of teachers seems to have been the most potent single factor.

2. Reputation of the institution appears to be tied up with the feeling of prestige the high schooler gains in working on a college campus. This seems particularly true when his instructors or laboratory supervisors are men of national importance in the field.

3. Subject matter offered.

4. Location was important to commuter students but of little importance to others, except in sparsely settled areas where going to a metropolitan area had appeal, or on the West coast where Eastern students were attracted. Nearness to home or the parochial nature of the school influenced others (or their parents.)

5. Time - Many preferred the early period directly following school in order to have the remainder of the summer for a job or vacationing with the family. To some, the 9 week program appealed as a "more solid course" than the usual 6 weeks.

6. Stipends and Cost - were mentioned by some, but generally rated of little importance. We must remember, however, that this is for those who applied and were accepted. There is no way of knowing how many ruled themselves out on this basis without taking even a first step. Observers were inclined to feel that a good many able students were not represented for this reason. They based this conclusion largely on talking with students about their colleagues back home who did not apply.

7. Student to Student Carryover from those who had been in programs other years was a potent factor in encouraging new applications.

8. Recognition of the value of such a summer as it would lend weight and distinction to future college admission and scholarship applications.

VI. Performance

In the opinion of the Directors practically 100% of students were benefiting from the programs. The degree of benefit varied from a very few who seemed to be in a little too deep for comfort on up to those who were taking it all in stride and pushing for more. The attitude throughout, however, was one of sincerity and enthusiasm.

As evidence of performance, 10 of the 18 schools have examinations and/or reports in some form and send some communication back to the high schools. Few had any well organized plan for making use of such records, but keep a copy in their own files as a counseling aid if the student returns later for college. Several, without written grade records, do send letters on completion of the course to the high school teacher. Four give the student a certificate of completion. In one Research program which gives no examination, each student gives a report of his own activities and his estimate of the progress he is making. Both the instructor and an Observer rated these reports equal to the work of college juniors or seniors. At another in addition to progress reports, both oral and written, there is hope for publication of research papers with some of these students as co-authors. At the request of the student, letters of recommendation will be sent to any college he designates.

In the Course program the trend seemed to be toward the more usual form of daily papers, and some graded and some not, some returned and some not.

Research programs varied from those reported above to those in which the student was left to decide for himself whether his summer efforts produced better work habits, knowledge or laboratory skills. Observers were inclined to feel the latter too "open-ended" with the result that students failed to find a proper amount of direction, either internally or externally, to make the program really profitable. Observers agreed that the students showed intense interest, high morale and that they are interested in and responsive to lectures. Their attack on laboratory problems, their wide use of notebooks, their after hour discussions all show high enthusiasm and unusual ability. Instructors generally judged the work of these groups as superior to that of regular undergraduate classes on campus. One Research program found that standards set by the staff and a sprinkling of older students aided in holding the whole program to a high level with younger students meeting performance standards expected of junior research assistants.

Loafing and horseplay were conspicuous by their absence. The isolated examples of "high school atmosphere", boredom, or uncooperation were due, in the Observer's opinion, to lack of stimulating challenge and occurred where students were doing fairly routine activities not of their own design or choice.

There was no report of any serious problems in discipline. For the most part everyone was too busy, too interested and too excited about what was going on in the classroom and laboratory. Probably the greatest impact reported is the students' recognition that there are other high school students just as bright as they are. The opportunity to discuss with peers their mutual problems, attitudes, ideas and ambitions has been of great personal importance to them, this bringing good minds together was mentioned many times. For others the chief impact has been to crystalize their up-to-now rather nebulous ideas of going on in science. In a few students, it has brought about a decision not to go for science. Another result has been a realization that there are possibilities open to deserving students for financial aid when it comes to college. Interestingly, several report they now want to go into teaching instead of professional practice as doctors or researchers.

Counselors were generally available. In only two programs did the Observers report a real need in this area. In one of these, the director plans to make some of the university staff available after talking with the Observer about the need for experienced help on information regarding College Entrance Board Examinations, scholarship applications, etc. One Observer thought more might be accomplished in group discussions of how to judge a college, how to find those with strong departments in your area of interest, how to track down possible financial resources, apply for scholarship, etc. Not all the questions were of this long range type. Some sought out the instructors or faculty for technical advice, and for suggestions and ideas on science fair projects. And again, they have gotten into the more philosophical approach of science as a way of life. The girls especially are concerned with the woman's role in science and the question of home versus career.

VII. Follow-Up

Follow-up was perhaps the weakest or least developed facet of the entire program. Nothing sufficiently organized and formal that it could be termed a real study of the impact of the program on students, schools or community was noted. However, ten reported they were doing something. Five had recognized the need but as yet had taken no action. Three had no plans whatsoever.

Action seemed to include only rather generalized ideas such as the following:

1. Plan to send questionnaire to students in senior year asking their own evaluation of impact on their senior work.

2. Try to determine where students go to college, how they do and if they graduate.

3. Send questionnaire at the end of the program asking the student's likes and dislikes.

4. Photos and news releases sent to home communities "to see what impact this has on the community."

One of the Negro colleges plans to check with the high school counselors next year on the performance of this summer's students. They will also make contact with school principals and with the students themselves. They have hopes of finding funds for long-term follow-up on honors won in college, participation in school activities, degrees and further education plans.

The Director of one program is making a thorough study of temperament, motivations and abilities of bright high school students in such a program with the hope of eventual publication. This is the most detailed study reported.

Keeping touch with the students is being actively pursued by ten, more or less incidentally by others. Kinds of action include the following:

1. Send a postcard to the home address of each participant each year asking if he is still in school and what kind of record he is making.

2. Encourage students to write back to the faculty for counsel and advice and keep them informed of their progress.

3. An Alumni Day which brings back last year's students to the campus while this year's students are still there or a reunion in the spring.

4. Circular letters.

5. Personal contacts, such as students who return to use the university library, drop in informally to see their old professors and supervisors.

6. In the program which has each year a center core of second year repeating students, this group sends welcome letters to those who will be coming in for the first time.

Others report informal, unplanned, incomplete and casual kinds of contacts, chiefly with those who happen to return to the university as students. One Observer was particularly distressed that no one was trying to make any studies of the behavior of these students while they are on the scene and available for test and observation. "An opportunity for the collection of a very considerable amount of information is slipping through the hands of the faculty," was his comment.

VIII. Non-Academic Facilities

Swimming, tennis, baseball, softball, golf, other outdoor sport facilities were generaly available. Game rooms, lounges, music rooms were likewise available in Student Centers or dormitories. Social evenings, concerts, dances, cook-outs, and beach parties were frequently reported. Most use of such facilities was made in those programs in which students were in residence. However, in the commuter programs, students generally had access to such facilities but since the students were spending less time on the campus, they were not much used. There were some reports of billiards, bowling, pingpong, and other games during the lunch hour.

Living arrangements ranged from adequate to elegant. For the most part, they were housed one or two per room, except in one instance in which there were three per room in order to get all of the students into one dormitory. In another case, in which the students were mostly commuters, eight from out of state were living in one dormitory, two double bunks in each room. These boys had made up self-governing rules of making beds each morning and keeping the room orderly. In this same program, girls from out of town lived with families selected by the guidance counselor and approved by the Director. This seemed to be working satisfactorily. At least one dormitory was reported as air conditioned, others reported coin-operated laundry facilities, and both boys and girls were taking advantage of these. In one case, both boys and girls were housed in the same dormitory but on separate floors. The counselors also lived there and one was on twenty-four hour duty each day. Some official dormitory person was at the desk during the day.

IX. Special Problems

A. In the High School: No one foresaw any clear-cut, real problems the student would face on his return to high school. Among those they thought might arise were the following:

1. High school classes might prove less stimulating.

2. Libraries might seem more meager and equipment second rate.

3. Some might be a bit cocky finding they really know more mathematics or modern techniques than their teachers do when they return. (Some are already recognizing this but for the most part they were realistic about it and when the question came up they were counseled to be reasonable.)

Where there has been feedback from the school, it appears teachers have been generally happy with last year's students, many have made them class assistants and anticipate doing the same this year. Schools interested in developing similar programs were expected to receive students with open arms and give them new leadership opportunities. Some students of previous years have returned to feel their old curricula too limited and the courses too elementary. There has also been some irritation in schools where the administration does not permit such extra activities as Science Talent Search or science fairs.

On the positive side, many students are planning to take correspondence courses or otherwise arrange college-level work in order to make up the deficiencies they know they will find in their own high schools. Others are organizing science clubs, making lists of books and periodicals for the high school to borrow or buy in order to upgrade their own facilities. Negro high schools tend to be low in facilities for advanced mathematics and science, but the students know this and know too that it is part of this program's objective to stimulate a desire to improve. One suggestion was that students coming from this program will take back to their high schools more respect for the "solid courses" such as English and Social Science. One Observer picked up a possible negative reaction in that students who were not well selected and unable to keep up with this powerhouse program in the summer might feel a sense of failure. For the most part, however, there was little feeling that there would be any very big problem. For the high schools it was felt that there would be no particular problems but that returning students from such courses would call attention to the need for better courses within their own schools. It was admitted that in small schools it may be difficult to program for these superior students but where administrators and teachers are interested in these students they feel they will prove no problem.

B In the Colleges: On the whole, Observers and instructors anticipate these superior students will cause any college less trouble than regular freshmen. They will come in with a more serious purpose and a more mature approach as a result of this experience. They should be wiser in their choice of courses and majors and less likely to flounder. An over-all effect on colleges eventually may be to start their incoming freshmen higher up the ladder as the high schools generally upgrade.

It is anticipated that colleges may find these students bored if they are placed in regular freshman courses. In one program they endeavor to help this situation by asking the students to inform them of their college plans as soon as they are complete. The Director then writes the colleges concerned, letting them know of the superior quality of this student, and something of the work which the student has done in the summer program. This gives the college a timely warning so that they can avoid a mistake in the placement of the student and be better prepared to handle him well.

There is a general feeling that high schools and colleges are reconsidering curricular, entrance and graduation requirements partly as a result of programs such as these. A committee of the Kansas Academy of Science is conducting, through grants from NSF, a series of conferences dealing in part with this problem. In other areas, surrounding high schools are sending observers with the intent of up-grading their teaching. In Indiana, as a result of this program, enrollment in Biology courses in the high school has increased and a third year of Biology, an introduction to bio-chemical research, will be offered this year for the first time.

C. Effect on the Community: Knowledge of the effect on the community is rather nebulous. In general, it is felt that parents are pleased. A good deal of newspaper publicity has been generated by these programs. Many of the students, either at the college or on their return to their local high schools, are asked to talk before Rotary Clubs or other such public groups. School boards are watching these programs with interest and it was favorably reported several times that newspapers and television stations were coming to the college campuses to request information and news of these programs and not waiting for it to be pushed at them.

D. Should the High Schools Take Over ? The observers were unanimous, after discussion with instructors and faculty, that the high schools should not try to take over these summer science programs. One or two suggested that maybe if mathematics could be provided, if real laboratories were supplied, it might work out but even so the students would miss the advantage of college atmosphere. For the most part there was strong feeling that the high schools could not handle the situation; that they are not set up administratively for such functions; that is important to be in the university environment. One observer reporting on a program in which high school teachers were employed noted that:

> "When the high school teachers lectured there was a definite change of pace, a definite inadequacy of scientific knowledge and ability to convey it. This convinced me once and for all that programs of this kind must be carried out on a university campus by university personnel. The greatest mistake the NSF could make would be to permit the high schools to take over this program."

E. Administrative Problems: There was some reporting of lack of faculty interest and interdepartmental friction at the beginning. As the program got underway most of these tended to disappear. Some professors felt they were having to spend more time than they had anticipated but the usual report is of complete and dedicated cooperation. One capable director finds most administrative problems, if ignored at the moment, generally manage to take care of themselves.

Some reported opportunities for enlarging student horizons were slipping through the hands of the individual supervisors because they personally did not think it important or had no time to do much about it. These then should be handled by the central office in the Observer's opinion. There are no reports of granting college or high school credits for these courses nor any expressed feeling that there should be.

X. Financing

A. Comments on financing are summarized as follows:

1. Budgetary problems: Four schools found themselves running short of money, not due to any NSF fault, but rather their own failure to anticipate costs correctly. However, there was some fretting about what seemed to be an NSF tendency to take a proposed budget and make a small cut in it, even though the institution felt it was absolutely minimal as submitted. One such comment is quoted, "As a consequence of such cuts, institutions whose programs could be quite good may become only satisfactory."

2. Faculty salaries: More financial support for faculties was seen as a need in two or three instances. Typical comments were: "More financial support for staff might be in order so that these people would not have to hold down two jobs in order to do this one." "No salary is drawn upon from this project for university professors, nor are other teachers involved in the program adequately paid. NSF and the public are getting an awful lot of return on a very modest investment."

3. Other:

   a. Another year, one school expects to extend help to those students who really need it, letting those who are able pay their own way. (It operated that way on some campuses.)

   b. More money could have been used for lunches, recreation, and especially for guidance.

   c. The nine weeks' program may have some advantages but it is also more expensive.

   d. Dormitory type programs are more expensive to run.

B. Who bears the cost? There were almost eighteen different arrangements for division of cost between the students and other funds. They could be lumped, more or less, as follows:

1. Board, room, and all or part transportation provided. This was true for three. In one of these, in addition, students each recieved $60 compensation for work done as laboratory assistants. Of this, the Observer remarks, "It might be better to make it less so the student doesn't feel he is just hired to do a job, or make it more and put more initiative and responsibility on the student."

2. All transportation costs provided: This was true for eight.

3. Some portion of board and room provided: In four programs, half this cost was provided, in two others subsidy could be applied for up to $90. Of 100 students in this instance, 72 had grants averaging $64 each. The remainder paid their own way.

4. Students paid fixed sums: In these four programs, the fee varied from $35 to $200.

C. Cost in relation to Recruitment: In only two cases did the Observers find anyone willing to suggest that students could bear more expense than they do now. These two thought possibly students should pay their own transportation costs. As to the effect on recruitment, there were two schools of thought.

1. Some student responsibility is good, and may even help rather than hamper recruitment. To be willing to bear some portion of the cost was seen as evidence of sincerity of interest. Buying your own books, or whatever, may make it more meaningful. Some kind of fee may serve to screen out "buggy riders." No one, however, argued for the student to pay the whole cost, unless really able.

2. More, or all, expenses should be borne by the grant, and stipends paid to equal what the student might have earned in a summer. This was the other stand, supported by arguments that the need for summer earnings bars many able young people from such a program, even if expenses are paid. There was general agreement that there had been many in this summer's program who would not have come had the cost been more, but no one knew how

many more might have been interested had the cost been less.

D. Sources of Financing

1. NSF bore the greater burden of financing for all 18 programs though this varied from approximately one-half the cost on up to most or all of it.

2. Host institutions contributed heavily, although their expenditures were often hidden in that they included facilities, equipment, utilities, overhead, janitorial services, breakage, and frequently staff. Some provided student board and room or scholarship funds.

3. Students contributed in varying degrees from nothing but their own pocket money up through one-half the cost of board and room, to $200 or all expenses.

4. Community contributions were not noted often. In some cases, a school board furnished transportation, service clubs provided scholarships, or out of town students for a commuter program were housed without charge in homes in the community.

E. Future Financing: Except for suggestions made above, almost all seemed to find the present system quite satisfactory for another year or so. For a longer term, there was some expression of large contributions from state and community in particular, and, where possible, from the host institution and alumni of the program.

XI. General Comments

A. Quality of Staff and Teaching: Sophisticated was the adjective most often used to describe the teaching level. Others employed included "superior," "sound," "college graduate level," and, in only one instance, "very ordinary."

B. Teacher's Interest: It was observed that teachers were taking more time for preparation of lectures and laboratory exercises for these students than they did for regular classes. In some cases interest was varied, that is, in one department there might have been more enthusiasm at the beginning of the program than in some others. As it all got under way, however, this tended to level off as teachers responded to the challenge and surprisingly high ability of this select group. Descriptive terms used in referring to teacher interest varied from "tremendous," "dedicated," "intense," to "sincere, but without deep understanding of the real potential."

C. Facilities: Classroom and study facilities were usually more than adequate. One Observer reports them better than he was accustomed to on his own campus. There were a few qualifying notations, of a minor nature, such as "some crowding because of remodeling" or "some lack of air-conditioning."

Libraries too, were found to be very good. The only complaint seemed to be an occasional case where they were not open weekends or where undergraduate students were not allowed free access to the stacks where the scientific periodicals were stored.

D. The Spirit of the Program: It is not easy to tell from studying these reports what accounts for this elusive thing called "spirit". It seemed observable at its highest pitch in the Residential Research programs, yet some of the Commuting programs had it too. Some suggested that it was more evident in the laboratory courses, but there were instances of reported boredom where students were in the laboratories all of the time. Another suggests that the high morale he observed was possibly due to the smallness of the group (20 to 30). Yet there were others reporting equally fine spirit in groups of 60 to 100. What it seemed to boil down to was that a good spirit existed wherever there was a common feeling of unity and enthusiasm.

1. Unity appeared to grow most naturally where the students both lived and worked together, so residence contributed. In this way, way, there was time after hours to compare objectives for the future, to bat about common ideas, and to stimulate each other. On one campus on which there were a large number of other summer school students, the science high schoolers were provided with pins and lapel buttons which enabled them to recognize each other in the crowd. At the other extreme, in a residence program which was just a little too highly organized and too formally disciplined, the feeling of unity was low. Unity was high in a commuter research group where, for example, students worked out a production line procedure for inoculating rats in which everyone helped in order to finish the job on time for a promised lecture. Here, students had a strong feeling of working together for the sake of the project, even though they did not see each other after hours.

2. Enthusiasm appeared to have been highest where students were most personally and deeply involved. Even in the laboratory, if the students did not have some part in the design of the project, or were without knowledge of the how, the why, and the what-comes-next, then enthusiasm waned, excitement lessened, and boredom threatened.

E. Does the Program Measure Up to Its Aims?

In answer to this question, several Observers reported, "Yes, and then some." This special group felt the program had gone even beyond their aims in the response from the students, in their ability to grasp concepts, and in providing a new kind of atmosphere for these students. For the most part Observers reported original aims had been lived up to and that some had done it with more spark and life than others. Where there were some weaknesses apparent, they could be categorized as follows:

1. Creative activities were given too minor a role. Students needed more opportunity to be really involved, to "get their hands dirty".

2. There was a néed for a more systematic plan for follow-up.

3. Student selection needed refining.

4. Guidance could be strengthened.

F. The "Tough" Problems: Fourteen say they have really no "tough" problems but among their minor difficulties they noticed the following:

1. Students come with varying degrees of preparation.

2. Not all teaching in the program was done at the same high level.

3. There was need to provide more guidance and counseling in college and career choice. Perhaps this could utilize some of the superior high school teachers who could better interpret the student problems to the college faculty.

4. A small liberal arts college has fewer recognized leaders in scientific research than have the larger universities.

5. One felt that recreational facilities could be improved.

Two of the somewhat tougher problems involved long-range administration and planning. In the first case, the program to date has involved one high school and chiefly one university medical school man. Now other schools want to participate in this program or develop those of their own. The problem, then, becomes one of planning for deliberate, controlled expansion since obviously the people who made this program grow are limited. In the other case, the program has developed at the request of 24 high schools who have turned to the area college. The Observer sees here the problem as one of attempting to tie up the loose ends which as of now have no planned facilities for carrying back to the schools what has been happening to the secondary teachers and the students who were involved. The university scientists don't feel this responsibility. The Department of Education is on the edge of the show and the schools which participate are too diversified to agree on a mode of attack. "This operation has many very promising ingredients for large scale and long term educational development but without agressive leadership and a carefully planned program of operation many of these potentialities are developed only slightly on a hit or miss basis." He feels this feedback should go especially to guidance personnel of the schools. He was dismayed at the lack of couseling for guiding pupils toward career possibilities or college admission.

One of the negro schools reports a third problem: that of trying to make it possible to get more boys in the program. Apparently, negro boys find it necessary to work during the summer time and, even if everything in the program is furnished, they could still not give up their summer work.

One program, more than the others, had a high school instead of a college feeling. The teachers say this group lacks the spark that last year's group had, but are at a loss to say why the spirit has changed other than to indicate that there are several other competing programs in the surrounding area. The Observer talked with the students and their answers lead him to feel that science teaching in their schools had not measured up to that of the better public schools. He raised the question as to whether this accounts for the lack of quality and spirit he found here.

G. What Evidences of "Effect" Should One Look For? A summary of what Observers of the Summer Science Programs felt might be looked for follows:

1. Do the students turn up as lab assistants in their own high school?

2. What happens to the high school curriculum? Are any courses dropped, added or changed?

3. What is the attitude of the teachers, school officials, parents, and returned students to the program after they are back in their own high schools?

4. Is there observable increase in the interest in science, in the effectiveness of teaching, or any enrichment in the curriculum as a result of these programs?

5. Do students return with more vigor and deeper interest?

6. How are these students utilized by the teachers?

7. How many students enter contests, such as Science Talent Search or National Scholarship, and how do they fare?

8. How interested are they in current science and engineering affairs, what special projects of their own have they started?

9. Have they furthered any portion of the research programs in which they were involved in the summer?

10. Have they continued contact with any people who were responsible for their work in the summer?

11. Have they interested any other students?

12. Are they cocky, over-sophisticated?

Two Observers suggest that high school is too soon to see much of the effect. Programs essentially for supplement may not show the effect, except in general maturity and in performance later in college.

Two report an observed need for a reaction conference in the fall in which the summer staff, the high school principals, science-math teachers, and guidance counselors would all get together. In such a conference, they might re-evaluate the program just past and plan further for the up-coming one.

The really great need for follow-up which was reiterated many times was nicely summarized by one Observer who wrote: "The whole crux of the situation as to what effect these programs have is what these people do in college. I think it extremely important that NSF itself conduct a follow-up study or make a contract with some suitable agency to conduct such a study. I think the longer such a study is postponed, the less value it will be. The sooner it is made, the sooner improvements in the high school programs can be made, and the more effective can college programs become. Such a follow-up study will become more expensive as time goes on, but in terms of the over-all cost of the NSF programs and science teaching improvement, the cost of this study will be quite small. I am convinced it would pay larger dividends than perhaps anything else in the program."

H. Attitude of High School Principals and Teachers

The attitude of high school principals and the high school science teachers is generally enthusiastic and favorable. Those who are weak teachers may be a little nervous about returning students. Occasional principals say students come back cocky and overbearing but a fair summary was that of the Observer who said, "These students come in the main from high schools with stimulating teachers and return to them, hence all are satisfied." There may be schools where they would not be so received. With both school administrators and the teachers involved appearing to be interested and sympathetic, one Observer was surprised that they were doing nothing about on-the-scene observations of these capable students, making comparison with other groups, or other observations with a view to contributing to educational literature or developing greater insight into the problem of how best to handle these able young people.

As Seen By Participating Students

The students' viewpoint was obtained through use of RBH Form G answered during the final week of the Summer Science Program.

Most Popular Features:

The Courses and Lectures Themselves were the high ranking feature in all the Orientation Programs. They included in this the subject matter, its broad and interesting variety, some opportunity for laboratory work and the advantage offered of "doing-learning" in combination with "listening-learning." The stimulating presentation and general high quality of instruction was noted.

In the Course Programs these same factors ranked either first or second. This trend was less pronounced in the Resident than in the Commuter programs though there is nothing to indicate that residence per se was the differentiating factor. Frequent note was made of the modern approach to the subject matter, as in mathematics for example, which was different from anything the student had met and which he recognized as unlike anything he expected to get later in the usual college course.

Students at one Research Program gave high rating to the value of the whole program as an orientation to science and its application.

Actual Laboratory and Research Work was ranked first by those in the Research Programs and also by those in the Negro Schools. The latter found great satisfaction in the high caliber of instruction, and in the opportunity to use their own equipment in laboratory work on their own choice of project.

Freedom to choose a project, to participate in designing the experiment and to set one's own pace without threat of interruption of examinations, were specifically noted with great satisfaction wherever these conditions prevailed.

The opportunity to be actively participating and doing, not passively serving as a receptacle into which knowledge could be funneled was greatly appreciated.

Contact with Stimulating Personalities was given first place by students on one campus, and various aspects of it appear high on the list of all. They included here the local instructional staff as well as distinguished scientists who were frequently brought in as guest lecturers.

In the Research Programs students valued the opportunity to work side by side in the laboratory with scientists who had already achieved.

Many students felt that the opportunity to meet and exchange ideas, not only with senior scientists but with other equally able students of similar interest was one of the most stimulating and valuable aspects of the entire program.

Working in a College Environment was important to all the students. They felt that they gained a pre-view of what college really is like. They appreciated the superior quality of laboratory equipment and facilities, and they responded to the challenge of college instruction at a tempo above that they had experienced in high school.

Guest Lecturers brought in news from the very forefronts of science. Program administrators often went out of their way to arrange person-to-person conferences with such men, which the students appreciated.

Field Trips and the opportunity they offered to see science in action were included in the Most Popular Features list in every program, but generally ranked lower than the items just discussed. At least some valued them for the respite they gave from the sometimes overwhelmingly fast pace of lecture and laboratory work.

Knowledge and Skill Gained in Scientific Report Writing was given high rank in one Research program.

Least Popular Features:

Most frequently mentioned dissatisfaction was the matter of not enough time. They complain, almost without exception, that these summer programs were too short. Perhaps it was less the length of the session and more a feeling that they had not completed a project, or digested the subject matter, or really got to the bottom of some new fascination. There never will be enough time for these young people to do all the things they want to do.

Some recognize and voice the thought that perhaps this pressure was good for them but there is a general irritation at programs so tightly scheduled as to leave little or no time for individual activities, especially for the highly valued "bull sessions" with their fellows. Students on only one campus, on the other hand, list as their prime complaint, a feeling of lack of accomplishment because they had too much free time.

On the whole they appear as a group to deplore any wastage of time, and list as examples: too long lunch hours, gaps between activities, time consuming tests and questionnaires (especially some low-level arithmetic tests which they considered childish) picnics and park trips, required participation in recreational exercise or in evening music and art programs, repetitious homework, spending weekends at home when they could be working on projects, etc.

Classes too long:

Some classes which ran for 90 minutes were considered too long without a break. Some evening lectures were found too long also, with a hard day of lectures and laboratory already behind them.

Classes not well timed:

One group complained about long afternoon lectures in the summer heat. These preceded the laboratory session. In another there was an early morning lecture-seminar at which neither lecturer nor students were at their best. Saturday morning classes were unpopular.

The Program:

Complaints revolving about the courses offered were usually a reflection of the primary interest of the students, in that each would have liked more offerings in his special interest and tended to regard as a waste of time those which lay outside that area. Other "gripes" in the program include:

Paucity of Laboratory Work and opportunity for individual projects, reported especially in Course programs.

Repetition within the program, this appeared to happen most frequently with guest lecturers.

Repetition of high school -- This depended on the background of the student and they usually recognized that what was repetitious for them might not be for someone else, but suggested that a different selection of students might eliminate this factor.

Too much listening, not enough doing -- came in for complaint chiefly in the Orientation and Course Programs.

Instruction And Methods:

On the whole there was admiration for the high quality of instruction but there was general lamenting over other matters.

Burdensome Homework was noted and with complaints that it was not a substitute for laboratory experience. Sitting up until 3 AM to grind out repetitious exercises in homework was resented chiefly as a waste of time.

Teaching "Over-the-Heads" of students again reflected the diversity of background preparation in many cases. Courses too "hard" were also a probable indication of need to look more carefully at student selection.

High School Teachers as supplements to University staff were strongly objected to by the students on one campus.

Insufficiency of Individual Help in doing research projects.

Writing Reports and Protocols seems to have drawn some of its unpopularity from failure to brief students as to how to write them. As a result they were often frustrating for the writer and boring for the listening class when read.

Student Selection and problems arising therefrom turned up not only in some who had difficulty in keeping up in the classroom but also in fitting harmoniously into the group. There is some reporting of fellow students whose serious science interest was questioned, and some reference to "odd-balls" and "goof-offs."

Other:

Rules and Requirements were a source of annoyance to some.

Compulsory Recreation was the most frequent source of complaint. While some lamented a lack of time for any recreation, they apparently wanted it at their own time and resented having time set apart for it which interfered with completing something else.

Curfew or other rigid rules which indicated regarding them as children were disliked after acceptance in the laboratories as young adults.

Tedium of Laboratory Work appeared on the unpopular list in the Research Programs. "Waiting for things to evaporate" and chores such as washing the animal cages as well as other repetitious procedures were not favorably regarded.

Tedium of Commuting appeared, naturally, in those programs with commuting students. Early rising, long, hot bus or subway rides and again the urgent feeling that time was being wasted were the usual complaints.

Social Outlet: The only evidence of any real discontent on this score was in an all male program where the highest praise anyone could give was to the effect that what there was, was all right, but it was evident they felt it had been in short supply and not too well planned. Absence of girls, however, was apparently the basic lack.

Generally students seemed not to be particularly interested in organized entertainment and didn't want to feel required to participate. The arrangement that seemed to work best was reported in those programs where the young people planned their own entertainment, pacing it to meet their own need with a result they happily tagged as "just right."

One Research program had special praise for the entertainment feature, interestingly because "it didn't interfere with their work."

In one of the residence programs entertainment was felt to be no problem during the week but on weekends some felt a certain emptiness.

Food was a source of complaint in only 2 instances.

Financing was troublesome also in 2. In one case checks were late in arriving, in the other expenses proved greater than anticipated with resulting strain for some.

In several programs large numbers of students found nothing to put on the Unpopular list, and in one program there were no expressed dislikes but frequent affirmations that it was "wonderful," "couldn't be improved," etc.

Facilities were generally highly rated.

Libraries were frequently described as "impressive" and personnel friendly. Where criticism occurred it was likely to be because the library was closed week-ends, or these young students were denied free access to all books, or some references were in short supply.

Laboratories generally drew enthusiastic approval for equipment and supplies.

Classrooms were generally good. In one there was protest over "squeaky chairs" which interfered with hearing the lecturer. The fact that students in this program seemed generally overscheduled and pushed to the fatigue point may have resulted in their overreacting to this annoyance. In another case the classroom had been designed for elementary school children so blackboards were uncomfortably low.

Living Facilities were generally good. Only one case of some crowding was indicated with 4 students in rooms designed for fewer. Food was mentioned as being especially good on 1 campus and only on 2 was there criticism.

Students: The usual report was that at least one half the students held each other in high regard. Adjectives commonly used were "brilliant," "stimulating," "of astonishing ability," "vigorous," "cooperative." In most of the programs there were a few exceptions who were referred to as "know-it-alls," "rowdies," "clods" or "loners". Student criticism of their fellows was more often directed at their attitudes than at their abilities. This was most likely to take the form of immature behavior, "goofing-off" or lack of diligence in applying themselves to the task at hand. All this was of deep concern to the more serious students.

Teaching, for the most part, was widely acclaimed. Most frequently mentioned on the credit side was the challenge the student felt in his first exposure to the lecture method at the college level. The general reaction was one of awe at the amount of inflormation which could be packed into one such session. Recurring with almost equal frequency was appreciation of the clear, understandable and effective presentation most of the faculty made. Other favorable comments included: Use of skillful lecture demonstrations, individual attention, encouragement to independent thinking, use of small groups for activities, use of visual aids, excellence of laboratory guidance.

About 50% had some reservations about some of the teaching. These included: Teaching which went "over-the-head" was "too fast" or "too deep." Such criticism seemed to stem from the dissimilarity of background preparation in the student. The same subject in the same program might, for instance, be described as "too hard" by one with no previous exposure and "repetitious" or "too easy" by one who had had some high school work in the area. Some who were finding it difficult to keep up to the pace of the class were inclined to blame the instructor. Others felt there was an effort to cover too much ground in too little time.

In the Orientation programs there was some evidence of desire for a more active role in a predominantly passive program. A few felt that at least a portion of the faculty were not really interested in the program (though it should be noted that a great number indicated the evident deep interest the great majority of the staff showed).

In one program students were critical of the high school teachers who supplemented lectures by the University staff. In this instance the Observer also commented on the lower level of ability of these particular teachers.

In the research programs students were sometimes annoyed or puzzled by lack of clear-cut direction where a non-directive technique was employed. In others where a "Sponsor" or "Research advisor" approach was used, some of the students "got lost" in their work through lack of communication or understanding with the sponsor.

Texts, References, Lectures: Texts were used regularly in six of the Course Programs and one Research but there were none in two of the Orientation Programs, one Course Program and one Research. Others made reference to them here and there. Student reaction to texts when they were used varied from "too general," to the belief that they were too difficult and highly specialized.

In two of the Course Programs, texts were provided free of charge. In the Research Programs there was some complaint about their high cost and a feeling that they should have been provided.

Students gave an enthusiastic receiption to lecture summaries which some instructors prepared and distributed. Without exception they found these helpful and frequently expressed a wish that they be available in all classes, even before the lecture was given.

Bibliographies of references were provided in one course Program but without any special pressure to use them. The students appreciated having them, however, for future use as well as during the session.

Libraries, on the whole, were well used and the reference material needed appeared to be available in all cases. Special mention was made in one Course Program of the fact that the staff made their own personal libraries available to students.

A special device which students found useful in one Research Program took the form of regular weekly meetings in which students discussed their project work.

The Program: Students from some 10 of the sampled 18 felt that the Program had been entirely successful in achieving its goals. In the remainder there was a division of opinion varying from 50% to 80% who thought this was true, while the rest of the group had reservations.

These reservations seemed to depend on the student's own background. Some felt certain courses should have been included and others omitted, others would have omitted those the first especially prized, etc.; some found the pace too fast, coverage too sketchy. Some in courses were disappointed at too little laboratory, some in Research laboratories would have liked some more concrete courses.

Typical descriptive phrases used by those who felt the programs had been successful were "Tough, but well balanced," "good opportunity to get more in your special field yet be exposed to a wide range of others," "effectively planned, content well chosen."

Expectations

In a few cases there was unanimous agreement that the whole session had lived up to or exceeded expectations. In the remainder 25% to 70% found it had fallen short in some respect.

Most frequently mentioned was the fact that they had expected to do more hard studying, less watching and listening, more "real science" in laboratories, less orientation. Again some found the subjects treated in a more cursory fashion than they expected while others found some topics too deep.

Time to pursue individual activities, to socialize, and to catch up generally was less than some had expected. There was a strong reaction on this score in one program in which the relentless pacing and excessive homework assignments almost "broke the camel's back."

Some Research students felt the need of more guidance, were not sure High School students were ready for so much freedom, or were disappointed at not being able to work on a project of their own design.

Recommended Improvements

Suggestions made by the students served them as a general summary of points made in preceding paragraphs. The suggestions made most frequently included the following -

Recommendations as to Organization of Time

1. There was an almost unanimous plea to lengthen the summer session or lessen the amount of material included. The feeling was that too much was crammed into too little time. This feeling was especially strong in the Course Programs.

2. Provide more leisure for more individual activities and time to digest new material more thoroughly. Shorter class periods and no Saturday classes were also recommended.

3. Eliminate time wastage by more efficient scheduling of events so time gaps between are lessened, lectures don't interfere with completion of laboratory

work, etc. Too many questionnaires and tests of an elementary nature were mentioned here also as time wasters, also excessive homework repetitive in nature or of "busy work" type. Lecturers who repeated or overlapped what another had covered were also felt to have wasted the student's time.

Organization of Program

1. Courses offered - avoid repetition of High School material, allow students some choice of courses.

2. Course Content - rather generally they asked for more "meat", less generalization and more concrete work requirements through homework assignments, tests, etc.

3. Balance lectures with projects - Classroom oriented programs found students asking for more laboratory and project opportunities, outlets for the "urge-to-do-something" themselves, not listen passively to others - Research programs, at the other extreme, found students asking for more lectures, courses, trips, supervision, etc. both for variety's sake and because they were sometimes lost in too much freedom.

Better Organization of Entertainment

1. Provide more of the mixing - socializing variety for both boys and girls, fewer old movies, possibly some organized athletics, no mandatory recreational activities.

Improve Student Selection

1. Give more attention to maturity and seriousness of purpose, not just scholastic ability. Admit larger numbers of students from wider geographical areas since diversity of background is stimulating.

Improve Living Conditions

1. Some suggestions were made here as to meal hours, food, more rigid enformcement of quiet hours in dormitories, etc.

Scattered suggestions were made such as providing more counseling as to college and vocational choice, improving detail and accuracy of preliminary brochures, eliminating high school teachers who supplemented University lectures in one program, and commuters who had already spent considerable time in travel were especially sensitive to activities which were widely separated on the campus.

Looking Back

In January 1961, about 6 months after the Summer Science Program ended, the students who had attended were again asked to report what they liked most about their Summer Science Program and what they liked least about it. Two "open-end" questions, under the heading "Brickbats and Bouquets" were asked. The coding of replies was done on the basis of analysis of a sample of answers. Their comments are shown in Table 11. Favorable characteristics were more frequently listed than were unfavorable.

The most frequently mentioned of the most liked characteristics was contact with stimulating personalities, followed by the courses or lectures themselves. Working in a college environment appealed to many and particularly to the boys. The SSP faculty was mentioned by a fourth of the students. The field trips also came in for substantial mention. It is particularly interesting to note that about one in twelve mention the guidance and counseling. There has been a feeling that the guidance counseling aspects of the Summer Science Programs should be strengthened, although in terms of the close working relationship of faculty and students it is believed that it is much stronger than indicated by the Observers.

Among the least liked characteristics most frequently mentioned was too much material covered. This was mentioned more frequently by girls than boys. This may be related to adequacy of subject matter background to handle the concepts of the course. Lack of or inadequate scheduling was mentioned. "Other students" came in for some mention. Whether other students would be mentioned more frequently if they were a random sample of high school Juniors rather than such a select sample of able individualists is not known. There was a little complaint about too little homework, testing and the like.

Table 12, Reactions of Students to the Summer Science Programs, offers some of the more substantial information regarding the immediate impact of summer science programs. The boys and girls in the Experimental groups were asked to indicate the courses covered in their 1960 Summer Science Programs. These include about 40% indicating multiple sciences and about 20% mixed sciences plus mathematics. More specifically named sciences did not occur as frequently, indicating that the bulk of the students as they saw it were exposed to a variety of courses or topics. This could, of course, reflect the fact that orientation programs were essentially multiple science programs and involved the largest number of students.

Almost half of the boys and girls, as the result of their Summer Science Program experiences, carried over projects or special studies from their SSP to work on during their spare time. These projects varied from outside reading and study in mathematics and science (about 15% of the total number of students) to experimental work in a variety of topics (about 20%). The fact that such a large proportion of the participants in the Summer Science Program did carry over projects and special studies to work on later is strong evidence of the impact of these programs. It might be added here that several of the winners in the 20th Annual Science Talent Search (1961) indicated their projects were related to work they had done in a Summer Science Program.

Another view of the attitudes of students toward the SSP may be reflected by comparing what they expected to find in their Summer Science Program with their answers to the same questions six months after the experience. Their answers were limited by the answers provided as a check list. The questions, answers and response frequencies for boys and for girls who attended a Summer Science Program are shown in Table 13. The first three questions shown in the table are essentially one, but divided for convenience in the presentation of the data. In each of these questions the students were asked to check as many of the things on the list as they thought would be a part or a result of the Summer Science Program.

The columns "% Response" show the per cents of Males and Females who marked each choice before they had attended their SSP.

Table 11

"Bouquet and Brickbat Page."

Item	% Response (Experimental) Male	Female	Male vs. Female
31. What did you like most about the Summer Science Program?			
a. The Summer Science Program faculty	25	25	0
b. Teaching methods used	14	17	0
c. The courses or lectures themselves	46	51	0
d. Actual laboratory and research work	33	42	F
e. Contact with stimulating personalities	49	54	0
f. Working in a college environment	33	24	M
g. Guest lecturers	11	13	0
h. Field trips	19	26	0
i. Library, classroom, and laboratory facilities	8	15	F
j. Living facilities	7	6	0
k. Recreational and social activities	12	14	0
l. Food	2	0	0
m. Texts, references and teaching aids	2	0	0
n. Knowledge and skill gained in scientific report writing	1	6	0
o. Individual attention	5	7	0
p. Guidance and counseling	6	7	0
q. Other	3	6	0
r. Everything	1	1	0
32. What did you like least about the Summer Science Program?			
a. Not enough time	4	6	0
b. Too much material covered	18	29	FF
c. Classes not well timed or scheduled - Lack of planning	8	11	0
d. Not enough laboratory work	9	8	0
e. Repetition within program	7	4	0
f. Repetition of high school materials	2	2	0
g. Too much listening, not enough doing	2	2	0
h. The faculty	6	4	0
i. Teaching methods	5	3	0
j. Too little homework, tests, etc.	8	11	0
k. Other students	14	12	0
l. Burdensome homework	6	3	0
m. Library, laboratory, and classroom facilities	3	3	0
n. Living facilities	1	1	0
o. Food	1	4	0
p. Insufficiency of individual help	3	2	0
q. Rules and requirements	2	1	0
r. Recreation, compulsory or too little	6	6	0
s. Other	9	6	0
t. Nothing	21	18	0

Table 12

Reactions of Students to Their Summer Science Programs. Form H, Part III.

Item	% Response (Experimental) Male	Female	Male vs. Female
16. Courses covered in 1960 Summer Science Programs.			
1. Physical sciences	3	4	0
2. Biological sciences	6	10	0
3. Multiple sciences	40	41	0
4. Mixed sciences plus Math	19	22	0
5. Mathematics	11	6	0
6. Mixed sciences	9	14	0
7. Physical sciences plus Math	10	2	M
8. Other	2	1	0
Y No Answer	0	0	0
26. As a result of your Summer Science Program experiences, have you carried over any projects, special studies, etc. to work on during your spare time.			
1. Yes	45	44	0
2. No	54	55	0
Y No Answer	1	1	0
27. If your answers to Question 26 was "Yes", please describe briefly the project carried over.			
1. Experimentation, Biology, Medicine	2	2	0
2. Experimentation, Chemistry	8	11	0
3. Experimentation, Physics and/or Electronics	3	3	0
4. Experimentation, Behavioral Sciences	7	4	0
5. Experimentation, and/or manipulation of numbers and Math	1	2	0
6. Outside reading or study - Science	4	4	0
7. Outside reading or study - Math	11	12	0
8. Building equipment, models, etc	9	7	0
9. Writing - papers, articles, results of experiments	1	1	0
0. Other	1	2	0
Y No Answer or none	55	56	0

Table 13

What Students Expected in Summer Science Programs

Forms H A		Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Comparison: Before & After SSP Male	Comparison: Before & After SSP Female
III-17; III-34		Check as many as apply of the things you expect to be a part of or a result of the Summer Science Program.					
	1.	Lectures by outstanding scientists	61	59	0	++	++
	2.	Work on research projects	72	73	0	--	-
	3.	Lectures by faculty members at the college	82	81	0	++	++
	4.	Tests on the material being studied	47	39	0	0	0
	5.	Conferences with college faculty members	48	42	0	++	++
	6.	Independent research work	56	58	0	--	--
	7.	Lots of homework	34	30	0	0	0
	8.	Lectures on all branches of science	62	71	M	++	+
	9.	Lectures on only one science	22	14	0	0	0
	0.	Writing a series of papers	15	17	0	0	0
	X	No Data	4	3	0	0	0
III-18; III-35		Check as many as apply of the things you expect to be part of or a result of the Summer Science Program.					
	1.	Participating in many non-academic campus activities	28	35	0	++	++
	2.	Having round-table discussions with other students	65	71	0	--	-
	3.	Publication of a paper in a scientific journal	4	3	0	0	0
	4.	Student dances	25	39	FF	++	++
	5.	A lot of laboratory work	65	69	0	0	+
	6.	Get to know a lot of outstanding scientists	27	23	0	0	0
	7.	Be able to continue any projects I now have underway	21	18	0	0	0
	8.	Be told what projects to work on	17	16	0	0	0
	9.	Increase my knowledge of a particular science	83	87	0	0	0
	0.	Learn more about the history of science	27	30	0	++	0
	X	No Data	5	3	0	0	0
III-19; III-36		Check as many as apply of the things you expect to be part of or a result of the Summer Science Program.					
	1.	Learn more about the scientific method	47	75	0	0	0
	2.	Find out how scientists work in industry	42	33	M	0	0

Table 13 (continued)

Forms H A		Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Comparison: Before & After SSP Male	Comparison: Before & After SSP Female
III-19; III-36	(continued)						
	4.	Help me decide what college to go to	43	38	0	0	+
	5.	Make it easier for me to get into college	48	38	M	-	0
	6.	Help me decide what field I want to major in in college	98	75	MM	--	0
	7.	Learn to make different kinds of laboratory equipment	29	17	MM	0	0
	8.	Learn how to use a lot of different lab equipment not yet known	67	74	0	--	0
	9.	Help make me a better student when I get back to my high school	88	88	0	0	0
	0.	Teach me how to study better	38	56	FF	++	0
	X	No Data	6	4	0	0	0
III-20; III-37		The three items you would most like to have in the program are:					
	1.	Lectures by outstanding scientists	25	27	0	++	0
	2.	Work on research projects	24	27	0	0	0
	3.	Lectures by faculty members at the college	7	9	0	+	0
	4.	Tests on the material being studied	2	2	0	0	0
	5.	Conferences with the college faculty members	7	6	0	0	0
	6.	Independent research work	16	14	0	0	0
	7.	Lots of homework	1	1	0	0	0
	8.	Lectures on all branches of science	14	20	0	0	0
	9.	Lectures on only one science	2	3	0	0	0
	0.	Writing a series of papers	1	1	0	0	0
	X	No Data	33	25	0	--	0
III-21; III-38		The three items you would most like to have in the program are:					
	1.	Participating in many non-academic campus activities.	5	5	0	0	0
	2.	Having round-table discussions with other students	13	19	0	0	0
	3.	Publication of a paper in a scientific journal	2	2	0	0	0
	4.	Student dances	3	4	0	0	0
	5.	A lot of laboratory work	23	28	0	0	0
	6.	Get to know a lot of outstanding scientists	5	7	0	0	0
	7.	Be able to continue any projects I now have underway	3	2	0	0	0
	8.	Be told what projects to work on	0	1	0	0	0
	9.	Increase my knowledge of a particular science	25	21	0	0	0
	0.	Learn more about the history of science	0	1	0	0	0
	X	No Data	38	31	0	0	0
III-22; III-39		The three items you would most like to have in the program are:					
	1.	Learn more about the scientific method	10	7	0	0	0
	2.	Find out how scientists work in industry	4	5	0	0	0
	3.	Find kinds of contributions scientists make to military establishment	1	0	0	0	0
	4.	Help me decide what college to go to	7	6	0	0	0
	5.	Make it easier for me to get into college	5	3	0	0	0
	6.	Help me decide what field I want to major in in college	25	24	0	0	0
	7.	Learn to make different kinds of laboratory equipment	3	3	0	0	0

Table 13 (continued)

Forms H A		Item	% Response (Experimental) Male	Female	Male vs. Female (Pre)	Comparison: Before & After SSP Male	Female
III-22; III-39 (continued)							
	8.	Learn how to use a lot of different lab equipment not yet known	11	10	0	0	0
	9.	Help make me a better student when I get back to my high school	17	15	0	-	0
	0.	Teach me how to study better	10	8	0	0	0
	X	No Data	35	38	0	0	0
	Y	Taking field trips	9	14	0	0	0
III-23; III-31		What effect do you expect this summer program to have on your high school work?					
	1.	Help in school work	53	50	0	0	0
	2.	Increase knowledge of subject	20	22	0	0	0
	3.	Increase interest in subject	9	14	0	0	0
	4.	Teach me something about college	2	2	0	0	0
	5.	Help determine my interests, Vocational goals	3	1	0	0	0
	6.	Miscellaneous	8	7	0	0	0
	7.	Don't know	2	1	0	0	0
	8.	None	0	0	0	++	0
	9.	Detrimental effects	0	0	0	0	0
	Y	No Data					
III-24; III-32		What effect do you expect this summer program to have on you personally?					
	1.	Improve personality, Meet people, Make friends	42	46	0	--	0
	2.	Increased development, Maturity	12	9	0	++	++
	3.	Give me ideas about college, life and work	9	6	0	0	0
	4.	Increase interest in science	7	7	0	0	0
	5.	Decide life work	7	11	0	0	0
	6.	Miscellaneous	14	13	0	-	0
	7.	Don't know	4	1	0	0	0
	8.	None	0	0	0	+	0
	Y	No Data	7	7	0	0	0
III-25; III-33		What are your parents' feelings concerning your attendance at the Summer Science Program?					
	1.	Happy about the whole thing	94	94	0	0	0
	2.	Neutral	4	5	0	0	0
	3.	Disapprove	0	1	0	0	0
	X	No Data	2	0	0	0	0
III-28; III-27		Would you attend a Summer Science Program this summer if: You had to pay for all your expenses excluding Tuition? Expenses and tuition?					
	1.	Yes - Yes	43	38	0	0	0
	2.	No - No	25	30	0	0	0
	3.	Yes - No	24	23	0	0	0
	4.	No - Yes	1	3	0	0	0
	5.	No Data - Yes	2	2	0	0	0
	6.	No Data - No	0	1	0	0	0
	7.	Yes - No Data	2	2	0	0	0
	8.	No - No Data	1	1	0	0	0
	Y	No Data - No Data	2	1	0	0	0

Table 13 (continued)

Forms H A	Item	% Response (Experimental) Male	Female	Male vs. Female (Pre)	Comparison: Before & After SSP Male	Female
III-29; III-28	How do you feel about the amount of financial aid given a student for the Summer Science Program?					
	1. I believe it is fair	90	94	0	0	0
	2. I believe the student should not have to pay any of his expenses	7	5	0	0	0
	3. I believe the student should pay all or most of his own expenses	1	1	0	0	0
	X No Data	2	1	0	0	0
III-30; III-29	How do your parents feel about the amount of financial aid given a student for the Summer Science Program?					
	1. They believe it is fair	90	95	0	0	0
	2. They believe the student should not have to pay any of his expenses	7	3	0	0	0
	3. They believe the student should pay all or most of his own expenses	1	0	0	0	0
	X No Data	2	1	0	0	0

The third column compares the per cents of males and females making each choice.

The entries in the column "Male vs. Female" are as follows:

MM: The % for Males exceeds that for Females at the 1% level of confidence or better.

M: The % for Males exceeds those for Females between the 5% and 1% levels of confidence.

0: There is no significant difference.

F: The % for Females response exceeds those for Males between the 5% and 1% levels of confidence.

FF: The % for Females responses exceeds those for Males at the 1% level of confidence or better.

The last two columns of the table show a comparison of the %'s marking each response before the SSP and six months after the SSP. The entries in the column are as follows:

++ the % of Post SSP responses exceeds the Pre SSP responses at the 1% level of confidence or better.

+ the % of Post SSP responses exceeds the Pre SSP responses between the 5% and 1% levels of confidence.

0 no significant difference.

- the % of Pre SSP responses exceeds the Post SSP responses between the 5% and 1% levels of confidence.

-- the % of Pre SSP responses exceeds the Post SSP responses at the 1% level of confidence or better.

The comparisons of the per cents of boys and girls who checked each of these items before they went to SSP and again the middle of the year following their attendance as they look back upon their experience offer further light on the attitudes of the participants.

They found more lectures by outstanding scientists than they had assumed. They had less work on research projects than they had expected. They had more lectures by college faculty members and more conferences with faculty members than anticipated. The amount of independent research work was less and there were more lectures on all branches of science than had been anticipated. They participated in many non-academic program activities to a greater extent than they had anticipated and participated in roundtable discussions with other students less than expected. Socially the students underrated the SSP's, attending more student dances than they had expected to. Fewer boys thought it would make it easier for them to get into college. There was also a decrease in the proportion of boys who thought it would help them to decide what field to major in in college and fewer indicated that it had taught them to use a lot of different equipment not yet known. There was a significant increase in the per cent of boys who indicated that this had taught them to study better.

The answers to the instructions to mark the three items they would "most like" to have in the program were not as informative as the instruction to "check as many as apply."

The frequencies for the "three items they would most like to have in the program" included lectures by outstanding scientists, work on research projects, a lot of laboratory work, increase in knowledge of a particular science, help in deciding what field to major in in college.

The comparisons in their Before and After SSP views are of interest. In general there was less of independent work than anticpated and more lectures by college faculty members and outstanding scientists covering all branches of science.

In terms of the students expectation of effect on their high school work, at least half thought it would help their high school work, increase their knowledge of the subject, and perhaps increase their interest in a subject. The only change in response from Pre to Post SSP of any statistical significance is the increase in the number of boys who said "none".

The students have greater expectations of an impact of the Summer Science program on them personally than in terms of their high school work. Almost half expected to "improve their personalities, gain an opportunity to meet people and make friends." For the boys this didn't entirely live up to expectation in that precise manner, but for both boys and girls there was a significant increase in those who believed that it increased their maturity.

In answer to the question, "Would you attend a Summer Science Program this summer if you had to pay all your expenses, excluding tuition or expenses and tuition?" - two out of five indicated that they would attend even if they had to pay both expenses and tuition. About a fourth would not attend if they had to pay either tuition or expenses. And another one-fourth still would attend if they had to pay for tuition but not both expenses and tuition. The answers to these questions regarding who pays for the privilege of SSP does not completely clarify the issue, since these are the responses of boys and girls who did attend.

There has been real fear that if students were required to pay the real cost for this opportunity many bright boys and girls would be excluded and the SSP would become a privilege only for the children of better income groups. On the other hand, there has been some feeling that it has been used by a few to give them a way to spend the summer that was socially acceptable and keep them at least busy enough to be out of mischief.

On the basis of the data offered it seems reasonable to assume that students feel, and perhaps their families feel, that they could afford to pay part or all of the students' expenses but that adding tuition to this might raise some questions regarding attendance. Whether these questions or whether the answers reflect real financial hardship, as they must in many cases, or whether it is a break with the tradition of full summer for vacation being expressed in terms of dollars, one can't be sure.

The students, themselves, believe that the financial aid given for Summer Science Programs is fair and believe that their parents feel the same way. Inquiry might be made in a selected number of high schools as to individuals who were recommended for Summer Science Programs but who did not go because they felt they must earn money.

It is of interest to know how the students believe they were selected for attendance of Summer Science Programs. Some of their opinions (Pre SSP) are shown in Table 14. Most of them indicated in answer to the question, "How were you selected for the Summer Science Program?" that

Table 14

Students Opinion as To How They Were Selected For SSP

Item	% Response (Experimental) Male	Female	Male vs. Female (Pre)
III-24 How were you selected for the Summer Science Program?			
1. Made application, description of procedure for applying.	38	39	0
2. Approved by some school personnel (Teacher, Principal, etc.)	13	10	0
3. Grades, Test scores	26	30	0
4. Don't Know	9	9	0
5. Miscellaneous	10	9	0
X No Data	4	4	0
III-25 What do you feel were the two factors which were most important in your being selected? (first factor mentioned)			
1. Grades, tests scores, scholarship, awards	69	69	0
2. Recommendations	11	10	0
3. Desire to attend, science interest	7	8	0
4. Outside research, science activities	3	3	0
5. Courses taken	1	2	0
6. Personality, attitude	0	0	0
7. Essay or interview	0	1	0
8. Don't know	0	0	0
9. Miscellaneous	4	4	0
X No Data	2	1	0
III-26 What do you feel were the two factors which were most important in your being selected? (second factor mentioned)			
1. Grades, tests scores, scholarship, awards	27	31	0
2. Recommendations	27	27	0
3. Desire to attend, science interest	18	17	0
4. Outside Research, science activities	6	3	0
5. Courses taken	2	2	0
6. Personality, attitude	2	3	0
7. Essay or interview	2	3	0
8. Don't know	0	0	0
9. Miscellaneous	10	10	0
X No Data	5	4	0
III-30 What would you do this summer if you were not attending this program?			
1. Nothing - sit around	1	3	0
2. Visit friends or relatives, trip, vacation	6	9	0
3. Work in non science job - unspecified "work"	52	37	MM
4. Work in science job	2	3	0
5. Study, go to summer school	11	19	F
6. Work and vacation	20	19	0
7. Miscellaneous	6	10	0
X No Data	2	2	0

it was through making application and described the procedure that they used. More than one-fourth indicated that grades and test scores were a basis for their selection, and some over 10% indicated approval by someone in the school system such as a teacher or prinicipal was the basis.

The factors which they believed most important in their selection were: school grades, test scores, scholarships and awards, followed by recommendations, presumably by teacher, counselors and principals. Another factor mentioned was the desire to attend and interest in science. It should be noted that the answers to these do not represent necessarily the real basis of selection but the bases on which the students believe they were selected. The answers to Question III-30, "What would you do this summer if you were not attending this program?" are very similar to the answers of those who were not privileged to attend the program.

With a written questionnaire, it is not easy to get the real reasons for selecting a particular school or program or at the factors that were really the most pertinent in getting this individual moving toward such a goal. Two questions were asked of the Experimental Group - those who were to attend a Summer Science Program. These are shown, with the percents giving each answer in Table 15. In answer to the question, "Why did you select the particular school or program that you did?" most answered, "Interest in the courses or program offered." The next largest group of responses was, "Near home or Location of the school." It is interesting to note that significantly more boys gave this answer than did girls. One out of ten said that this is the only program of which they were aware. In answer to the question, "Who was most influential in making up your mind to apply to the Summer Science Program," the Science and Mathematics teachers stand out. This may also be related to the feeling of the Science and Mathematics teachers that announcements and information regarding the program should come directly to them rather than indirectly through principals and guidance counselors. One out of seven of the E group indicated that their parents were the most influential in getting them to apply to a Summer Science Program. There was no significant difference in the answers of boys and girls considering the fact of the teacher's influence. It might be well to look into ways and means of making more effective and uniform use of teacher's judgment in the selection of students to attend the Summer Science Programs.

It may be valuable also to compare the responses of students who had applied for admission to an SSP but who were not accepted by schools in the sample of 18. Table 16 shows the answers of the Comparison Group C-1 to Question III-19. This group of students are those who had applied for admission to the Summer Science Programs but who had not been accepted. The real reasons for their non-acceptance are not known. Inevitably, however, some were not accepted because there were more applicants than there were spots to be filled. These students were asked, "if you applied and were not selected, why do you think this happened?" Table 17 shows their responses. A few replied that they did not know. Still more did not answer the question at all, which suggests that they did not know. The largest single reason given was competition. Distinctly more of the girls indicated this as the reason they thought they had not been selected (33% as compared with 19% of the boys). A few of the boys, but none of the girls, suggested that late application could be the reason. Almost 10% of the students thought their low high school grades had disqualified them.

Table 17 shows the answers to the next question which one would normally ask under these conditions. "If you are not going to attend the Summer Science Program, indicate your plans for the summer." In Comparison Group C-1, those who were named as alternates, approximately three out of five boys and one out of four girls indicated work in a non-science job. The next largest answer category is "Work and Vacation" indicated by more girls than boys. In the Comparison Group C-2, those boys and girls nominated by their high schools as comparable in ability and interest to the students who attended Summer Science Programs, more boys than girls indicated they expected to work in a Non-science Job. More C-2 students than C-1 students planned to work in non-science jobs. This may be true because such students had earlier made plans for a non-SSP summer. Very few in either C-1 or C-2 indicate that they expected to work in a Science Job. It is entirely possible that Summer Science Jobs could be further developed as part of a program to increase the intensity of interest and motivation in Science careers.

Two other questions from Form H may be of interest in describing the Comparison groups. These questions were asked in January 1961, six months after completion of the studied SSP's. Table 18 shows the questions and responses of the two groups. As one might expect, the great majority of the C-1 group would like to attend a Summer Science Program. It is interesting to note, however, that only three-quarters of the C-1 Group said they knew anyone who had attended a Summer Science Program while well over ninety per cent of those in the C-2 Group had known such a person. It should be remembered that the C-2 Group are those named by the high schools as the Comparison or Control students matched to the individual students from their schools who did attend a Summer Science Program during the summer of 1960.

In order to find out more about the kind of publicity needed to reach the students who might be applying for the Summer Science Program, several questions were included in Form A to be answered by all the students, Experimental and Comparison, prior to the 1960 Summer Science Programs. These are shown in Table 19.

In answer to Question III-13, "How did you first hear about the Summer Science Program?" - all apparently had heard of it, mostly through their teachers who were not counselors. Over half of the Experimental Group indicated such a teacher. The C-1 Group did not differ significantly from this, but both boys and girls in the C-2 Group showed some smaller percentage who had first heard of the program through their teacher. About ten per cent indicated the counselor, and about as many indicated some other student as the source. The answers to this question indicate a variety of channels of information. This suggests that the program of announcing and publicizing the Summer Science Programs should employ a variety of approaches and media in order to reach most of the people who should be reached. The answer "Yes" to Question 18 may be quite important. 59% of the boys and girls indicated that their grades were about as good as those of the individual they knew who had been selected. And further, within the Comparison Groups, the answers did not differ significantly from those of the Experimental Group with the exception of the boys in the C-2 Group, which differed at the five per cent level of confidence.

Table 15

Why Students Selected Their SSP

Item	% Response (Experimental) Male	Female	Male vs. Female
22. Why did you select the particular school program that you did?			
1. Only place accepted	3	3	0
2. Interest in courses offered, program	39	46	0
3. Reputation of university	8	7	0
4. Near home, Location	18	11	M
5. Suggested to me	4	3	0
6. Good chance of acceptance	2	0	0
7. Financial reason	3	2	0
8. Only one aware of Teacher's choice	10	11	0
9. Miscellaneous	10	15	0
X No Data	2	1	0
23. Who was most influential in making up your mind to apply to the Summer Science Program?			
1. Me, Myself	9	12	0
2. Science or mathematics teacher	38	45	0
3. Other teacher, principal, superintendent	6	6	0
4. Parents	14	14	0
5. No one person	1	0	0
6. Other student	3	2	0
7. Counselor	8	9	0
8. Miscellaneous	7	10	0
X No Data	4	3	0

Table 16

Student's Opinion As To Why Their Applications For SSP Were Rejected

Item	% Responses of Comparison Group 1: Male	Female	Males vs. Females
III-19 If you applied and were not selected, why do you think this happened?			
1. Don't know	12	9	0
2. Didn't have required courses, Not enough science	8	7	0
3. Competition	19	33	FF
4. Late application	6	0	M
5. Low high school grades	10	8	0
6. Disqualified by tests	2	0	0
7. No science projects	2	6	0
8. Location of host institution	1	0	0
9. Miscellaneous	22	19	0
0. No Data but attended previously or stated previous attendance	0	1	0
X No Data	18	18	0

Table 17

Summer Plans of Comparison Students

Item	% Response and Comparisons: Comparison Group 1: Male	Female	Male vs. Female (Pre)	Comparison Group 2: Male	Female	Male vs. Female (Pre)
20. If you are not going to attend a Summer Science Program,						
1. Nothing - Sit around	0	1	0	0	0	0
2. Visit friends or relatives, Trip, vacation	2	6	0	6	3	0
3. Work in non-science job - Unspecified work	39	26	MM	54	33	MM
4. Work in science job	3	1	0	2	2	0
5. Study, Go to summer school	9	11	0	7	17	FF
6. Work and Vacation	24	33	FF	19	17	0
7. Miscellaneous	8	16	F	7	19	FF
X No Data	13	7	M	6	9	0

Table 18

Desire For Attending SSP

Item	% Response C1 Male	Female	Male vs. Female	% Response C2 Male	Female	Male vs. Female
13. If you did not attend, would you like to attend a Summer Science Program?						
1. Yes	89	85	0	59	70	0
2. No	3	6	0	14	19	0
3. Don't Know	8	9	0	26	12	MM
Y No Answer	1	0	0	0	0	0
14. Do you know anyone who attended a Summer Science Program?						
1. Yes	75	75	0	92	97	0
2. No	24	24	0	7	3	0
Y No Answer	1	1	0	0	0	0

Table 19

How Did You Hear About SSP?

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
III-13 How did you first hear about the Summer Science Program?							
1. Never heard of it	0	0	0	0	0	0	0
2. Teacher: Non-counselor	57	56	0	0	EE	0	E
3. Counselor	11	10	0	0	0	0	0
4. Principal or supt.	5	3	0	0	0	0	0
5. Other student	9	13	0	0	0	0	0
6. Non-specific school source, bulletin board	7	9	0	0	0	0	0
7. Not aware prior to this	0	1	0	0	0	0	0
8. Newspaper	4	3	0	0	0	0	0
9. Miscellaneous	5	5	0	0	0	0	0
X No Data	2	1	0	0	0	0	0
III-14 Have you ever applied for admission to a Summer Science Program?							
1. Yes	91	94	0	E	EE	E	EE
2. No	8	7	0	C	CC	C	CC
X No Data	1	0	0	0	0	0	0
III-17 Do you know anyone who was selected for this Summer Science Program?							
1. Yes	64	63	0	0	CC	0	CC
2. No	26	29	0	C	EE	0	EE
X No Data	10	8	0	0	0	0	0
III-18 If "Yes," to Item 17, are your grades about as good as his(hers)?							
1. Yes	59	59	0	0	C	0	0
2. No	4	3	0	0	CC	0	CC
X No Data	36	38	0	0	EE	0	EE

The Teachers' Viewpoint

The high school teachers see the Summer Science Programs from many points of view, including the problems of encouraging and selecting students to attend, effects on the college and career planning of these students, impacts on the school and its program and reaction of fellow students to those who attend. As a way of getting a look at the SSP's through the eyes of the teachers, each school which had students included in the Richardson, Bellows, Henry & Company study was asked to have one or more of its science and mathematics teachers complete the questionnaire, RBH Form I, and to complete the questionnaire, RBH Form E for each student included in this study from their school.

A Form E was filled out by a science or mathematics teacher for each student in the samples before the beginning of the Summer Science Programs (Pre-SSP) and again in January following the SSP summer (Post SSP).

Table 20 shows the per cents of teachers giving each answer to the questions before and again after the SSP. The answers of teachers of the Experimental and Comparison-2 groups were combined in this table, a total of 966 answers Pre SSP and 808 Post SSP.

According to the table, most of the teachers felt that they had at least a general knowledge of the SSP. There were no significant differences between the Pre and Post SSP data.

As one should expect there were larger changes in the answers to Question 2. The Before and After look in the areas in which they felt students would be most changed are shown in the answers to Questions 3 and 4. Most of all, teachers expected to find a more realistic knowledge of what a scientist does (62%), increased scientific knowledge and understanding (54%), and increased interest (53%), increased independence of thought and action (52%).

The answers showing a statistically significant decrease in per cent from Pre to Post SSP, include 3-1, "aquisition of increased scientific skills, "3-6 "Better performance in future college science work," and 3-9, "Increased scientific knowledge and understanding." These changes may reflect an increased realistic understanding. For all three the answer there still remains a substantial number who expect the indicated result. Answer 3-2, "Increased interest in science," showed an increase from 53% to 57%, but that is not statistically significant at the 5% level. Two answers showed statistically significant increase in per cents marking them from the Pre to the Post SSP. There are 3-7, "Improved study habits," and 3-8, "changes in maturity and social skills."

These changes reflect the observations of the teachers, since all of the reports are from teachers in schools which had students attending a 1960 SSP.

The categories mentioned most frequently by the teachers as expected outcomes of SSP have appeared in other parts of this report to be the major areas showing changes which could be associated with attendance at a Summer Science Program. The benefits most expressed were in generally favorable terms: good program, wonderful opportunity, and the like, 90% indicating that they felt that it encouraged gifted students to go into science and to continue in school. Negative outcomes of the SSP scarcely seemed to exist. Its need to be available to a greater number of students was noted. The disappointment, the heartbreak of being turned down were mentioned by 6% of the teachers.

All-in-all the program is viewed favorably by the high school teachers with perhaps its limitations in numbers being its greatest drawback. The question has been raised elsewhere, however, "If it were more generally available, wouldn't it lose a considerable amount of its potency in terms of being less selective, less of a privilege and less of an honor?"

A better opportunity to see the SSP through eye of the high school teachers is offered through the responses of teachers to RBH Form I. This brief questionnaire was answered by high school teachers of science and mathematics who had students included in this study. It should be noted that Form I was answered in January 1961, six months after the SSP's with which this study is concerned and by only one or two teachers from each high school.

The questions in Form I were all "open end," asking for observation, opinion and judgement in the teacher's own words, rather than offering a pre-structured list of answers to be checked.

The teachers offered almost unanimous agreement that the Summer Science Programs were of benefit to the students. 90% of the 487 teachers who returned questionnaires expressed an opinion on the matter but of these 88%* approved and only 2% were in disagreement.

The opinions emerging from the teacher comments tended to fall into two areas of agreement; the one approving the SSP's as they stand, and pointing out certain positive gains they felt were resulting; the other with suggestions for improvement and change on the basis of certain weaknesses they felt existed.

In the first category the most frequently mentioned were:

1. satisfaction with the manner in which the students were selected
2. a conviction that students learned more about mathematics and science than they would without SSP, and that student interest in same was increased
3. a prediction that SSP's would force high schools to expand and upgrade their science curricula
4. a belief that high school-college relationships were improved by SSP, that transition to college life would be made easier for the participating student and that more students were encouraged to go on to college.
5. a prediction that high schools will have to use some form of ability grouping.

* (The per cents reported here are based on the replies of all 487 teachers).

Table 20

Comparison of Responses, Part IV, Form E.
Summer Science Programs As Seen Through
the Eyes of Their Teachers

Item	% Response Pre SSP	% Response Post SSP	Pre vs. Post
1. Which statement would best describe your understanding of the SSP?			
1. I feel I am fully acquainted with all the important aspects of the program.	32	31	0
2. I have a general knowledge of the program but am somewhat hazy with regard to certain aspects of it.	52	49	0
3. My knowledge of the program is quite scanty.	11	13	0
4. I have not as yet heard about this program.	1	0	0
X No Data	5	7	0
2. Do you have students in your classes who attended a SSP?			
1. Yes	43	86	++
2. No	49	7	--
3. Don't know	3	1	-
X No Data	5	7	0
3. In which three areas do you feel students will be most changed by attendance at a SSP?			
1. Acquisition of increased scientific skills.	37	30	--
2. Increased interest in science.	53	57	0
3. Changes in vocational or orientation goals.	8	9	0
4. Changes in high school or college course plans.	4	6	0
5. Better performance in future high school science work.	29	26	0
6. Better performance in future college science work.	22	17	--
7. Improved study habits	14	17	+
8. Changes in maturity and social skills.	16	20	+
9. Increased scientific knowledge and understanding.	54	44	--
Y. No Answer	6	8	0
4. Question 4 same as 3.			
1. Better prepared for college work.	46	44	0
2. Better chance for winning a college scholarship	14	14	0
3. More realistic knowledge of what a scientist does.	62	62	0
4. Increased independence of thought and action.	52	48	0
5. Will demand more attention.	1	2	0
6. Will become a discipline problem.	0	0	0
7. Will feel he knows more than the teacher.	1	0	0
8. Other	1	1	0
9. I do not feel there will be any marked effect.	1	1	0
X No Data	20	18	0
5. For Summer Science Program concept.			
1. Offers opportunities not found in high school (must mention not available in high school)	4	4	0
2. Encourages gifted students to go into science, continue in school.	9	7	0
3. Vocational counseling, find out if fitted for science career, help set goals.	3	3	0
4. Generally favorable; good program, wonderful opportunity.	26	25	0
5. Gives chance to student to find out about advanced work, college.	4	4	0
6. Chance to meet other top students, scientists.	3	4	0
7. Good for the nation's welfare and/or security.	1	0	0
8. Help students become good scientists - what is learned in course is important.	2	5	+
9. Miscellaneous	2	1	0
0. None	2	1	0
X No Data	45	48	0

Table 20 (Continued)

Item	% Response Pre SSP	% Response Post SSP	Pre vs. Post
6. Against Summer Science Program concept.			
1. Greater availability, turn downs cause heartbreak, doesn't help enough students.	6	5	0
2. Basis of selection unfair, selection procedure bad.	0	2	0
3. Should be expanded in science scope.	0	1	0
4. Scope too broad.	0	1	0
5. Should be expanded in geographical selection.	0	0	0
6. Has bad effect on return to high school; high school lacks glamour, etc.	0	0	0
7. Not enough coordination with high school program, material at wrong level.	1	2	0
8. Has bad effect on student - becomes swell headed, etc.	0	0	0
9. None, nothing	11	14	+
0. Miscellaneous	4	5	0
X No Data	77	70	--

6. a belief that SSP's increased motivation toward intellectual achievement

7. a belief that enrichment of high school science courses would follow as a result of SSP.

On the less positive side there was considerable agreement on the following points, again listed in descending order of frequency:

1. a desire for more information from NSF and SSP routed directly to teachers instead of through administrative channels. This comment, made by 82%, usually occurred after general approval.

2. suggestions for improvement of the selection procedure were offered by 50%

3. criticisms of some specific program of their own acquaintance

4. recognition of dangers to both high school and students from over-emphasis on science at the high school level

5. a feeling that pressures on high school science teachers are being increased by SSP's

6. a belief that financial problems eliminate the best qualified SSP prospects (11%)

7. objection to SSP because it is contrary to their philosophy of education

8. a belief that SSP is now directed toward too small a group of students and should also include those of superior but not exceptional ability.

While the above "encapsulates" the large areas of teacher agreement, a question by question review of teachers' answers to the 9 questions turns up some additional information.

1. <u>In what ways was the Summer Science Program of benefit to your students?</u>

   The 88% who felt that it was of benefit gave these reasons:

   a. Students gained a better understanding of science (46%)

   b. Students interest in mathematics and/or science was increased (34%)

   c. Valuable information and experience in college work and college living were increased (22%)

   d. The student's proficiency as a student or potential as a scientist was improved (19%)

   e. The experience had a favorable effect on his matu ity or other personal qualities (15%)

   f. It helped him decide on a career, or decide which of several areas of science he preferred to make his life's work (11%)

   g. The student brought back information which was useful in enrichment of the science courses at his high school (9%).

2. <u>In what ways was the Summer Science Program not of benefit to your students?</u>

   60% gave blanket approval or made no comment but 40% had some specific points in mind. These included:

   a. The course content was improperly related to the high school curriculum: i.e., it was "over the heads" of the students because they had not had enough preparatory work, or merely gave a course the student had planned to take during his senior year (10%)

   b. The course was too hard or too much was given in too short a time (9%)

   c. Attendance at a Summer Science Institue aggravated undesirable personality traits of the student (6%)

   d. Only 4% mentioned that not enough students could attend SSP's, or that the courses were too easy to challenge high ability students, while financial problems drew only a 2% response.

   e. Objections classifiable only as "miscellaneous" were noted by 7%.

3. <u>Do the Summer Science Programs select the right students for the program?</u>

   Unqualified approval of the present selection was expressed by 61%, and some sort of qualified approval was expressed by 18%. A few (3%) felt that students from small high schools need the SSP experience more and hence they should be given preference. Some thought that financial problems eliminated the best qualified students because they have to work during the summer. Only 1% flatly disapproved of the selection.

4a. <u>What suggestions do you have regarding improving the liaison between the Summer Science Program and high schools?</u>

   This question drew some answer from 83% of the sample. Only 17% said that the liaison was all right at present. The suggestions most frequently mentioned included:

   a. Get information to the high schools earlier, in more complete and usable form.

   b. Send information directly to teachers "because it usually gets lost on desks of administrators and counselors."

   c. Report on student's SSP performance to his home science teacher.

   d. Consult high school teachers in planning for better coordination of SSP with school science program.

4b. What suggestions do you have regarding insuring that the right students attend a Summer Science Program?

This question had a relatively high response (79%). The largest number, 26%, said that the right students are picked by the present methods. Suggested changes were:

a. Improve the selection criteria (19%): some said add tests, some would eliminate tests, send interviewer to high schools, speed up processing of applications, etc.

b. Give the teachers more authority in the selection (16%). On the contrary, 1% thought local high schools should have no power of recommendation thus eliminating political consideration.

c. Give financial assistance for the summer and/or college scholarship guarantee to eliminate student's need for summer paid employment (5%).

d. Lower selection criteria (2%).

4c. What suggestions do you have for making changes in your high school to take better advantage of the Summer Science Program?

Suggestions were offered by 49%. A few implied that they might like to say more, but were not willing to have the school principal read their comments.

a. First among the suggestions was that the high schools should step up their science and math curricula (18%).

b. Almost the same number (15%) indicated that the programs do stimulate the high schools to pay more attention to bright students.

c. Eleven per cent suggested that if the NSF and SSP's were to send more usable information on the programs directly to teachers, perhaps some changes might be made.

d. That the programs increase student interest in science, that they can be credited with getting more recognition and support for the science teacher, and that they are increasing the demands made on science teachers were mentioned by 4%, 3% and 2%, respectively.

5. In light of the Summer Science Program what changes in the high schools do you see coming?

The most popular prophecies were that:

a. High schools would expand the science curriculum (33%), and would raise their standards for all mathematics and science courses (32%).

b. Increased interest in high school scholarship on the part of both students and the community (13%).

c. Pressure engendered by the program would result in ability grouping of the students (9%).

d. Some noted that it dramatized the need for better mathematics and science teachers (8%)

e. that they can be credited with getting more recognition and support for the science teacher, and that they are increasing the demands made on science teachers were mentioned by 4%, 3% and 2% respectively.

f. However, 14%, some in resignation and some in retaliation, said that they could see no changes because the Summer Science Programs are available to only a few selected students and therefore wouldn't last.

5a. In what ways do you think these (changes) may be beneficial?

This question drew comments from 70% of the sample. Eight topics cover most of the comments.

a. Increase student knowledge in science and math (15%)

b. Increase student motivation to develop new concepts, and to develop real scholarship (14%)

c. Improve the high school-college relationship and/or the transition from high school to college (14%)

d. Raise standards for all mathematics and science courses (15%)

e. Get the high schools to make greater allowance for individual differences in learning capacity in favor of the high ability student (9%)

f. Increase interest in mathematics and science (7%)

g. 6% made sweeping comments such as "this will close the missile gap," "it will benefit all America," etc., and

h. 4% commented that it might increase teacher load, raise teacher qualifications and "force some teachers to attend some Summer Science Programs, too."

5b. In what ways do you think these (changes) may be unwise?

There were only two themes on which there was substantial agreement.

a. That an over-emphasis on mathematics and science might be responsible for deficiencies in other subjects which the student needs to master at the high school level (11%); and

b. That accelerated programs geared to the exceptionally high-ability student might discourage the students of average ability (10%). While some of the comments classified in this category were apparently based on a protective attitude toward the student of limited ability, there were some to the effect that "the good B student who develops into a meticulous investigator and is the backbone of American progress in science and technology," might also become discouraged.

c. 6% deplored the danger of overspecialization at so early an age.

d. 3% mentioned each of the following: that the changes would place an additional strain on teachers; would encourage some high schools to overexpand their science curriculum; and that many high schools can't afford to expand their science offerings and/or facilities.

6. Further Comments

"Continue the Summer Science Program and expand it" was the only item of substantial agreement here with less than one third of the teachers responding at all.

That the answers to these questions may vary with the quality of science and educational background of the schools was recognized. An "Index of High School Science Background" was constructed* to reflect some of the qualities of the school which are implied in the statement, "Well now, that will depend on the kind of high school the student comes from."

There were some noticeable differences in the answers of those teachers from schools rated "high" in the Science Background Index compared with those from schools which were rated low.

Teachers from the high Science Background schools

As a group, the teachers from the high science background schools reflect a higher level of training, higher interest in science than in "developing young people," and appear to have set higher standards of accomplishment, both for themselves and for their students, than any other group of teachers in the sample. They are better informed about NSF and SSP than the other teachers. They offered more comments, and made a greater variety of suggestions, throughout the questionnaire.

They view the value of the Summer Science Program as improving knowledge rather than interest in science, as providing better preparation for college, improving the student's proficiency as a student and his potential as a scientist, note the value of SSP experience as an aid to the student in deciding which science he would work in as a career, and more frequently criticize the SSP as too easy than as too hard.

They are conscious of their role as dedicated professionals, showing more resentment of the "administrative shackles" which deprive them of a stronger voice in the selection of students for Summer Science Programs. They were more insistent on receiving communications directly from NSF instead of through the office of the principal or the counselor. They are not worried about financial problems for their students, or for their high schools if the science curriculum is expanded. They are more conscious of the need for better teachers and of the possibility that teacher load will increase as science programs are upgraded and expanded. They are also more aware of the dangers of early specialization which may be stimulated by the SSP experience. This concern is not expressed as a threat to the personality development of the student, but that he will not develop a sufficiently broad base in the academic tool subjects and related sciences, and that these deficiencies will detract from his performance in his chosen science.

Probably because they are already working in an educational climate where real scholarship (as distinguished from working for grades only) is an acceptable goal, they did not credit SSP with stimulating an interest in scholarship or with making it easier for them to allow high ability students to work at a level above their course syllabi.

From their individual comments, it can be inferred that they are relatively well satisfied with the physical conditions under which they work, that they are more prone to identify with some of their high potential students whom they are proud to develop, not "to catch up with Russia" but simply for the ultimate advancement of science, and that they are not apprehensive that the distinguished scholars in the SSPs will "show them up." A few suggested that NSF would do well to grant some project funds so they could also conduct research, as do some college professors.

Teachers from less adequate Science Background schools

In general, teachers in this group were more prone to give blanket approval, make fewer specific suggestions, and were more conscious of the physical and financial limitations under which they were working, than were the teachers in the high science background schools. They stressed the value of the Summer Science Program as increasing interest, rather than knowledge, in science, and found that SSP experience provided enrichment for high school science courses. They were less critical of the selection criteria, and of specific SSP courses, but more critical of the adverse effect of SSP on the personality of some students. They did not appear to be as concerned about having to learn about NSF and SSP through their school administrators, but they did remark more frequently that selection of students was "too strongly influenced by local political consideration."

As a group, they seemed to be looking to the Summer Science Program for help. They were more concerned about maintaining a contact with the SSP institution throughout the school year, receiving reports and advice from the SSP faculty, and appeared to be giving the SSP considerable credit for exerting favorable pressure on the local high school. They gave it credit, in particular, for increasing student and eventually, community interest in high scholarship, and for some influence that would allow them to pay more attention to their bright students, instead of having to struggle under the yoke of teaching only the average students. More of them also looked to NSF and SSP as an influence for enhancing the status of the science teacher, obtaining for him some of the recognition "now given only to the football coach."

The answers to the questions in Form I were also studied in terms of the region of the country in which the school is located. It must be noted that while the 18 Programs around which this study is centered, were selected to be representative of all the Summer Science Programs of the

* Described in detail in Section VI of this report.

United States, it does not produce a random selection of high schools from which the participants come.

There is some relationship between the Science Background Index and the geographic area of the high school. However, the degree of the relationship is low enough that the answers to Form I should be reviewd on a basis of geography.

Northeast - including Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania

The responses of teachers from this area are rather similar to those made by teachers from the high Science Background schools. They are more critical of details of the Summer Science Programs, and less appreciative of SSP as an aid to high school science instruction. They are less concerned about the financial problems of both students and high schools, problems which would be created by participation in SSP's on the part of the students, or by expansion of science instruction facilities in the schools. More teachers in this group see the SSP's contribution as improving the academic proficiency of their students, and welcome its influence toward increasing the emphasis to be placed on high scholarship.

South - including Dela., Md., W.Va., D. C., Va., N. C., S.C., Ga., Fla., Ky., Tenn., Ala., Miss., Okla., Ark., La., Texas.

Teachers in this group are the most accepting (or resigned to their lot) of the four geographical groups. They make greater note of financial problems. They look to SSP for enrichment of their courses, and feel that SSP will ultimately be responsible for raising the standards and expanding the science curriculum in their schools.

North Central - including Wis., Mich., Ohio, Ind., Ill., Minn., Iowa, Mo., N.D., S.D., Neb., Kansas

Teachers in this group appear to be more accepting of details of the SSP than the group in the Northeast. They welcome SSP as improving relationships between the high schools and colleges. They place more emphasis on the burden that may be placed on small schools which struggle to keep pace by providing adequate and/or up-to-date facilities for science instruction. Of incidental interest, at least, more teachers in this group expressed annoyance at having to take time to fill out the questionnaires used in the study.

West - including Mont., Idaho, Wyo., Nev., Utah, Colo., N. Mex., Ariz., Wash., Ore., Calif.

The responses of the teachers in this group were similar to those of the teachers in the Northeast. An inspection of the forms during coding suggests that the similarity may be due to the fact that there are a few high Science Background schools - some private - located on the West Coast. They expressed less interest in SSP as improving academic accomplishment than the teachers in the Northeast, but they resemble that group in being sensitive about any encroachment on their powers and responsibilities as teachers of science. They place more emphasis on the influence of SSP in raising the standards for high school science courses, increasing interest in high scholarship, and welcome the pressure toward ability grouping of students. They express more concern over the financial problems of the students but not over the problems of the schools. More of this group criticized SSP as ignoring all but the very high ability students, said that accelerated programs in high schools might discourage average (good B) students, and pointed out the detrimental effect of encouraging students to become over specialized too early.

V

THE STUDENTS

The students comprising the samples for this study are described by the information given in Tables 21 and 22.

The information show in Table 21 came from questions which were asked in RBH Form A (Pre SSP), but not repeated in RBH Form H in the Post SSP data collection. These data describe the students as a group, their family and academic backgrounds.

In Table 21 the age of the students is shown in terms of date of birth: 80% of the boys and 79% of the girls in the Experimental group were born in 1943. The control groups do not differ significantly from this norm.
At the time of the Summer Science Program in 1960 they were about 17 years old and at the end of their junior year in high school, a normal age for the educational level. Those younger than this model age slightly outnumbered those who were older.

A third of the students were born in the same city in which they were presently attending high school. About a fourth, however, were born in a different state from their high school and in a different geographic region. Over 80% gave their home address as the same city as their high school. The home address given by practically all was that of their parents. Almost two-thirds have not changed their home address during the past five years, and over 88% have not changed their home address more than once during the past five years. For example 39% of the boys had lived at their present address more than 10 years, 64% more than five years and 79% more than 3 years. The data for the girls are similar.

71% of the group had entered the first grade at the age of six, 14% at five or younger and 11% at seven. 88% of the boys and 84% of the girls have attended no other high school than the one in which they were presently enrolled. Even at the completion of the 11 grade, 27% had received at least one award for scholarship. Just half of the group indicated no data or no award. The Experimental group is slightly more select from this point of view in that both boys and girls showed some greater numbers of awards or scholarships than did the control groups. However, the differences were not too great. 22% of the boys and 30% of the girls had been editors of their school publications. This difference is just less than statistically significant at the 5% level. The boys showed no great excess of athletic offices or awards over the girls. About 50% of the boys and 45% of the girls had received one or more science or mathematics awards. In comparison with Control groups the Experimental group had a slight edge. Club officerships show about the same proportion of boys and girls with the exception of the proportion of those having three or more entries as club officers. Three or more club officerships gave a distinct advantage to the girls (35%) who outclassed the boys (15%). In student government officerships, the boys and girls shared equally. About 38%, almost 2 out of 5, had held one or more offices in student government. There apparently are no normative data to which one may compare these frequencies of honors, recognition and activities. They do seem, on the surface at least, to indicate a very superior group of students in terms of ability, of achievement, and of willingness to carry their load within their social system.

Most of the students, 3 out of 5, rate their family financial situation as "comfortable, but not well to do," but over one fourth drop to the lower rating of "all necessities but not many luxuries." These ratings are supported by other kinds of information such as occupation and education of parents. 88% of the group indicate that they live in a one-family house.

There is nothing unusual or particularly noteworthy about the distribution of birthplace of father or mother nor of the ages of fathers or mothers of these boys and girls. However, parents activities show some interesting information. Both parents participate in church or religious activities more than any one class of activities. The second most frequent activity is parent-teacher associations in which the mothers are distinctly more active than are the fathers.

Parental occupation is of considerable interest. About 16% had a father who was a proprietor or business executive. Almost 40% had fathers who hold non-professional non-executive jobs. This percentage was exceeded by the fathers of the C-2 group. About half of the mothers were reported as being housewives or having no occupation. About 16% of the fathers had not finished high school and 39% of the fathers were reported as being college graduates or more. About 12% of the mothers had not finished high school, while 32% of them as compared with 39% of the fathers had graduated from college and possibly had some further training. No normative data with which to compare these observations are available. They do, however, indicate that more women have been schooled to some minimum standard such as high school graduation than is true for the men but that more men complete college and go on for graduate education. It can be assumed that the sample of fathers and mothers are fairly comparable.

Question 96 indicates that almost nine out of ten had never skipped any whole grade or half grade. More girls had skipped than had boys. These evidences are consistent with the ages of the student.

One fourth of the boys and over half of the girls indicated that when younger they had never been given any scientific toys such as microscope, chemistry set or anything of that nature (Question I-111). There is a growing belief that toys of this sort have some bearing on interest in science as a career and in the understanding and enjoyment of science. An interesting thing here is that such toys were given to three fourths of the boys but to less than half the girls, reflecting the commonly held notion that science is basically masculine.

The academic background of each student in both Experimental and Comparison groups was obtained through Form C, Student Academic Record. Form C was filled out by the high school principal at the end of the students' Junior year. The information was not asked for again after the Summer Science Program, since so little of the information sought in this form could have changed within the time span available between the pre and post-SSP observation period.

The data from Form C are summarized in Table 22. These

Table 21

Backgrounds of Students Included In The Study

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
I-1 Date of Birth:							
0. 1940	0	0	0	0	0	0	0
1. 1941	0	0	0	0	0	0	0
2. 1942	6	4	0	0	0	0	0
3. 1943	80	79	0	0	0	0	0
4. 1944	11	15	0	0	0	0	0
5. 1945	1	1	0	0	0	0	0
6. 1946	0	0	0	0	0	0	0
7. 1947	0	0	0	0	0	0	0
8. 1948	0	0	0	0	0	0	0
9. 1949	0	0	0	0	0	0	0
X No Data, 1960	2	1	0	0	0	0	0
I-3 Place of Birth:							
1. Same city as high school.	33	33	0	0	0	0	0
2. Same state as high school but not same city.	36	33	0	0	0	0	0
3. Different state from high school, but in same geographic region.	8	5	0	0	0	0	0
4. Different state from high school and different geographic region.	22	28	0	0	0	0	0
5. Outside U.S.A.	1	2	0	0	0	0	0
X No Data or Unknown	0	0	0	0	0	0	0
I-4 Home Address:							
1. Same city as high school.	81	87	0	0	0	0	0
2. Same state as high school but not same city.	18	13	0	0	0	0	0
3. Different state from high school, but in same geographic region.	0	0	0	0	0	0	0
4. Different state from high school and different geographic region.	0	0	0	0	0	0	0
5. Outside U.S.A.	0	0	0	0	0	0	0
X No Data or Unknown	0	0	0	0	0	0	0
I-5 Is the Home Address indicated that of your:							
1. Parent(s)	98	95	0	0	0	0	0
2. Relative(s)	1	3	0	0	0	0	0
3. Friend(s)	0	0	0	0	0	0	0
4. Other	1	1	0	0	0	0	0
X No Data	0	0	0	0	0	0	0
I-6 How many times have you changed your home address during the past years?							
1. Never	64	61	0	C	0	0	0
2. Once	24	28	0	0	0	0	0
3. Twice	5	8	0	0	0	0	0
4. Three times	4	2	0	0	0	0	0
5. More than three times	3	1	0	0	0	0	0
X No Data	0	1	0	0	0	0	0
I-7 How long have you lived at your present address?							
1. 1 year or less	6	7	0	0	0	0	0
2. 1 year but not more than 3 years.	14	11	0	0	0	0	0
3. More than 3 years but not more than 5 years	15	19	0	0	0	0	0
4. More than 5 years but not more than 10 years.	25	26	0	0	0	0	0
5. More than 10 years.	39	37	0	C	0	0	0
6. No Data	0	0	0	0	0	0	0

Table 21 (Continued)

Item	% Response (Experimental) Male	Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	E vs C2	Female E vs C1	E vs C2
I-8 Where did you live before moving to your present address?							
1. Have always lived at present address.	22	21	0	0	0	0	0
2. Same city as high school.	36	41	0	0	0	0	EE
3. Different city from high school but same state.	27	23	0	0	0	0	0
4. Different state from high school.	14	14	0	0	0	0	0
5. Outside U.S.A.	1	1	0	0	0	0	0
X No Data or Unknown	1	1	0	0	0	0	0
I-9 Age (to nearest birthday) entered first grade.							
1. 4 years	1	1	0	0	0	0	0
2. 5 years	14	14	0	0	0	0	0
3. 6 years	71	71	0	0	0	0	0
4. 7 years	11	10	0	0	0	0	0
X No Data	2	3	0	0	0	0	0
I-10 Height: (Inches)							
1. Under 60	1	2	0	0	0	0	0
2. 60-62	1	15	FF	0	0	0	0
3. 63-65	5	46	FF	0	0	0	0
4. 66-68	20	29	F	0	0	0	0
5. 69-71	39	7	MM	0	0	0	0
6. 72-74	26	0	MM	0	0	0	0
7. 75-77	4	0	MM	0	0	0	0
8. 78 and over	1	0	0	0	0	0	0
X No Data or Unknown	2	1	0	0	0	0	0
I-11 Weight: (Pounds)							
1. Under 100	0	3	0	0	0	0	0
2. 100-109	1	19	FF	0	0	0	0
3. 110-119	3	27	FF	0	0	C	0
4. 120-129	9	26	FF	0	0	0	0
5. 130-139	15	13	0	E	0	0	0
6. 140-149	22	6	MM	C	0	0	0
7. 150-159	18	3	MM	0	0	0	0
8. 160-169	13	1	MM	0	0	0	0
9. 170-179	8	0	MM	0	0	0	0
0 180 Plus	10	0	MM	0	0	0	0
X No Data or Unknown	2	2	0	0	0	0	0
I-12 Is your present high school the only high school you have attended?							
1. Yes	88	84	0	0	0	0	0
2. No	11	14	0	0	0	0	0
X Data	1	2	0	0	0	0	0
I-34 Awards for scholarship:							
1. One entry	27	27	0	0	0	EE	0
2. Two entries	15	17	0	0	E	E	0
3. Three entries	7	8	0	0	0	0	0
4. Four entries	2	2	0	0	0	0	0
5. Five entries	1	1	0	0	0	0	0
6. Six entries	0	1	0	0	0	0	0
7. Seven entries	0	0	0	0	0	0	0
8. Eight entries	0	0	0	0	0	0	0
9. Nine or more entries	0	0	0	0	0	0	0
X No Data or "None"	48	45	0	0	0	CC	0

Table 21 (Continued)

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
I-35 Editor: School Publication							
1. One entry	16	19	0	C	0	0	0
2. Two entries	5	10	0	0	0	0	0
3. Three entries	1	1	0	0	0	0	0
4. Four entries	0	0	0	0	0	0	0
9. Five or more entries	0	0	0	0	0	0	0
X No Data or "None"	78	61	MM	0	0	CC	CC
I-36 Athletic offices or Awards							
1. One entry	22	24	0	0	0	0	0
2. Two entries	9	5	0	0	0	0	0
3. Three entries	8	4	0	0	0	0	0
4. Four entries	3	1	0	0	0	0	0
5. Five entries	1	0	0	0	0	0	0
9. Six or more entries	0	0	0	0	0	0	0
X No Data or "None"	56	66	F	0	0	0	0
I-37 Science or Mathematics Awards							
1. One entry	25	27	0	0	0	0	EE
2. Two entries	15	10	0	E	E	0	0
3. Three entries	7	5	0	0	0	0	0
4. Four entries	2	2	0	0	0	0	0
5. Five entries	1	0	0	0	0	0	0
6. Six entries	1	0	0	0	0	0	0
7. Seven entries	0	1	0	0	0	0	0
8. Eight entries	0	0	0	0	0	0	0
9. Nine or more entries	0	0	0	0	0	0	0
X No Data or "None"	50	55	0	CC	CC	0	CC
I-38 Club officer							
1. One entries	28	26	0	0	0	0	0
2. Two entries	18	18	0	0	E	0	0
3. Three entries	10	22	FF	0	0	0	0
4. Four entries	3	7	0	0	0	0	0
5. Five entries	1	3	0	0	0	0	0
6. Six entries	1	1	0	0	0	0	0
7. Seven entries	0	0	0	0	0	0	0
8. Eight entries	0	1	0	0	0	0	0
9. Nine or more entries	0	1	0	0	0	0	0
X No Data or "None"	40	22	MM	0	C	0	0
I-39 Officer - Student Government							
1. One entry	27	27	0	0	0	0	0
2. Two entries	9	9	0	0	0	0	0
3. Three entries	2	2	0	0	0	0	0
4. Four entries	0	1	0	0	0	0	0
5. Five entries	0	0	0	0	0	0	0
9. Six or more entries	0	0	0	0	0	0	0
X No Data or "None"	62	62	0	0	0	CC	0

Table 21 (Continued)

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre): Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
I-40 Other honors or Awards							
1. One entry	33	29	0	0	0	0	0
2. Two entries	16	18	0	0	0	0	0
3. Three entries	8	8	0	0	0	0	0
4. Four entries	1	4	0	0	0	0	0
5. Five entries	1	2	0	0	0	0	0
6. Six entries	0	0	0	0	0	0	0
7. Seven entries	0	0	0	0	0	0	0
8. Eight entries	0	0	0	0	0	0	0
9. Nine or more entries	40	39	0	0	CC	0	0
X No Data or "None"							
I-43 How would you describe your family's financial situation?							
1. Below average	3	2	0	0	0	0	0
2. All the necessities but not many luxuries	29	27	0	0	0	0	0
3. Comfortable but not well-to-do	62	61	0	0	0	0	0
4. Well-to-do	10	10	0	0	0	0	0
5. Wealthy	0	0	0	0	0	0	0
X No Data	1	1	0	0	0	0	0
I-44 Check the one phrase which best describes the building in which you live.							
1. One-family house	88	88	0	0	0	0	0
2. Two-family house	5	5	0	0	0	0	0
3. Small apartment house	3	3	0	0	0	0	0
4. Large apartment house	2	1	0	0	0	0	0
5. Rooming house, hotel or trailer	0	0	0	0	0	0	0
6. Something other than the above	2	3	0	0	0	0	0
X No Data	0	0	0	0	0	0	0
I-45 How many people live in your home?							
1. One	0	0	0	0	0	0	0
2. Two	2	3	0	0	0	0	0
3. Three	16	16	0	0	0	0	0
4. Four	38	36	0	0	0	C	0
5. Five	23	19	0	0	0	C	C
6. Six	10	15	0	0	0	0	0
7. Seven	6	5	0	0	0	0	0
8. Eight or more	4	5	0	0	0	0	0
X No Data	0	0	0	0	0	0	0
I-46 Birthplace...Father							
1. New England - Conn., Maine, Mass., N.H., Vt., R.I.	3	4	0	0	0	0	0
2. Mid-Atlantic - N.J., N.Y., Pa.	13	13	0	0	0	0	0
3. East North Central - Ill., Ind., Mich., Ohio, Wisc.	17	15	0	0	0	0	0
4. West North Central - Iowa, Kans., Minn., Mo., Nebr., S.D., N.D.,	12	11	0	C	0	0	0
5. South Atlantic - Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W.Va.	7	4	0	0	0	0	0
6. East South Central - Ala., Ky., Miss., Tenn.	11	14	0	0	0	0	0
7. West South Central - Ark., La., Okla., Tex.	16	19	0	0	0	0	0
8. Mountain - Ariz., Colo., Idaho, Mont., Nev., N.Mex., Utah, Wyo.	5	4	0	0	0	0	0
9. Pacific - Calif., Oreg., Wash., Alaska, Hawaii	5	5	0	0	0	0	0
0. Outside U.S.A.	6	9	0	0	0	0	0
X No Data	5	2	0	0	0	0	0

Table 21 (Continued)

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
I-47 Birthplace...Mother							
1. New England	1	3	0	0	0	0	0
2. Mid-Atlantic	12	15	0	0	0	0	0
3. East North Central	17	15	0	0	0	0	0
4. West North Central	14	10	0	0	0	C	C
5. South Atlantic	9	5	0	0	0	0	0
6. East South Central	10	14	0	0	0	0	0
7. West South Central	16	21	0	0	0	0	0
8. Mountain	5	3	0	0	0	0	0
9. Pacific	5	6	0	0	0	0	0
0 Outside U.S.A.	6	6	0	0	0	0	0
X No Data	5	1	0	0	0	0	0
I-48 Age...Father							
1. Under 30	0	0	0	0	0	0	0
2. 30-34	0	1	0	0	0	0	0
3. 35-39	10	9	0	0	0	0	0
4. 40-44	25	22	0	0	0	CC	0
5. 45-49	27	28	0	0	0	0	E
6. 50-54	16	17	0	0	0	0	0
7. 55-59	8	9	0	0	0	0	0
8. 60 and over	4	7	0	0	0	0	0
9. Deceased	5	3	0	0	0	0	0
X No Data	4	3	0	0	0	0	0
I-49 Age...Mother							
1. Under 30	0	0	0	0	0	0	0
2. 30-34	2	1	0	0	0	0	0
3. 35-39	22	18	0	0	0	0	0
4. 40-44	30	28	0	0	0	C	0
5. 45-49	26	30	0	0	0	E	0
6. 50-54	11	12	0	0	0	0	0
7. 55-59	2	3	0	0	0	0	0
8. 60 and over	0	0	0	0	0	0	0
9. Deceased	1	6	0	0	0	0	0
X No Data	6	2	0	0	0	0	0
I-50 Activities parents participate in? Father:							
1. Church or religious group	71	58	MM	0	EE	0	0
2. School organizations	38	31	0	0	E	0	0
3. Political groups	15	9	0	0	0	0	0
4. Labor or trade unions	16	19	0	0	0	0	0
5. Business or Professional organizations	40	33	0	0	0	0	0
6. Hobby groups such as dramatics, band, etc.	9	9	0	0	0	0	0
7. Sports or social groups	35	39	0	0	0	0	0
8. Civic organizations	35	33	0	0	E	0	0
9. Active military reserve or Veteran's organizations	13	10	0	0	0	0	0
0. Parent-Teachers associations	47	43	0	0	0	0	0
X No Data	11	10	0	0	0	0	0

Table 21 (Continued)

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
I-51 Activities parents participate in? Mother:							
1. Church or religious group	73	69	0	0	0	0	0
2. School organizations	51	49	0	0	E	0	0
3. Political groups	11	9	0	0	0	0	0
4. Labor or trade unions	3	3	0	0	0	0	0
5. Business or professional organizations	17	16	0	0	0	CC	0
6. Hobby groups such as dramatics, band, etc.	13	10	0	0	0	0	0
7. Sports or social groups	38	36	0	0	0	0	0
8. Civic organizations	29	31	0	0	0	0	E
9. Active military reserve or Veterans organizations	1	1	0	0	0	0	0
0 Parent-Teachers associations	70	65	0	0	0	0	0
X No Data	9	11	0	0	0	0	0
I-52 Occupations? Father:							
1. Scientific profession or Mathematician	3	5	0	0	0	0	0
2. Medicine	4	2	0	0	0	0	0
3. Engineering	6	2	0	0	0	0	0
4. Professional (not including education or teaching)	5	3	0	0	0	0	0
5. Proprietor or business executive	16	18	0	0	0	E	E
6. Nonprofessional, nonexecutive	37	44	0	0	C	0	C
7. Housewife or None (Not No Data)	0	0	0	0	0	0	0
8. Military, Civil Service	7	5	0	0	0	0	0
9. Educator	9	7	0	0	0	0	0
0. Sales	7	8	0	0	0	0	0
X No Data	7	6	0	0	0	0	0
I-53 Occupations? Mother:							
1. Scientific profession or Mathematician	1	0	0	0	0	0	0
2. Medicine	3	2	0	0	0	0	0
3. Engineering	0	0	0	0	0	0	0
4. Professional (Not including Education or Teaching)	2	2	0	0	0	0	0
5. Proprietor or business executive	2	2	0	0	0	0	0
6. Nonprofessional, nonexecutive	17	21	0	0	0	0	0
7. Housewife or None (Not No Data)	53	48	0	E	0	0	0
8. Military, Civil Service	2	0	0	0	0	[illegible]	0
9. Educator	12	14	0	0	0	0	0
0. Sales	1	1	0	0	0	0	0
X No Data	9	10	0	0	0	0	0
I-54 Education? Father:							
1. Some grade school	3	1	0	0	0	0	0
2. Grade school graduate	4	3	0	0	0	0	0
3. Some high school	9	11	0	0	0	0	0
4. High school graduate	22	27	0	0	0	0	0
5. Some college	21	20	0	0	0	0	0
6. College graduate	16	19	0	0	0	E	0
7. Postgraduate work	8	6	0	0	0	0	0
8. Postgraduate degree	15	12	0	0	0	0	0
X No Data	1	1	0	0	0	0	0

Table 21 (Continued)

Item	% Response (Experimental) Male	Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	E vs C2	Female E vs C1	E vs C2
I-55 Education? Mother:							
1. Some grade school	1	1	0	0	0	0	0
2. Grade school graduate	3	3	0	0	0	0	0
3. Some high school	8	9	0	0	0	0	0
4. High school graduate	33	37	0	0	0	0	0
5. Some college	22	22	0	0	0	0	0
6. College graduate	20	16	0	0	0	0	0
7. Postgraduate work	7	6	0	0	0	0	0
8. Postgraduate degree	5	6	0	C	0	0	0
X No Data	1	1	0	0	0	0	0
I-56 Highest college degree attained? Father:							
1. B.S., B.A., or equivalent	20	20	0	0	0	0	0
2. M.S., M.A., or equivalent	10	7	0	0	0	0	0
3. D.Sc., or Ph.D. or any doctoral degree	5	6	0	0	0	0	0
4. None	59	59	0	0	0	0	C
X No Data	5	8	0	0	0	0	0
I-57 Highest college degree attained? Mother:							
1. B.S., B.A., or equivalent	25	22	0	E	0	0	0
2. M.S., M.A., or equivalent	5	6	0	0	0	0	0
3. D.Sc., or Ph.D. or any doctoral degree	0	0	0	0	0	0	0
4. None	62	63	0	C	0	0	0
X No Data	8	10	0	0	0	0	0
I-75 Check any of the industries listed below which have a plant or laboratory in your community and which employ over 100 people.							
1. Electronics	31	25	0	0	0	0	0
2. Electrical	35	35	0	0	0	0	0
3. Chemical	38	32	0	0	0	C	0
4. Military Missile Installation	17	17	0	0	0	0	0
5. Nuclear	8	8	0	0	0	0	0
6. Aircraft or Rocket	21	22	0	0	0	0	0
7. Oil or Petroleum	29	22	0	0	0	0	0
8. None of these	34	38	0	0	0	0	0
X No Data	3	7	0	0	0	0	0
I-96 Have you ever skipped a whole grade or half grade?							
1. Yes	7	13	F	0	0	E	0
2. No	91	86	0	0	0	C	0
X No Data	1	1	0	0	0	0	0
I-111 When you were younger were you ever given any scientific toys such as: Microscope, chemistry set, or anything of that nature?							
1. Yes	76	42	MM	0	E	0	0
2. No	24	58	FF	0	C	0	0
X No Data	0	1	0	0	0	0	0
I-112 If "Yes," What?							
1. Chemistry set and microscope	33	11	MM	E	E	0	0
2. Chemistry set	27	12	MM	0	0	0	0
3. Microscope	14	14	0	0	0	0	0
4. Do it yourself kits, Erector set (not electronics)	4	1	0	0	0	0	0
5. Electronics, radio kits	3	1	0	0	0	0	0
6. Telescope	3	2	0	0	0	0	0
7. Miscellaneous	4	7	0	0	0	0	0
X No Data	23	58	FF	0	C	0	C

data show that the Experimental and Comparison groups were quite similar in their academic records both as to the kinds of courses taken and the quality of work done.

Question 1 shows that the principals felt that, as of the end of the junior year, they could recommend practically all of the students for admission to college.

Roughly three out of four of the students achieved the honor roll within their first, second or third years. This was also true of the girls in the Comparison groups. However, the boys in the Comparison groups did not do as well in this area as the boys in the Experimental group.

Absenteeism during the Junior year appeared to be low. According to Quesion 4, 46% of the boys and 43% of the girls had no more than two days of absences during that year. The Comparison groups showed no significant difference from this norm. How this compares with high school Juniors generally is not known.

The Experimental group showed a slight superiority to the Comparison groups in terms of estimated rank in scholarship in the Junior class: 23% of the boys and 33% of the girls were ranked as number one in their Junior class. This was a higher proportion than for either of the male comparison groups or the female comparison groups. Typically, a larger proportion of girls attain this top rank than do boys. Almost none of the students were ranked lower than the top fourth of their class. Actually, 70% of the boys and 79% of the girls ranked in the top 5% of their class or as number one, two or three. The participants in the SSP are a really superior group academically, with the Comparison groups not far behind. The remainder of Table 22 shows the per cents of boys and of girls who had taken various courses during their high school career (through the 11th grade). Almost all had had three years of English. Mathematics through quadratics and plane geometry had been taken by 90% or more of the students. Alegbra beyond quadratics was the most common course taken beyond the customary two years of mathematics. Most of the students had had a course in Biology, almost two-thirds in general Science and in Chemistry. More had planned to take Physics during their Senior year, a fact that does not show in this particular table. Courses the students expected to take in their Senior year and those they reported being taken indicate considerable enrollment in the mathematics and science courses. Latin was the most common language in high school with French and Spanish holding about second and German coming next in order.

Very few students took languages other than the Latin, German, French or Spanish. One hears frequently through the newspapers or other similar sources of students or groups of students studying Russian. This, however, does not exist in any considerable quantity or else has not become an official part of the high school curriculum and hence cannot appear in the transcript.

As a group these students compare favorably in terms of academic record with the students who participate in the Annual Science Talent Search for the Westinghouse Science Scholarships.

Table 22: Comparisons of Responses, Form C, Student Academic Record. (Comparisons of Experimental and Control groups Before Summer Science Program Experience.)

Item	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)			
				Male		Female	
	Male	Female		E vs C1	E vs C2	E vs C1	E vs C2
1. As far as you can tell at the present time, would you recommend this student for admission to college?							
1. Yes	97	95	0	0	0	0	0
2. No	-	1	0	0	0	0	0
X No Data	3	3	0	0	0	0	0
3. Honor Rolls achieved							
1. First year	70	77	0	EE	EE	0	0
2. Second year	74	79	0	EE	EE	0	0
3. Third year	76	77	0	EE	EE	0	0
4. Fourth year	5	4	0	0	0	0	0
0. None	1	0	0	0	0	0	0
X No Data	15	15	0	CC	C	0	0
4. Days absent during Junior year to date.							
None	18	16	0	0	0	0	0
1 - 2 days	28	27	0	0	0	0	0
3 - 4	14	12	0	0	0	0	0
5 - 6	11	9	0	0	0	0	0
7 - 8	5	7	0	0	0	0	0
9 - 10	3	5	0	0	0	0	0
11 - 12	1	1	0	0	0	0	0
13 - 14	0	2	0	0	0	0	0
15 - 16	1	2	0	0	0	0	0
17 or more	2	2	0	0	0	0	0
No Data	17	17	0	0	0	0	0
92. Estimated rank in Scholarship in Junior class.							
Rank 1	23	33	F	EE	EE	EE	EE
Rank 2	10	5	0	0	0	0	0
Rank 3	5	4	0	0	0	0	0
Top 5% (If not in ranks 1, 2, or 3.)	32	37	0	0	0	0	0
Top 10% (If not in ranks 1, 2, or 3.)	14	9	0	0	CC	0	0
Top 25% (If not in ranks 1, 2, or 3.)	8	5	0	0	C	C	0
Top 50% (If not in ranks 1, 2, or 3.)	0	2	0	0	0	0	0
Lower 50% (If not in ranks 1, 2, or 3.)	0	1	0	0	0	0	0
No Data	7	4	0	0	0	0	0
COURSES TAKEN (through 11th grade)							
English							
1st year	99	99	0	0	0	0	0
2nd year	99	99	0	0	0	0	0
3rd year	85	89	0	0	0	0	0
4th year	2	5	0	0	0	0	0
Other	14	12	0	0	0	0	0
History							
Civil government	14	17	0	0	0	0	0
American	73	73	0	0	0	0	0
World	63	67	0	0	0	0	0
Ancient and Medieval	4	7	0	0	0	0	0
Modern	4	5	0	0	0	0	0
Community Civics	7	24	FF	0	0	0	0
Problems of Democracy	2	0	0	0	0	0	0
Other	21	17	0	0	0	0	0
No Data	4	4	0	0	0	0	0

Table 22 (Continued)

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre): Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
Mathematics							
Algebra - through quads	97	98	0	0	0	0	0
Algebra - beyond quads	77	67	M	[illegible]	0	E	0
Geometry - plane	90	90	0	0	0	0	0
Geometry - solid	14	13	0	0	0	0	0
Trigonometry	16	14	0	0	0	0	0
No Data	11	19	F	0	0	0	0
Science							
Physics	28	20	M	0	0	0	0
Chemistry	64	67	0	0	0	0	0
Physical Geography	4	1	0	0	0	0	0
Botany	0	1	0	0	0	0	0
Physiology	2	2	0	0	0	0	0
Zoology	1	1	0	0	0	0	0
Agriculture	2	2	0	0	0	0	0
Biology	87	91	0	0	0	0	0
General science	63	63	0	0	0	0	0
Other	16	13	0	0	0	0	0
No Data	1	1	0	0	0	0	0
Latin							
1st year	46	52	0	0	0	0	0
2nd year	37	42	0	0	0	0	0
3rd year	5	9	0	0	0	0	0
4th year	1	1	0	0	0	0	0
German							
1st year	11	5	0	0	0	0	0
2nd year	5	2	0	0	0	0	0
3rd year	2	1	0	0	0	0	0
4th year	1	0	0	0	0	0	0
French							
1st year	19	25	0	0	0	0	0
2nd year	12	17	0	0	0	0	0
3rd year	4	8	0	0	0	0	0
4th year	0	0	0	0	0	0	0
Spanish							
1st year	20	22	0	0	0	0	0
2nd year	14	14	0	0	0	0	0
3rd year	5	3	0	0	0	0	0
4th year	0	0	0	0	0	0	0
Other Language							
1st year	2	1	0	0	0	0	0
2nd year	2	0	0	0	0	0	0
3rd year	1	0	0	0	0	0	0
4th year	0	0	0	0	0	0	0

Table 22 (Continued)

Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2
Vocational Agriculture	6	1	0	0	0	0	0
Manual Training - Wood Shop	17	0	MM	0	0	0	0
Shopwork - Metals shop	3	0	0	0	0	0	0
Art	9	13	0	0	0	0	0
Mechanical Drawing	19	5	MM	0	0	0	0
Domestic Science	0	34	FF	0	0	0	0
Music	35	47	FF	0	0	0	0
Bookkeeping	1	4	0	0	0	0	0
Stenography	0	2	0	0	0	0	0
Typewriting	30	44	FF	0	0	0	0
Commercial Arithmetic	1	1	0	0	0	0	0
Commercial Law	0	1	0	0	0	0	0
Commercial Geography	1	1	0	0	0	0	0
Economics	3	4	0	0	0	0	0
Sciology	5	2	0	0	0	0	0
Other	64	69	0	0	0	0	0

VI

HIGH SCHOOL SCIENCE BACKGROUND

Informal assessments of the possible effects of Summer Science Programs upon high school students, often conclude with the statement, "that depends upon the kind of school the student comes from." Back of this is the assumption that schools, because of special ingredients combined in their teaching staff, their subject matter enrichment, their science-mathematics climate, affect the attitudes and achievements of their students in special ways. The idea that the kind of school in a major way determines the kind of student is omnipresent, not only in the study at hand, but in many previous and current attempts to understand and to evaluate the promise of young people as future scientists.

Seeking a way of better understanding this phenomenon an effort was directed at developing some measure, index or description of the student-shaping factors present in the high schools of the students included in this study.

The result was Form D, School Inventory. The questions in this form are those which could offer an operational definition of "kind of school," and are an answer to "In what way do high schools affect the quality of science and mathematics students?" particularly those aspects of a high school which might bear on the student's sophistication or understanding of science. It includes a description of the school, of the teaching staff, the offerings in science and mathematics, and in addition some information regarding the methods of selecting students to attend the Summer Science Programs. The data from Form D provide a way for exploring differences in "kinds of schools" insofar as they may be associated with differences in performance of students and with changes in performance, interests and attitudes, accompanying attendance and participation of these students in a Summer Science Program.

The end result of this should be an index of the science orientation of the high school environment. Organization of the most pertinent material in this form has been simplified, although this risks some loss in assuming that the information can be represented by a linear scale rather than "pattern."

Form D was returned by 644 high schools each of which had had an 11th grade applicant for admission to one of the 18 Summer Science Programs selected for this study.

Three types of analysis of the data from Form D were considered. Of these, the first alternative was chosen since it was economical, straight forward and understandable. The other two alternatives were set aside for the time. The three possibilities were:

1. Set up two lists of schools, one to be those known for their outstanding work in science and the other those not so known. Then compare the data from Form D for the two groups of schools.

2. A priori, set up particular items deemed to have bearing on adequacy of school background and experience for the teaching of science. Compare schools on such items.

3. Compute the intercorrelations of the questionnaire items for the schools in the sample, extracting factors from this matrix, with the idea that whatever was common to such a matrix of interrelations would necessarily be the kind of common information sought for this kind of study.

The first condition was to require that items of information should reflect differences between high schools acknowledged to have a strong science background in comparison with those not so recognized.

Each of the observers, scientist-educators, who had participated in this study by visiting and reporting in detail on one or more of the SSP's, was asked to take the list of high schools which had students participating in this study and indicate those schools which, to their knowledge, had a strong science background. Altogether the observers nominated 54 schools in 16 states. This produced a somewhat unequal dichotomy. To increase the smaller category, those schools which had two or more students in the Honors group in the 1959 and/or 1960 Annual Science Talent Searches were added to the group having a strong science background. There was high coincidence among the schools nominated by the Observers and those which had had students in the Honors group in the Science Talent Search, giving further evidence of validity of the selection. This step yielded a total of 96 schools in 21 states.

Unfortunately not all schools which had students in the E (experimental - attended SSP) group or the C-1 (Comparison, applied but not accepted for SSP) group submitted the data requested in Form D. The 644 high schools which had submitted complete data on Form D were then divided into three groups:

<u>Group A</u> - High schools presumed to have a superior background for science students since they were:

1. Nominated by an Observer, or

2. Had at least two students on the Science Talent Search honors list in 1959 and/or 1960.

There were 96 such schools among the 644 in this study.

<u>Group B</u> - 408 other high schools from the <u>same states</u> as the 96 in Group A, but which <u>did not meet</u> Group A requirements. The "same states" selection avoided implicit comparison between states and made for a fairer comparison with Group A.

<u>Group C</u> - 140 high schools from states not represented in Group A.

The data of Form D were tabulated according to the three groups as shown in Table 25. Per cents of high schools of each group giving each answer are given. Statistically Group C closely resembled Group B. Comparisons of per cents for Groups A and B are made for each answer. The comparisons are indicated by five symbols:

0: No significant difference

A: % in Group A exceeded Group B between 5 and 1% levels of confidence

B: % in Group B exceeded Group A between 5 and 1% levels of confidence

AA: % in Group A exceeded Group B at 1% level of confidence or better

BB: % in Group B exceeded Group A at 1% level of confidence or better.

Review of the table shows that most of the responses to the questions reflect differences between Groups A and B. Standing out are differences in size and economic strength of the communities and their schools.

In the construction of the proposed index, it was desirable to select those questions for which the answers most effectively and sensibly discriminate between Groups A and B. In doing this these conditional concepts were used.

1. Omit all information bearing directly on size of high schools. Substantial evidence in these data indicates that favorable science-mathematics environment is associated with size of school. (There may be a minimum "critical" size of school).

2. Keep the number of variables comprising the index small, perhaps no more than 10 or 12. While many questions bear on the character of the high school science-mathematics environment, it is probably not particularly profitable to go beyond the suggested number of questions since adding new questions will add little new information and make little change in such an indicator.

3. Make the index itself a very simple structure, leaving it statistically unpolished at the moment. If such an index does show useful information, it may be refined at that time.

In the selection of items to be included in the preliminary index, three characteristics were given particular consideration:

1. those which, in terms of comparisons of Groups A and B, showed the most effective discrimination,

2. those the Observers believed to be more important, and

3. those which carry the greater face validity, and are hence more acceptable.

On these bases, 12 questions or evidences were selected to reflect the strength of the "Science Background" of each high school. The questions and combining values are as follows:

1. (Q. 10) The per cent of parents of students in PTA:

39% or less	0
40% or more	2

2. (Q. 22) Approximately what per cent of your high school graduates go on to college?

0 - 59	0
60 and above	2

3. (Q. 36) Annual Salary after 5 years service for teachers with bachelor's degrees

$3,999 or less	0
4,000 to 4,999	1
5,000 and above	2

4. (Q. 44) Per cent of teachers in the high school holding BS or BA as their highest degree

59 and less	2
60 and more	0

5. (Q. 47) Per cent of science and mathematics teachers holding master's degree or higher

0-49	0
50 and above	2

6. (Q. 48) Per cent of Science and Mathematics teachers with six or more years of experience.

0 - 59%	0
60% and above	2

7. (Q. 49) The per cent of high school science and math teachers who teach no other subjects except science or mathematics.

0 - 79%	0
80% and more	2

8. (Q. 53) Is there a guidance counselor in the school?

Yes - full time	2
Yes - part time	1
No	0

9. (Q. 55, 56) Organizations sponsored by the school.

Score

0 if school has 2 or less of the kinds of organizations named below

1 if school has 3 or 4 of the kinds of organizations named below

2 if school has 5 or more of the kinds of organizations named below.

The following kinds of organizations are considered in scoring this question:

Service clubs

Science or math clubs

Foreign language clubs

Dramatic or speech clubs

Student government

Debating team

Science fairs.

10. (Q 61, 62, 63) For how many of the following sciences does the high school have a laboratory? Biology, physics, chemistry.

None	0
1	1
2 or 3	2

11. (Q 68, 69) How many of the following advanced mathematics courses are regularly taught in the high school? Solid geometry, trigonometry, college algebra, analytic geometry, mathematical analysis, calculus?

None	0
1 - 2	1
3 or more	2

12. (Q 70) How many of the following science courses are regularly taught in the high school? Chemistry, Physics, Advanced Chemistry, Advanced Biology, Advanced Physics, Earth Science.

None	0
1 - 2	1
3 or more	2

The values used in combining the twelve pieces of information reflect the relative discrimination of the questions between Groups A and B. This produces an index with a range from 0 to 24. In cases of "no data," the least favorable category was used, that is, a score of zero was assigned rather than to use the statistically more defensible mean value.

It may be desirable, at some later time, to organize such an index on some more sophisticated base, such as using a factor analysis, selecting those items which seem factorially to give a most consistent kind of a "desirable" configuration. It would also be of interest to compare our selection of items with those that might be proposed by a high school inspection or accrediting committee.

Table 23 shows the frequency distribution of Science Background Indexes for the three groups of schools. The distributions include the indexes for Groups A and B, which furnished the data for Table 25. The indexes for Groups B and C are quite similar.

Table 23

Frequency Distribution For Science

Background Indexes

Index	Group A	Group B	Group C	Total
22	4	1		5
21	8	2	1	11
20	8	4	1	13
19	10	13	1	24
18	18	17	5	40
17	12	27	6	45
16	11	34	8	53
15	4	32	15	51
14	9	39	10	58
13	2	35	17	54
12	4	41	18	63
11	1	35	11	47
10	2	39	9	50
9	3	19	7	29
8		28	9	37
7		12	7	19
6		10	8	18
5		11	3	14
4		6	1	7
3		2	3	5
2		1		1
1				
0				
Total	96	408	140	644
Mean Score	17	12	12	13

Table 24

Frequency Distribution For Science

Background Indexes

Index	North East	North Central	South	West	Total
22	4			1	5
21	4		1	6	11
20	5	4	1	3	13
19	7	12	3	2	24
18	8	15	5	12	40
17	6	18	14	7	45
16	11	11	16	15	53
15	8	15	20	8	51
14	8	17	20	13	58
13	5	13	31	5	54
12	8	18	22	15	63
11	3	17	23	4	47
10	2	21	22	5	50
9	3	7	15	4	29
8	3	15	15	4	37
7		5	11	3	19
6		7	10	1	18
5		5	9		14
4		1	6		7
3			4	1	5
2			1		1
1					
0					
Total	85	201	249	109	644
Mean Score	16	13	12	14	13

Table 24 shows the frequency distributions of the Science Background Indexes by geographic regions of the United States. These do not represent a random or comparable sample of the high schools in the regions. They do show some relationship to a priori expectation; considerable variation, the south lowest but with many high indexes, and the west (mostly California) holding at a fairly high level. The differences among the means of the four regions is statistically significant: $F = 24.03$ with the value for the 1% level of confidence being 3.78.

Before we can describe the real meaning of the index, it will be necessary to use it in a number of studies, in order to understand the operation of the aggregate of the evidences combined in it. Hopefully it will help to get around the evasive that depends on the kind of high school the student comes from.

The relationship of this index to Pre and Post SSP performance of the Experimental group of boys is presented later in this report.

Table 25

Comparison of Three Groups of High Schools -
A Superior Science Background (N = 96)
B Not Superior Science Background (N = 408)
C Other High Schools (N = 140)

Questions from Form D	Percents: A	B	C	Comparison: A vs. B
1. Description of community in which high school is located.				
Urban	59	42	45	AA
Suburban	35	20	18	AA
Rural	4	37	35	BB
No Data	1	1	2	0
2. Size of community in which high school is located.				
Under 10,000	9	51	53	BB
10,000 - 19,999	11	12	16	0
20,000 - 49,999	22	14	12	A
50,000 - 99,999	8	5	7	0
100,000 - 500,000	25	11	12	AA
Over 500,000	20	6	3	AA
No Data	0	1	1	0
3. What grade levels are covered by your high school?				
10 - 12	41	21	21	AA
9 - 12	42	52	41	0
8 - 12	5	4	16	0
7 - 12	10	22	22	BB
Other	2	2	1	0
No Data	0	0	0	0
6. Number in eleventh grade.				
0 - 99	7	43	44	BB
100 - 299	18	35	37	BB
300 - 599	34	14	8	AA
600 or Over	31	3	6	AA
No Data	8	6	6	0
9. Number in entire high school.				
0 - 399	7	38	30	BB
400 - 999	20	33	43	BB
1000 - 1799	22	16	11	0
1800 and Over	42	7	9	AA
No Data	7	7	7	0
6/9. Ratio: eleventh grade to total high school enrollment.				
.10 - .24	26	48	63	BB
.25 - .34	48	34	25	AA
.35 and Above	16	9	6	0
No Data	9	9	7	0
6/9. Ratio: eleventh grade to total high school enrollment, corrected to 3 year high school base.				
.10 - .24	3	4	10	0
.25 - .34	42	41	59	0
.35 and Above	44	45	25	0
No Data	9	9	7	0
*10. Per cent of parents of students in PTA.				
0	18	20	18	BB (0 to 20 - 39)
1 - 19	8	18	15	
20 - 39	17	23	25	
40 - 59	23	15	20	AA (40 - 59 to 80 and Above)
60 - 79	16	9	11	
80 and Above	11	9	2	
No Data	5	8	8	0

Table 25 (Continued)

Questions from Form D	Percents: A	B	C	Comparison: A vs. B
13. Number of full time teaching faculty.				
0 - 19	2	32	36	BB
20 - 39	16	32	34	BB
40 - 59	20	15	9	0
60 - 79	19	9	10	A
80 - 99	20	4	4	AA
100 - 119	6	1	1	
120 - 139	3	0	0	
140 - 159	5	0	0	AA
160 - 179	5	0	0	
180 and Above	1	1	1	
No Data	3	6	4	0
16/13. Ratio: Part time to full time teachers.				
No part time	42	41	47	0
.01 - .06	35	19	18	AA
.07 - .12	10	16	11	BB
.13 and Above	9	18	20	
No Data	3	6	4	0
17/13. Ratio: New teachers to regular full time.				
0	3	4	4	0
.01 - .06	11	11	10	0
.07 - .12	21	24	27	0
.13 - .18	26	21	15	0
.19 - .24	11	16	11	0
.25 and Above	17	22	29	0
No Data	3	4	4	0
18/13. Ratio: Teachers left school to teachers stayed on.				
0	2	9	4	BB
.01 - .06	27	17	17	A
.07 - .12	39	29	32	A
.13 - .18	16	19	12	
.19 - .24	8	11	14	A
.25 and Above	7	12	18	
No Data	0	3	4	0
19/13. Ratio: New Science and Mathematics teachers to regular full time teachers.				
0	16	35	29	BB
.01 - .03	46	17	16	AA
.04 - .06	24	20	21	0
.07 - .09	9	11	16	
.10 - .12	5	7	7	B
.13 and Above	0	5	8	
No Data	0	3	2	0
20/13. Ratio: Science and Mathematics teachers who left to regular full time teachers.				
0	32	49	42	BB
.01 - .03	46	20	16	AA
.04 - .06	17	14	18	0
.07 and Above	5	14	22	BB
No Data	0	2	2	0
21. Percent of 10th grade students who leave before graduation.				
0 - 1	10	7	6	
2 - 3	15	12	10	0
4 - 5	18	18	15	
6 - 7	3	4	5	
8 - 9	6	5	6	0
10 - 11	16	15	11	
12 - 13	2	3	5	
14 - 15	7	5	9	0
16 - 17	0	0	1	
18 and Above	30	20	26	A
No Data	2	10	6	B

Table 25 (Continued)

Questions from Form D	Percent: A	B	C	Comparison: A vs. B
*22. Percent of graduates gone on to college.				
0 - 9	0	2	3	
10 - 19	1	7	4	BB
20 - 29	8	14	16	
30 - 39	11	16	17	
40 - 49	12	16	20	BB
50 - 59	11	17	15	
60 - 69	11	10	9	
70 - 79	18	7	6	AA
80 - 89	9	3	2	
90 and Above	16	4	4	
No Data	1	3	4	0
23. Number of graduates.				
0 - 99	9	49	57	BB
100 - 299	31	32	26	0
300 - 599	39	9	10	AA
600 and Above	17	1	1	AA
No Data	4	6	6	0
24. Percent attending city or state colleges.				
0 - 49	30	31	26	0
50 - 89	42	42	35	0
90 and Above	20	24	31	0
No Data	6	7	5	0
26. Percent received scholarships to college.				
0 - 9	21	28	35	0
10 - 11	23	17	21	0
12 and Above	24	20	14	0
No Data	30	36	31	0
27. Does community have adult education program?				
Yes	89	57	57	AA
No	11	42	43	BB
No Data	0	0	0	0
28. Is school on multiple session schedule?				
Yes	15	6	9	AA
No	84	91	89	B
No Data	1	4	2	0
29. Kinds of courses taught.				
Academic	100	98	98	0
General	81	81	80	0
Vocational	48	63	64	B
Commercial	82	81	77	0
Other	9	10	3	0
No Data	0	0	0	0
30. Is school specialized?				
Yes	9	6	5	0
No	91	93	93	0
No Data	0	1	2	0
31. What specialization area?				
Mathematics or Science	7	2	3	A
Social studies, humanities	0	0	1	0
College preparatory	6	4	4	0
Vocational or trade courses	1	1	3	0
Miscellaneous	5	2	1	0
No Data	80	87	87	0

Table 25 (Continued)

Questions from Form D	Percent: A	Percent: B	Percent: C	Comparison: A vs. B
32. Academic requirements of high school				
Exams, Tests including intelligence tests.	5	7	6	0
Class standing, grades	6	4	5	0
Religious requirements	0	0	0	0
Nothing particular, 8 yr. Grad or Jr. High school grad.	66	54	57	0
Geographical restriction	4	0	0	0
Miscellaneous	4	4	6	0
No Data	14	30	26	0
33. High school is:				
Public	94	92	94	0
Parochial	1	4	3	0
Private - boarding	3	1	1	0
Private - non-boarding	2	2	1	0
No Data	0	0	0	0
34. Expenditure per pupil.				
0 - 299	11	25	56	BB
300 - 499	40	33	18 }	
500 - 699	17	15	4 }	A
700 - and Above	8	4	2 }	
No Data	24	24	21	0
35. Starting salary for teachers with Bachelor degree.				
2000 - 2999	0	5	12	B
3000 - 3999	21	37	58	BB
4000 - 4999	74	52	26	AA
5000 - and Above	2	4	1	0
No Data	2	2	3	0
***36. Salary after 5 years of service.**				
2000 - 2999	1	1	4 }	BB
3000 - 3999	5	22	47 }	A
4000 - 4999	34	41	31	AA
5000 - 5999	54	25	11	AA
6000 and Above	3	6	1	0
No Data	2	5	6	0
37. Replacement value of science lab equipment.				
No Lab equipment	0	0	0	0
0 - 14,999	15	49	45	BB
15,000 - 29,999	24	15	20	A
30,000 - 59,999	26	13	9	AA
60,000 and Above	17	10	8	A
No Data	17	12	8	0
37/70. Ratio: Value of science lab equipment to number of students enrolled in science courses.				
0 - 99	69	67	82	0
100 - 199	9	12	6	0
200 and Above	2	2	1	0
No Data, no lab	20	18	11	0
38. Is there a library in school?				
Yes	97	99	100	0
No	0	1	0	0
No Data	2	0	0	0
39. How many volumes in library?				
0 - 5999	18	57	60	BB
6000 - 11,999	51	25	20	AA
12,000 and Above	22	5	9	AA
No Data and No library	7	12	10	0
40. Number of librarians on staff?				
None	0	16	14	BB
One	56	75	71	BB
Two	28	8	13	AA
Three	4	0	1 }	AA
Four and Above	11	0	0 }	
No Data	0	0	1	0

Table 25 (Continued)

Questions from Form D	Percent: A	Percent: B	Percent: C	Comparison: A vs. B
41. Hours per week spent by teachers in extra curricular activities.				
None	0	1	1	0
1 - 2	36	43	39	0
3 - 4	16	18	16	0
5 - 6	16	23	22	0
7 - 8	4	3	4	0
9 - 10	12	5	6	AA
11 and Above	1	2	5	0
No Data	15	6	6	0
43. Percent of teachers not holding college degree.				
0 - (None)	73	82	76	B
1 - 9	20	10	15	AA
10 and Above	3	3	4	0
No Data	4	4	5	0
*44. Percent of teachers holding BA or BS as highest degree.				
0 - (None)	4	2	0	0
1 - 19	12	4	1	A
20 - 39	30	16	5	AA
40 - 59	39	29	24	A
60 - 79	9	34	44	BB
80 and Above	6	12	21	B
No Data	0	2	4	0
45. Percent of teachers holding MA or MS degree as highest degree.				
0 - (None)	0	1	0	0
1 - 19	0	10	20	BB
20 - 39	14	35	50	BB
40 - 49	18	17	11	0
50 - 59	23	12	7	A
60 - 79	26	15	5	A
80 and Above	11	8	6	0
No Data	7	1	0	A
46. Percent of teachers holding Ph.D as highest degree.				
0 - (None)	57	81	86	BB
1 - 9	33	13	8	AA
10 and Above	8	6	6	0
No Data	1	0	0	0
*47. Percent of science and math teachers with MA degree or higher degree.				
0 - (None)	2	13	16 }	
1 - 9	0	0	1 }	BB
10 - 29	4	14	24 }	
30 - 49	10	21	23 }	
50 - 69	43	27	22 }	
70 - 89	24	10	6 }	AA
90 and Above	15	9	4 }	
No Data	2	5	4	0
*48. Percent of science and math teachers with six years or more experience.				
0 - (None)	2	5	4 }	
1 - 19	1	0	3 }	BB
20 - 39	6	9	12 }	
40 - 59	11	25	27 }	
60 - 79	41	26	26	AA
80 and Above	36	27	23	A
No Data	2	5	4	0
*49. Percent of science and math teachers teaching science or math only.				
0 - (None)	1	3	2 }	
1 - 19	1	0	0 }	
20 - 39	2	5	5 }	BB
40 - 59	0	10	9 }	
60 - 79	10	15	15 }	
80 and Above	81	63	66	AA
No Data	4	2	3	0

Table 25 (Continued)

Questions from Form D	Percent: A	B	C	Comparison: A vs. B
51. Number of years of science required for academic program.				
0	3	2	2	AA (0–1)
1	40	23	14	
2	39	36	42	0
3	12	30	23	BB (3–4)
4	6	6	16	
No Data	0	3	3	0
52. Number of years of math required for academic program.				
0	2	0	1	0
1	21	20	11	0
2	48	34	44	A
3	19	28	21	B
4	8	15	20	BB
No Data	2	2	3	0
*53. Is there a guidance counselor in school?				
Yes - full time	68	48	47	AA
Yes - part time	27	38	38	B
No	4	14	14	BB
No Data	1	0	1	0
54. Full time teaching load is				
Too heavy	29	20	28	A
About right	68	79	72	B
Too light	0	1	0	0
No Data	3	1	0	0
*55/56. Organizations sponsored by school.				
School publications	100	92	96	0
Music, band, glee club, etc.	100	98	97	0
Service clubs	82	60	67	AA
Athletic teams	100	100	100	0
Science or math clubs	93	71	78	AA
Foreign language clubs	86	59	59	AA
Dramatic or speech clubs	92	70	69	AA
Student government	99	88	82	AA
Debating team	57	40	37	AA
Science fairs	71	54	70	AA
Other	19	24	22	0
*57/65. Kinds of laboratories in school.				
General science	28	37	39	B
Labs serving two or more	34	61	59	BB
Botany	5	4	4	0
Zoology	4	4	1	0
Biology	87	60	59	AA
Physics	89	54	46	AA
Chemistry	92	59	51	AA
None	0	0	1	0
Other	17	6	1	AA
No Data	0	2	2	0
66. Total number of labs in school.				
0 - 1	1	23	21	BB
2 - 3	28	31	33	0
4 - 5	30	18	14	AA
6 - 7	14	5	4	AA
8 - 9	5	2	2	AA (8 and above)
10 and Above	6	2	1	
No Data	16	19	25	0
67. Adequacy of lab facilities.				
All are good	48	39	39	0
Most are good	44	42	44	0
Most are poor	5	11	6	0
All are poor	1	6	9	0
No lab	0	0	1	0
No Data	2	3	3	0

Table 25 (Continued

Questions from Form D	Percent: A	B	C	Comparison: A vs. B
***68/69. Percent of schools having students in math courses.**				
Solid geometry	79	62	51	AA
Trigonometry	86	76	66	A
College algebra	42	21	19	AA
Analytic geometry	19	10	4	A
Math analysis	20	8	8	AA
Introduction to calculus	27	6	5	AA
Other mathematics	45	24	35	AA
No Data	2	16	14	BB
***70. Percent of schools having students in science courses.**				
General science	55	71	85	BB
Biology	97	92	98	0
Chemistry	99	89	91	AA
Physics	93	78	81	AA
Advanced general science	8	8	10	0
Advanced biology	28	11	11	AA
Advanced chemistry	27	6	6	AA
Advanced physics	17	5	2	AA
Earth science	22	8	4	AA
Other science	47	20	17	AA
No Data	1	3	1	0
***71. Are science students assigned special projects.**				
Yes	78	52	57	AA
No	20	44	39	BB
No Data	2	4	4	0
73. Are there experimental courses in science or math?				
Yes	53	25	26	AA
No	45	71	69	BB
No Data	2	4	5	0
74. Description of experimental courses in science or math.				
Advanced science or math courses, advanced placement, advanced lab.	27	13	14	AA
Experimental courses, e.g., modern math, chem - physics sequence (SMSG, PSSC, etc.)	14	6	5	AA
Advanced topics, not true courses, variety of fields	2	1	0	0
Seminar work	2	1	0	0
Projects	2	0	0	0
Miscellaneous	3	4	6	0
No Data/None	50	75	75	BB
75. Was Summer Science Program announced publicly?				
Yes	86	70	77	AA
No	12	27	21	BB
No Data	1	3	2	0
76. Number of students who applied for Summer Science Program.				
None	0	0	0	0
1 - 2	30	43	51	B
3 - 4	14	21	18	0
5 - 6	14	13	13	0
7 - 8	2	5	4	AA (7 - 8 through 19 and Above)
9 - 10	3	4	2	
11 - 12	4	2	1	
13 - 14	2	1	1	
15 - 16	1	1	1	
17 - 18	16	1	3	
19 and Above	15	8	6	
No Data	0	0	0	A

Table 25 (Continued)

Questions from Form D	Percent: A	B	C	Comparison: A vs. B.
77. Number of students accepted in a Summer Science Program.				
None	2	10	12	BB
1 - 2	48	67	66	BB
3 - 4	24	11	8	AA
5 - 6	3	3	2	
7 - 8	3	1	3	
9 - 10	3	0	0	
11 - 12	0	0	1	AA
13 - 14	1	0	1	
15 - 16	2	0	0	
17 - 18	4	0	0	
19 and Above	9	6	6	
No Data	0	0	0	0
77/76. Ratio of students accepted to students applied.				
0	2	10	12	BB
.01 - .06	13	11	10	0
.07 - .12	25	30	26	0
.13 - .18	16	9	10	A
.19 and Above	27	30	33	0
No Data	15	10	9	0
78. How many students were given suggestion to apply?				
0 - 9	30	55	54	BB
10 - 19	20	19	19	
20 - 39	14	9	6	A
40 - 59	4	2	2	
60 and Above	5	2	2	
No Data	26	12	16	AA
79. Does principal have to approve application?				
Yes	59	69	68	0
No	36	28	31	0
No Data	4	2	1	0
80. Basis of schools' approval or disapproval of application.				
Grades, school record, etc.	48	51	54	0
I.Q. test scores	5	6	6	0
Interest in science, participation	8	8	7	0
Work habits	0	0	1	0
Good character	1	1	1	0
Recommendations, approvals	29	19	16	A
Miscellaneous	1	5	6	0
No Data	7	7	9	0
81. Number of applications not approved.				
0	49	48	54	0
1 - 2	16	19	18	0
3 - 4	6	9	4	0
5 - 6	1	3	4	0
7 - 8	2	2	1	0
9 - 10	5	1	0	0
11 - 12	1	0	0	0
13 - 14	0	1	1	0
15 - 16	1	0	0	0
17 - 18	0	0	0	0
19 and Above	3	0	1	0
No Data	16	15	17	0
82. Reasons for rejection.				
Academic standing not high enough	14	5	7	AA
Low IQ test scores	0	3	1	0
Lack of preparation	0	1	1	0
Too many applicants	8	8	5	0
Poor behavior	0	0	1	0
No reason given	6	11	10	0
Miscellaneous	10	8	10	0
No Data	61	64	65	0

VII

BEFORE AND AFTER

The most telling data regarding impact of the Summer Science Programs is in terms of student attitudes, beliefs, school programs, educational plans, and patterns of performance as science students before the SSP compared with similar evidences obtained after the SSP. Such comparisons are reported in this section. In making these comparisons it is important to be sure that a change is not due to the added maturity of all high school boys and girls or to the student role change from being a high school junior (11th grade) to being a senior. Hence, the comparison groups. Any change from Pre-to Post-SSP which is not paralleled in the comparison groups may be properly associated with the experience of attending a SSP.

Some Educational Attitudes

Students' attitudes towards their academic work is reflected by answers to a group of eleven statements which were contained in both RBH Forms A and H. Each statement was marked "Yes", "No", or ? indicating how well the student agreed with the statement. The statements and the per cents of response are shown in Table 25. About four out of five of the students reported they usually did a little more than the course required. Almost all said that they made sure that they understood what they were to do before they started an assignment. More than nine out of ten believe that their teachers graded them fairly. Nine out of ten considered a difficult assignment a challenge to their ability and there was an increase in the numbers of boys in both Experimental and Comparison who marked this statement "Yes" in their senior year as compared to their junior year. More boys than girls said that unless they liked the course they did only enough to get by. The proportions here are small but for such a select group there are still too many. About four out of five say they do not seem to study more than necessary for the amount they accomplish. Three out of four, and more girls than boys, disagree to the statement, "I have difficulty in expressing my self." More girls than boys say they enjoy writing compositions and reports. Six out of seven students indicate that they do not have trouble in keeping their mind on what their teachers say. Distinctly more girls than boys say, "No" to the statement, "I try to get things done too quickly and consequently I am sometimes very sloppy." This is also consistent with information shown in work habits, in Forms B and E.

The only one of eleven statements to show a significant change for the Experimental boys and not for the Comparison group from Pre to Post-SSP. Fewer boys say "No" to the statement, "I have trouble in keeping my mind on what the teacher is saying." This may be interpreted as showing that the boys have either improved their work habits or increased their interest in their courses, or both, as a result of attendance at a SSP. Reasons for this change would be quesswork, but it is possible that classwork in the high school seems less impelling after SSP.

Attitudes, Beliefs and Superstitions

85 statements regarding science, school, and scientists, were presented to all of the students both before and again after the Summer Science Program. These statements were presented in RBH Form A just before the end of the junior year in high school and prior to the beginning of the 1960 SSP's and again in January 1961 as part of RBH Form H. Each statement could be marked A (Agree): the statement is true, D (Disagree): the statement is false, or ? (Question mark): which could mean don't know or reflect some opinion between "A" and "D".

The 85 statements shown in Table 26 were classified into 14 groups, each group dealing essentially with the same concept or topic. For each statement the per cent marking only one of the answers is given, either the per cent marking Agree or the per cent indicating Disagree. For each statement the choice was made so as to characterize most clearly the responses of the student. The reader should be warned particularly about the resulting double negatives.

While there is a substantial correlation between the per cents of boys and per cents of girls who marked each response shown, for 25 of the 85 statements (29%) the difference was significant at the 5% level of confidence or better.

In the first group there are six statements regarding high school Science courses. More than a fourth of the students "Agree" that they learn more in a science course from the laboratory than they do from the classwork. A larger proportion of girls than boys accepted this statement. Just over a half thought they learned more from the classwork. Practically all students Disagree with the statement that one should not "learn too much about chemistry or physics since it will all be changed tomorrow." The reactions to statement 51 are of particular interest, "Students lose interest in courses primarily because they have poor teachers", is agreed to more frequently by girls than by boys. This may reflect greater objectivity of boys. Only one of the six group 1 questions showed significant change from Pre to Post SSP and this (number 42) indicates a change (Boys) in favor of broader high school programs.

In the second group of questions, interdependence of sciences, more of the boys than girls believe that there is a relationship between chemistry and physics and between mathematics and science in general. Statements 2 and 4 show an increase in the proportions of Post SSP If this is a result of the Summer Science Program, it is all to the good.

Group 3 statements refer to the presumed social standing of scientists. The boys apparently carry a stronger bias in favor of science, since more boys than girls believe that scientists contribute more than artists to society, however, the proportions of all groups of boys who agreed to this statement did decrease. More girls than boys disagreed to, "The Armed Services do not make good use of scientists once they are in the Service." They also disagreed that the scientists make better fathers than do non-scientists. Within Group 3 the Experimental sample of girls shows a decrease, Pre to Post SSP, in the proportion who disagreed with 17, "Scientists are not paid as well as the average business man." And there is an increase in the boys who agreed to 18, "Scientists make poor politicians." This could reflect some change in their role image of a scientist.

Group 4 includes a number of stereotypes in regard to scientists and science. Only two of these ten

Table 26

Comparisons of Responses, Part I, Form A, 76-86 and Form H, 30-40. (Students Description of His Own Study and Work Habits)

Forms A H	Item	Yes No ?	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
76-30	I usually do a little more than the course requires.	Yes	77	84	0	E	E	0	0	0	0	0	0	0	0
77-31	I make sure that I understand what to do before I start an assignment.	Yes	94	96	0	0	0	0	0	0	0	0	0	0	0
78-32	My teacher grades me fairly.	Yes	93	94	0	0	0	0	0	0	0	0	0	0	0
79-33	I consider a very difficult assignment a challenge. to my ability.	Yes	87	92	0	0	E	0	0	+	0	+	0	0	0
80-34	Unless I really like a course, I do only enough to get by.	Yes	20	11	M	0	0	0	0	0	0	0	0	0	0
81-35	I really don't do my best work.	Yes	33	29	0	0	0	0	0	0	0	0	0	0	0
82-36	I seem to study more than is necessary for the amount I accomplish.	No	78	84	0	0	0	E	E	0	+	0	0	0	0
83-37	I have difficulty in expressing myself.	No	72	81	F	0	0	0	EE	0	0	0	0	-	0
84-38	I enjoy writing compositions and reports.	Yes	47	66	FF	0	0	0	0	0	0	0	0	0	0
85-39	I have trouble in keeping my mind on what the teacher is saying.	No	85	83	0	0	EE	0	0	--	0	0	0	0	0
86-40	I try to get things done too quickly and consequently am sometimes pretty sloppy.	No	63	78	FF	0	0	0	0	0	-	0	-	0	-

Table 27

Comparisons of Responses, Forms A and H,
(Attitudes and Beliefs of Students)

Group	Forms H A	Item	A D ?	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
Group 1	1.	In a science course you learn more from the laboratory work than you do from the class work.	A	26	35	F	0	C	CC	0	0	0	0	0	0	0
	7.	In high school one should not learn too much about chemistry or physics since it will all be changed to-morrow.	D	99	100	0	0	0	0	0	0	0	0	0	0	0
	31.	Most high schools don't work students hard enough and let them fool around too much.	A	62	64	0	0	0	E	EE	0	0	0	0	0	0
	42.	More time in high school should be spent in studying cultural subjects such as music appreciation and art.	D	61	55	0	0	0	0	0	--	0	-	0	0	0
	51.	Students lose interest in courses primarily because they have poor teachers.	A	42	61	FF	0	0	0	0	0	0	0	0	0	0
	52.	Students who do poorly in academic work have better mechanical ability than do the brighter students.	D	61	60	0	0	0	EE	EE	0	0	0	0	0	0
Group 2	2.	You can't be a good biologist unless you know chemistry very well.	A	60	60	0	0	E	0	0	++	0	0	+	0	0
	4.	You can't be a good chemist unless you know physics very well.	A	54	45	M	0	EE	E	E	++	0	++	0	+	0
	9.	You have to know a lot of mathematics in order to be a good scientist.	A	86	75	M	0	0	0	0	0	0	0	0	0	0
Group 3	3.	Scientists contribute more than artists to society.	A	66	43	MM	E	EE	0	0	--	--	--	0	0	0
	6.	The armed services do not make good use of scientists once they are in the service.	D	49	68	FF	C	CC	0	0	-	0	0	0	0	0
	10.	Scientists make better fathers than do non-scientists.	D	39	60	FF	0	C	0	0	0	0	-	0	0	0
	11.	Most scientists prefer to work by themselves and are really anti-social.	D	77	77	0	EE	EE	0	E	0	0	0	0	0	0
	17.	Scientists aren't paid as well as the average business-man.	D	38	50	FF	0	0	EE	0	0	0	0	-	0	0
	18.	Scientists make poor politicians.	A	23	19	0	0	0	0	0	+	0	0	0	0	0
	19.	Scientists are less likely to understand world problems than are literary men.	D	67	77	F	0	0	0	0	0	0	0	0	0	0
	24.	Most scientists, other than teachers, are not very help-ful to a young student.	D	69	74	0	0	E	0	0	0	0	0	0	0	0

Table 27 (Continued)

Group	Forms (H A)	Item	A D ?	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
Group 4	5.	It is better not to know how others made scientific discoveries so that you won't be limited by their thinking.	D	89	92	0	0	0	0	0	0	0	0	0	0	0
	8.	More people are getting interested in science because of the "space age."	A	91	91	0	0	0	0	0	0	0	0	0	+	0
	13.	A scientific discovery is one of the greatest contributions an individual can make to society.	A	76	81	0	0	E	0	0	0	0	0	0	0	0
	14.	A scientist is better off working alone than as part of a team.	D	71	63	0	0	0	0	0	-	0	0	0	0	0
	16.	A scientist's primary responsibility is to investigate matters which will have some application to industry or the military.	D	82	85	0	E	EE	0	E	0	0	0	0	0	0
	20.	Knowing what earlier scientists did is a great help to present-day scientists.	A	95	96	0	0	0	0	0	0	0	0	0	0	0
	21.	Whether a scientist discovers something that is applicable or not does not matter as long as it adds to man's knowledge.	A	77	78	0	0	E	0	0	+	0	0	0	0	0
	23.	In order to get ahead as a scientist and make real contributions to science you have to have a Ph.D. degree.	A	28	15	MM	0	0	C	0	0	0	0	+	0	0
	53.	Good students should be encouraged to do extra projects outside of the regular classroom activities.	A	95	95	0	0	0	0	0	0	0	0	0	0	0
	58.	The best scientists go into college teaching.	D	47	62	FF	0	0	E	EE	0	0	0	-	0	0
Group 5	15.	Engineers are not real scientists.	D	58	69	F	0	0	0	0	0	+	0	0	0	0
	33.	Most high school graduates are not really prepared for college work.	A	47	56	F	0	0	0	E	0	-	0	0	0	0
	75.	Most of the things you learn in a science course depend on rote memory rather than figuring things out.	A	19	15	0	0	E	0	0	0	-	0	0	++	0
	78.	Some people get ahead by working hard but more frequently it is because of their personality.	A	27	24	0	0	0	0	0	0	0	0	0	0	0
	79.	Getting ahead depends more on whom you know than what you know.	D	73	80	0	0	0	0	0	-	0	-	0	0	0
	80.	There is just as much reason to have athletic scholarships in college as to have academic scholarships.	A	29	36	F	CC	CC	0	0	0	0	0	0	0	0
	81.	A college education is worth every cent it costs.	A	91	91	0	0	0	0	0	0	0	0	0	0	0
	82.	I would rather start earning money right after high school and learn a job than go to college.	D	98	99	0	0	0	0	0	0	0	0	0	0	0
	83.	College professors really live in an ivory tower and don't know what's going on in the world.	D	87	91	0	0	0	0	0	0	0	0	0	0	0
	84.	The most important thing in college is to get to know people and be well rounded.	D	66	70	0	0	EE	0	0	0	0	0	0	0	0

Table 27(Continued)

Group	Forms H A	Items	A D ?	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
Group 6	25.	Many students don't go into science because their high school teacher never made it interesting enough.	A	45	54	F	C	0	0	0	0	0	0	0	0	0
	26.	Many students don't go into science because they are not interested.	A	91	92	0	0	0	0	0	0	0	0	0	0	0
	27.	Many students don't go into science because they have had poor preparation in high school.	A	63	70	0	C	0	0	E	0	0	0	0	0	0
	60.	Many students don't go into science because they are not smart enough.	A	46	45	0	0	CC	0	0	0	++	0	0	0	0
	61.	Many students don't go into science because scientists are not paid enough.	A	24	22	0	0	0	0	0	0	0	0	0	0	0
	62.	Many students don't go into science because scientists don't get enough recognition.	A	12	13	0	0	0	0	EE	0	0	0	0	0	0
Group 7	28.	Teachers expect too much of students.	D	85	90	0	0	E	0	0	0	0	0	0	0	0
	34.	High school teachers deserve a lot more recognition than they get.	A	82	78	0	0	0	0	0	0	0	0	0	0	0
	35.	Science teachers are less apt to show favoritism to students than are teachers of other subjects.	D	50	57	0	0	0	0	0	0	0	0	0	0	0
	36.	Some students get better grades because they get along better with the teacher not because they are any brighter.	A	52	49	0	0	0	0	0	0	0	0	0	-	0
	38.	Math teachers give too much homework.	D	91	86	0	EE	0	0	0	0	0	0	0	0	0
	44.	Science teachers give too much homework.	D	91	91	0	0	0	0	0	0	0	0	0	0	0
	45.	English teachers give too much homework.	D	74	85	FF	0	E	0	0	0	0	0	0	0	0
	47.	My community should spend more money on teachers' salaries.	A	73	67	0	0	0	0	0	0	0	0	0	0	0
	59.	College science teachers are much better teachers than high school science teachers.	A	31	15	MM	0	0	0	0	0	0	0	0	0	0
Group 8	12.	My parents think it foolish to be a scientist.	D	95	93	0	0	0	0	0	0	0	0	0	0	0
	22.	My parents think you can make more money in business than by becoming something like a chemist or physicist.	D	49	65	FF	0	0	0	0	0	0	0	0	0	0

Table 27 (Continued)

Group	Forms H A	Item	A D ?	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Exp. vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
Group 9	29.	Everyone should have to take four years of a foreign language in high school.	A	22	31	F	0	0	0	0	0	0	0	0	0	0
	43.	High school students do not have enough time for extracurricular activities.	D	74	75	0	0	0	0	0	0	0	0	0	0	0
	55.	Everyone should have to take four years of science in high school.	A	39	38	0	CC	0	0	0	0	-	0	0	0	0
	56.	Everyone should have to take four years of English in high school.	A	83	89	0	0	0	0	0	0	0	0	0	0	0
Group 10	30.	One of the best reasons for giving a test is to allow the teacher to find out how much a student knows.	A	67	73	0	0	0	0	0	0	0	0	0	0	0
	32.	The standards for grading in most high schools are too low.	A	45	45	0	0	0	0	0	0	0	0	0	0	-
	46.	One of the best reasons for giving a test is to allow the student to find out what he does not know.	A	82	84	0	0	0	0	0	0	0	0	+	0	0
	54.	If tests weren't given a student would learn just as much.	D	81	78	0	0	0	0	0	0	0	0	0	0	0
	57.	Tests are usually unfair.	D	91	95	0	0	0	0	0	0	0	0	0	0	0
Group 11	37.	My high school should spend more money on scientific and laboratory equipment.	A	68	71	0	0	0	0	0	0	0	0	-	0	0
	39.	Our laboratory equipment for science courses is about as good as that found in other high schools.	A	55	55	0	0	0	0	0	+	0	0	0	0	0
	40.	Our science teachers are about as good as those found in other high schools.	A	73	75	0	0	0	0	0	0	0	0	0	0	0
	48.	An "A" in a subject in my high school is as good as an "A" in that same subject in any other high school.	A	56	66	F	0	0	0	EE	0	0	0	0	0	0
	50.	Students in my high school are as interested in world events as students in other high schools.	A	62	68	0	C	0	0	0	0	0	0	0	0	0
Group 12	41.	I doubt that many other students of my age know more about the science I am most interested in than I do.	A	31	21	M	0	EE	0	0	0	0	0	0	0	0
	49.	I would rank in the top 5% in any high school.	A	45	49	0	EE	EE	E	EE	0	0	0	+	0	0
	86.	Some people like to kid me about being a scientist.	A	34	35	0	0	EE	0	EE	0	-	0	0	--	0
	87.	I do not like being kidded about being a scientist.	A	16	14	0	0	0	0	0	0	0	0	0	0	0

Table 27 (Continued)

Forms H A	Item	A D ?	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs. C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
63.	A strong leader could make this country better than all the laws and talk.	A	26	25	0	0	0	0	0	0	0	0	0	0	0
64.	When a man is born the success he is going to have is already in the cards so he might as well accept it and not fight against it.	D	96	95	0	0	0	0	0	0	0	0	0	0	0
65.	Planning only makes a person unhappy since plans hardly ever work out anyway.	D	96	97	0	0	0	0	0	0	0	0	0	0	0
66.	These days with world conditions the way they are, the wise person lives for today and lets tomorrow take care of itself.	D	93	90	0	0	0	0	0	0	0	0	0	0	0
67.	People can be divided into two distinct classes: the weak and the strong.	D	76	74	0	0	0	0	0	0	0	0	0	0	0
68.	Someday it will probably be shown that astrology can explain a lot of things.	A	11	18	F	CC	0	0	0	0	0	0	0	0	0
69.	Wars and social troubles may some day be ended by an earthquake or flood that will destroy the whole world.	A	9	13	0	C	0	0	0	0	0	0	0	0	0
70.	Science has its place but there are many important things that can never be understood by the human mind.	A	59	71	FF	0	0	0	0	-	0	0	0	0	0
71.	Every person should have complete faith in some supernatural power whose decisions he obeys without question.	A	39	50	F	0	0	0	0	0	0	0	0	+	0
72.	Many people are instinctively afraid of the dark.	A	51	52	0	C	0	0	0	0	0	0	0	0	0
73.	Appendicitis is sometimes caused by swallowing fruit seeds.	D	51	63	FF	0	0	0	0	0	0	0	0	0	0
74.	Infection cannot occur without the presence of some bacteria or virus.	A	78	81	0	0	0	0	0	0	0	0	0	0	0
77.	People who read fast remember less of what they read than do slower readers.	D	72	78	0	0	0	0	0	0	0	0	0	0	0
76.	Girls do not make as good scientists as boys.	D	65	89	FF	0	0	0	0	0	0	0	0	0	0
85.	There is really no reason for a girl to go to college.	D	96	100	0	0	0	0	0	0	0	0	0	0	0

Group 13 (items 63–77); Group 14 (items 76, 85) statements show any statistical change from Pre to Post SSP: Fewer boys Disagree to statement 14, "A scientist is better off working alone than as part of a team" and an increase in Agreement to the statement, "Whether a scientist discovers something that is applicable or not, does not matter as long as it adds to man's knowledge." Only two of the ten statements show a significant difference in the responses of boys as compared to girls. More boys than girls agree that scientists should go ahead and get a Ph. D. degree. More girls than boys Disagree to the statement, "The best scientists go into college teaching."

Group 5 contains statements that reflect educational stereotypes. The students responses show no significant differences between Pre SSP and Post SSP. One can however speculate on how such beliefs were developed, and why people persist in them.

Group 6 includes statements referring to why students don't go into science. The per cents agreeing to these six items show no significant change from Pre to Post-SSP samplings. The students believe that choosing a career in science is primarily a function of interest. About half of them believe that it is because their high school teacher didn't make it interesting enough. While such evidence presents a somewhat circular argument, it does put a serious responsibility on the teacher to create in the student a real and burning interest. On the other hand about two-thirds believe that students do not go into science because they have poor preparation in high school, and almost half say that students avoid science because they are not smart enough.

The statements in Group 7 refer to teachers and teaching. Not one of these shows a significant difference between Pre-SSP and Post-SSP answers. Half of the students "Agree" that some students get better grades because they get along better with the teacher, not because they are any brighter. Among these very able students there is disagreement with statements indicating teachers are expecting too much of them or giving too much homework. It is interesting that a significantly larger proportion of girls than boys Disagree to the statement, "English teachers give too much homework," and a significantly larger proportion of boys than girls Agree to statement 59, "College science teachers are much better teachers than high school teachers."

Statements in Group 8 indicate how students believe their parents regard science as a career.

Group 9 statements relate to curricular questions. About a quarter of the students believe that they should take four years of a foreign language in high school. Three out of four Disagree to statement 43, "High school students do not have enough time for extra-curricular activities." Two out of five students believe that everyone should take four years of science in high school, and six out of seven Agree that everyone should take four years of English in high school. The SSP experience apparently caused no change of belief here.

Group 10 statements have to do with the students' attitudes toward tests. A significant change (at the 5% level) of confidence between Pre and Post-SSP samplings is shown for only one of these five statements. The attitudes of students toward tests are apparently satisfactory and offer no indication that the students as a group feel that tests are unfair or improperly used.

Three out of four of the students believe their science teachers are about as good as those found in other high schools, and well over half believe that the quality of grading in their school is as good as in other high schools. (Group 11)

In terms of attitudes towards themselves as students and scientists (Group 12), over a fourth of the students believe that they know more about their area of science than do other students of their age. The boys more strongly support this belief than do the girls. It is the Observers' belief that most of the students should mark such a statement, "Agree." Almost half believe that they rank in the top 5% in their high school class. More of the girls have this belief after having attended a Summer Science Program than did before. One out of three say that some people like to kid them about being a scientist.

The thirteenth group of statements can best be characterized as a miscellaneous group of superstitions. Both boys and girls show strong disagreement with suggestions that the pattern of life is foreordained. Only a small proportion, and more girls than boys, indicate a belief that astrology can explain a lot of things. By and large the boys show greater objectivity than do the girls, while the girls adhere to a greater extent to a pattern of beliefs which one might call "fundamentalism." One statement, "Infection cannot occur without the presence of some bacteria or virus," is Agreed to by about four out of five of the boys and girls but is marked Disagree or "?" by one out of five. It is important to note that the responses to these statements did not change from Pre SSP to Post SSP! One of the problems of becoming a scientist is that of shaking off the folklore and disproved beliefs which abound in our culture.

The last two statements (Group 14) have to do with the potential for girls in the area of education and science. The girls' answers are more optimistic than are those of the boys. While 65% of the boys Disagree to the statement, "Girls do not make as good scientists as boys," 89% of the girls Disagree to it.

These responses to statements show a surprising amount of change in attitudes, beliefs and superstitions which can be associated with attendance at the Summer Science Programs. Answers for 11 of the statements showed a statistically significant change from Pre- to Post-SSP for the Experimental group of boys, and of these, 8 had no corresponding change in either comparison group. Answers to only 6 statements showed significant changes for boys C-1, and 5 for boys C-2. Seven of the statements showed a similar degree of change in opinion on the part of the Experimental group of girls.

While it is entirely possible that the form of response to these is too limited to reflect changes, the instruction as such was not aimed at such areas of information. It may also be that the period of exposure and the kind of exposure did not offer an antidote to erroneous or unscientific beliefs. The Programs have been oriented to presentation of the structure, facts and procedures of science rather than implications of science and scientific attitudes to everyday living.

Attitudes Toward Science and Science Courses:

Student attitudes toward science and science courses in high school are varied. Table 28 gives a summary of their likes and dislikes in this area. This table shows the attitudes of the students both before the SSP (as of May 1960) and again after SSP (January 1961). Per cents of students giving each of the answers are shown for the boys and girls of the Experimental groups (Pre-SSP). All of the remaining columns of the table show comparisons to these two key groups.

In answer to Question 1, "Which of the sciences do you

Table 28

Attitudes Toward Science and Science Courses.

Forms (H; A)	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparison: Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
III-1; III-1	Which of the following sciences do you think most interesting?													
1	Chemistry	30	38	0	0	C	0	0	0	0	0	0	0	0
2	Physics	40	13	MM	0	EE	0	E	0	0	++	0	0	0
3	Biology	11	30	FF	0	0	0	0	0	0	0	0	0	0
4	Botany	1	2	0	0	0	0	0	0	0	0	0	0	0
5	Astronomy	8	4	0	0	0	0	0	0	0	0	0	0	0
6	Geology	1	2	0	0	0	0	0	0	0	0	0	0	0
7	Physiology	3	6	0	0	0	0	0	0	0	0	0	0	0
8	Zoology	3	6	0	0	0	0	0	0	0	0	0	0	0
X	No Data	1	0	0	0	0	0	0	0	0	0	0	0	0
III-2; III-2	Which science do you think is the most difficult to learn?													
1	Chemistry	23	13	MM	0	0	0	C	0	0	0	0	0	0
2	Physics	26	49	FF	0	0	E	0	++	+	0	0	0	0
3	Biology	11	5	0	0	0	0	0	0	0	0	0	0	0
4	Botany	6	3	0	0	0	0	0	0	0	0	0	0	0
5	Astronomy	13	15	0	0	0	0	0	0	0	0	0	0	0
6	Geology	4	5	0	0	0	0	0	0	0	0	0	0	0
7	Physiology	9	6	0	0	0	0	0	0	0	0	0	0	0
8	Zoology	4	2	0	0	0	0	0	0	0	0	0	0	0
X	No Data	3	3	0	0	0	0	0	0	0	0	0	0	0
III-3; III-3	The best way to learn something in science is:													
1	To read about it	33	23	M	E	E	0	0	0	0	0	0	0	0
2	To have someone explain it to you	23	14	M	0	0	0	C	0	0	0	0	0	0
3	To do an experiment in that field	43	59	FF	0	C	0	0	0	0	0	0	0	0
X	No Data	1	4	0	0	0	0	0	0	0	0	0	0	0
III-4; III-4	Compared to other high school students the intelligence of the students in my high school is:													
1	Above Average	35	33	0	0	0	0	0	0	0	0	0	0	0
2	About Average	59	61	0	0	0	0	0	0	0	0	0	0	0
3	Below Average	4	5	0	0	0	0	0	0	0	0	0	0	0
X	No Data	1	2	0	0	0	0	0	0	0	0	0	0	0
III-5; III-5	The person I would most want to be like is: His (her) occupation is:													
1	An individual, Me.	11	13	0	E	0	0	E	0	0	0	0	0	0
2	Scientist	18	6	MM	0	0	0	0	0	0	0	0	0	0
3	Teacher	12	27	FF	0	0	0	0	0	0	0	0	-	0
4	Doctor-Dentist, Nurse, Psychiatrist	7	7	0	0	0	0	0	0	0	0	0	0	0
5	Religious figure, Missionary, Do gooder	5	7	0	0	0	0	0	0	0	0	0	0	0
6	Industrialist, Military leader, Non-scientist	7	5	0	0	C	0	0	+	0	+	0	0	++
7	Parent	3	5	0	0	0	0	0	0	0	0	0	0	0
8	Don't know, Undecided, No one in particular	11	7	0	0	0	0	0	0	0	0	0	0	0
9	Miscellaneous, Engineer-Technician	4	1	0	0	0	0	CC	0	0	0	0	0	--
0	Student, Friend	0	0	0	0	0	0	0	0	0	0	0	0	0
X	No Data	22	22	0	0	0	0	0	0	0	0	0	0	0
III-6; III-6	Have you gone to talk to your high school guidance counselor?													
1	Yes	69	77	0	0	0	0	0	++	++	++	0	0	0
2	No	16	8	M	0	0	0	0	-	-	-	0	0	0
3	No counselor	14	15	0	0	0	0	0	0	0	0	0	0	0
X	No Data	1	0	0	0	0	0	0	0	0	0	0	0	0

Table 28 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparison: Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
III-7; III-7	Name one science course you are now taking or the last science course you took:													
1	Chemistry	63	66	0	0	0	0	0	--	--	--	--	--	-
2	Physics	30	18	MM	0	0	0	0	++	++	++	++	++	++
3	Biology	4	14	FF	0	0	0	0	0	0	0	-	-	0
4	Botany	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Astronomy	0	1	0	0	0	0	0	0	0	0	0	0	0
6	Geology	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Physiology	0	1	0	0	0	0	0	0	0	0	0	0	0
8	Zoology	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Other	1	1	0	0	0	0	0	0	0	0	0	0	0
X	No Data	1	0	0	0	0	0	0	0	0	0	0	0	0
III-8; III-8	The thing you <u>like</u> <u>most</u> about the course just named in Item 7 is:													
1	The teacher	18	20	0	0	0	0	0	0	0	0	0	0	0
2	The amount of homework	2	1	0	0	0	0	0	0	0	0	0	0	0
3	The laboratory work	25	28	0	0	0	0	0	--	-	0	0	0	0
4	The absence of laboratory work	0	1	0	0	0	0	0	0	0	0	0	0	0
5	The special projects	4	4	0	0	0	0	0	0	0	0	0	0	0
6	The text	5	3	0	0	0	0	0	0	0	0	0	0	0
7	The tests	1	0	0	0	0	0	0	0	0	0	0	0	0
8	The other students	1	1	0	0	0	0	0	0	0	0	0	0	0
9	The subject matter	43	42	0	0	0	E	0	+	0	0	0	0	0
0	Field trips	0	1	0	0	C	0	0	0	0	0	0	0	0
X	No Data	1	1	0	0	0	0	0	0	0	0	0	0	0
Y	Other	0	1	0	0	0	0	0	0	0	0	0	0	0
III-9; III-9	The thing you <u>like</u> <u>least</u> about the course just named in Item 7 is:													
1	The teacher	9	5	0	0	0	0	0	0	0	0	0	0	0
2	The amount of homework	7	6	0	0	0	0	0	0	0	0	0	0	0
3	The course was too hard	1	1	0	0	0	0	0	0	0	0	0	0	0
4	The course was too easy	19	12	0	E	E	C	0	0	0	0	0	0	0
5	The laboratory work	2	2	0	0	0	0	0	0	0	0	0	0	0
6	The absence of laboratory work	20	16	0	0	0	0	0	0	0	0	0	0	0
7	The special projects	3	5	0	0	0	0	0	0	0	0	0	0	0
8	The text was too hard	2	4	0	0	0	0	0	0	0	0	0	0	0
9	The text was too easy	8	7	0	0	0	0	0	0	0	0	0	0	0
X	No Data	30	42	FF	0	0	0	0	0	0	0	0	0	0
III-10; III-10	The thing you <u>like</u> <u>least</u> about the course just named in Item 7 is:													
1	The tests were too hard	7	10	0	0	0	0	0	0	0	0	0	0	0
2	The tests were too easy	2	2	0	0	0	0	0	0	0	0	0	0	0
3	The tests were too frequent	2	2	0	0	0	0	0	0	0	0	0	0	0
4	The other students	1	2	0	0	0	0	0	0	0	0	0	0	0
5	The material was not interesting	1	2	0	0	0	0	0	0	0	0	0	0	0
6	Field trips	2	2	0	0	0	0	0	0	0	0	0	0	0
7	Other	9	18	F	0	0	0	0	0	0	0	0	0	0
X	No Data	76	63	MM	0	0	0	0	0	0	0	0	0	0

Table 28 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparison: Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
III-11; III-11	How do you rate the lab facilities in your high school?													
	1 Excellent	14	18	0	0	0	0	0	0	0	0	0	0	0
	2 Quite good	33	33	0	0	0	0	0	0	0	0	0	0	0
	3 Fair	32	27	0	0	0	0	0	0	0	0	0	0	0
	4 Inadequate	15	15	0	0	0	0	0	0	0	0	0	0	0
	5 Very inadequate	5	6	0	0	0	0	0	0	0	0	0	0	0
	X No Data	1	1	0	0	0	0	0	0	0	0	0	0	0
III-15; III-12	What did you do last summer?													
	1 Nothing - Sat around	2	7	0	0	0	0	0		0	0		0	0
	2 Visited friends or relatives, Trip, Vacation	12	23	FF	0	0	0	0		0	0		0	0
	3 Worked in non-science job - Unspecified "work"	38	23	MM	0	C	0	0		0	0		0	0
	4 Worked in science job	2	3	0	0	0	0	0		0	0		0	0
	5 Studied, Went to summer school, Went to summer camp	18	19	0	E	EE	0	0		0	0		0	0
	6 Work and vacation	20	12	M	0	0	E	0		0	0		0	0
	7 Miscellaneous	8	13	0	0	0	0	0		0	0		0	0
	X No Data	1	1	0	0	0	0	0		0	0		0	0

think is most interesting?" physics was rated as most interesting by the boys (40%) but by only 13% of the girls in the Experimental group. This difference is significant at the 1% level of confidence. Looking on across that row in the table, the Experimental boys and the Experimental group of girls both felt that Physics was more interesting than did their corresponding C-2 Comparison groups. For none of the scores was there any significant change in preference from the Pre to the Post-SSP period.

The answers to Question 2, "Which science do you think is the most difficult to learn?" gives physics the highest rating with more of the girls thinking that physics is the hardest (49%) than do the boys (26%). Other than these, the differences in the answers of boys and girls are of no great significance. It is particularly interesting to note that the proportion of boys in the experimental group goes up significantly from Pre-SSP to Post-SSP in picking physics as the most difficult.

The answers to Question 3, "The best way to learn something in science is," may represent stereotyped response rather than a judgment made on the base of experience.

A majority of the experimental group believe that compared to other high school students the intelligence of the students in their own high schools is about average. However, a third of the students believe that the students in their high school are above the average of intelligence of high schools generally.

One of the few negatives showing up in the before versus after impact of the Summer Science Programs is the increase in the proportion of boys in the Experimental group, who, after the Summer Science Program, want to be more like a person in "6, industrialist, military leader, non-scientist." This change involves only a small proportion of the sample so does not need to sound any alarm.

Question 6 is, "Have you gone to talk with your high school counselor?" It is particularly interesting to note that boys, regardless of group, showed a significant increase in those who said they had gone to talk to their high school guidance counselor, but no such change occurred with the girls. Perhaps they had been to see the counselor earlier.

To question 7, "Name one science course you are now taking or a last science course you took at the end of the junior year," chemistry was named by almost two thirds of the students, physics by less than a third. The effect of the curricular sequence is reflected in their Post-SSP answers. Chemistry is an eleventh grade subject and physics is a twelfth grade subject in the majority of the high schools.

Two out of five mentioned subject matter, one out of four the laboratory work, and about one out of five the teacher, as the thing most liked about the course just named in Question 7.

The boys, Experimental group, show a decrease in the number mentioning laboratory work as the thing they most liked. There is some other evidence that the Summer Science Program has produced a relative decrease in their love of laboratory work, perhaps being crowded out by other activities or aspects of science which they deem more urgent or important to them at the moment.

Liked least about the science courses mentioned were the absence of laboratory work and courses which were easy. There is no evidence in these data either pro or con that the students enjoy a real challenge to their ability and are willing to "pay the price." However, reports of the observers and of the program directors indicate that the students really work and enjoy it during the summer. There are more complaints about lack of work and work that is not challenging than there are to the contrary.

About one half of the students rate the laboratory facilities in their own high school as "quite good" or "excellent". Only about one in five rated their facilities as inadequate or very inadequate.

In answer to the question, "What did you do last summer?" (1959, the summer prior to attendance at the SSP) the largest number indicated that they had worked in non-science jobs and distinctly more boys than girls had worked in such jobs. More girls visited relatives or friends, took a trip or vacation. About equal proportions of boys and girls studied, went to summer school or to camp.

The response "work in non-science job" leaves open the question of the need for work for these boys and girls for financial reasons and the need of a job from the point of view of its training value to the individual.

This table suggests strongly that the students who go to Summer Science Programs are a select group and that their patterns of likes and dislikes among their high school subjects are typical of those which other studies have pointed to as "interested and able in the sciences."

Data from RBH Forms B and E:

RBH Forms B and E have been organized to explore the impact of Summer Science Programs on high school students in terms of

1. patterns of on-the-job performance as high school science students
2. educational attitudes and beliefs, and
3. characteristics of the students which abet or hinder the development of their careers as scientists.

Form B was designed for the student to answer, describing his own performance pattern, attitudes and characteristics as he saw them. Form E was constructed parallel to Form B, but to be answered by the students' science or mathematics teacher.

Forms B and E were completed for each student both Experimental and Control (C-1 and C-2) in May of 1960 before attendance at any SSP, and again in January 1961 after the Experimental group of students had been exposed to the SSP experience and had had several months back in their own high schools.

This permits investigation of several questions:

1. What answers are given by boys and girls who expect to become leading scientists?
2. What are the differences in answers which can be legitimately associated with attendance at a SSP?
3. How do the answers of boys compare with those of girls?

4. How similar are the answers of the Experimental and Comparison groups?

Forms B and E - Part I

Part I of both Forms was designed to produce a description of the student's patterns of performance as a high-school science student. The forms avoid the concept of discriminating between more and less effective science students, describing the patterns of behavior without considering how meritorious the behavior might be.

Materials for these two forms are in the language and concepts of the high school science teachers and their pupils. Phrases describing the performance of high school science students were obtained from performance descriptions of students by their teachers given on the Personal Data Blanks of students who won honors in the Westinghouse Annual Science Talent Search. These phrases were those which the teachers presented as pertinent to the evaluation of the student's potential for becoming a scientist. Some 800 such descriptive phrases were obtained. These were edited for clarity, removing any with dual ideas, double meanings and "weasel words". The remaining words and phrases were submitted to two groups of high-school science teachers, enrolled in academic-year institutes. Each of these teachers reviewed the entire list of descriptive phrases and rated each phrase on a scale of 1 to 5 for each of the following:

1. "how good it is to say about a high-school science student"

2. "how well each phrase described the performance of his or her best high-school science student"

3. "how well each word or phrase applied to one of his better science students but not his best science student."

The ratings from the teachers for each item were tabulated. Those items which showed too much heterogeneity in "how good it is to say about a student" were immediately eliminated from further consideration. Such phrases were not used with sufficient uniformity over the country or had differing values or differing meanings among high-school science teachers. The average rating of "how good it is to say about a science student" was computed and is identified as the "face validity" for the descriptive phrase.

For each descriptive phrase the averages of the ratings of how well it describes the best science student of the teachers was computed and the averages of how well the item describes a more ordinary science student were also computed. The difference between these two mean values for each phrase is its differential or discrimination value, the extent to which it is descriptive of the best as contrasted with the ordinary science student.

Review of the phrases indicated that the teachers had been using about seven different groups of descriptive phrases. These factors are as follows:

S: Scientific interest and attitude. These reflect interest in science and the attitudes that are commonly thought of as being "the scientific attitude."

C: Creativity, inventiveness and ingenuity.

B: Breadth of interest, curiosity and inquisitiveness.

W: Work habits, goal orientation, work planning, systematic dependability, responsibility, attention to detail.

SS: Science Connected Skills such as helpfulness, cooperativeness, teamwork

T: Technician, "cookbook" scientist, equipment builder, activity for activities' sake.

I: Independence of thought and action, individualism, disregard of authority, insisting on checking errors in work of others.

All of these factors have appeared in discussing with scientists, science educators and high school teachers the kinds of evidences one might expect to reflect the effects of Summer Science Program participation. The phrases were classified according to the above factors.

Part I for the two forms was then organized as follows:

- Decriptive phrases would be combined in groups of 4 per group.
- Within each group of 4 phrases the student (Form B) or the teacher (Form E) was asked to indicate which two of the four phrases were "most descriptive of the behavior or performance of the student".
- Each group would contain phrases from 4 different factors.
- Since the combinations of 7 things, 4 at a time is 35, that number of groups was required so that each factor would be compared with all others in a uniform manner.
- Phrases within each group are equal in face validity and equal in discrimination.

Thus the forms contain 140 descriptive phrases, organized as 35 groups of 4 phrases each. Within each group the phrases are arranged in alphabetic order so as to offer no clues as to their patterning. The same phrases are used in both Form E and Form B. The two forms were used since there may be a difference in the student's perception of his own performance as compared with that of his teacher. Such differences should be those of different points of view, information available and perhaps ego involvement.

Table 29 shows the data obtained through use of Part I, Form B. These are the students' descriptions of their own performances. The successive columns of the table are:

- the descriptive phrases
- the category or factor to which the descriptive phrase belongs, indicated by letter
- the % of Males, who before attending SSP marked the phrases as being one of two in the group most descriptive of himself
- the % of Females, who before attending SSP, marked the phrase as being one of two in the group most descriptive of herself
- comparison of % of Males and Females who had marked the phrases as being descriptive of them-

selves

The differences between the percents of Males and Females marking the phrases as most descriptive are shown by the following code:

- MM The % for Males exceeds the % for Females at the 1% level of confidence or better
- M The % for Males exceeds the % for Females between the 5% and 1% levels of confidence
- 0 There is no significant difference in the way the phrase has been marked by Males and by Females
- F The % for Females exceeds the % of Males between the 5% and 1% levels of confidence
- FF The % of Females exceeds the % for Males at the 1% level of confidence or better

The Experimental vs. Control columns compare the %'s of males and of females marking each phrase (Pre SSP) in the Experimental groups with those of the corresponding C-! and C-2 groups. In each of the four columns the entries are as follows:

- EE The % in the Experimental group marking the phrase exceeded the % in the Control group at the 1% level of confidence
- E The % in the Experimental group marking the phrase exceeded the % in the Control group between the 5% and 1% levels of confidence
- 0 No significant difference in the way the phrase has been marked by the Experimental and the Control groups
- C The % in the Control group marking the phrases exceeded the % in the Experimental group between the 5% and 1% levels of confidence
- CC The % in the Control group marking the phrase exceeded the % in the Experimental group at the 1% level of confidence.

The last six columns of the table show a comparison of pre SSP and post SSP marking of each descriptive phrase for each of the three groups of males and in each of the three groups of females in the marking of the phrases. The comparisons are indicated as follows:

- ++ An increase in the % marking the phrase, significant at the 1% level of confidence
- \+ An increase in the % marking the phrase, significant between the 5% and 1% levels of confidence
- 0 No statistically significant difference
- \- A decrease in the % marking the phrase, significant between the 5% and 1% levels of confidence.
- -- A decrease in the % marking the phrase, significant at the 1% level of confidence.

In reading and interpreting the information from the table, one should remember that the frequencies of marking the phrases in each group are relative, two and only two phrases are to be marked, hence marking two ph.ases me ans that the other two, no matter how apt, should be unmarked for any individual. The per cent marking any one phrase itself is not in itself a useful number. It is meaningful only when compared with some other relevant datum.

There is similarity in the per cents of boys and of girls marking each phrase. These vary from 1% of girls and 2% boys indicating phrase 7-1, "Has devised laboratory techniques which appear to be absolutely new" to 97% of boys and 87% girls marking phrase 7-3, "Is taking all the mathematics and science he possibly can in his high school." The frequency distributions and comparisons of per cents for males and females are summarized in Table 30. The girls had marked 47 of the 140 phrases within the 40-59% range while the boys had marked 37 phrases within that range.

Table 30

Comparison of Per Cents of Males and of Females Marking Each of the 140 Phases - Form B, Part I.

Per Cent - Males \ Per Cent - Females	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	Total
90-99									2		2
80-89							2	3	1		6
70-79							4	6	6		16
60-69					5	5	16	2	1		29
50-59			1		4	6	2	2			15
40-49				7	7	7			1		22
30-39	1	1	4	3	9	1					19
20-29	1	10	4	4	2	1					22
10-19		5	2								7
0- 9	1	1									2
Total	3	17	11	14	27	20	24	13	11		140

Table 31 shows the numbers of phrases for which there was a statistically significant comparison of per cents of males and of femal. s marking each of the 140 phrases - Form B, Part I.

Factor B: Breadth of Interest: six of the Factor B phrases show significant differences in favor of the females and seven in favor of the males. The 6 Factor B phrases favoring the girls are more general in content while those favoring the boys are more specific, and may reflect a tendency to mark such general phrases when the specifics are not known or are not so applicable.

Factor C: Creativity, shows one phrase more characteristic of the females and three more descriptive of the males. Here too, the phrases which are more descriptive of the boys are more specific than the one which favors the girls.

The girls show up most strongly in Factors SS, a Science-Communication skill factor, and Factor W: Work Habits. Half of the Factor W phrases show a % significantly favoring the girls. This adds to the question regarding evidence of

Table 29

Comparisons of Responses, Part I, Form B
(Student's Description of Own Performance)

Descriptive Phrases	Factor	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)				Comparisons Before & After SSP					
					Male		Female		Male			Female		
		Male	Female		E vs C1	E vs C2	E vs C1	E vs C2	E	C1	C2	E	C1	C2
1. 1. Does much outside reading- general as well as scientific.	B	47	58	F	0	EE	0	0	0	0	0	0	0	0
2. Is interested in both pure science and its application.	S	55	43	MM	0	0	0	0	0	0	0	0	0	0
3. Keeps after a problem until a satisfactory solution is found.	W	60	66	0	0	0	0	0	0	0	0	0	0	0
4. Tries to explain unexpected results in an experiment.	C	39	31	0	0	0	0	0	0	0	0	0	0	0
2. 1. Can express scientific ideas clearly.	SS	50	58	0	E	0	0	0	+	0	0	++	0	0
2. Formulates original theories and discusses them with his teachers.	C	28	13	MM	0	0	0	0	0	0	0	0	0	-
3. Keeps abreast of recent scientific developments.	B	49	50	0	0	0	0	0	0	0	0	0	0	0
4. Satisfies curiosity by scientific logic and fact.	S	72	75	0	0	0	0	0	--	0	0	-	0	0
3. 1. Has attended many science conferences and fairs.	B	30	42	FF	E	EE	EE	EE	0	0	0	0	0	0
2. Intensely interested in science even before entering high school.	S	68	59	M	0	0	0	0	0	0	0	0	0	0
3. Is skillful in maintaining and repairing laboratory equipment.	T	41	36	0	0	0	C	0	0	0	0	0	0	0
4. Prefers to deal with ideas rather than things.	C	58	58	0	0	0	0	0	0	0	0	0	0	0
4. 1. Does a great deal of scientific reading in advanced texts and research papers.	B	25	14	MM	0	EE	0	0	0	0	0	0	0	0
2. Has a good knowledge of the methods and philosophy of basic scientific research.	S	54	45	M	0	0	0	0	+	0	0	+	0	0
3. Likes to try out new ideas in proving old ones.	C	63	61	0	0	C	0	0	0	0	0	0	0	0
4. Not satisfied with one author's explanation or opinion, goes to several sources for confirmation.	I	56	77	FF	0	0	0	0	0	0	0	0	0	0
5. 1. Communicates with experts to get information.	SS	25	30	0	0	0	0	0	0	0	0	0	0	0
2. Design and concept of research projects are original.	C	41	40	0	0	0	0	0	0	0	0	0	0	0
3. Follows up his ideas for a project with extensive reading on the subject.	W	70	82	FF	0	0	0	0	-	0	0	0	0	0
4. Learns theory behind each piece of laboratory equipment as well as its operation.	S	60	42	MM	0	0	0	0	0	0	0	0	0	0
6. 1. Is most interested in differences of opinion among scientists working in the same field.	C	77	76	0	0	0	0	0	0	0	0	0	0	0
2. Prefers reading source articles to semipopular scientific periodicals.	S	70	61	M	0	0	0	0	0	0	0	0	0	0
3. Records progress in a notebook, adds additional problems as they occur and jots down possible solutions.	W	33	47	FF	C	C	0	0	0	0	0	0	0	0
4. Scientific collection work is of a professional quality.	T	15	10	0	0	0	0	0	0	0	0	0	0	0
7. 1. Has devised laboratory techniques which appear to be absolutely new.	C	2	1	0	0	0	0	0	0	0	0	0	0	0
2. Is always trying another way to do something.	I	35	24	M	0	CC	CC	C	0	0	0	0	0	0
3. Is taking all the mathematics and science he possibly can in his high school.	S	97	87	MM	0	EE	EE	EE	0	0	0	0	0	-
4. Works diligently to reach the goals he has set for himself.	W	44	86	FF	CC	CC	0	0	++	0	0	0	0	0

Table 29 (Continued)

Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
8. 1. Is quick to devise and use short-cuts in his work.	T	68	56	MM	0	0	0	0	0	0	0	0	0	0
2. Shows a highly competitive drive and urge to succeed in science.	S	69	68	0	0	EE	E	0	0	0	0	0	0	0
3. When mathematics required are beyond his level, solution is found through unique application of known operations.	C	52	54	0	0	C	0	0	0	0	0	-	0	0
4. Writes articles on scientific and mathematical topics with little or no assistance from the school staff.	SS	11	18	F	0	0	0	0	0	0	0	0	0	0
9. 1. Doesn't hesitate to question details of techniques if he feels it necessary.	I	63	63	0	0	0	0	0	-	0	0	0	0	0
2. Enjoys exchanging ideas with fellow students, teachers and outside experts.	SS	64	64	0	0	0	0	0	0	0	0	0	0	0
3. Is adept at using scientific source materials and references.	S	21	20	0	0	0	0	0	0	0	0	0	0	0
4. Is quick to see relationships between one problem and another.	C	52	51	0	0	0	0	0	+	0	0	0	0	0
10. 1. Has figured out more direct methods for performing traditional mathematical operations.	T	38	31	0	0	0	0	0	0	0	0	0	0	0
2. Is quick to recommend improvements even in already well organized routines.	I	62	62	0	0	0	0	0	0	0	0	0	0	0
3. Prefers sciences requiring rigorous proofs of basic laws.	S	40	45	0	E	0	0	0	-	0	0	0	0	0
4. When given general directions for setting up a demonstration he produces it with innovations of his own.	C	56	58	0	0	0	0	0	0	0	0	0	0	0
11. 1. Draws up a detailed working plan before starting on a project.	W	28	37	F	0	0	0	0	0	0	0	0	0	0
2. Fosters and encourages scientific development and experimentation through discussion with fellow students and instructors.	SS	45	37	0	0	0	0	0	0	0	0	0	0	0
3. He carries more than the average number of major subjects.	B	78	73	0	0	0	0	0	0	0	0	0	0	0
4. He looks to either experimental evidence or reasons quoted from authorities for support of his hypotheses.	S	47	47	0	0	0	0	0	0	0	0	0	0	0
12. 1. Formulates plans for projects almost as soon as they are conceived.	W	46	59	FF	0	0	0	0	0	0	0	0	0	0
2. On the lookout for simpler, more economical ways of doing things.	T	75	75	0	0	C	0	0	0	0	0	0	0	0
3. Readings in science magazines serve him as a source of ideas.	S	66	50	MM	0	E	0	0	0	0	0	0	0	0
4. Uses free time, week-ends and vacations to visit local organizations carrying out work of a scientific nature.	B	10	13	0	0	0	0	0	0	0	0	0	0	0
13. 1. Attempts to prove or disprove the conclusions of authorities through own research.	I	48	40	0	0	0	0	0	0	0	0	-	0	--
2. Makes trips to educational centers to broaden knowlege or ask questions.	B	31	39	0	0	E	0	0	0	0	0	0	0	0
3. Repeats experiments several times to minimize the percentage of error.	W	64	67	0	E	0	0	0	0	0	0	0	0	+
4. Tries to use mathematical induction as a method of discovery.	S	31	49	FF	0	0	0	0	0	0	0	0	0	0

Table 29 (Continued)

Descriptive Phrases	Factor	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)				Comparisons Before & After SSP					
					Male		Female		Male			Female		
		Male	Female		E vs C1	E vs C2	E vs C1	E vs C2	E	C1	C2	E	C1	C2
14. 1. Has taught himself special laboratory techniques.	T	62	46	MM	0	0	0	0	0	0	0	0	0	0
2. Has written scientific papers describing his completed projects.	S	31	46	FF	0	0	0	0	+	0	0	0	0	0
3. Is extremely interested in modern mathematics.	B	83	72	MM	0	0	0	0	0	0	0	0	0	0
4. Makes his own contacts with local scientists.	SS	18	28	F	C	0	0	0	0	0	0	0	0	++
15. 1. Willingly forgoes "creature comforts" for his scientific pursuits.	S	41	35	0	0	0	0	0	0	0	0	0	0	0
2. His home life is intellectually stimulating.	B	55	69	FF	0	0	0	0	0	0	0	0	0	0
3. Has led group discussions of scientific topics in class	SS	64	65	0	0	E	0	0	0	0	0	0	0	0
4. Refuses to accept even a common scientific law without deriving or testing it.	I	37	25	MM	0	0	0	0	0	0	0	0	0	0
16. 1. Borrows copies of any and all scientific books and periodicals he can get his hands on.	B	21	13	M	0	E	0	0	0	0	0	0	0	0
2. Demands proof for new ideas.	I	60	56	0	0	0	0	0	0	0	0	0	0	0
3. Insists on understanding the operation of all apparatus used in the experimental set-up for his projects.	T	71	72	0	0	0	0	0	0	0	0	0	0	--
4. Is good at finding pertinent material in college texts, research papers, and periodicals.	S	47	54	0	0	0	0	0	0	0	0	0	0	++
17. 1. Can assemble a needed piece of equipment from a bewildering assortment of odds and ends.	T	64	49	MM	0	0	0	0	0	0	0	0	0	0
2. Has performed most of the science experiments on his own before they have been presented in class.	S	32	24	0	0	0	0	0	0	0	-	0	+	--
3. Starts discussion groups on scientific topics.	SS	58	76	FF	0	0	0	0	0	0	0	0	0	0
4. Works night and day on new projects until results begin to appear.	W	39	40	0	0	0	0	0	0	0	0	0	0	+
18. 1. If the apparatus in the lab does not satisfy him, he makes his own.	I	21	17	0	CC	CC	0	0	++	0	+	0	0	0
2. Is the type of student a science teacher turns to when help is needed.	SS	69	63	0	E	E	0	0	0	0	0	0	0	0
3. Reads several science publications regularly.	S	43	31	MM	0	E	0	0	0	0	0	0	0	0
4. Works steadily and consistently in the laboratory.	W	63	77	FF	0	C	0	0	-	0	0	0	0	0
19. 1. Is quick to simplify procedures in carrying out routine tasks.	T	76	61	MM	0	0	0	0	0	0	0	0	0	0
2. Is respectful, but never acquiesces to authority when he thinks he is right.	I	81	80	0	0	0	0	0	0	0	0	0	0	0
3. Maintains a notebook containing outlines and notes on scientific books he has read and enjoyed.	S	11	18	F	0	0	0	0	0	0	0	+	0	0
4. Shows excellent planning ability and initiative in science club activities.	W	28	29	0	0	EE	0	0	0	0	0	0	0	0
20. 1. Chooses projects without help and works entirely on his own.	I	70	68	0	0	0	0	0	0	0	0	0	0	0
2. Has directed mathematics or science contests.	SS	9	10	0	0	0	0	0	0	0	0	0	0	0
3. Likes to disassemble and reassemble new equipment to see how it works.	T	80	60	MM	0	0	0	0	0	0	0	++	0	0
4. Scientists and scientific personnel are his favorite sources of information.	S	35	51	FF	0	0	0	0	0	0	0	0	0	0

Table 29 (Continued)

Descriptive Phrases	Fact(	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre): Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP: Male E	Male C1	Male C2	Female E	Female C1	Female C2
21. 1. Can translate complex ideas and concepts into terms easily understood by the average student.	SS	73	85	FF	0	0	EE	E	0	0	0	-	0	0
2. Projects undertaken show continuity and planning.	W	40	51	F	0	0	0	0	-	0	0	0	0	0
3. Subscribes to scientific and technical publications.	B	28	16	MM	0	0	0	0	0	0	0	0	0	0
4. When necessary material or equipment is not available endeavors to devise his own.	C	34	42	0	0	0	0	0	0	0	0	++	0	0
22. 1. Has done a great deal of study on his own in order to qualify for an honors course.	B	44	53	F	0	0	0	0	0	0	0	0	0	0
2. Has on occasion demonstrated unique approaches in solving problems.	C	68	53	MM	0	0	0	0	0	0	0	0	0	0
3. Learns how to use new apparatus as soon as the opportunity presents itself.	T	66	62	0	0	0	0	0	0	0	0	0	0	0
4. Sets up a control program to prevent drawing conclusions from subjective data.	W	19	26	0	0	0	0	0	+	0	0	0	0	0
23. 1. Asks intelligent questions even in the face of authority.	I	70	68	0	0	0	0	0	0	0	0	0	0	0
2. Checks fact against theory whenever the equipment is available.	W	21	16	0	0	0	0	0	0	0	0	0	0	0
3. Shows a high degree of ability in non-science subjects.	B	73	89	FF	0	0	0	0	0	0	0	0	0	0
4. When "bugs" develop in his project, he analyzes them and is able to correct the trouble.	C	35	23	MM	0	0	0	0	0	0	0	0	0	0
24. 1. Has learned how to use all the instruments found in the laboratory.	T	52	49	0	0	C	0	0	0	0	-	0	0	0
2. Frequently quotes from science publications.	B	22	19	0	0	E	0	0	0	0	0	0	0	0
3. Methods used in gathering required materials are often unique.	C	41	51	F	0	0	0	0	0	0	0	0	0	0
4. Serves as a consultant to fellow students in advanced mathematics and science.	SS	80	73	0	0	0	E	0	0	0	0	0	0	0
25. 1. Can render technical matter into interesting and informative demonstrations for non-technical students.	SS	59	58	0	0	E	0	0	--	0	0	0	0	0
2. Has devised original proofs for new ideas.	C	20	18	0	0	0	0	0	0	0	0	0	0	0
3. Has taken advanced courses in mathematics either through special high school programs or through outside or correspondence schools.	B	41	35	0	0	0	0	0	++	+	+	++	0	0
4. Makes use of the work of others without being bound by or limited to their conclusions.	I	77	81	0	0	0	0	0	--	-	0	0	0	0
26. 1. Carries out work successfully with little resource help from teachers or others.	I	61	67	0	0	0	0	0	0	-	0	0	0	0
2. Has insatiable curiosity as to the nature of his environment.	C	57	60	0	0	0	0	0	0	0	0	-	0	0
3. Learns to use laboratory apparatus proficiently.	T	46	49	0	0	C	0	0	0	0	0	0	0	0
4. Maintains a growing science library.	B	34	19	MM	0	EE	0	0	0	0	0	++	0	0
27. 1. Gave up recreational period to work on scientific experiments.	W	65	82	FF	E	E	E	EE	0	0	0	0	0	0
2. Has repaired school science apparatus in a most competent manner.	T	20	9	MM	CC	0	0	0	0	0	0	0	0	0
3. Has sought out, on his own, equipment which could help in teaching other students.	SS	28	27	0	0	0	C	0	0	0	0	0	0	0
4. Is not challenged by "run-of-the-mill" experiments.	C	80	73	0	EE	0	0	0	0	0	0	0	0	0

Table 29 (Continued)

Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
28. 1. Has invented proofs for various mathematical theorems.	C	41	35	0	0	0	E	0	0	0	0	0	0	0
2. Has repeated classical experiments on his own to satisfy himself regarding findings.	I	50	47	0	0	0	0	0	0	0	0	0	0	0
3. Is an excellent tutor in mathematics and science subjects.	SS	69	67	0	0	0	0	0	0	0	0	0	0	0
4. Works on planned schedules and spends available time after school in the laboratory.	W	35	40	0	0	0	0	0	0	0	0	0	0	0
29. 1. Consults experts even if it is only a matter of satisfying his own curiosity.	C	40	38	0	0	0	0	0	-	0	0	0	0	0
2. Expresses dissatisfaction with shoddy work.	I	70	78	0	0	0	EE	0	0	0	0	0	0	0
3. Has devised simpler approaches to a problem than those outlined in laboratory manuals.	T	23	15	M	0	0	0	0	0	0	0	0	0	0
4. Repeats experiments until he finds out why he failed to get an expected result.	W	64	64	0	0	0	0	0	0	0	0	0	0	0
30. 1. Contacts instructor very infrequently when carrying out projects.	I	69	74	0	0	C	0	0	0	0	0	0	0	0
2. Has built electronic apparatus (such as hi-fi set) from component parts.	T	32	2	MM	0	0	0	0	0	0	0	0	0	0
3. Literary efforts have appeared frequently in school publications.	SS	26	51	FF	E	E	EE	EE	0	+	0	0	0	0
4. Would rather plan new work than gather experimental data.	C	69	65	0	0	0	0	0	-	0	0	0	0	0
31. 1. Explains solutions to problems lucidly when called upon.	SS	66	63	0	0	0	0	0	0	0	0	0	0	0
2. Interested in new or unusual mathematical problems.	B	82	67	MM	E	0	0	0	0	0	0	0	0	0
3. Possesses near-professional skill in at least one laboratory specialty.	T	18	16	0	0	0	0	0	++	++	0	0	+	0
4. Starts projects early, plans them well and carries them through to completion in advance of deadlines.	W	29	49	FF	C	CC	0	0	0	0	0	0	0	0
32. 1. Explains difficult concepts to a class easily.	SS	39	45	0	0	0	0	0	0	0	0	0	0	0
2. Explores topics not found in the standard curriculum.	B	64	43	MM	0	E	0	0	0	0	0	0	0	0
3. Shows great persistence in gathering equipment and material needed for his project.	W	27	35	0	0	0	0	C	0	0	0	0	0	0
4. Tries things himself, seeking advice or help only when needed.	I	68	69	0	0	C	0	0	0	0	0	0	0	0
33. 1. Calls attention to flaws in student demonstrations which might affect results.	I	65	49	MM	0	0	0	0	0	0	0	0	0	0
2. Modifies standard methods to see if better product will result.	T	27	18	M	0	0	0	0	0	0	0	0	0	0
3. Plans and outlines his work well in advance.	W	27	42	FF	0	0	0	0	0	0	0	0	0	0
4. Shows the same intellectual curiosity in other areas that he does in science courses.	B	79	88	F	0	0	0	0	0	0	0	0	0	0

Table 29 (Continued)

Descriptive Phrases	Factor	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)				Comparisons Before & After SSP					
					Male		Female		Male			Female		
		Male	Female		E vs C1	E vs C2	E vs C1	E vs C2	E	C1	C2	E	C1	C2
34. 1. Arranges visits or field trips on own to gain further knowledge or to satisfy personal curiosity.	B	24	32	0	0	0	0	0	0	0	0	0	0	0
2. Makes use of original "visual aids" in the presentation of his science reports.	SS	31	45	FF	0	0	0	0	0	0	0	0	0	0
3. Prefers to construct own apparatus rather than buying it.	T	50	29	MM	0	0	0	0	0	0	0	0	0	0
4. Takes pleasure in working problems other students fail to solve.	I	91	87	0	0	0	0	0	0	0	0	0	0	0
35. 1. Demands perfection in his own work.	W	75	82	0	E	0	0	0	0	0	0	0	+	0
2. Is quick to understand the operation of mechanical devices.	T	59	40	MM	C	0	0	0	0	0	0	0	0	0
3. Joins groups with experimental interests.	SS	42	49	0	0	E	0	0	0	0	0	0	0	0
4. To avoid "prescribed" answers, works out laboratory experiments in own way and writes own reports.	I	22	24	0	0	0	0	0	0	0	0	0	0	0

science talent among girls as compared to boys. Perhaps they are more competent conformists, with a greater likelihood of doing their work in the fashion and at the time that is more acceptable and that such behavior is relatively more characteristic than that described by the competing phrases. In the 10 groups of phrases in which the Factor W phrase favors the girls, five show Factor S, Scientific Attitude, favoring the boys, two show Factor B phrases, one each show Factors I and T, favoring the boys, and one shows no phrase favoring the boys.

For Factor S, 8 of the 20 phrases were marked more frequently for the boys and 5 of them for the girls. As one might predict, half of the phrases T: Technical Interest favor the boys.

Table 31

Sex Difference in Phrases Describing Performance of Science Students: Numbers of Phrases Showing Statistically Significant Differences for Males and Females.

	Factor	M and MM	F and FF
B:	Breadth of Interest	7	6
C:	Creativity	3	1
I:	Individualism	3	1
S:	Scientific Attitude	8	5
SS:	Scientific Communication Skill	0	5
W:	Work Habits	0	10
T:	Technical Interest	11	0
	Total	32	28

Comparing the Pre-SSP - Experimental and Control groups: 17 of the 120 phrases were significantly more characteristic of Experimental boys than of C-2 boys, while 9 were the reverse. The pattern of differences is distinct. The Experimental group of boys have greater Breadth of Interest, stronger Scientific Attitude, better Scientific-Communication Skills and are less Individualistic and have a bit less Technical Interest than do the C-2 group of boys. Only 7 of the 140 phrases show significant differences between Experimental and Control-2 groups of girls. One can expect 5% by chance. These Pre-SSP differences between the Experimental and Control groups of boys do not vitiate the experiment. They do reflect the difficulty in obtaining control groups for such highly selected students as the Experimental group. However, it should be observed that only 2 of the 19 phrases which show statistically significant Pre and Post-SSP differences for the Experimental boys also showed significant differences between the Experimental and C-2 Control groups.

Differences in marking the phrases before as compared to after the SSP experiment do reflect some real impact on the students who participated in the SSP's.

A total of 25 phrases showed statistically significant differences at the 5% level of confidence or better in the Pre-SSP marking of phrases as compared to the Post-SSP marking. Of these, 19 showed significant changes for the Boys-Experimental and only 4 for each of the boy's comparison groups. For the Girls-Experimental, 11 phrases showed significant differences, with 3 and 9 respectively for the girls C-1 and girls C-2 groups.

Four of these phrases showed differences for both boys and girls. These are:

2.1 SS (+) (++)	Can express scientific ideas clearly.
2.4 S (- -) (-)	Satisfies curiosity by scientific logic and fact.
4.2 S (+) (+)	Has good knowledge of the methods and philosophy of basic scientific research
25.3 B (++)(++)	Has taken advanced courses in mathematics either through special high school programs or through outside or correspondence schools.

The first two phrases come from the same group and compete with each other. If the student felt that they had increased their ability to "express scientific ideas clearly," and marked that phrase, some other phrases could not be marked. Phrase 4.2 indicates greater feeling of familiarity with research, while phrase 25.3 indicates the taking of more courses in advanced mathematics.

Fifteen phrases show statistically significant change for boys but not for girls:

7.4 W (++)	Works diligently to reach the goals he has set for himself.
22.4 W (+)	Sets up a control program to prevent drawing conclusions from subjective data.
5.3 W (-)	Follows up his ideas for a project with extensive reading on the subject.
18.4 W (-)	Works steadily and consistently in the laboratory.
21.2 W (-)	Projects undertaken show continuity and planning.

The first two phrases, 7.4 and 22.4, are more characteristic of the boys after SSP than before, and can be accepted as evidence of the impact of SSP. The last three Factor W phrases indicate no lessening or relaxing of work habits but seem rather to reflect minor strengthening of the other behaviors with which they were compared.

18.1 I (++)	If the apparatus in the lab does not satisfy him, he makes his own.
9.1 I (-)	Doesn't hesitate to question details of techniques if he feels it necessary.
25.4 I (- -)	Makes use of work of others without being bound by or limited to their conclusion.
9.4 C (+)	Is quick to see relationships between one problem and another.
29.1 C (-)	Consults experts even if it is only a matter of satisfying his own curiosity.
30.4 C (-)	Would rather plan new work than gather experimental data.

Two of the Factor I phrases indicate improvements in the students, especially when one notes that 9.4C is the phrase which increased at the expense of 9.1I. The change in 29.1 C reflects an increase in independence.

14.2 S (+)	Has written scientific papers describing his completed projects.
10.3 S (-)	Prefers sciences requiring rigorous proofs of basic laws.
25.1 SS (--)	Can render technical matter into interesting

and informative demonstrations for non-technical students.

31.3 T (+ +) Possesses near professional skill in at least one laboratory specialty.

Phrase 25.1 SS has been crowded out or displaced in its group by 25.3 B. Phrase 31.3 T, shows that the boys believe that their laboratory skills have shown some improvement.

The 8 phrases which showed statistically significant change from Pre-SSP to Post-SSP for girls and not for boys are:

21.4 C (+ +) When necessary material or equipment is not available endeavors to devise his own.

8.3 C (-) When mathematics required are beyond his level, solution is found through unique application of known operations.

26.2 C (-) Has insatiable curiosity as to the nature of his environment.

The change for phrase 21. 4 C reflects an increase in skill and self-reliance, and this at the expense of phrase 21.1 SS.

26.4 B (+ +) Maintains a growing science library.

Of the phrases above, the former was apparently replaced by 26.4 B as students started assembling their own science libraries.

21.1 SS (-) Can translate complex ideas and concepts into terms easily understood by the average student.

20.3 T (+ +) Likes to disassemble and reassemble new equipment to see how it works.

Again it is quite likely that the emphasis on research in the SSP's produced the increase on use of phrase 20.3 T.

13.1 I (-) Attempts to prove or disprove the conclusions of authorities through own research.

19.3 S (+) Maintains a notebook containing outlines and notes on scientific books he has read and enjoyed.

The decrease for phrase 13. 1 I may be evidence for greater maturity, and the increase for 19.3 S is a specific form of behavior in that same direction.

Comparable data showing how the science and mathematics teachers saw these same boys and girls was obtained through Form E, Student Description. The teachers see the students much as the students see themselves, but the views of the teachers appear to be clearer and more distinct.

Table 32 summarizes the teachers' description of the students' performance as science students in the same way comparable data from the students themselves was organized as Table 29.

Table 33 shows the correspondence between per cents of boys and of girls for whom each of the 140 descriptive phrases were marked. The per cents vary from 7.1 "Has devised laboratory techniques which appear to be absolutely new," marked for 3% of girls and of boys, to 7.3 "Is taking all the mathematics and science he possibly can take in his high school," marked for 92% of the boys and 82% of the girls. These same two phrases are the most extreme as chosen by the students in describing themselves.

Table 33

Comparison of Per Cents of Males and of Females For Whom Each of the 140 Phases, Form E, Part I Were Marked by Their Teachers.

Per Cent - Males \ Per Cent - Females	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	Total
90-99									1		1
80-89								1	2		3
70-79						2	4	8	3		17
60-69			1	2	1	6	6	6	2		24
50-59				3	5	9	7	2			26
40-49				7	6	5	5				23
30-39		4	4	9	4	1					22
20-29	2	6	3	3							14
10-19	1	3	2		1						7
0- 9	1	1	1								3
Total	4	14	11	24	17	23	22	17	8		140

Table 34 identifies the factors in which there is a statistically significant difference (5% level of confidence or better) in the per cents of boys and girls for whom the phrases were checked.

Table 34

Difference Between the Descriptions of Boys and Girls

	M or MM	F or FF
B: Breadth of Interest	6	4
C: Creativity	8	2
I: Individualism	7	2
S: Scientific Attitude	4	5
SS: Social Communication-Skill	0	8
W: Work Habits	0	14
T: Technical Interests	11	0
Total	36	35

Table 32

Comparisons of Responses, Part I, Form E
(Teachers Description of Student Performance)

Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
1. 1. Does much outside reading-general as well as scientific.	B	50	53	0	0	0	0	0	0	0	0	0	0	+
2. Is interested in both pure science and its application.	S	48	43	0	0	0	0	0	0	+	0	0	0	0
3. Keeps after a problem until a satisfactory solution is found.	W	66	76	F	0	0	E	0	0	0	0	-	0	0
4. Tries to explain unexpected results in an experiment.	C	33	37	0	0	0	E	0	0	0	0	-	0	-
2. 1. Can express scientific ideas clearly.	SS	61	77	FF	0	0	0	0	0	0	0	0	0	0
2. Formulates original theories and discusses them with his teachers.	C	32	19	MM	0	E	0	0	0	0	0	0	++	0
3. Keeps abreast of recent scientific developments.	B	56	34	MM	0	0	CC	0	0	0	0	+	0	0
4. Satisfies curiosity by scientific logic and fact.	S	50	68	FF	CC	C	EE	0	0	0	0	0	0	0
3. 1. Has attended many science conferences and fairs.	B	28	38	F	0	EE	0	0	++	0	+	++	0	0
2. Intensely interested in science even before entering high school.	S	76	68	0	0	0	0	0	0	0	0	0	0	- -
3. Is skillful in maintaining and repairing laboratory equipment.	T	39	27	MM	CC	C	0	0	0	-	0	0	0	0
4. Prefers to deal with ideas rather than things.	C	52	64	FF	0	0	0	0	0	0	0	0	0	0
4. 1. Does a great deal of scientific reading in advanced texts and research papers.	B	41	31	M	E	E	0	0	0	0	0	0	0	0
2. Has a good knowledge of the methods and philosophy of basic scientific research.	S	48	57	F	0	0	0	0	0	0	0	0	0	0
3. Likes to try out new ideas in proving old ones.	C	55	46	M	0	C	0	0	0	0	0	0	0	0
4. Not satisfied with one author's explanation or opinion, goes to several sources for confirmation.	I	52	63	F	0	0	0	0	0	0	0	0	0	0
5. 1. Communicates with experts to get information.	SS	44	58	FF	0	0	0	0	0	0	0	0	0	0
2. Design and concept of research projects are original.	C	30	26	0	0	0	0	0	0	0	0	0	++	0
3. Follows up his ideas for a project with extensive reading on the subject.	W	69	74	0	0	0	0	0	0	0	0	0	-	0
4. Learns theory behind each piece of laboratory equipment as well as its operation.	S	51	39	MM	0	0	0	0	0	0	0	0	0	0
6. 1. Is most interested in differences of opinion among scientists working in the same field.	C	63	48	MM	0	0	0	0	0	0	0	0	0	0
2. Prefers reading source articles to semipopular scientific periodicals.	S	66	59	0	0	0	0	0	0	0	0	0	++	0
3. Records progress in a notebook, adds additional problems as they occur and jots down possible solutions.	W	43	69	FF	0	0	0	0	0	0	0	0	0	0
4. Scientific collection work is of a professional quality.	T	22	22	0	E	0	0	0	0	0	0	0	-	0
7. 1. Has devised laboratory techniques which appear to be absolutely new.	C	3	3	0	0	0	0	0	0	0	0	0	0	0
2. Is always trying another way to do something.	I	32	29	0	0	CC	0	0	0	0	0	0	+	0
3. Is taking all the mathematics and science he possibly can in his high school.	S	92	82	M	0	E	E	0	0	0	0	0	0	0
4. Works diligently to reach the goals he has set for himself.	W	71	84	FF	0	0	0	0	0	0	0	0	0	0

Table 32 (Continued)

Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre): Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP: Male E	Male C1	Male C2	Female E	Female C1	Female C2
8. 1. Is quick to devise and use short-cuts in his work.	T	62	55	0	0	0	0	0	0	0	0	0	0	0
2. Shows highly competitive drive and urge to succeed in science.	S	77	85	0	0	0	0	EE	0	0	0	0	0	0
3. When mathematics required are beyond his level, solution is found through unique application of known operations.	C	51	39	MM	E	0	0	0	0	0	0	0	0	0
4. Writes articles on scientific and mathematical topics with little or no assistance from the school staff.	SS	9	15	0	0	0	0	0	0	0	0	0	0	0
9. 1. Doesn't hesitate to question details of techniques if he feels it necessary.	I	55	59	0	0	C	0	0	0	0	0	0	0	0
2. Enjoys exchanging ideas with fellow students, teachers and outside experts.	SS	59	53	0	0	0	0	0	0	0	0	+	0	0
3. Is adept at using scientific source materials and references.	S	23	19	0	0	0	0	0	0	0	0	+	0	0
4. Is quick to see relationships between one problem and another.	C	63	68	0	0	0	EE	0	0	0	0	-	0	0
10. 1. Has figured out more direct methods for performing traditional mathematical operations.	T	35	27	0	0	0	0	0	0	0	0	0	0	0
2. Is quick to recommend improvements even in already well-organized routines.	I	65	64	0	0	0	0	0	0	0	0	0	0	0
3. Prefers sciences requiring rigorous proofs of basic laws.	S	41	51	F	E	0	E	0	0	++	0	0	0	0
4. When given general directions for setting up a demonstration he produces it with innovations of his own.	C	56	52	0	C	0	0	0	0	-	0	0	0	0
11. 1. Draws up a detailed working plan before starting on a project.	W	31	43	FF	0	0	0	0	0	+	0	-	0	0
2. Fosters and encourages scientific development and experimentation through discussion with fellow students and instructors.	SS	46	38	0	0	0	0	EE	0	0	0	0	0	+
3. He carries more than the average number of major subjects.	B	73	76	0	E	0	0	0	+	0	0	0	0	0
4. He looks to either experimental evidence or reasons quoted from authorities for support of his hypotheses.	S	48	38	M	C	0	0	0	0	0	0	0	0	0
12. 1. Formulates plans for projects almost as soon as they are conceived.	W	40	49	F	0	0	0	0	0	0	0	0	0	0
2. On the lookout for simpler, more economical ways of doing things.	T	59	56	0	C	CC	EE	CC	0	0	0	0	0	0
3. Readings in science magazines serve him as a source of ideas.	S	71	55	MM	0	0	CC	0	0	0	-	0	0	0
4. Uses free time, week-ends and vacations, to visit local organizations carrying out work of a scientific nature.	B	27	36	F	0	EE	0	EE	0	0	0	0	0	0
13. 1. Attempts to prove or disprove the conclusions of authorities through own research.	I	47	33	MM	0	0	0	0	0	0	0	0	0	0
2. Makes trips to educational centers to broaden knowledge or ask questions.	B	41	51	F	0	E	0	0	0	0	0	0	0	0
3. Repeats experiments several times to minimize the percentage of error.	W	54	62	0	0	0	0	0	0	0	0	0	+	0
4. Tries to use mathematical induction as a method of discovery.	S	52	49	0	0	C	0	0	0	0	0	0	0	0

Table 32 (Continued)

Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Exp. vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
14. 1. Has taught himself special laboratory techniques.	T	59	52	0	0	0	0	0	0	0	0	0	+	0
2. Has written scientific papers describing his completed project.	S	19	26	0	0	0	0	0	+	0	0	0	0	0
3. Is extremely interested in modern mathematics.	B	79	68	M	E	0	E	0	0	0	0	0	0	0
4. Makes his own contacts with local scientists.	SS	38	45	0	0	0	0	0	0	0	0	0	0	0
15. 1. Willingly foregoes "creature comforts" for his scientific pursuits.	S	36	32	0	0	0	0	0	0	-	0	0	0	0
2. His home life is intellectually stimulating.	B	72	75	0	0	0	0	0	-	0	0	0	0	0
3. Has led group discussions of scientific topics in class.	SS	58	67	F	0	0	0	0	+	0	+	0	0	-
4. Refuses to accept even a common scientific law without deriving or testing it.	I	29	18	MM	0	0	0	0	0	0	0	++	0	0
16. 1. Borrows copies of any and all scientific books and periodicals he can get his hands on.	B	34	33	0	0	E	0	0	0	--	0	0	0	0
2. Demands proof for new ideas.	I	44	38	0	0	C	0	0	0	++	0	+	0	0
3. Insists on understanding the operations of all apparatus used in the experimental set-up for his projects.	T	59	57	0	0	0	0	0	0	0	0	0	0	0
4. Is good at finding pertinent material in college texts, research papers, and periodicals.	S	58	67	F	0	0	0	0	0	0	0	0	0	0
17. 1. Can assemble a needed piece of equipment from a bewildering assortment of odds and ends.	T	61	35	MM	0	0	0	0	0	0	0	0	0	0
2. Has performed most of the science experiments on his own before they have been presented in class.	S	34	32	0	0	0	0	0	0	0	0	0	0	0
3. Starts discussion groups on scientific topics.	SS	64	76	FF	0	0	0	0	0	0	0	0	0	0
4. Works night and day on new projects until results begin to appear.	W	32	43	F	0	0	0	0	0	0	0	0	0	0
18. 1. If the apparatus in the laboratory does not satisfy him, he makes his own.	I	19	6	MM	E	0	0	0	0	0	0	+	0	0
2. Is the type of student a science teacher turns to when help is needed.	SS	70	73	0	0	E	0	0	0	0	0	0	0	0
3. Reads several science publications regularly.	S	39	34	0	0	0	0	0	0	0	0	+	0	0
4. Works steadily and consistently in the laboratory.	W	68	81	FF	0	0	E	0	0	0	0	-	0	0
19. 1. Is quick to simplify procedures in carrying out routine tasks.	T	66	52	MM	0	0	0	0	0	0	0	0	0	0
2. Is respectful, but never acquiesces to authority when he thinks he is right.	I	76	73	0	0	0	0	0	0	0	0	0	0	0
3. Maintains a notebook containing outlines and notes on scientific books he has read and enjoyed.	S	21	22	0	0	0	CC	CC	0	0	0	0	0	0
4. Shows excellent planning ability and initiative in science club activities.	W	34	46	FF	0	0	0	EE	0	0	0	0	0	0
20. 1. Chooses projects without help and works entirely on his own.	I	78	69	M	EE	EE	0	0	--	0	0	0	0	0
2. Has directed math or science contests.	SS	8	21	FF	0	0	0	E	++	0	0	0	0	0
3. Likes to disassemble and reassemble new equipment to see how it works.	T	61	35	MM	CC	0	0	0	0	0	0	0	0	0
4. Scientists and scientific personnel are his favorite sources of information.	S	45	61	FF	0	0	0	0	+	0	0	0	0	--

Table 32 (Continued)

		Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Exp. vs. Control (Pre) Male E vs C1	Exp. vs. Control (Pre) Male E vs C2	Exp. vs. Control (Pre) Female E vs C1	Exp. vs. Control (Pre) Female E vs C2	Before & After SSP Male E	Before & After SSP Male C1	Before & After SSP Male C2	Before & After SSP Female E	Before & After SSP Female C1	Before & After SSP Female C2
21.	1.	Can translate complex ideas and concepts into terms easily understood by the average student.	SS	64	71	0	E	0	0	0	0	0	0	0	0	0
	2.	Projects undertaken show continuity and planning.	W	59	72	FF	E	0	0	0	0	0	0	0	0	0
	3.	Subscribes to scientific and technical publications.	B	25	13	MM	0	0	C	0	0	0	0	0	0	0
	4.	When necessary material or equipment is not available endeavors to devise his own.	C	47	36	M	CC	0	0	0	0	0	0	0	0	0
22.	1.	Has done a great deal of study on his own in order to qualify for an honors course.	B	62	68	0	EE	0	EE	0	0	0	0	+	0	0
	2.	Has on occasion demonstrated unique approaches to solving problems.	C	64	60	0	0	0	0	E	0	0	0	0	0	0
	3.	Learns how to use new apparatus as soon as the opportunity presents itself.	T	56	40	MM	C	0	C	C	0	0	0	0	0	0
	4.	Sets up a control program to prevent drawing conclusions from subjective data.	W	13	22	FF	0	0	0	0	0	0	0	0	0	0
23.	1.	Asks intelligent questions even in the face of authority.	I	82	84	0	0	0	0	0	0	0	0	0	0	0
	2.	Checks fact against theory whenever the equipment is available.	W	19	13	0	0	0	0	0	+	0	0	0	0	0
	3.	Shows a high degree of ability in non-science subjects.	B	72	82	F	0	0	0	0	0	0	0	0	0	0
	4.	When "bugs" develop in his project, he analyzes them and is able to correct the trouble.	C	25	14	MM	0	0	0	0	0	0	0	0	0	0
24.	1.	Has learned how to use all the instruments found in the laboratory.	T	54	49	0	0	0	0	C	0	0	0	0	0	0
	2.	Frequently quotes from science publications.	B	38	37	0	0	0	0	0	0	0	0	0	0	0
	3.	Methods used in gathering required materials are often unique.	C	33	34	0	0	C	0	0	0	0	0	0	0	0
	4.	Serves as a consultant to fellow students in advanced mathematics and science.	SS	69	68	0	0	E	0	0	0	0	0	0	0	0
25.	1.	Can render technical matter into interesting and informative demonstrations for non-technical students.	SS	55	62	0	0	0	0	0	--	0	-	-	0	0
	2.	Has devised original proofs for new ideas.	C	28	15	MM	0	0	0	0	0	0	0	0	0	0
	3.	Has taken advanced courses in mathematics either through special high school programs or through outside or correspondence schools.	B	38	37	0	0	0	0	0	++	++	0	++	0	0
	4.	Makes use of the work of others without being bound by or limited to their conclusions.	I	75	75	0	0	0	0	0	--	0	0	0	0	0
26.	1.	Carries out work successfully with little resource help from teachers or others.	I	73	78	0	0	0	0	0	0	0	0	0	0	0
	2.	Has insatiable curiosity as to the nature of his environment.	C	46	48	0	0	0	0	0	0	0	0	0	0	0
	3.	Learns to use laboratory apparatus proficiently.	T	58	55	0	0	0	0	0	--	0	0	0	0	0
	4.	Maintains a growing science library.	B	19	11	M	0	E	0	0	0	0	0	+	0	0
27.	1.	Gave up recreational period to work on scientific experiments.	W	66	75	F	0	E	E	0	0	--	0	0	0	0
	2.	Has repaired school science apparatus in a most competent manner.	T	22	8	MM	0	0	0	0	0	+	0	0	0	0
	3.	Has sought out, on his own, equipment which could help in teaching other students.	SS	32	32	0	0	0	0	0	0	0	0	0	0	0
	4.	Is not challenged by "run-of-the-mill" experiments.	C	72	71	0	E	0	0	0	0	0	0	0	0	0

Table 32 (Continued)

		Descriptive Phrases	Factor	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
28.	1.	Has invented proofs for various mathematical theorems.	C	30	19	MM	0	0	0	0	0	0	0	0	0	0
	2.	Has repeated classical experiments on his own to satisfy himself regarding findings.	I	50	41	M	0	0	C	0	0	0	0	+	0	0
	3.	Is an excellent tutor in mathematics and science subjects.	SS	64	69	0	0	0	0	0	0	0	0	0	0	0
	4.	Works on planned schedules and spends available time after school in the laboratory.	W	49	60	F	0	0	0	0	0	0	0	0	0	0
29.	1.	Consults experts even if it is only a matter of satisfying his own curiosity.	C	44	46	0	0	E	0	0	0	0	0	0	0	0
	2.	Expresses dissatisfaction with shoddy work.	I	59	72	FF	0	0	0	0	0	0	+	0	0	0
	3.	Has devised simpler approaches to a problem than those outlined in laboratory manuals.	T	31	17	MM	0	0	0	0	0	0	0	0	0	0
	4.	Repeats experiments until he finds out why he failed to get an expected result.	W	61	55	0	0	0	0	0	0	0	0	0	0	0
30.	1.	Contacts instructor very infrequently when carrying out projects.	I	83	82	0	0	0	0	0	0	0	0	0	0	0
	2.	Has built electronic apparatus (such as hi-fi set) from component parts.	T	24	3	MM	0	0	0	0	++	0	0	0	0	+
	3.	Literary efforts have appeared frequently in school publications.	SS	16	44	FF	0	0	0	0	0	0	0	0	0	0
	4.	Would rather plan new work than gather experimental data.	C	65	58	0	0	0	0	0	-	0	0	0	0	0
31.	1.	Explains solutions to problems lucidly when called upon.	SS	73	68	0	0	0	0	0	--	0	0	0	0	0
	2.	Interested in new or unusual mathematical problems.	B	63	52	M	0	0	0	0	0	0	0	0	0	0
	3.	Possesses near-professional skill in at least one laboratory speciality.	T	17	16	0	C	0	0	0	++	0	0	0	0	0
	4.	Starts projects early, plans them well and carries them through to completion in advance of deadlines.	W	44	60	FF	0	0	0	0	0	0	0	0	0	0
32.	1.	Explains difficult concepts to a class easily.	SS	51	58	0	EE	0	E	0	0	+	0	0	0	0
	2.	Explores topics not found in the standard curriculum	B	49	43	0	0	0	0	0	+	0	0	0	0	0
	3.	Shows great persistence in gathering equipment and material needed for his project.	W	26	32	0	CC	0	0	0	0	--	0	0	0	0
	4.	Tries things himself, seeking advice or help only when needed.	I	71	59	MM	0	0	0	0	0	0	0	0	0	0
33.	1.	Calls attention to flaws in student demonstrations which might affect results.	I	45	35	M	0	0	0	0	0	0	0	0	0	0
	2.	Modifies standard methods to see if better products will result.	T	27	10	MM	0	0	0	0	+	0	0	0	0	0
	3.	Plans and outlines his work well in advance.	W	49	69	FF	0	0	0	0	0	0	0	0	0	-
	4.	Shows the same intellectual curiosity in other areas that he does in science courses.	B	74	78	0	0	0	E	0	--	0	0	0	0	0

Table 32 (Continued)

Descriptive Phrases	Factor	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)				Comparisons Before & After SSP					
					Male		Female		Male			Female		
		Male	Female		E vs C1	E vs C2	E vs C1	E vs C2	E	C1	C2	E	C1	C2
34. 1. Arranges visits or field trips on own to gain further knowledge or to satisfy personal curiosity.	B	41	45	0	0	EE	0	0	0	0	0	0	0	0
2. Makes use of original "visual aids" in the presentation of his science reports.	SS	33	50	FF	0	0	0	0	0	0	0	--	0	0
3. Prefers to construct own apparatus rather than buying it.	T	39	18	MM	C	0	0	0	0	0	0	0	0	0
4. Takes pleasure in working problems other students fail to solve.	I	81	76	0	0	0	0	0	0	0	0	0	0	0
35. 1. Demands perfection in his own work.	W	65	82	FF	0	0	0	0	0	0	0	0	0	0
2. Is quick to understand the operation of mechanical devices.	T	61	28	MM	0	0	0	0	0	0	0	+	0	0
3. Joins groups with experimental interests.	SS	45	59	FF	0	0	0	0	0	0	+	0	0	-
4. To avoid "prescribed" answers, works out laboratory experiments in own way and writes own reports.	I	24	27	0	0	0	0	0	0	0	0	0	0	0

Half of the phrases, 71 out of 140, showed significant differences in their use in describing the performance of boys as compared with girls. The factor pattern of the differences is similar to but more distinct than shown by Form B. Girls are more frequently characterized by their Work Habits (W) and Communication Skills (SS), while the boys are more frequently described as having Creativity (C), Individualism (I), and Technical Interests (T). The differences in marking the phrases for the Experimental and Control groups, particularly the C-2 group, follow the same pattern as in Form B. Only two of the 28 phrases discriminating between the E and C-2 groups were common to both boys and girls, one factor B phrase (12. 4) and one for factor T (12. 2). Of the remaining phrases, 19 were for boys and 7 for girls. For the girls, the differences between group E and C-2 can be considered chance, but not so for the boys.

The crucial question is the extent to which the teachers described differently the performance of boys and of girls of the Experimental group before SSP as compared to after SSP. For 35 of the 140 phrases there was a difference statistically significant at at least the 5% level of confidence. Of these 35 phrases 20 showed differences for Boys-Experimental and 20 for Girls-Experimental groups. Only 9 and 6 phrases respectively showed significant changes for Boys C-1 and C-2 groups, and 8 and 9 respectively showed such changes for Girls C-1 and C-2 respectively. These facts, in gross, reflect some impact of SSP. Only 3 of the phrases showed significant differences both for boys and for girls. These were:

3. 1 B (++)(++)	Has attended many science conferences and fairs.
25. 1 SS (--)(-)	Can render technical matter into interesting and informative demonstrations for non-technical students.
25. 3 B (++)(++)	Has taken advanced courses in math either through special high school programs or through outside or correspondence schools.

Listed below are seventeen other phrases from 10 of the groups which showed statistically significant differences for boys and not for girls.

15. 2 B (-)	His home life is intellectually stimulating.
15. 3 SS (+)	Has led group discussions of scientific topics in class.

(Phrase 15. 3 has been chosen rather than 15. 2 to describe the behavior of the boys, and suggests an increase in science activity.)

20. 1 I (- -)	Chooses projects without help and works entirely on his own.
20. 2 SS (+ +)	Has directed mathematics or science contests.
20. 4 S (+)	Scientists and scientific personnel are his favorite source of information.

In group 20, three phrases showed significant change.

25. 4 I (- -)	Makes use of work of others without being bound by or limited to their conclusions.
30. 2 T (+ +)	Has built electronic apparatus (such as hi-fi set) from component parts.
30. 4 C (-)	Would rather plan new work than gather experimental data.

Phrase 30. 2 indicates more specific activity than 30. 4.

31. 1 SS (- -)	Explains solutions to problems lucidly when called upon.
31. 3 T (+ +)	Possess near-professional skill in at least one laboratory specialty.

Phrase 31. 3 is one of the important changes related to SSP attendance.

33. 2 T (+)	Modifies standard methods to see if better product will result.
33. 4 B (- -)	Shows the same intellectual curiosity in other areas that he does in science courses.

Phrase 33. 2, again is a choice for a more specific behavior over a general statement.

11. 3 B (+)	He carries more than the average number of major subjects.
14. 2 S (+)	Has written scientific papers describing his completed project.
23. 2 W (+)	Checks fact against theory whenever the equipment is available.
26. 3 T (- -)	Learns to use laboratory apparatus proficiently.
32. 2 B (+)	Explores topics not found in the standard curriculum.

As intense science interest continues, it is manifested in more specific behaviors and it is not so necessary for the reporting teacher to resort to broad generalizations when the choices are as close as afforded by Form E. Phrases 11. 3, 14. 3 and 32. 2 all refer to the specific intensification of academic-science-math activity. Phrase 23. 2 reflects an increase in the number of boys who are learning to act more and more like mature scientists. The drop in per cent for 26. 3 is likely related to increases in the other and perhaps higher-level behaviors in that group of phrases.

There are 17 phrases in 11 groups which showed statistically significant changes for girls (Experimental group) and not for boys, between the Pre-SSP and the Post-SSP observations. These phrases are listed below.

1. 3 W (-)	Keeps after a problem until a satisfactory solution is found.
1. 4 C (-)	Tries to explain unexpected results in an experiment.

In group 1, phrases 1. 1 B and 1. 2 S show a small increase at the expense of 1.3 W and 1.4 C, but not enough to establish them statistically.

9.2 SS (+)	Enjoys exchanging ideas with fellow students, teachers and outside experts.
9.3 S (+)	Is adept at using scientific source materials and references.
9.4 C (-)	Is quick to see relationships between one problem and another.

Both of the phrases 9.2 SS and 9.3 S show improvement in attitude and performance as science students.

18.1 I (+)	If the apparatus in the laboratory does not satisfy him, he makes his own.
18.3 S (+)	Reads several science publications regularly.
18.4 W (-)	Works steadily and consistently in the laboratory.

Phrase 18.3 S is a specific observable behavior and here is evidence of increased activity as a scientist. It draws from phrases 18.2 and 18.4 rather than 18.1 which is not frequently chosen to desc ibe the girls.

2.3 B (+)	Keeps abreast of recent scientific developments.
11.1 W (-)	Draws up a detailed working plan before starting on a project.
15.4 I (++)	Refuses to accept even a common scientific law without deriving or testing it.
16.2 I (+)	Demands proof for new ideas.
26.4 B (+)	Maintains a growing science library.
28.2 I (+)	Has repeated classical experiments on his own to satisfy himself regarding findings.
34.2 SS (- -)	Makes use of original "visual aids" in the presentation of his science reports.
35.2 T (+)	Is quick to understand the operation of mechanical devices.
22.1 B (+)	Has done a great deal of study on his own in order to qualify for an honors course.

Both phrases 2.3 and 26.4 indicate an increase in science reading as a result of SSP experience. Phrases 15.4, 16.2 and 28.2 form a strong cluster of behaviors, an increase in skepticism, with willingness to recheck.

Phrase 35.2 T suggests that some girls showed an increase in their use of understanding of equipment. The remaining two phrases in the list, 11.1 and 34.2, show decreases, probably not because they were lessened, but because the competing phrases became more potent.

The outstanding impact factors for girls are:

- increased Breadth of Interest
- increased Individualism
- decrease in Work habits
- small increase in Scientific attitude
- small increase in Creativity

The impact factors for boys are not so clear. But there is

- increase in Breadth of Interest
- small increases in Scientific attitude
- small increase in Science Communication
- small decrease in Individualism

Factor Scores - Forms B and E, Part I

Scores for each of the seven factors from Part I were obtained for each Form B and for each Form E which had been completed in the Pre SSP period. The score for any factor is the number of times phrases representing that factor were marked as being one of the two more descriptive. Since phrases for each factor occurred twenty times with the 35 groups of descriptive phrases the score on any one factor can range from 0 to 20. Table 35 shows the means of factor scores for each of Forms B and E for males and for females for both Pre-SSP and Post-SSP. In general, the highest scores were for Factor I, Individualism and the lowest for C, Creativity, However, it is not proper to conlcude that Individualism occurs in greater frequency or amount than Creativity, since this may be a function of the phrases used rather than of any relative strength of the factors. At this time, comparison may be made only within factors and not between factors. Comparisons may be made between factors after norms are are established for each factor for the group. Data from this study might be used for establishing such norms, but because of the necessary assumptions of equivalence of means and of variances, comparison within these data cannot be made. The factor scores for any individual are almost a "closed system" - if some scores are high, perforce others must be low.

The impact of the Summer Science Programs is shown by changes in mean scores of the experimental groups from the Pre SSP and the Post-SSP data:

- increase in SS: communication skills - Boys, Form B. (Significant at the 1-5% level of confidence)
- increase in B: Breadth of Interest - Girls, Form B and also Form E (significant at or beyond the 1% level of confidence)
- decrease in W: Work Habits - Girls, Form E, (significant at the 1-5% level of confidence)

Scores for FactorB: Breadth of Interest as seen by the teachers are a little greater for boys than for girls. As seen by the students themselves, the boys have a slightly higher score than girls, and the scores on Form B, - the students as seen by themselves, - are slightly lower than that seen by the teachers.

In Factor C: Creativity, the boys score distinctly higher than girls, both as seen by teachers (Form E) and as seen by themselves (Form B). The teachers see the boys as having a greater degree of Individualism than the girls; the difference as the boys and girls see themselves was not significant.

In Factor S: Scientific Attitude, only one of the four scores

Table 35

Comparisons of Means of Performance Factor Scores, Forms B and E: Pre and Post SSP.

Factor	Form	Sex	Group	Pre-SSP M	Pre-SSP N	Post-SSP M	Post-SSP N	Comparison
B. Breadth of Interest	E	M	E	9.80	430	10.18	365	
C. Creativity	E	M	E	8.90	430	8.72	365	
I. Individualism	E	M	E	11.35	430	11.27	365	
S. Scientific Attitude	E	M	E	9.93	430	10.09	365	
SS. Communication Skills	E	M	E	9.60	430	9.59	365	
T. Technical Interest	E	M	E	9.11	430	9.21	365	
W. Work Habits	E	M	E	9.58	430	9.33	365	
B. Breadth of Interest	B	M	E	9.21	444	9.50	377	
C. Creativity	B	M	E	9.72	444	9.63	377	
I. Individualism	B	M	E	11.79	444	11.47	377	
S. Scientific Attitude	B	M	E	10.14	444	9.88	377	
SS. Communication Skills	B	M	E	9.26	444	9.67	377	+
T. Technical Interest	B	M	E	9.84	444	10.21	377	
W. Work Habits	B	M	E	9.01	444	8.71	377	
B. Breadth of Interest	E	F	E	9.59	157	10.55	121	++
C. Creativity	E	F	E	7.94	157	7.84	121	
I. Individualism	E	F	E	10.80	157	11.07	121	
S. Scientific Attitude	E	F	E	9.88	157	10.48	121	
SS. Communication Skills	E	F	E	11.01	157	10.77	121	
T. Technical Interest	E	F	E	6.61	157	6.87	121	
W. Work Habits	E	F	E	11.68	157	10.98	121	+
B. Breadth of Interest	B	F	E	8.99	173	10.15	137	++
C. Creativity	B	F	E	9.01	173	8.47	137	
I. Individualism	B	F	E	11.56	173	11.23	137	
S. Scientific Attitude	B	F	E	9.57	173	9.88	137	
SS. Communication Skills	B	F	E	10.16	173	10.37	137	
T. Technical Interest	B	F	E	7.85	173	8.33	137	
W. Work Habits	B	F	E	10.77	173	10.74	137	
B. Breadth of Interest	E	M	Cl	9.03	236	9.01	160	
C. Creativity	E	M	Cl	8.88	236	8.91	160	
I. Individualism	E	M	Cl	11.53	236	11.95	160	
S. Scientific Attitude	E	M	Cl	10.16	236	10.01	160	
SS. Communication Skills	E	M	Cl	9.38	236	9.68	160	
T. Technical Interest	E	M	Cl	9.71	236	10.01	160	
W. Work Habits	E	M	Cl	9.59	236	8.82	160	--

Table 35 (Continued)

Factor	Form	Sex	Group	Pre-SSP M	Pre-SSP N	Post-SSP M	Post-SSP N	Comparison
B. Breadth of Interest	B	M	C1	8.90	231	8.92	166	
C. Creativity	B	M	C1	9.62	231	9.76	166	
I. Individualism	B	M	C1	11.55	231	11.68	166	
S. Scientific Attitude	B	M	C1	9.92	231	9.67	166	
SS. Communication Skills	B	M	C1	8.82	231	9.22	166	
T. Technical Interest	B	M	C1	10.05	231	10.81	166	+
W. Work Habits	B	M	C1	9.06	231	8.97	166	
B. Breadth of Interest	E	F	C1	9.01	80	9.91	64	
C. Creativity	E	F	C1	7.66	80	8.72	64	+
I. Individualism	E	F	C1	10.91	80	11.42	64	
S. Scientific Attitude	E	F	C1	9.80	80	9.48	64	
SS. Communication Skills	E	F	C1	10.72	80	10.58	64	
T. Technical Interest	E	F	C1	7.21	80	7.78	64	
W. Work Habits	E	F	C1	10.91	80	11.12	64	
B. Breadth of Interest	B	F	C1	8.16	90	9.09	74	+
C. Creativity	B	F	C1	8.96	90	8.95	74	
I. Individualism	B	F	C1	11.66	90	12.09	74	
S. Scientific Attitude	B	F	C1	8.99	90	9.08	74	
SS. Communication Skills	B	F	C1	9.10	90	9.05	74	
T. Technical Interest	B	F	C1	8.51	90	8.73	74	
W. Work Habits	B	F	C1	10.46	90	11.47	74	+
B. Breadth of Interest	E	M	C2	8.85	299	8.95	242	
C. Creativity	E	M	C2	8.97	299	9.21	242	
I. Individualism	E	M	C2	11.72	299	11.66	242	
S. Scientific Attitude	E	M	C2	10.16	299	9.61	242	-
SS. Communication Skills	E	M	C2	7.39	299	9.58	242	++
T. Technical Interest	E	M	C2	9.70	299	9.65	242	
W. Work Habits	E	M	C2	9.24	299	9.07	242	
B. Breadth of Interest	B	M	C2	8.19	284	8.28	253	
C. Creativity	B	M	C2	9.91	284	10.08	253	
I. Individualism	B	M	C2	12.13	284	12.34	253	
S. Scientific Attitude	B	M	C2	9.85	284	9.57	253	
SS. Communication Skills	B	M	C2	8.71	284	8.83	253	
T. Technical Interest	B	M	C2	10.44	284	10.43	253	
W. Work Habits	B	M	C2	9.18	284	9.13	253	
B. Breadth of Interest	E	F	C2	8.51	91	8.69	80	
C. Creativity	E	F	C2	8.12	91	8.44	80	
I. Individualism	E	F	C2	11.07	91	11.54	80	
S. Scientific Attitude	E	F	C2	9.85	91	9.09	80	
SS. Communication Skills	E	F	C2	10.41	91	10.58	80	
T. Technical Interest	E	F	C2	7.71	91	7.81	80	
W. Work Habits	E	F	C2	11.27	91	10.72	80	
B. Breadth of Interest	B	F	C2	8.23	103	8.56	78	
C. Creativity	B	F	C2	9.18	103	8.88	78	
I. Individualism	B	F	C2	11.85	103	12.00	78	
S. Scientific Attitude	B	F	C2	9.46	103	9.26	78	
SS. Communication Skills	B	F	C2	9.63	103	10.08	78	
T. Technical Interest	B	F	C2	8.66	103	8.38	78	
W. Work Habits	B	F	C2	10.85	103	11.24	78	

is distinctly different from the other three - that for girls as seen through their own eyes.

The Factor SS: Science Communication Skills, gives the edge to the girls. The teachers describe the girls as being distinctly stronger in this area than boys, and in both cases higher than the students describe themselves on Form B. The Form B scores for girls are distinctly higher than for boys.

On Factor T: Technical Interests, the scores for boys are substantially higher than those for girls. The scores from Form B are higher than for Form E.

Work Habits (W) scores for both boys and girls are higher for both forms for girls than for boys, and the Form E scores are higher than the Form B scores.

This evidence here on Work Habits plus the analysis of Table 36, the intercorrelations of the seven factors, raises the question as to whether the girls entering science may not be motivated by different factors or that their pattern of motivation may be somewhat different. They appear to have a high order of conformance in performing as science students and in showing their interest in the more socially acceptable ways than do boys. This is also related to the observation in the Annual Science Talent Search for the Westinghouse scholarships, that the average class standing of the girl contestant is slightly higher than for the boys, and at the same time one gets the impression that girls, as a group, do not have as great a depth of interest and drive to be a scientist as the boys.

The seven factor scores might be better understood on the basis of more detailed look at their organization. Table 36 shows the intercorrelations of the seven factor scores for four samples. The numbers of cases included all of the Form E's and Form B's in the Pre-SSP samples. Data for Experimental and Comparison groups were pooled. This is an examination of the instrument rather than comparison of samples. The coefficients of correlation shown in Table 36, are not of great magnitude. However, 43 of the 84 coefficients differ significantly from zero (at the 1% level of confidence). Because only two out of each group of 4 phrases can be marked, the intercorrelations will be lower than if there were no such constraint. The most consistent groups of correlation coefficients are those between Factors B: Breadth of Interest and S: Scientific Attitude, indicating that there is some communality of these two factors. Factors C and I, Creativity and Individualism also show substantial positive correlations. While some other pairs of factors do show all positive correlations, say, such as between C, Creativity and T, Technical Interest or between Individualism and Communication Skills, or Individualism and Technical Interest, no others have coefficients for all of the four groups greater than the 1% level.

A simple factor analysis of the four sets of intercorrelations offers a clearer understanding of the factor scores. The statistical factors were obtained by the centroid method and rotated to reflect the most information. The statistical factor loadings are shown in Tables 37 and 38. These values can be interpreted as the correlations of each of the factor scores with the statistical factors.

For all four groups there is a statistical factor made up of C and I. This is the clearest statistical factor. This relationship of Creativity and Individualism could suggest that creativity and teen-age drive for independence are related, at this stage of development or only that creativity and individualism are empirically associated in such a group of would-be scientists.

The second statistical factor, independent of the first, was organized around Breadth of Interest. Associated with B, in this statistical factor are S and SS.

This would suggest that within this sample there is not a strong relationship between Breadth and Creativity. For the boys (Form B) a third factor stands out, a substantial loading for technical interest. Technical interest does not stand out in any other of the three samples.

Form E for girls shows substantial loadings for all seven factors in the first statistical factor but with higher loadings for creativity and individualism. This suggests that there may be either a general halo effect or else the girls are able to demonstrate to their teachers a high and subtle conformance to the standards and behaviors they believe their teachers expect of them. The second factor for Form E (Girls) includes substantial loadings for Breadth of Interest, Scientific Attitude and SS: Communications Skills.

There is considerable similarity between the data from Form B and from Form E for boys and also betweeen Form B and Form E for girls. In all four samples the Creativity-Individualism axis stands out. A second axis in all cases contains Breadth of interest as its most substantial factor, but the other variables or the other characteristics which show high relationship to this cluster vary from sample to sample. These variations can be due to different points of view and to the difference of cultural pressures. Different points of view, one as viewed by the students in the report on their own performance and the other as the teachers report their performance while there are cultural differences in the social outlook and performance of boys and girls. The interaction of these two kinds of pressures could account for the differences.

Attitudes Regarding Career and School:

Part II of Forms B and E is a series of 27 questions answerable by marking "Yes," "No," or "?." Table 39 shows the data from this section of Form B. To simplify the presentation, the data for only one of the three possible answers are given. For each question the answer used is the "key" answer. For example, Question 1, "Do you think you will enter a career of science?" the "Yes" answer was used. Fifty-nine per cent of the males answered it "Yes," while 45% of the females answered "Yes." This difference is significant at the 1% level and is in favor of the males.* Most of these questions, 18 of the 27, showed a statistically significant difference between the responses of males and females. Essentially these differences show that more of the boys expect to go into a career of science, that they feel more certain of being successful in science and that they think they understand science. These differences also show that the girls think of themselves as being less of a discipline problem, having less of the know-it-all attitude, and being less critical of authority and are all around less disruptive. They do not antagonize fellow students as much or argue as much with their teachers or other students in the classses. This is a picture of two kinds of factors. One, the drive and expectation of a career in science is stronger in the males and there is a greater docility among the girls. This we must remember is as the students describe themselves.

For the boys only 2 of the 27 questions show statistically significant differences before and after the Summer Science

* The same set of symbols are used as in Table 29.

Table 36

Intercorrelations of 7 Factors of "On the Job Performance of High School Science Students." (Form B was filled out by Students themselves, and Form E was filled out by their teachers.)

Factor	Group	B	C	I	S	SS	T	W	Mean	Std.Dev.
B:	E - Male		-.143	-.199	.282	.069	-.256	-.008	9.29	3.16
Breadth	B - Male		-.164	-.177	.207	.114	-.249	-.064	8.83	2.90
of	E - Female		.251	.329	.576	.471	.063	.298	8.97	3.93
Interest	B - Female		-.144	-.118	.241	.216	-.155	-.013	8.62	2.81
C:	E - M	-.143		.333	-.070	-.012	.107	-.188	8.92	2.76
Creativ-	B - M	-.164		.186	-.144	.008	.136	-.118	9.77	2.64
ity	E - F	.251		.382	.084	.124	.190	.172	7.86	2.72
	B - F	-.144		.327	-.034	.049	.199	.062	8.97	2.56
I:	E - M	-.199	.333		-.101	.029	.160	-.066	11.51	2.85
Indi-	B - M	-.177	.186		-.058	.024	.066	-.028	11.83	2.59
vidual-	E - F	.329	.382		.195	.260	.337	.347	10.85	2.94
ism	B - F	-.118	.327		-.014	.183	.113	.172	11.67	2.84
S:	E - M	.282	-.070	-.101		.009	-.027	.041	10.03	2.49
Scientific	B - M	.207	-.144	-.058		.060	-.051	.049	9.99	2.35
Atti-	E - F	.576	.084	.195		.320	.076	.215	9.93	2.80
tude	B - F	.241	-.034	-.014		.072	-.059	.133	9.41	2.65
SS:	E - M	.069	-.012	.029	.009		-.071	-.003	9.48	2.92
Commun-	B - M	.114	.008	.024	.060		-.216	-.137	8.98	2.97
ication	E - F	.471	.124	.260	.320		-.052	.260	10.80	3.28
Skill	B - F	.216	.049	.183	.072		-.062	.026	9.79	3.02
T:	E - M	-.256	.107	.160	-.027	-.071		-.062	9.40	3.48
Techni-	B - M	-.249	.136	.066	-.051	-.216		-.051	10.09	3.32
cal	E - F	.063	.190	.337	.076	-.052		.170	7.05	3.07
Skill	B - F	-.155	.199	.113	-.059	-.062		.016	8.16	3.09
W:	E - M	-.008	-.188	-.066	.041	-.003	-.062		9.53	3.47
Work	B - M	-.064	-.118	-.028	.049	-.137	-.051		9.09	3.17
Habits.	E - F	.298	.172	.347	.215	.260	.170		11.28	3.49
	B - F	-.013	.062	.172	.133	.026	.016		10.77	3.33

Nos. of Cases:		1% Level
E - Male	= 967	.085
B - Male	= 967	.085
E - Female	= 310	.145
B - Female	= 359	.140

Table 37

Rotated Loadings For The 7 Factors
With The Statistical Factors - Males

The Seven Factors		Form B			Form E		
		I	II	III	I	II	III
B:	Breadth of Interest	-.35	.42	.04	-.26	.56	.03
C:	Creativity	.48	.05	-.04	.61	.07	.06
I:	Individualism	.32	-.08	.06	.56	-.06	-.06
S:	Scientific Attitude	-.24	.15	-.04	-.11	.33	-.30
SS:	Communication Skills	.02	.32	.28	-.01	.17	.06
T:	Technical	.24	-.16	-.55	.32	-.32	-.16
W:	Work Habits	-.24	-.34	.05	-.24	-.07	-.25

Table 38

Rotated Loadings For The 7 Factors
With The Statistical Factors - Females

The Seven Factors		Form B			Form E		
		I	II	III	I	II	III
B:	Breadth of Interest	-.15	.60	.14	.41	-.67	-.16
C:	Creativity	.55	-.12	-.08	.51	-.03	.14
I:	Individualism	.62	-.04	.07	.70	-.06	.14
S:	Scientific Attitude	-.01	.42	-.13	.27	-.67	.06
SS:	Communication Skills	.23	.17	.31	.27	-.59	.10
T:	Technical	.25	-.16	-.22	.47	.25	-.16
W:	Work Habits	.22	.18	-.16	.47	-.19	.00

Comparisons of Responses, Part II, Form B
(Student's Self Description)

Item	Response Definitely "Yes" or "No"	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre): Male E vs C'	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP: Male E	Male C1	Male C2	Female E	Female C1	Female C2
1. Do you think you will enter a career of science?	Yes	59	45	MM	E	EE	0	E	0	0	0	0	0	0
2. Do you generally participate in class discussions?	Yes	58	67	F	0	0	C	C	0	0	0	0	0	0
3. Are your contributions to class discussions generally worthwhile?	Yes	27	27	0	0	E	0	0	0	0	0	0	0	0
4. Are you ever disruptive to other students in class?	No	26	39	FF	0	0	0	0	0	0	0	0	0	0
5. Are you very interested in your classwork?	Yes	46	62	FF	0	0	0	0	0	-	-	0	0	0
6. Are you very interested in your laboratory work?	Yes	63	65	0	0	E	0	0	-	0	0	0	0	0
7. Do you pay attention in class?	Yes	41	48	0	0	0	0	0	0	-	0	0	0	0
8. Are you skillful in handling laboratory equipment and apparatus?	Yes	23	15	M	0	E	0	0	0	0	0	0	0	0
9. Are you skillful in setting up apparatus?	Yes	26	17	M	0	0	0	E	0	0	0	0	-	0
10. Do you show an above average amount of creativity?	Yes	24	19	0	0	0	0	0	0	0	0	0	0	0
11. Do you feel that your chances are good of becoming a successful scientist?	Yes	37	22	MM	EE	EE	0	0	0	0	0	0	0	0
12. Do you create a discipline problem?	No	62	75	FF	0	0	0	0	0	0	0	0	0	0
13. Do you have a "know it all" attitude?	No	43	58	FF	C	0	0	0	0	--	0	0	0	0
14. In science courses do you understand what you are doing?	Yes	44	35	M	E	EE	0	E	0	0	0	0	0	0
15. Are you critical of authority?	No	19	35	FF	0	0	0	0	0	0	0	0	0	0
16. Are you an independent worker?	Yes	26	34	0	0	0	0	E	0	-	0	0	0	0
17. Are you a student leader?	Yes	14	20	0	0	0	0	0	0	0	0	0	0	0
18. Do you devise new ways of doing things?	Yes	12	8	0	0	0	0	0	0	0	0	0	0	0
19. Are you dependent on the teacher for telling you what to do?	No	22	20	0	0	0	0	0	0	0	0	0	0	0
20. Do you annoy other students in class?	No	42	51	F	0	0	0	0	0	0	0	0	0	0
21. Do you help other students with their work?	Yes	21	27	0	0	0	0	0	0	0	0	0	0	0
22. Do you antagonize your teacher?	No	59	68	F	0	0	0	0	0	0	0	0	0	0
23. Do you antagonize your fellow students?	No	52	66	FF	0	0	0	0	0	0	0	0	0	0
24. Do you think you know more than your fellow students?	No	9	25	FF	0	C	0	0	0	0	0	0	+	0
25. Do you think you know more than your teachers?	No	65	74	F	0	0	0	0	--	0	0	0	0	0
26. Do you argue with the teacher in class?	No	23	43	FF	CC	0	0	0	0	0	0	0	0	0
27. Do you argue with the other students in class?	No	15	28	FF	0	0	0	0	0	0	0	0	0	0

Program. A decrease in Interest in Laboratory Work and a significant decrease in those who say "No" to Item 25, "Do you think you know more than your teachers?" One may imply from this that more of the boys believe they know more than their teachers. No item shows a significant difference between the Pre-SSP and Post-SSP responses for the girls Experimental group.

Table 40 shows the item analysis data for Part II, Form E - the teachers' description of the boys and girls in terms of the 27 questions just discussed. Fourteen of the 27 questions show statistically significant differences between boys and girls. The differences can be classified or summarized in the same fashion as those shown by Form B. The girls are better behaved in class, pay better attention, are less disruptive, less "know-it-all," and less argumentative. For the boys the teachers see stronger drive toward entering a career of science and continuing in such direction.

Only one question shows a difference between the Experimental and Control for both boys and girls, no. 14, "Does he show understanding of what he is doing." The differences are in favor of the experimental group in all cases, suggesting that all those who did go to summer science programs, in spite of efforts to secure an adequate-control group, still had better motivation as seen by their own teachers.

The comparisons Before and After the Summer Science Program is of particular interest. Fourteen questions show a statistically significant Pre-S to Post SSP change. Eight of the questions show a significant difference between the Before and After Summer Science Program for the boys as compared to 1 and 4 respectively for the C-1 and C-2 boys. Six show such difference for the Experimental group of girls.

For the boys in the Experimental group, the changes are:

- a decrease in the amount of interest in laboratory work,
- a decrease in paying attention in class,
- an increase in "know-it-all attitude,"
- an increase in being critical of authority
- an increase in annoying other students in class
- increase in antagonizing fellow students and
- in arguing with teachers and other students in the class.

For the girls, the differences are of much the same kind but not nearly so pronounced.

When we subject very bright high school students who are strongly motivated toward being a scientist, and who have learned to get a large "kick" or "charge" out of being a scientist, to a Summer Science Program on a college campus under the instruction of college professors, where they are treated like adult college students, in a situation where they have an opportunity to give their best both qualitatively and quantitatively to the effort, it is no wonder that we have coming back to our high schools boys and girls who feel that they know more than their fellow students, who feel that they may know more than their teachers, who may have information superior to that offered in their high school text books. The purposes of the Summer Science Program are not to encourage mediocrity or conformity to a high school performance norm but rather to stretch the thinking of able students interested in science both quantitatively and qualitatively.

One may well accept the reported kind of behavior as being evidence that there is some real positive impact of the Summer Science Program.

Aids and Hindrances Toward a Career in Science:

Part III of both Forms B and E has two questions: "Please describe your attributes, kinds of performance and characteristics which lead you to believe you will make a good scientist"; and the contrary question, "Please describe your attributes, kinds of performance and characteristics which may be detrimental to your following a science career."

The answers given to these questions by the students themselves are summaraized in Table 41. The answers were classified into 10 categories. The most frequently mentioned was 3, "Interest in science outside of school science work, behavioral evidence of scientific interest; followed in order by numbers 5 and 2. None of the categories of answers to question showed any significant difference between the males and females. Differences between the experimental and control groups were not of any great import. Before and After the Summer Science Program - the Experimental group of males showed a distinct increase in the numbers who offered answers in most of the answer categories. It should be remembered that this is an "open-end" question with the answers being classified after they had been mailed to RBH.

The patterns of changes reflect a more general pattern of increased maturity rather than specific impact of SSP.

For those negative traits which might be detrimental to following a scientific career, only two have any substantial proportion of answers. No. 4, "Lacks real science interests, spread too thin, too many interests," was indicated by 13% of the males and 13% of the females. No. 6, "Lazy, lack of drive, lack of perserverance, etc.," characteristic of 30% of the males and 27% of the females. There was a significant increase in the number of boys in the Experimental group who thought that perhaps they were overspecialized in science, worked too hard in science, and those who thought that they had a lack of drive. There is also an increase in the number of boys who saw in themselves an increase in "over competent know it all, stubborn, undesirable personality traits." Recognition of this is a start in the right direction.

The answers to similar questions asked of the teachers are shown in Table 42. The same answer categories are used. The most commonly indicated desirable attribute or trait is No. 5, "Intelligent, Alert, Analytic, Good Student," indicated as characteristic of 42% of the boys and 39% of the girls. Comparing the Before and After the Summer Science Program experience with the boys and girls in Experimental groups, we find Category 0, "Desirable personality trait"- shows an increase for the boys in Experimental group. No. 2, "Originality, Creativity, Imagination, etc." an increase significant at the 1% level of confidence for the boys. No. 3, "Interests in science outside school work," a significant increase for all boys whether Control or Experimental. Being Intelligent, Alert, Good Student, and the like, - an increase for practically all boys and girls, Experimental and Control. The same is true of No. 7, "Hardworker, Perserverence, Follow-through," and for No. 8, "Desirable Study Habits, Plans well, Accurate and Prompt." Overall, the teachers report about the same improvement in maturity of the students as reported by the students themselves.

Table 40

Comparisons of Responses, Part II, Form E
(Teachers Description of Student)

Item	Response Definitely "Yes" or "No"	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
1. Is it likely he will enter a career of science?	Yes	55	33	MM	E	EE	0	E	0	0	0	0	0	0
2. Does he participate in class discussions?	Yes	68	68	0	0	E	0	0	0	0	0	0	0	0
3. Are his contributions to class discussions worthwhile?	Yes	72	70	0	E	EE	0	0	0	0	0	0	--	0
4. Is this student disruptive to other students in class?	No	68	82	FF	0	0	0	0	0	0	0	0	0	0
5. Does he show a great amount of interest in classwork?	Yes	66	73	0	0	0	0	0	--	0	--	0	-	0
6. Does he show a great amount of interest in laboratory work?	Yes	62	61	0	0	E	0	0	0	0	--	-	-	--
7. Does this student pay attention in class?	Yes	73	85	FF	0	0	E	0	--	0	0	-	0	0
8. Is he skillful in handling laboratory equipment and apparatus?	Yes	47	34	MM	0	0	0	0	0	0	0	0	0	0
9. Is he skillful in setting up apparatus?	Yes	44	27	MM	0	0	0	0	0	0	0	0	0	0
10. Does he show an above average amount of creativity?	Yes	44	36	0	0	E	E	0	0	0	0	0	0	0
11. Are his chances of being a successful scientist good?	Yes	55	43	MM	EE	EE	EE	0	0	0	0	0	0	-
12. Does he create a discipline problem?	No	85	95	FF	0	0	E	0	0	0	0	0	0	0
13. Does he have a "know it all" attitude	No	66	80	FF	0	0	0	0	-	0	0	--	0	-
14. Does he show understanding of what he is doing?	Yes	57	58	0	E	E	EE	EE	0	0	-	0	0	0
15. Is he critical of authority?	No	49	54	0	0	C	0	0	-	0	-	0	0	0
16. Is he an independent worker?	Yes	40	42	0	0	0	E	0	0	0	0	0	0	-
17. Is he a student leader?	Yes	25	31	0	0	0	0	0	0	0	0	0	0	0
18. Does he devise new ways of doing things?	Yes	18	9	M	0	0	0	0	0	0	0	0	0	0
19. Is he dependent on the teacher for telling him what to do?	No	36	31	0	0	0	0	0	0	0	0	0	0	0
20. Does he annoy other students in class?	No	75	83	F	0	0	0	0	-	0	0	0	0	0
21. Does he help other students with their work?	Yes	21	21	0	0	0	0	0	0	0	0	0	0	0
22. Does he antagonize his teacher?	No	82	89	0	0	0	0	0	0	0	0	0	0	0
23. Does he antagonize his fellow students?	No	74	82	0	0	0	0	0	--	0	0	-	0	0
24. Does he think he knows more than his fellow students?	No	31	45	FF	0	CC	0	0	0	0	0	0	0	0
25. Does he think he knows more than his teachers?	No	58	79	FF	CC	C	0	0	0	-	0	--	0	0
26. Does he argue with his teachers in class?	No	53	68	FF	0	C	0	0	-	0	0	--	0	0
27. Does he argue with the other students in class?	No	34	46	FF	0	CC	0	0	-	0	0	0	0	0

Table 41

Comparisons of Responses, Part III, Form B
(Student's Description of Attributes, Traits, Kinds of Performance Which He Believes Will Be An Aid or Hindrance to a Career in Science)

Item	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)				Comparisons Before & After SSP					
				Male		Female		Male			Female		
	Male	Female		E vs C1	E vs C2	E vs C1	C vs C2	E	C1	C2	E	C1	C2
1. Please describe your attributes, kinds of performance and characteristics which lead you to believe you will make a good scientist.													
0 Desirable personality trait, leadership, accepts responsibility.	6	2	0	0	0	0	0	0	0	0	0	0	0
1 Independence of thought and action.	2	2	0	0	0	0	0	0	0	0	+	0	0
2 Originality, creativity, imagination, scientific attitude, curiosity.	17	17	0	E	0	0	0	++	0	++	++	0	0
3 Interest in science, outside of school science work, behavioral evidence of scientific interest.	29	28	0	0	0	0	0	++	++	+	++	++	+
4 Breadth of interest outside of science, outside interests.	1	1	0	0	0	0	0	+	+	0	0	0	0
5 Intelligent, alert, analytical, good student.	22	16	0	EE	E	E	0	++	++	++	++	++	+
6 Manipulative skill, good at handling equipment.	2	1	0	0	0	0	0	++	0	++	+	0	0
7 Hard worker, perseverance, follow thru	12	17	0	0	0	0	0	++	++	++	++	++	+
8 Desirable study habits, plans well, accurate, prompt.	3	5	0	0	0	0	0	+	+	+	0	0	0
9 Miscellaneous	2	1	0	0	0	CC	0	0	0	0	0	-	0
X No Data	6	10	0	0	C	0	0	0	-	--	0	0	0
2. Please describe your attributes, kinds of performance and characteristics which may be detrimental to your following a scientific career.													
0 None, Nothing, Don't know.	4	5	0	0	0	0	0	0	0	0	0	0	0
1 Shy, not independent, lack of confidence.	4	6	0	0	0	0	0	0	0	0	++	0	0
2 Over confident, know it all, stubborn, undesirable personality traits.	8	10	0	0	0	0	0	++	0	0	0	0	0
3 Lacks curiosity, creativity, originality.	1	5	0	0	0	0	0	0	0	0	0	0	0
4 Lacks real science interest, spread too thin, too many interests.	13	13	0	0	0	0	0	++	++	++	++	++	0
5 Over specialized in science, works too hard in science, not well rounded	1	-	0	0	0	0	0	++	0	0	0	0	0
6 Lazy, lack of drive, lacks perseverance, gives up, gets by, poor work habits.	30	27	0	0	EE	0	0	+	0	0	0	0	0
7 Jumps to conclusion, poor analyser, poor student.	11	10	0	0	0	0	0	0	+	0	0	0	0
8 Lacks manipulative skill, can't handle equipment.	3	1	0	0	0	0	0	0	0	0	0	0	0
9 Financial	2	2	0	0	0	0	0	0	0	0	0	0	0
X No Data	8	10	0	CC	CC	0	0	+	0	0	0	0	0
Y Miscellaneous	14	10	0	0	0	0	0	0	0	0	0	0	0

Table 42

Comparisons of Responses, Part III, Form E
(Teachers's Description of Student's Attributes,
Traits, Kinds of Performance Which He Believes
Will Be a Handicap to the Student in a Career in
Science)

Item	% Response (Experimental)		Male vs. Female (Pre)	Experimental vs. Control (Pre)				Comparisons Before & After SSP					
				Male		Female		Male			Female		
	Male	Female		E vs C1	E vs C2	E vs C1	E vs C2	E	C1	C2	E	C1	C2
1. Please describe this student's attributes, kind of performance and characteristics which lead you to believe he will make a good scientist.													
0 Desirable personality trait, leadership, accepts responsibility.	7	8	0	0	0	0	0	++	0	0	0	0	0
1 Independence of thought and action.	5	1	0	0	0	0	0	+	+	+	+	0	0
2 Originality, creativity, imagination, scientific attitude, curiosity.	9	6	0	0	0	0	0	++	+	0	0	0	0
3 Interest in science, outside of school science work, behavioral evidence of scientific interest.	15	16	0	C	0	0	0	++	++	++	++	0	0
4 Breadth of interest outside of science, outside interests.	0	1	0	0	0	0	0	+	0	0	+	0	0
5 Intelligent, alert, analytical, good student.	42	39	0	EE	0	0	0	++	++	+	++	0	++
6 Manipulative skill, good at handling equipment.	1	1	0	0	0	0	0	0	0	0	0	0	0
7 Hard worker, perseverance, follow thru.	12	17	0	0	0	0	0	++	++	++	++	0	++
8 Desirable study habits, plans well, accurate, prompt.	4	8	0	0	0	0	0	++	++	++	++	+	0
9 Miscellaneous	1	1	0	0	0	0	0	0	0	0	0	0	0
X No Data	4	1	0	0	0	0	0	0	0	0	0	0	0
Y Don't Know, Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Please describe this student's attributes, kinds of performance and characteristics which may be detrimental to his following a scientific career.													
0 None, Nothing, Don't Know	27	24	0	0	0	0	0	0	0	0	+	0	0
1 Shy, not independent, lack of confidence.	8	13	0	0	0	0	0	0	0	0	0	0	0
2 Over confident, know it all, stubborn, undesirable personality traits.	9	6	0	0	0	0	0	0	0	0	0	0	0
3 Lacks curiosity, creativity, originality.	2	4	0	0	0	0	0	0	0	0	0	0	0
4 Lacks real science interest, spread too thin, too many interests.	10	16	0	0	0	0	0	0	++	0	+	++	+
5 Over specialized in science, works too hard in science, not well rounded.	3	1	0	0	0	0	0	0	0	0	0	0	0
6 Lazy, lack of drive, lacks perseverance, gives up, gets by, poor work habits.	3	4	0	0	0	0	0	0	0	0	0	0	0
7 Jumps to conclusion, poor analyser, poor student.	2	3	0	0	0	0	0	0	++	0	0	0	0
8 Lacks manipulative skill, can't handle equipment.	2	2	0	0	0	0	0	0	0	0	0	0	0
9 Financial	3	3	0	0	0	0	0	0	0	0	0	0	0
X No Data	15	10	0	0	0	0	C	0	0	0	0	0	0
Y Miscellaneous	10	15	0	0	0	C	0	0	0	0	0	0	0

With this select group the teachers reported less of a negative or detrimental nature than one might expect. For 42% of the boys, the teachers either gave "no answer" or said they knew of no detrimental characteristics. The same is true for 34% of the girls.

Only No. 4, "Lacks real science interest, etc." shows an increase for an Experimental group - girls. It also shows increase for all samples of girls in the study.

High School Background and Kind of Program:

Two sets of conditions may be related to the kind or amount of SSP impact on student performance. As suggested in VI: HIGH SCHOOL SCIENCE BACKGROUND students from high schools having superior science backgrounds may react differently from those having less superior backgrounds.

In addition, the kind of program attended may operate as an "auto-selector" or may produce a different impact on participants.

As a way of exploring these ideas, the data from Forms B and E, Part I for all of the boys in the Experimental group were retabulated. Breakdowns for each Form were:

Pre and Post SSP
Superior and Not Superior High School Background
Kind of Program attended

Negro
Orientation
Research (resident)
Course (resident)
Course (commuter)
Research (commuter)

Thus it is possible to compare the pre and post SSP performance description of boys from Superior high school backgrounds who attended Orientation SSPs.

The comparison of pre and post SSP performance descriptions without consideration of kind of high school the students come from or kind of SSP attended have already been examined.

The data for both Forms B and E were tabulated in the detail indicated above. The pre-versus post-SSP differences from the performance descriptions of the students themselves (Form B) could be accounted for by chance factors. For the 140 descriptive phrases, differences significant at the 5% level of confidence were noted for only slightly more than 5% of the phrases. Those reported by the teachers in describing the performance of their students were sufficiently great that chance could not account for them.

For these reasons, only the data for Form E are presented in detail. Table 43 summarizes the item analysis of the data from Form E, the teachers' descriptions of performance of the boys who attended a Summer Science Program.

The first column of this table gives the phrases descriptive of the behavior of the students, and the second column the factor to the phrase belongs. The third column shows the % of students, pre SSP, from Superior (above average) science background high schools for whom the phrases were marked. The fourth column gives the % students, pre SSP, for whom these same phrases were marked who came from the Not Superior science background high schools. The fifth column shows the comparison of these pairs of per cents. A plus (+) shows that the per cent for the Superior background high schools is greater than that for the Not-Superior at the 5% level of confidence or better, while the converse is shown by a minus sign (-). Differences which are not significant at at least a 5 per cent level of confidence are left blank.

Of the 140 descriptive phrases, 25 show a significant difference for these two groups. Of these, 11 show a difference in favor of the Superior science high schools. The 4 Breadth of interest phrases show a significant difference in favor of the Superior science background high schools. The 4 Individualism phrases favor the Not Superior high school group. The 3 Scientific attitude phrases show a difference in favor of the Superior background high schools. Five phrases belonging to Factor SS, Science Communication, showed significant differences, four in favor of the Not Superior high school background group. The remaining phrases which had significant differences do not show such distinct patterning.

This suggests that students from the high schools with Superior science background have a greater Breadth of interest, are less aggresively Individualistic, are less characterized as communicative or as leaders in science activities, and are characterized as demonstrating more of a Scientific attitude.

The remaining columns of the table are used to compare the per cents of students from whom each phrase was marked Pre SSP with the per cents for whom the phrase was marked Post-SSP.

The students from the Superior science background high schools (column S) show improvement in Breadth of interest and in their Science communication skills. Those from the Not Superior science background high schools (column NS) also show distinct improvement in their Breadth of interest and their Science communication skills, but a decrease in their Work habits. The last is due perhaps to some of the other factor phrases crowding out the possibility of marking these descriptive phrases.

Data by type of program attended are shown separately for the students from Superior science background schools and for those from the Not Superior science background high schools.

Among the students from the Superior science background schools, those who went to the Orientation-type programs showed much change from before to after the SSP in their pattern of performance.

There are three factors for which the descriptive phrases showed consistent changes: Creativity, Technical interests, and Work habits. All showed a decrease, not following the pattern for the Superior background schools.

The Research-resident group from Superior science background high schools showed changes in 14 of the 140 descriptive phrases significant at the 5 per cent level or better. However, no particular pattern of change appeared. For the Course-resident group, the most noticeable change is in factor SS: communication skills. More of these phrases were marked as characteristic of these students post-SSP as compared with pre-SSP. The Course-commuter group showed 11 descriptive phrases with statistically significant

Table 43

Comparison of Pre SSP and Post SSP Descriptions of Performance of Boys (Experimental Group) by Their Teacher

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions								
					S	NS	Superior Science Background High Schools: Orienta-tion	Research (resident)	Course (resident)	Course (commuter)	Not Superior Science Background High Schools: Orienta-tion	Research (resident)	Course (resident)
1. 1. Does much outside reading-general as well as scientific.	B	51	49										
2. Is interested in both pure science and its application.	S	52	44			+					+		
3. Keeps after a problem until a satisfactory solution is found.	W	62	70			-							-
4. Tries to explain unexpected results in an experiment.	C	31	35				-	+					-
2. 1. Can express scientific ideas clearly.	SS	60	62										
2. Formulates original theories and discusses them with his teachers.	C	35	29										
3. Keeps abreast of recent scientific developments.	B	54	57				+					-	
4. Satisfies curiosity by scientific logic and fact.	S	48	51				-						
3. 1. Has attended many science conferences and fairs.	B	33	23	+	+	+			+	+		+	
2. Intensely interested in science even before entering high school.	S	73	79				-						
3. Is skillful in maintaining and repairing laboratory equipment.	T	31	47					-					
4. Prefers to deal with ideas rather than things.	C	57	48	+									
4. 1. Does a great deal of scientific reading in advanced texts and research papers.	B	44	37			+							
2. Has a good knowledge of the methods and philosophy of basic scientific research.	S	49	46		+		+	+					
3. Likes to try out new ideas in proving old ones.	C	53	57		-		-			-			
4. Not satisfied with one author's explanation or opinion, goes to several sources for confirmation.	I	47	57	-			+						

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions								
							Superior Science Background High Schools				Not Superior Science Background High Schools		
					S	NS	Orientation	Research (resident)	Course (resident)	Course (commuter)	Orientation	Research (resident)	Course (resident)
5. 1. Communicates with experts to get information.	SS	52	36	+		+							
2. Design and concept of research projects are original.	C	29	31										
3. Follows up his ideas for a project with extensive reading on the subject.	W	65	72			-						-	
4. Learns theory behind each piece of laboratory equipment as well as its operation.	S	48	55										
6. 1. Is most interested in differences of opinion among scientists working in the same field.	C	64	61										
2. Prefers reading source articles to semipopula. scientific periodicals.	S	65	66		+		+						
3. Records progress in a notebook, adds additional problems as they occur and jots down possible solutions.	W	42	44				-						
4. Scientific collection work is of a professional quality.	T	20	23										
7. 1. Has devised laboratory techniques which appear to be absolutely new.	C	4	1										
2. Is always trying another way to do something.	I	30	33				+						
3. Is taking all the mathematics and science he possibly can in his high school.	S	93	91										
4. Works diligently to reach the goals he has set for himself.	W	71	71				-						
8. 1. Is quick to devise and use short-cuts in his work.	T	60	63										
2. Shows a highly competitive drive and urge to succeed in science.	S	76	77					-		-			
3. When mathematics required are beyond his level, solution is found through unique application of known operations.	C	52	49				-						
4. Writes articles on scientific and mathematical topics with little or no assistance from the school staff.	SS	11	7				+						

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions		Superior Science Background High Schools				Not Superior Science Background High Schools		
					S	NS	Orientation	Research (resident)	Course (resident)	Course (commuter)	Orientation	Research (resident)	Course (resident)
9. 1. Doesn't hesitate to question details of techniques if he feels it is necessary.	I	52	57				+						
2. Enjoys exchanging ideas with fellow students, teachers and outside experts.	SS	58	59				-			-			
3. Is adept at using scientific source materials and references.	S	27	19	+									
4. Is quick to see relationships between one problem and another.	C	62	65										
10. 1. Has figured out more direct methods for performing traditional mathematical operations.	T	39	30	+			+						
2. Is quick to recommend improvements even in already well organized routines.	I	61	69										
3. Prefers sciences requiring rigorous proofs of basic laws.	S	43	38				-	-					
4. When given general directions for setting up a demonstration he produces it with innovations of his own.	C	54	58										
11. 1. Draws up a detailed working plan before starting on a project.	W	31	31										
2. Fosters and encourages scientific development and experimentation through discussion with fellow students and instructors.	SS	42	50										
3. He carries more than the average number of major subjects.	B	76	70			+					+		
4. He looks to either experimental evidence or reasons quoted from authorities for support of his hypotheses.	S	48	47				-				-		
12. 1. Formulates plans for projects almost as soon as they are conceived.	W	39	41										+
2. On the lookout for simpler, more economical ways of doing things.	T	55	63				+						
3. Readings in science magazines serve him as a source of ideas.	S	72	69						+				
4. Uses free time, week-ends and vacations to visit local organizations carrying out work of a scientific nature.	B	29	25										

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions: S	NS	Superior Science Background High Schools: Orientation	Research (resident)	Course (resident)	Course (commuter)	Not Superior Science Background High Schools: Orientation	Research (resident)	Course (resident)
13. 1. Attempts to prove or disprove the conclusions of authorities through own research.	I	48	45										
2. Makes trips to educational centers to broaden knowledge or ask questions.	B	44	38				-			+			
3. Repeats experiments several times to minimize the percentage of error.	W	48	60	-									
4. Tries to use mathematical induction as a method of discovery.	S	54	50				+				+		
14. 1. Has taught himself special laboratory techniques.	T	55	63										
2. Has written scientific papers describing his completed projects.	S	22	15									+	
3. Is extremely interested in modern mathematics.	B	78	80										
4. Makes his own contacts with local scientists.	SS	39	37										
15. 1. Willingly forgoes "creature comforts" for his scientific pursuits.	S	40	30	+			-	+					
2. His home life is intellectually stimulating.	B	72	71										
3. Has led group discussions of scientific topics in class.	SS	53	64	-			+		+	+			
4. Refuses to accept even a common scientific law without deriving or testing it.	I	29	29										
16. 1. Borrows copies of any and all scientific books and periodicals he can get his hands on.	B	35	33				+				-		
2. Demands proof for new ideas.	I	42	45				+						
3. Insists on understanding the operation of all apparatus used in the experimental set-up for his projects.	T	55	63				-						
4. Is good at finding pertinent material in college texts, research papers, and periodicals.	S	62	54				-						

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions: S	NS	Superior Science Background High Schools: Orienta-tion	Research (resident)	Course (resident)	Course (commuter)	Not Superior Science Background High Schools: Orienta-tion	Research (resident)	Course (resident)
17. 1. Can assemble a needed piece of equipment from a bewildering assortment of odds and ends.	T	59	63				-						
2. Has performed most of the science experiments on his own before they have been presented in class.	S	35	43				+						
3. Starts discussion groups on scientific topics.	SS	61	68		+				+				
4. Works night and day on new projects until results begin to appear.	W	36	28									-	
18. 1. If the apparatus in the lab does not satisfy him, he makes his own.	I	19	19			+						+	
2. Is the type of student a science teacher turns to when help is needed.	SS	65	74	-									
3. Reads several science publications regularly.	S	43	36				+					-	+
4. Works steadily and consistently in the laboratory.	W	67	69			-	-						
19. 1. Is quick to simplify procedures in carrying out routine tasks.	T	66	66										
2. Is respectful, but never acquiesces to authority when he thinks he is right.	I	74	78										
3. Maintains a notebook containing outlines and notes on scientific books he has read and enjoyed.	S	23	18										
4. Shows excellent planning ability and initiative in science club activities.	W	32	36										
20. 1. Chooses projects without help and works entirely on his own.	I	79	77				-						
2. Has directed mathematics or science contests.	SS	8	9		+		+		+	+	+		
3. Likes to disassemble and reassemble new equipment to see how it works.	T	56	65	-			-						
4. Scientists and scientific personnel are his favorite, sources of information.	S	50	40	+		+							

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions								
							Superior Science Background High Schools				Not Superior Science Background High Schools		
					S	NS	Orientation	Research (resident)	Course (resident)	Course (commuter)	Orientation	Research (resident)	Course (resident)
21. 1. Can translate complex ideas and concepts into terms easily understood by the average student.	SS	65	64				-			-			
2. Projects undertaken show continuity and planning.	W	59	59									-	
3. Subscribes to scientific and technical publications.	B	28	21							+			
4. When necessary material or equipment is not available endeavors .o devise his own.	C	43	52	-				+					
22. 1. Has done a great deal of study on his own in order to qualify for an honors course.	B	61	63					+					
2. Has on occasion demonstrated unique approaches in solving problems.	C	66	61										
3. Learns how to use new apparatus as soon as the opportunity presents itself.	T	53	59					-				-	
4. Sets up a control program to prevent drawing conclusions from subjective data.	W	15	21										
23. 1. Asks intelligent questions even in the face of authority.	I	82	81					-					
2. Checks fact against theory whenever the equipment is available.	W	19	18					+					
3. Shows a high degree of ability in non-science subjects.	B	72	72					-					
4. When "bugs" develop in his project, he analyzes them and is able to correct the trouble.	C	23	27										
24. 1. Has learned how to use all the instruments found in the laboratory.	T	58	50										
2. Frequently quotes from science publications.	B	35	42										
3. Methods used in gathering required materials are often unique.	C	32	33						-				
4. Serves as a consultant to fellow students in advanced mathematics and science.	SS	69	70			+		-					

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions: S	NS	Superior Science Background High Schools: Orienta-tion	Research (resident)	Course (resident)	Course (commuter)	Not Superior Science Background High Schools: Orienta-tion	Research (resident)	Course (resident)
25. 1. Can render technical matter into interesting and informative demonstrations for nontechnical students.	SS	49	65	-	-	-		-			-	-	
2. Has devised original proofs for new ideas.	C	32	25						-				
3. Has taken advanced courses in mathematics either through special high school programs or through outside or correspondence schools.	B	45	30	+	+	+	+	+	+		+	+	+
4. Makes use of the work of others without being bound by or limited to their conclusions.	I	70	79	-		-	-						
26. 1. Carries out work successfully with little resource help from teachers or others.	I	74	71										
2. Has insatiable curiosity as to the nature of his environment.	C	40	51	-	+				+				
3. Learns to use laboratory apparatus proficiently.	T	57	59		-								
4. Maintains a growing science library.	B	24	14	+		+	-					+	
27. 1. Gave up recreational period to work on scientific experiments.	W	66	66										
2. Has repaired school science apparatus in a most competent manner.	T	17	27	-			-						+
3. Has sought out, on his own, equipment which could help in teaching other students.	SS	34	30				+						
4. Is not challenged by "run-of-the mill" experiments.	C	75	68				-					-	
28. 1. Has invented proofs for various mathematical theorems.	C	35	24	+							+		-
2. Has repeated classical experiments on his own to satisfy himself regarding findings.	I	46	55	-									
3. Is an excellent tutor in mathematics and science subjects.	SS	64	65				-						
4. Works on planned schedules and spends available time after school in the laboratory.	W	47	51				-						

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	S	NS	Superior Science Background High Schools: Orienta-tion	Superior Science Background High Schools: Research (resident)	Superior Science Background High Schools: Course (resident)	Superior Science Background High Schools: Course (commuter)	Not Superior Science Background High Schools: Orienta-tion	Not Superior Science Background High Schools: Research (resident)	Not Superior Science Background High Schools: Course (resident)
					Comparisons of Pre and Post SSP Descriptions								
29. 1. Consults experts even if it is only a matter of satisfying his own curiosity.	C	48	41					-					
2. Expresses dissatisfaction with shoddy work.	I	56	62										
3. Has devised simpler approaches to a problem than those outlined in laboratory manuals.	T	32	30										
4. Repeats experiments until he finds out why he failed to get an expected result.	W	58	65							-			
30. 1. Contacts instructor very infrequently when carrying out projects.	I	80	85										-
2. Has built electronic apparatus (such as hi-fi set) from component parts.	T	25	24		+	+	-						+
3. Literary efforts have appeared frequently in school publications.	SS	19	14										
4. Would rather plan new work than gather experimental data.	C	65	65			-	-						-
31. 1. Explains solutions to problems lucidly when called upon.	SS	73	73		-	-	-	-			-	-	
2. Interested in new or unusual mathematical problems.	B	65	61				+						
3. Possesses near-professional skill in at least one laboratory specialty.	T	19	14			+	-	+			+	+	
4. Starts projects early, plans them well and carries them through to completion in advance of deadlines.	W	39	50	-									
32. 1. Explains difficult concepts to a class easily.	SS	51	50										
2. Explores topics not found in the standard curriculum.	B	52	45		+		+	+					+
3. Shows great persistence in gathering equipment and material needed for his project.	W	28	24					-					
4. Tries things himself, seeking advice or help only when needed.	I	65	76	-									

Table 43 (Continued)

Descriptive Phrases	Factor	S Pre SSP	NS Pre SSP	S vs NS	Comparisons of Pre and Post SSP Descriptions								
							Superior Science Background High Schools				Not Superior Science Background High Schools		
					S	NS	Orienta-tion	Research (resident)	Course (resident)	Course (commuter)	Orienta-tion	Research (resident)	Course (resident)
33. 1. Calls attention to flaws in student demonstrations which might affect results.	I	43	48				+						
2. Modifies standard methods to see if better product will result.	T	29	25			+							
3. Plans and outlines his work well in advance.	W	49	49										
4. Shows the same intellectual curiosity in other areas that he does in science courses.	B	74	74			-	-						-
34. 1. Arranges visits or field trips on own to gain further knowledge or to satisfy personal curiosity.	B	47	33	+	-		-						
2. Makes use of original "visual aids" in the presentation of his science report.	SS	27	39	-									
3. Prefers to construct own apparatus rather than buying it.	T	39	39										
4. Takes pleasure in working problems other students fail to solve.	I	78	84				+			+			
35. 1. Demands perfection in his own work.	W	66	63										
2. Is quick to understand the operation of mechanical devices.	T	57	65										
3. Joins groups with experimental interests.	SS	43	46		+		+						
4. To avoid "prescribed" answers, works out laboratory experiments in own way and writes own reports.	I	25	23				-						+

differences after as compared with before the Summer Science Program. These did not show any distinctive pattern.

Among the students from the Not Superior science background high schools, the pattern of impact of the SSP is similar to that of the students from the Superior science background schools, with the addition of increased Technical interests and a decrease in Work habits.

Increase in Technical interests is characteristic of all groups of students. Increase in Breadth of interest is also characteristic of all three groups for which sufficient data were available. Among the students who attended Research-resident types of SSP's there was a decrease in the frequency of marking the Work habits factor.

Table 44 shows the mean factor scores for both Forms B and E, Pre and Post SSP, by Superior and Not Superior high school background, for students in different types of programs. Two kinds of comparisons of data in this table have pertinence:

1. Comparison of Pre and Post-SSP mean factor scores of groups, and

2. Comparisons of mean factor scores of groups so as to characterize differences among them.

Of the 52 comparisons of Pre and Post SSP mean factor scores for Form B, 13 are the 5% level of confidence or better. These may be briefly summarized as follows:

Boys from Superior science background high schools who attended

- Orientation type SSPs had a lower mean score for S: Scientific attitude and higher for SS: communication after SSP than before.

- Course-resident SSP's had lower mean scores for I: Individualism and lower mean scores for W: Work habits after SSP than before.

- Course-commuter SSP's, had a higher mean score for B: breadth of interest, and lower mean scores for C: Creativity and I: Individualism following attendance at SSP than before.

Boys from Not Superior science background high schools who attended

- Orientation SSP's showed lower mean factor scores for B: breadth of interest and W: Work habits following attendance at SSP.

- Research-resident SSP's, showed a higher mean score for B: breadth of interest and T: technical interests and a lower mean for S: Scientific attitude after attending SSP than before.

- Course-resident SSP's showed a higher mean score for factor SS: Communication skills after SSP than before.

For the 42 pre and post SSP comparisons for Factor mean scores from Form E, 11 were significant at the 5% level of confidence or better. These differences are summarized briefly as follows:

Boys from Superior science background high schools who attended

- Orientation SSP's had lower mean scores for factors C: creativity and W: work habits following attendance at SSP than before.

- Research-resident SSP's showed a lower mean for SS: communication skills and a higher mean for W: work habits following attendance at SSP than before.

- Course-resident SSP's, had higher a mean score for SS: Communication skills, and lower mean scores for C: creativity, T: technical interest and W: work habits after attending SSP than before.

Boys from Not Superior science background high schools who attended

- Orientation SSP's showed a lower mean score for W: Work habits after attendance at SSP than before.

- Course-resident SSP's showed higher mean scores for B: Breadth of interest and S: Scientific attitude following attendance at SSP than before.

Estimation of the relative potency of the high school science background and kind of program has not been made. That there is some real pertinence in the kind of program attended or the kind of students who are drawn to a given type of program can be inferred from Table 45, because the difference in factor means for Superior and Not Superior science background high schools does not show a close similarity to the difference in factor means of the sub groups, divided according to kind of SSP attended. B: breadth of interest, as reported by teachers (Form E) shows a decrease for Superior science high school background boys and an increase for those from Not superior science background boys following SSP. Four other comparisons out of the 28 possible, are significant at the 5% level of confidence or better. These are:

- Boys from Not Superior science background high schools reporting on their own performance (Form B) show higher mean scores for SS: communication skills and T: technical interests after SSP than before.

- Boys from Superior science background high schools (Form B) had a lower I: Individualism mean score after SSP than before.

- Boys from Not Superior science background high schools (Form E) had a lower mean for W: work habits after SSP than before.

The above discussion raises questions regarding the differences among students attending the different kinds of SSP's. To obtain one estimate of such differences, the tabulation of times each phrase was marked by a teacher (Form E) in describing a boy who later attended SSP was reviewed. For each phrase the kind of SSP for which the phrase had the highest frequency was marked (+) and the least frequency (-). The phrases for which the difference between these two extreme relative frequencies was significant at the 5% level of confidence or better were retained and are summarized in Table 46. There are noticeably greater differences among the boys attending different kinds of SSP's who came from Superior science background high schools than among those who came from Not Superior science background high schools.

Table 44

Mean Factor Scores For Boys - Experimental Group
For Different Kinds of Programs

Form	Pre/Post SSP	HS Background S/NS	Kind of Program*	B Breadth of Interest	C Creativity	I Individualism	S Scientific Attitude	SS Communication Skills	T Technical	W Work Habits	No. Cases
B	Pre	S	B	9.2	10.0	11.5	10.7	8.7	9.8	8.8	42
			C	9.8	9.1	11.0	10.6	10.2	9.5	9.6	48
			D	9.2	9.8	12.1	10.3	9.6	9.9	8.7	72
			E	9.9	10.1	12.0	10.2	8.8	9.6	8.7	48
B	Post	S	B	9.2	9.8	11.6	9.8	10.0	9.8	8.8	40
			C	10.2	9.3	10.4	10.1	9.6	10.0	9.5	42
			D	10.0	9.7	11.5	10.0	9.9	9.9	8.1	61
			E	10.8	9.4	11.0	11.0	9.3	9.3	8.4	42
B	Pre	NS	A	8.6	8.6	12.0	10.0	8.9	9.6	10.2	18
			B	10.3	9.7	11.7	9.9	9.4	10.0	9.3	69
			C	7.6	10.1	12.5	9.8	9.2	10.0	8.9	65
			D	9.1	9.1	11.2	10.2	8.6	9.7	8.8	53
B	Post	NS	B	9.4	9.6	11.6	10.0	9.8	10.4	8.6	54
			C	9.4	9.6	12.2	9.1	9.6	10.9	8.9	55
			D	9.1	9.6	11.3	9.9	9.8	10.3	8.9	45
E	Pre	S	B	10.8	8.8	10.9	10.3	10.4	9.3	10.8	49
			C	9.9	7.9	10.7	9.9	8.8	9.1	9.8	45
			D	11.1	9.6	10.9	10.4	9.0	8.8	10.6	70
			E	10.4	9.4	11.4	10.0	9.5	8.0	8.9	44
E	Post	S	B	10.4	7.9	10.8	9.8	10.2	8.7	9.2	39
			C	10.4	8.3	10.6	10.1	7.7	9.5	10.6	37
			D	10.9	8.7	10.8	10.6	10.3	8.1	9.7	63
			E	10.4	9.7	11.4	10.4	9.7	8.4	8.7	42
E	Pre	NS	A	8.4	8.2	11.6	9.6	9.0	7.6	10.6	20
			B	9.7	8.8	11.7	9.5	10.2	9.7	10.0	59
			C	9.5	9.0	11.8	9.6	9.8	10.3	9.8	61
			D	9.6	8.6	11.8	9.5	10.0	8.6	9.7	53
E	Post	NS	B	9.7	8.6	11.7	10.0	9.7	10.0	9.0	54
			C	9.9	9.0	11.7	9.6	9.5	10.0	9.3	58
			D	10.3	8.4	11.4	10.4	9.4	9.1	9.3	38

*A includes the SSP's for Negro students, B indicates Orientation Program, C is Research-resident, D is Course-resident, and E is Course-commuter.

Table 45

Mean Factor Scores for Boys - Experimental Groups

Form	Pre/ Post SSP	High School Background S/NS	Mean Scores For Factors B Breadth of Interest	C Creativity	I Individualism	S Scientific Attitude	SS Communication Skills	T Technical	W Work Habits	No. Cases
B	Pre	S	9.45	9.79	11.73	10.34	9.39	9.73	8.94	220
B	Post	S	9.87	9.53	11.16	10.15	9.66	9.89	8.61	198
B	Pre	NS	8.97	9.65	11.84	9.93	9.12	9.97	9.08	224
B	Post	NS	9.10	9.73	11.81	9.58	9.67	10.54	8.81	179
E	Pre	S	11.97	9.00	11.01	10.23	9.40	8.82	9.39	223
E	Post	S	10.43	8.76	10.96	10.34	9.61	8.71	9.48	191
E	Pre	NS	9.39	8.80	11.70	9.59	9.81	9.40	9.78	207
E	Post	NS	9.91	8.67	11.60	9.82	9.56	9.75	9.17	174

Table 46

Patterns of Performance of Students Reported By Their Teachers (Form E, Part I) By Level of Science Background of High School And Kind of SSP Attended

High School Science Background	Factor	Orientation +	Orientation -	Research resident +	Research resident -	Course resident +	Course resident -	Course Commuter +	Course Commuter -
Students From Superior Science Background High Schools	B: Breadth of Interest		2	5	1	3	1		6
	C: Creativity	2	1	2	3	2	2	2	2
	I: Individualism	2	2	4	1		1	3	4
	S: Scientific Attitude	2	3	3	2	4	4		1
	SS: Communication Skills	7	2	3	5	1	1	5	7
	T: Technical	3	2	1	1	1	1	1	2
	W: Work Habits	1	2	5		1	1	3	7
Students From Not Superior Science Background High Schools	B: Breadth of Interest	1			1				
	C: Creativity		1	2			1		
	I: Individualism		1	2			1		
	S: Scientific Attitude			1	1	1	1		
	SS: Communication Skills	1	1	1		1	1		
	T: Technical	2		2	1		3		
	W: Work Habits	3			1		2		

The different groups may be characterized as follows:

For boys from Superior science background high schools, those who attended:

- Orientation SSP's were described as high in SS: Communication skills
- Research-resident SSP's were described as high in these factors: B: Breadth of interest, I: Individualism, and W: Work habits.
- Course-Commuter SSP's were lower in factors B: Breadth of interest and W: Work habits.

For boys from Not Superior science background high schools, those who attended:

- Orientation SSP's were higher in factors T: Technical interests and W: Work habits.
- Research-resident SSP's were stronger in factors C: Creativity and I: Individualism.
- Course-resident SSP's were weaker in factors T: Technical interests and W: Work habits.

Among the boys from the Superior science background high schools the Research-resident and Course-commuter patterns are somewhat opposites, while in the Not Superior science background groups the Orientation and Course-resident groups show somewhat opposite patterns.

VIII

FURTHER EDUCATIONAL PLANS

The further educational plans of the students are shown in Table 47. Questions about such plans were asked on May 1960, before the SSP, and again in January 1961, several months after the SSP. These questions were asked of all the participants in the study, both Experimental and Comparison.

Practically all of the participants in the Experimental group in this study expect to graduate from high school in May or June 1961. They were selected in fact because they had been accepted for attendance at a summer science program, were finishing their Junior year in May 1960, and were planning to return to their high schools to finish their high school Senior year.

The courses which they plan to take during their senior year in high school leaned heavily to mathematics and sciences. The most popular mathematics courses were trigonometry, solid geometry, and college algebra. In the sciences, physics and chemistry were the most frequent choices. Among the foreign languages, French came first with Latin next. The last six columns of the table reflect the changes from before SSP to the January following SSP. It is particularly interesting to note the decrease among the boys, Experimental group, who are taking solid geometry. This may be due to shifting career goals from engineering to the sciences on the assumption that solid geometry is frequently put in as a college entrance requirement for engineering while other mathematics might appear more important for the sciences. There is a slight increase in the boys planning to take college algebra or advanced algebra but not sufficient to be statistically significant. The plans regarding science courses seem to follow fairly close to schedule.

Practically all of the students in all groups, both Experimental and Comparison, plan to attend college after graduation from high school. Three out of five of them plan to go to some college other than the SSP college, while almost one out of five plan to go to his own SSP college. The college which the students would "like most to attend" is, in at least half the cases, the same as the one they planned to attend. Just over 40% named some college other than the one they planned to attend as the one they would prefer.

The fields in which the students planned to major in college, as of the end of their high school Junior year, are shown. More planned to major in the physical sciences than any other one area, followed by engineering, (almost exclusively a male vocational aim), mathematics and then biological sciences (largely a female vocational field). Those giving no answer presumably had not made up their minds. Considerably more girls than boys are included in this category. It is interesting to note that, as of the middle of their 12th grade, following the SSP, there were no significant changes in choice of major areas or fields. As of the end of the 11th grade, almost none had applied to college for admission. It is not known whether the few who said they had applied for admission had applied for early entrance, or had only stated an intention. By the middle of their Senior year of course, many had applied and quite a few had been accepted. Almost all planned to go on to college right after high school.

Question 14, "How much education do you expect to obtain during your lifetime?" - within this group a substantial proportion, 83% of the boys and 61% of the girls planned advanced study after college - that is, beyond the bachelor's degree. Distinctly more boys than girls planned to go ahead with such study. This planning is consistent with the educational patterns of fathers and mothers of these students and presumably reflects a cultural pattern. There is no difference between boys and girls in the way they expect to pay for the major part of their college costs. About a third say that parents will pay the costs. Another third are looking forward to scholarships.

The occupations they expect actually to follow are not inconsistent with the college major plans. More of the girls than boys plan to go into teaching and distinctly more boys than girls plan to go into engineering. More girls than boys expect to be biological scientists. The gross vocational plans do not seem to have been affected by the SSP experience. This, in itself, is to be expected since those who attended the summer programs had already said rather strongly at that time that they intended to go into science and these aims do persist.

In reply to the question, "If you could do just as you please what would you really like to be doing 10 to 15 years from now?", the largest change for the girls is the increase in those who indicate that being a housewife or mother is what they really hope for. This response is in line with reactions of women in a study of Science Talent Search participants* fifteen years later. (Many of these women had achieved considerable status as scientists but those who had not married frequently expressed feelings of unfulfillment. On the other hand, others had happily combined the role of scientist with that of wife and mother.) There is a drop in the number of boys who would go into engineering and perhaps an increase - the largest increase - in those who would go into some non-scientific occupation. Their reasons for this basically are that they think it is interesting - they like it.

"At what age did you make up your mind concerning the profession you would now like to follow?" It is interesting to note that as of the end of the 11th grade about one fourth indicated ages 12 to 14. A few more indicated the ages 15 to 16 and about a fifth of them had not made up their minds. After the Summer Science Program, midway through the 12th grade, there must have been some changes in their recollection or feelings as to when their minds had been made up regarding their professional aims. There was a distinct increase in the proportions who answered "after age 16," by those in the Control groups as well as Experimental groups. Perhaps the approach of high school graduation forced some clarification of vocational aims and change of facts which might be recalled. There was a decrease in the numbers who felt that they had made their decision between the ages of 12 and 14.

* Edgerton, Harold A., Science Talent, Its Early Identification and Continuing Development, 1961, Science Service, Inc.

Table 47

Educational Plans

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-2; I-14	When do you expect to graduate from high school?													
1	May or June, 1961	99	97	0	0	0	0	0	0	0	0	0	0	0
2	Prior to May, 1961	1	2	0	0	0	0	0	0	0	0	0	0	0
3	After June, 1961	0	1	0	0	0	0	0	0	0	0	0	0	0
4	No Data or Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0
I-3; I-15	Please list each of the courses which you plan to take during your senior year in high school.													
1	Algebra	3	7	0	0	0	0	0	0	0	0	0	0	0
2	Solid Geometry	39	26	MM	0	0	0	0	--	0	0	0	0	0
3	Trigonometry	57	55	0	0	0	EE	E	0	0	0	0	0	-
4	College Algebra, Advanced Algebra	16	18	0	C	0	0	0	+	0	0	0	0	0
5	Analytical Geometry	7	3	0	0	0	0	0	0	0	0	0	0	0
6	Mathematical Analysis	6	3	0	0	0	0	0	0	0	0	0	0	0
7	Introduction to Calculus	9	6	0	0	0	0	0	0	0	0	0	0	0
8	Other Mathematics	25	25	0	0	0	0	0	0	0	0	0	0	0
9	Plane Geometry	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	No Math Course Listed	6	9	0	0	0	CC	CC	0	0	0	0	0	0
1	General Science	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Biology	2	3	0	0	0	0	0	0	0	0	0	0	0
3	Chemistry	29	28	0	0	0	0	0	0	0	0	0	0	0
4	Physics	63	62	0	0	0	0	EE	0	0	0	0	0	0
5	Advanced General Science	1	0	0	0	0	0	0	0	0	0	0	0	0
6	Advanced Biology	2	2	0	0	0	0	0	0	0	0	0	0	0
7	Advanced Chemistry	5	5	0	0	0	0	0	0	0	0	0	0	0
8	Advanced Physics	2	2	0	0	0	0	0	0	0	0	0	0	0
9	Earth Science, Geology	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Other Science	7	4	0	0	0	0	0	0	0	0	0	0	0
Y	No Science Course Listed	5	9	0	0	0	0	CC	0	0	0	0	0	0
1	French	13	22	F	0	0	0	0	0	-	0	0	0	0
2	German	11	3	MM	EE	0	0	0	0	0	0	0	0	0
3	Spanish	7	9	0	0	0	0	0	0	0	0	0	0	0
4	Russian	0	1	0	0	0	0	0	0	0	0	0	0	0
5	Latin	10	13	0	0	0	0	0	0	0	0	0	0	0
6	Greek	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Other Foreign Language or Language not named	1	2	0	0	0	0	0	0	0	0	0	0	0
Y	No Foreign Language Listed	59	52	0	CC	0	0	0	0	+	+	0	0	0
I-4; I-16	Do you plan to attend college after graduation from high school?													
1	Yes	100	98	0	0	0	0	0	0	0	0	0	0	0
2	No	0	2	0	0	0	0	0	0	0	0	0	0	0
X	No Data	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 47 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Exp. vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-6; I-18	Name of college you plan to attend.													
	1 Don't plan to go	0	2	0	0	0	0	0	0	0	0	0	0	0
	2 Plan to go to SSP College	18	17	0	0	0	0	0	0	0	0	0	0	0
	3 College other than SSP College	59	60	0	C	0	0	0	+	-	+	0	0	0
	4 Plan to go but no college named	20	21	0	E	E	0	0	--	++	-	-	0	0
	Y No Answer	3	1	0	0	0	0	0	0	-	0	0	0	0
I-7; I-19	Name of college you would most like to attend.													
	1 Same answer as #18	47	46	0	0	0	0	0	++	0	0	++	+	+
	2 Different answer from #18	42	41	0	0	E	0	0	--	0	0	--	-	0
	Y No Data or Don't Plan to Attend; Undecided.	11	13	0	0	0	0	0	0	0	0	0	0	0
I-8; I-20	What do you plan to major in in college?													
	1 Don't plan to go	0	1	0	0	0	0	0	0	0	0	0	0	0
	2 Physical Sciences	29	23	0	0	E	0	EE	0	0	0	0	0	0
	3 Biological Sciences	4	15	F	0	0	0	0	0	0	0	0	0	0
	4 Mathematics	14	16	0	0	0	0	M	0	0	0	0	0	0
	5 Engineering	26	1	MM	0	0	0	0	0	0	0	0	0	0
	6 Pre-Medical or Pre-Dental	10	6	0	0	0	0	0	0	0	0	0	0	0
	7 Business Administration	0	0	0	0	0	0	0	0	0	0	0	0	0
	8 Education	0	5	0	0	0	0	0	0	0	0	0	0	0
	9 Social Science	0	4	0	0	0	0	0	0	0	0	0	0	0
	Y No Data	16	29	FF	0	CC	0	C	0	0	0	0	0	0
I-9; I-21	What do you plan to major in in college?													
	1 Liberal Arts	2	2	0	0	0	0	0	0	0	0	0	0	0
	2 Fine Arts	0	2	0	0	0	0	0	0	0	0	0	0	0
	3 Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0
	4 Nursing	0	5	0	0	0	0	0	0	0	0	0	0	0
	5 Home Economics	0	1	0	0	0	0	0	0	0	0	0	0	0
	6 Pre-Theology	1	0	0	0	0	0	0	0	0	0	0	0	0
	7 Not sure yet	11	16	0	0	0	0	0	0	0	0	0	0	0
	8 A program not listed above	3	6	0	0	0	0	0	0	0	0	0	0	0
	X No Data	83	69	MM	0	EE	0	EE	0	0	+	0	+	0
I-10; I-22	To how many colleges have you applied for admission?													
	1 None	96	95	0	0	0	0	0	--	--	--	--	--	--
	2 One	1	4	0	0	0	0	0	++	++	++	++	++	++
	3 Two	0	0	0	0	0	0	0	++	++	++	++	++	++
	4 Three	1	0	0	0	0	0	0	++	++	[illegible]	++	0	0
	5 Four	0	0	0	0	0	0	0	++	0	0	0	0	0
	6 Five or more	0	0	0	0	0	0	0	++	0	0	0	0	0
	X No Data	1	1	0	0	0	0	0	-	0	0	0	0	0

Table 47 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-11; I-23	Have you been accepted by any colleges?													
	1 Yes	1	1	0	0	0	0	0	++	++	++	++	++	++
	2 No	4	3	0	0	0	0	0	++	++	++	++	++	++
	3 Have not applied	93	95	0	0	-	0	0	--	--	--	--	--	--
	X No Data	2	1	0	0	0	0	0	0	0	0	0	0	0
I-13; I-25	When do you expect to start college?													
	1 Right after high school	96	96	0	0	0	0	0	0	0	0	0	0	0
	2 After completing Military Service	1	0	0	0	0	0	0	0	0	0	0	0	0
	3 After I have worked a few years	0	1	0	0	0	0	0	0	0	0	0	0	0
	4 Sometime in the future, but my plans aren't definite	2	2	0	0	0	0	0	0	0	0	0	0	0
	5 Don't plan to go	0	1	0	0	0	0	0	0	0	0	0	0	0
	X No Data	0	0	0	0	0	0	0	0	0	0	0	0	0
I-14; I-26	How much education do you expect to obtain during your lifetime?													
	1 High school	0	0	0	0	0	0	0	0	0	0	0	0	0
	2 Some college	0	2	0	0	0	0	0	0	0	0	0	0	0
	3 Graduate from college	16	36	FF	0	CC	0	0	0	0	0	0	0	+
	4 Advanced study after college	83	61	MM	0	EE	0	0	0	0	0	0	0	-
	X No Data	1	2	0	0	0	0	0	0	0	0	0	0	0
I-15; I-27	How do you plan to pay for the <u>major</u> part of your college costs?													
	1 Don't plan to go	0	2	0	0	0	0	0	0	0	0	0	0	0
	2 Parents will pay costs	32	33	0	0	0	0	0	0	0	++	0	+	0
	3 Loans from college loan fund	3	2	0	0	0	0	0	0	0	0	0	0	0
	4 Scholarships	33	36	0	0	E	0	E	0	0	0	0	0	0
	5 Work my way through	9	10	0	0	0	0	0	0	0	0	0	0	0
	6 Savings from part-time or summer work	7	2	0	E	0	0	0	0	0	0	0	0	0
	7 Don't Know	14	11	0	0	0	0	0	0	0	0	0	0	0
	X No Data	2	4	0	0	0	0	0	0	0	0	0	0	0
I-21; I-28	What occupation do you actually expect to follow?													
	1 Physical scientist	25	19	0	0	E	0	E	0	0	0	0	0	0
	2 Biological scientist	3	8	0	0	0	0	0	0	0	0	0	0	0
	3 Unspecified science occupation	5	7	0	0	0	0	0	0	0	0	0	0	0
	4 Mathematician	9	10	0	0	0	E	E	0	0	0	0	0	0
	5 Engineer	28	2	MM	0	0	0	0	0	-	0	0	0	0
	6 Medical	11	15	0	0	0	0	C	0	0	0	0	0	0
	7 Occupation other than science	7	10	0	C	CC	0	0	0	0	0	0	0	0
	8 Teacher	5	21	FF	0	0	0	0	0	0	0	0	0	0
	9 Housewife, Mother	0	1	0	0	0	0	0	0	0	0	0	0	0
	0 Travel, Retire	0	0	0	0	0	0	0	0	0	0	0	0	0
	X No Data, Don't Know	7	7	0	0	0	0	0	0	0	0	0	0	0

Table 47 (Continued)

Forms H; A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-22; I-29	If you could do just as you please, what would you really like to be doing 10 to 15 years from now?													
1	Physical scientist	24	15	M	0	EE	0	0	0	0	0	0	0	0
2	Biological scientist	2	5	0	0	0	0	0	0	0	0	0	0	0
3	Unspecified science occupation	13	9	0	0	0	0	0	0	0	0	0	-	0
4	Mathematician	6	5	0	0	0	0	0	0	0	0	0	0	0
5	Engineer	16	1	MM	0	0	0	0	0	0	0	0	0	0
6	Medical	11	13	0	0	0	0	0	0	0	0	0	0	0
7	Occupation other than science	15	11	0	0	C	0	0	0	0	0	0	0	0
8	Teacher	5	11	0	0	0	0	0	0	0	0	0	0	0
9	Housewife, Mother	0	25	FF	0	0	0	0	0	0	0	0	0	0
0	Travel, Retire	2	1	0	0	0	0	0	0	0	0	0	0	0
Y	No Data, Don't Know	7	6	0	0	0	0	0	0	0	0	0	0	0
I-23; I-30	Why would you like to be doing this?													
1	Like it, Think it's interesting	49	47	0	0	0	0	0	0	0	0	0	0	0
2	Serves society, Altruistic motives	9	14	0	0	0	0	0	0	0	0	0	0	0
3	Father's occupation, Previous experience in job	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Promising future in field, Opportunities	11	2	M	0	0	0	0	0	0	0	0	0	0
5	Challenging, Exciting	7	3	0	0	0	0	0	0	0	0	0	0	0
6	Best qualified for this	5	1	0	0	0	0	0	0	0	0	0	0	0
7	Housewife, Mother, A Woman's place	0	13	FF	0	0	0	0	0	0	0	0	+	0
8	Don't Know	0	1	0	0	0	0	0	0	0	0	0	0	0
9	Miscellaneous	10	9	0	0	C	0	0	0	-	--	0	0	0
X	No Data	8	8	0	0	0	0	0	0	0	0	0	0	0
I-24; I-31	At what age did you make up your mind concerning the profession you would now like to follow?													
1	At age 11 or earlier	9	7	0	0	0	0	0	0	0	0	0	0	0
2	Age 12-14	23	27	0	0	0	0	0	-	-	-	0	0	0
3	Age 15-16	36	31	0	0	0	C	0	0	0	0	0	-	-
4	After age 16	10	11	0	0	0	0	0	++	++	++	++	+	++
5	I have not as yet made up my mind	20	22	0	0	0	E	0	0	0	0	0	0	0
X	No Data	2	2	0	0	0	0	0	0	0	0	0	0	0
I-25; I-32	What course have you liked least in high school?													
1	Modern Foreign Language	10	5	0	0	0	0	0	0	0	0	0	0	0
2	Latin, Greek	11	8	0	0	0	0	0	0	0	0	0	0	0
3	English	21	10	M	0	C	0	0	0	0	0	0	0	0
4	History and/or social studies	25	33	0	0	0	0	0	0	0	0	0	0	0
5	Science	3	5	0	0	0	0	0	0	0	0	0	+	0
6	Mathematics	2	7	0	0	0	C	0	0	0	0	0	0	0
7	Other	23	26	0	0	EE	0	0	0	0	0	0	0	0
8	None	2	2	0	0	C	0	0	0	0	0	0	0	0
X	No Data	2	5	0	0	0	0	0	0	0	0	0	0	0
I-26; I-33	What course have you liked most in high school?													
1	Modern Foreign Language	0	1	0	0	0	0	0	0	0	0	0	0	0
2	Latin, Greek	1	1	0	0	0	0	0	0	0	0	0	0	0
3	English	2	5	0	0	0	0	0	0	0	0	0	0	0
4	History and/or social studies	2	2	0	0	0	0	0	0	0	0	0	0	0
5	Science	48	57	F	0	0	E	0	0	0	0	0	0	0
6	Mathematics	44	31	MM	0	0	0	E	0	-	--	0	0	0
7	Other	2	2	0	0	0	0	0	0	0	0	0	0	0
8	None	0	0	0	0	0	0	0	0	0	0	0	0	0
X	No Data	1	2	0	0	0	0	0	0	0	0	0	0	0

Table 47 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Experimental vs. Control (Pre) Male E vs 2	Experimental vs. Control (Pre) Female E vs C1	Experimental vs. Control (Pre) Female E vs C2	Comparisons Before & After SSP Male E	Comparisons Before & After SSP Male C1	Comparisons Before & After SSP Male C2	Comparisons Before & After SSP Female E	Comparisons Before & After SSP Female C1	Comparisons Before & After SSP Female C2
I-27; I-41	Check here the extra-curricular activities and organizations in which you are now participating.													
	1 School publications	26	41	FF	0	0	E	E	++	+	++	++	++	+
	2 Music: Bank, orchestra, glee club, etc.	38	43	0	0	E	0	0	0	0	0	0	0	0
	3 Athletics	43	31	MM	C	C	0	0	0	0	0	0	0	0
	4 High school science and/or math club	49	41	0	0	E	0	E	+	0	+	0	0	0
	5 Foreign language club	22	27	0	0	0	0	0	0	0	-	0	0	0
	6 Dramatics	14	18	0	0	0	0	0	0	0	0	0	0	0
	7 Religious groups	52	68	FF	0	E	0	0	0	0	0	0	0	0
	8 Y.M.C.A., Y.W.C.A., Y.M.H.A., etc.	11	23	FF	0	0	0	0	0	0	0	0	0	0
	9 Scouts	19	12	0	0	0	0	0	0	0	0	0	0	0
	X No Data	5	2	0	0	0	0	0	0	0	0	0	0	0
I-28; I-42	Check here the extra-curricular activities and organizations in which you are now participating.													
	1 Student Government	26	34	0	0	0	0	0	++	0	+	0	0	0
	2 Speech or debating clubs	14	10	0	0	0	0	0	0	0	0	0	0	0
	3 Social clubs	17	38	FF	0	0	0	0	0	0	0	0	0	0
	4 Science fairs	27	26	0	0	EE	0	E	0	0	0	0	0	0
	5 Boys Clubs of America	1	0	0	0	0	0	0	0	0	0	0	0	0
	6 4-H Clubs	6	7	0	0	0	0	0	0	0	0	0	0	0
	7 Service clubs	20	29	F	0	0	0	0	++	0	0	0	0	0
	8 None	3	1	0	0	0	0	0	0	0	0	0	0	0
	9 Other	32	39	0	0	EE	0	0	++	++	++	0	0	0
	X No Data	17	14	0	0	CC	0	0	0	0	--	0	0	0
I-29; I-74	Name here the one hobby in which you have been most active this year.													
	1 Outdoor scientific	3	2	0	0	0	0	0	0	0	0	0	0	0
	2 Outdoor nonscientific, non-sport	4	3	0	0	0	0	0	0	0	0	0	0	+
	3 Indoor scientific (include ham radio)	22	9	MM	0	E	0	0	0	0	0	0	0	0
	4 Indoor nonscientific-nonsport	29	46	FF	0	0	E	0	++	++	+	++	++	0
	5 Team sport	6	1	M	0	0	0	0	0	0	0	0	0	0
	6 Individual sport	19	7	MM	0	0	0	0	--	0	0	0	0	0
	7 Miscellaneous	11	25	FF	0	0	0	0	--	--	0	--	--	--
	8 None	1	1	0	0	0	0	0	0	0	0	0	0	0
	X No Data	5	7	0	0	0	0	0	0	0	0	0	0	0
I-41; I-97	In what course did you have the best teacher?													
	1 Modern foreign languages	3	2	0	0	0	0	0	0	0	0	0	0	0
	2 Latin, Greek	3	6	0	0	0	0	0	0	0	0	0	0	0
	3 English	12	17	0	0	0	CC	0	0	0	0	0	0	0
	4 History and/or social studies	6	4	0	0	0	CC	0	0	0	0	0	0	+
	5 Science	30	34	0	0	0	0	0	0	0	0	0	0	0
	6 Mathematics	43	35	0	0	0	0	0	0	-	0	0	0	0
	7 Other	2	1	0	0	0	0	0	0	0	0	0	0	0
	8 None	0	0	0	0	0	0	0	0	0	0	0	0	0
	X No Data	2	1	0	0	0	0	0	0	0	0	0	0	0

Table 47 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-42; I-98	In what course did you have the worst teacher?													
1	Modern foreign languages	7	5	0	0	0	0	0	0	0	0	+	0	0
2	Latin, Greek	7	6	0	0	0	0	0	0	0	0	0	0	0
3	English	25	25	0	0	0	0	0	0	0	0	-	0	0
4	History, and/or social studies	22	17	0	E	0	0	0	0	0	0	++	0	0
5	Science	15	14	0	0	0	0	0	0	0	0	0	0	0
6	Mathematics	9	11	0	0	0	0	0	0	0	0	0	0	0
7	Other	9	16	0	0	0	0	0	0	0	0	-	0	0
8	None	2	2	0	0	0	0	0	0	0	0	0	0	0
X	No Data	4	3	0	0	0	0	0	0	0	0	0	0	0
I-43; I-87	Are there any living scientists in your family?													
1	Yes	14	18	0	0	0	0	0	0	0	0	0	0	0
2	No	86	82	0	0	0	0	0	0	0	0	0	0	0
X	No Data	1	1	0	0	0	0	0	0	0	0	0	0	0
I-44; I-88	Relationship to you.													
1	Brother	1	1	0	0	0	0	0	0	0	0	0	0	0
2	Sister	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Father	3	6	0	0	0	0	0	0	0	0	0	0	0
4	Mother	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Uncle or Aunt	6	7	0	0	0	0	0	0	0	0	0	0	0
6	Cousin	4	3	0	0	0	0	0	0	0	0	0	0	0
7	Grandparent	0	0	0	0	0	0	0	0	0	0	0	0	0
8	No Data and "No" to #87	86	83	0	0	0	0	0	0	0	0	0	0	0
Y	No Data and "Yes" to #87 or No Data for #87	0	0	0	0	0	0	0	0	0	0	0	0	0
I-45; I-89	Occupation													
1	Physical scientist	7	11	0	0	0	0	0	0	0	0	0	0	0
2	Biological scientist	1	2	0	0	0	0	0	0	0	0	0	0	0
3	Social scientist	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Mathematician	0	1	0	0	0	0	0	0	0	0	0	0	0
5	Engineer	3	1	0	0	0	0	0	0	0	0	0	0	0
6	Physician	1	1	0	0	0	0	0	0	0	0	0	0	0
7	Non-scientist	1	2	0	0	0	0	0	0	0	0	0	0	0
8	Science student	0	0	0	0	0	0	0	0	0	0	0	0	0
X	No Data	87	84	0	0	0	0	0	0	0	0	0	0	0
I-50; I-94	What one person has been most influential in the development of your interest in science or math?													
1	Parent	17	17	0	0	0	0	0	0	0	0	0	0	0
2	Relative other than parent	5	4	0	0	0	0	0	0	0	0	0	0	0
3	Science and/or math teacher	60	70	F	0	0	0	0	0	0	0	0	0	0
4	No one person	3	1	0	0	0	0	0	0	0	0	0	0	0
5	Me, myself, No one special	4	2	0	0	0	0	0	0	0	0	0	0	0
6	Teacher - non-science	1	1	0	0	0	0	0	0	0	0	0	0	0
7	Other school personnel	1	1	0	0	0	0	0	0	0	0	0	0	0
8	Miscellaneous	5	4	0	0	0	0	0	0	0	0	0	0	0
9	None	0	0	0	0	0	0	0	0	0	0	0	0	0
X	No Data	4	2	0	0	0	0	0	0	0	0	0	0	0

Table 47 (Continued)

Forms (H; A)	Item	% Response (Experimental) Male	Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-51; I-95	How did this person influence you?													
	1 Good teacher, Made course interesting	30	45	FF	0	0	0	0	++	0	+	0	0	0
	2 Encouragement (Must imply individual attention)	20	22	0	0	0	E	0	++	0	0	0	0	0
	3 Encouraged me to study	8	5	0	0	0	0	0	--	0	0	0	-	0
	4 Discussing the field, Explaining science as career	10	9	0	0	0	0	0	0	0	0	0	0	0
	5 Giving outside work, Additional problems	6	4	0	0	0	0	0	0	0	0	0	0	0
	6 No specific reason given	1	1	0	0	0	0	0	0	0	0	0	0	0
	7 Miscellaneous	15	9	0	0	0	0	0	-	0	0	0	0	0
	X No Data	10	6	0	0	CC	0	C	0	0	0	0	0	0
I-52; I-99	On the average how much do you study outside of class?													
	1 None	1	0	0	0	0	0	0	0	0	0	0	0	0
	2 About 1-4 hours per week	11	6	0	0	0	0	0	0	0	0	0	0	0
	3 About 5-9 hours per week	23	19	0	0	0	0	0	0	0	0	0	0	0
	4 About 10-14 hours per week	31	31	0	0	0	0	0	0	0	0	-	0	0
	5 About 15-19 hours per week	15	27	FF	0	0	0	0	0	0	0	0	0	0
	6 About 20 or more hours per week	18	17	0	C	0	0	0	0	0	0	0	0	0
	X No Data	0	0	0	0	0	0	0	0	0	0	0	0	0
I-53; I-100	Do you study alone more than you study with someone else?													
	1 Yes	87	97	0	0	0	0	0	0	0	0	0	0	0
	2 No	3	3	0	0	0	0	0	0	0	0	0	0	0
	X No Data	0	0	0	0	0	0	0	0	0	0	0	0	0
I-54; I-101	How often do you help someone else with their homework?													
	1 Never	6	5	0	0	0	0	0	0	0	0	0	0	0
	2 Perhaps once a week or less	39	45	0	0	0	0	0	0	0	0	0	0	0
	3 Twice a week	23	19	0	0	0	0	0	0	0	0	0	0	0
	4 Three or more times a week	32	31	0	0	0	0	0	0	0	0	0	0	0
	X No Data													
I-55; I-102	Do your parents help you with your school work?													
	1 Very little	38	49	F	0	0	0	0	0	0	0	0	0	0
	2 Some, but not very much	16	18	0	0	0	0	0	0	0	-	0	0	0
	3 Quite a bit	1	1	0	0	0	0	0	0	0	0	0	0	0
	4 A great deal	0	0	0	0	0	0	0	0	0	0	0	0	0
	5 I never ask them for help	45	31	MM	0	0	0	0	0	0	+	0	0	0
	X No Data	1	0	0	0	0	0	0	0	0	0	0	0	0
I-56; I-103	How much money have you earned so far during your high school career?													
	1 None	8	24	FF	0	0	0	0	0	0	0	0	-	0
	2 Less than $100	25	35	F	E	EE	0	0	0	0	0	0	0	0
	3 Between $100-299	24	25	0	0	0	0	0	0	0	0	0	0	0
	4 $300-499	14	11	0	0	C	0	0	0	0	0	0	0	0
	5 $500-999	19	3	MM	0	0	0	0	0	0	0	0	0	0
	6 $1,000 or over	11	1	MM	0	0	0	0	0	++	++	0	+	0
	X No Data	0	0	0	0	0	0	0	0	0	0	0	0	0
I-57; I-104	How many books are in your own science library?													
	1 1-10	44	48	0	0	0	E	0	--	0	-	0	0	0
	2 11-25	27	15	MM	0	EE	0	0	0	0	+	0	0	0
	3 26-50	8	3	0	0	0	0	0	0	0	0	0	0	0
	4 51-75	2	2	0	0	0	0	0	0	0	0	0	0	0
	5 76-100	1	0	0	0	0	0	0	0	0	0	0	0	0
	6 100 or more	2	2	0	0	0	0	0	0	0	0	0	0	0
	7 I have no science library	15	29	FF	0	CC	CC	0	0	0	0	-	0	0
	X No Data	1	1	0	0	0	0	0	0	0	0	0	0	0

Table 47 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-58; I-105	In the past twelve months which of the following types of books have you read, not including those required for school.													
	1 Recent Fiction	57	75	FF	0	0	EE	0	++	0	0	0	0	0
	2 Classical Fiction	52	74	FF	0	E	E	0	++	0	0	0	0	0
	3 Popular Science	45	29	MM	EE	E	0	0	0	0	0	0	0	0
	4 General Non-Fiction, Philosophy	34	34	0	0	0	0	0	++	0	+	++	0	0
	5 Biography, Autobiography	40	69	FF	0	0	0	0	0	0	0	0	0	0
	6 Science - Mathematics text books	61	49	MM	EE	EE	E	EE	0	0	0	0	0	0
	7 History, World affairs	33	47	FF	0	0	0	0	++	0	0	0	0	0
	8 Religious	25	42	FF	0	0	0	0	0	0	0	0	0	0
	9 Science Fiction	48	35	MM	EE	E	0	0	0	0	0	0	0	0
	X No Data	2	0	0	0	0	0	0	0	0	0	0	0	0
I-59; I-106	In the past twelve months which of the following types of books have you read not including those required for school?													
	1 Humor	49	55	0	0	0	0	0	0	0	0	0	0	0
	2 Advanced science	37	18	MM	0	EE	0	0	0	0	0	0	0	0
	3 Technical ("Do-it-yourself")	22	6	MM	0	0	0	0	0	0	0	0	0	0
	4 Sports	32	9	MM	0	CC	0	0	0	0	0	0	0	0
	5 Mystery	37	39	0	0	0	0	0	-	-	0	0	0	0
	X No Data	17	26	F	0	0	0	0	0	0	0	0	0	0
I-60; I-107	What magazines do you receive regularly in your home? (Number)													
	1 One Magazine	6	5	0	0	0	0	0	0	0	0	0	0	0
	2 Two Magazines	14	16	0	0	0	0	0	0	0	0	0	0	0
	3 Three Magazines	18	13	0	0	0	0	0	0	0	0	0	0	0
	4 Four Magazines	18	15	0	0	0	0	0	0	0	0	0	0	0
	5 Five Magazines	14	20	0	0	0	0	0	0	0	0	0	0	0
	6 Six Magazines	9	13	0	0	0	0	0	0	0	0	0	0	0
	7 Seven Magazines	6	6	0	0	0	0	0	0	0	0	0	0	0
	8 Eight Magazines	4	4	0	0	0	0	0	0	0	0	0	0	0
	9 Nine or More	6	11	0	0	0	0	0	0	0	0	0	0	0
	0 None	0	0	0	0	0	0	0	0	0	0	0	0	0
	X No Data	4	3	0	0	0	0	0	0	0	0	0	0	0
I-61; I-108	1 Science Magazine mentioned	50	33	MM	E	E	0	EE	0	0	0	0	0	0
	2 No Science Magazine mentioned	45	63	FF	0	0	0	CC	0	0	+	0	0	0
	X No Data or None	5	4	0	0	0	0	0	0	0	0	0	0	0
I-62; I-109	To what magazines do you personally subscribe? (Number)													
	1 One Magazine	35	35	0	E	0	0	0	0	0	0	0	0	+
	2 Two Magazines	19	18	0	0	0	0	0	0	0	0	0	0	0
	3 Three Magazines or more	10	7	0	0	0	0	0	0	0	0	0	0	0
	0 None	0	0	0	0	0	0	0	0	0	0	0	0	0
	X No Data	33	41	0	0	C	0	0	0	0	0	0	-	0
I-63; I-110	1 Science Magazine mentioned	36	13	MM	0	0	0	0	0	0	0	0	0	0
	2 No Science Magazine mentioned	30	47	FF	0	0	E	0	0	0	0	0	+	0
	X No Data or None	34	41	0	0	C	0	0	0	0	0	0	-	0

Table 47 (Continued)

Forms H A	Item	% Response (Experimental) Male	% Response (Experimental) Female	Male vs. Female (Pre)	Experimental vs. Control (Pre) Male E vs C1	Male E vs C2	Female E vs C1	Female E vs C2	Comparisons Before & After SSP Male E	Male C1	Male C2	Female E	Female C1	Female C2
I-64; I-113	Do you have any kind of science lab or science equipment at home?													
	1 Yes	51	26	MM	0	EE	0	0	0	0	0	0	0	0
	2 No	49	73	FF	0	C	0	0	0	0	0	0	0	0
	X No Data	0	2	0	0	0	0	0	0	0	0	0	0	0
I-65; I-114	If "Yes" describe it briefly.													
	1 Chemistry and microscope	6	5	0	0	0	0	0	0	0	0	0	0	0
	2 Chemical only	20	10	M	0	0	0	0	0	0	0	0	0	0
	3 Microscope only, Biological	7	6	0	0	0	0	0	0	-	0	0	0	0
	4 Electronic, Radio	14	2	MM	0	0	0	0	0	-	0	0	0	0
	5 Photographic	1	2	0	0	0	0	0	0	0	0	0	0	0
	6 Miscellaneous	14	8	0	0	0	0	0	-	-	0	0	0	0
	7 Chemistry and Physics	0	0	0	0	0	0	0	0	0	0	0	0	0
	8 Two or more sciences	0	0	0	0	0	0	0	0	0	0	0	0	0
	X No Data	50	73	FF	0	CC	0	0	0	0	0	0	0	0
I-66; I-115	When you're about 35 years old, about how much do you expect to be earning per year?													
	1 Less than $10,000 per year	24	56	FF	0	0	0	0	0	0	0	0	0	0
	2 $10,000 - $14,999 per year	43	19	MM	0	0	EE	0	0	0	0	0	-	0
	3 $15,000 - $19,999 per year	18	5	MM	0	0	0	0	0	0	0	0	0	0
	4 $20,000 or over	15	5	M	0	0	0	0	0	0	0	0	0	0
	5 Not earning	0	11	FF	0	0	0	0	0	0	0	0	0	0
	X No Data	2	5	0	0	0	0	0	0	0	0	0	++	+

The Courses least and most liked in high school are typical for those who are interested in science. The courses in history, social studies and English capture the most votes for least-liked studies while science and mathematics courses rank as the most-liked studies.

The chief extracurricular activities and organizations in which the students were participating at the end of their Junior year were, in order of numbers participating: religious groups, high school science or mathematics clubs, athletics, music and school publications. The fact that participation in science and/or mathematics clubs is near the top of the list is of importance. Participation in school publications showed significant increases for both boys and girls between the pre-SSP time and the post-SSP time. This is true for Control groups as well as the Experimental, and represents more the activities typical of high school seniors rather than those which might be charged to increased interest due to SSP. There were no changes in this total picture that could be particularly identified as an impact of the Summer Science Programs. Only participation in service clubs showed a significant increase for the Experimental group and not for Control groups.

Hobbies in which the students have been active this year are "indoor scientific" and "indoor non-scientific (Non-sport)." These were participated in by larger proportions of students. There was a significant increase in almost all groups - both experimental and control - in the indoor non-scientific, non-sport activities. These activities include: music, non-science reading, dramatics, and the like.

The identification of courses in which they had the best teacher is another way of measuring interests of the group. If one assumes quality of teachers to be about equal in all subjects, students will identify the course they like best as having the best teacher. Science and mathematics, in this case, are identified as having the best teachers. There were no significant changes in the reaction Before the Summer Science Program and After which seems to have any bearing on the aims of this study. The courses in which they had the worst teachers follow the same pattern as least-liked courses, English, history and the social studies.

From the point of view of family background, only 14 per cent of the boys and 18 per cent of the girls indicated there were living scientists in their families. Uncle or aunt, father and cousin, in that order, were the relationship of the scientist to the student.

The one person most influential in development of interest in science or mathematics is identified by most of the students as a science or mathematics teacher, and this even more frequently for girls than for boys. Next in order, but much less frequently, a parent has been identified in this role. These figures are comparable to those reflected for the participants in the National Science Fair and in the Annual Science Talent Search for the Westinghouse Science Scholarships and Awards. How that person influenced the student is shown.

"Good teacher, made the course interesting" is the gist of the reasons for many, and more so for girls than boys. There is a recurrence of this pattern of response, interest in the subject or course, which seems important and even more important to girls than boys. The data for this study do not define what "interesting" may mean, except a more favorable attitude for the students toward the course. Encouragement of the individual is important. Both of these kinds of influences were mentioned more frequently by boys in the Experimental group after SSP than before, while the reverse was true of the category "encouraged me to study."

The frequency distribution of hours per week studied outside of class shows the girls reporting more study hours. The comparison groups show no significant difference from the Experimental groups and no difference in pre-SSP as compared to post-SSP. These data can be assumed to be typical for superior science and mathematics students in high school, 35% of boys report less than 10 hours of outside study per week while 33% of them claim 15 hours or more. Typically those students study alone, but are quite willing to help their fellow students with homework. They seldom call on their parents for help with school work. This probably reflects an independence, but also may be because their courses are not those in which their parents have sufficient knowledge or proficiency.

Typically boys have earned more money during their high school careers than have girls. 44% of the boys earnings fall in the $300 to $1,000 category as compared to 15% of the girls. In fact, 24% of the girls report no earnings at all. At this stage of development, one may see the beginnings of personally owned libraries, in this case, science libraries. Only 15% of boys and 29% of girls report no science library. The reported libraries are small, but they are present. If having a library or size of library is related to intensity or seriousness of science interest, then the boys have a deeper interest.

The kinds of materials read adds to the picture, particularly the increase in the non-science reading of the boys in the Experimental group following SSP: recent fiction, classical fiction, general non-fiction and philosophy, history and world affairs. Only one of these four classes of reading showed an increase for any of the Control groups and one of the classifications showed a significant increase for the girls in the Experimental group. Increase in breadth of reading interests can be associated with attendance at SSP. While this could be a result of maturation, this change does not occur in the comparison groups of students who did not have the SSP experience.

Between 3 and 4 magazines appears to be the median number of the magazines received regularly in the home. Half of the boys and a third of the girls listed a science magazine among those regularly received in their homes. However, 45% of the boys and 63% of the girls listed no science magazine among those received in the home. In terms of the magazines to which the students themselves personally subscribed, about one third indicated that they subscribed to one, and about a fifth to two magazines. 36% of the boys mentioned a science magazine while only 13% of the girls did so.

Half of the boys and a fourth of the girls said they had some kind of science laboratory in their home. The kind of laboratory is indicated in the answer to Question 65.

The last question in this table, "When you are about 35 years old, how much do you expect to be earning for a year?" shows that one fourth of the boys and over half of the girls expect to be earning less than $10,000 a year, while 43 per cent of the boys and 19 per cent of the girls expect to be earning from $10,000 upwards to $15,000 a year. Attendance at a Summer Science Program seems to have had no effect on their estimate of later earnings. Earnings are not an index of creativity or productivity of scientists. Questions have been raised regarding the background of high school students to answer such a question well.

FINANCING COLLEGE EDUCATION

There is real concern regarding the problems of financing college education, especially that of such able and promising boys and girls as represented by the samples included in this study. Table 22 shows how these boys and girls viewed their problems of college financing at the middle of their senior year following the Summer Science Program. The responses of the Experimental group are compared with those of the two Comparison groups.

Almost two out of five of the students say they will need to borrow money to attend college; a little less than three out of five say they will not need to. The boys feel more secure in going into debt for their entire education and indicate higher limits. In fact, 61% of the girls as compared with 47% of the boys say, "I haven't thought about it." Over half of these students report that they have talked with a principal, counselor or teacher about financing college education. It may be noted that significantly fewer of the C-2 group of girls had talked with a counselor than was true for the Experimental group. Over two-thirds of the students had not received information through their high school about the National Defense Student Loan Program. It is entirely possible that more of them will have received information later in the spring of their senior year, but as of January in their Senior year too few had heard about this resource.

Almost all of the students - 91% of the boys and 87% of the girls indicated that they plan to apply for scholarship assistance. This is assumed to mean some sort of scholarship rather than loan. Significantly fewer of the Comparison groups of boys have such a plan than do those in the Experimental group.

There still needs to be a substantial and detailed study of how college financing is actually done in the case of such boys and girls as these. This kind of study needs to start with statements from the students and from their parents following up, year by year or perhaps at half-yearly intervals, the details of how college was financed. Much college financing appears to be inadequately planned with families and students just muddling through.

Table 48

Comparisons of Responses to Questions about Financing College Attendance, Part III, Form H. (Comparisons of Responses of Experimental and Comparison Groups, Post SSP, About Middle of Senior Year.

Item	% Response (Experimental)		Male vs. Female (Post)	Experimental vs. Control (Post)			
				Male		Female	
	Male	Female		E vs C1	E vs C2	E vs C1	E vs C2
16. Will you need to borrow money to enter college.							
1. Yes	37	40	0	0	0	0	0
2. No	59	54	0	0	0	0	0
X No Answer	3	5	0	0	0	0	0
17. How much do you feel you can go into debt safely for your entire education?							
1. Under $500	4	7	0	0	0	0	0
2. $500 - $999	7	7	0	0	0	0	0
3. $1000 - $1999	11	5	M	0	0	0	0
4. $2000 - $2999	10	7	0	0	0	0	0
5. $3999 - $5999	14	8	M	0	0	0	0
6. $6000 or More	6	1	0	0	0	0	0
Y I haven't thought about it.	47	61	FF	0	0	0	0
X No Data	1	4	0	0	0	0	0
18. Has anyone such as a high school principal, counselor or teacher talked with you about financing your college education?							
1. Yes	51	62	0	0	0	0	EE
2. No	49	37	0	0	0	0	CC
Y No Answer	0	0	0	0	0	0	0
19. Have you received information through your high school about the National Defense Student Loan Program?							
1. Yes	29	33	0	0	0	0	0
2. No	70	66	0	0	0	0	0
X No Data	0	0	0	0	0	0	0
20. Do you plan to apply for scholarship assistance?							
1. Yes	91	87	0	EE	EE	0	E
2. No	9	11	0	0	0	0	0
X No Data	1	1	0	0	0	0	0

Appendix A.

OBSERVERS

Who Visited the 18 Summer Science Programs

Dr. Paul Reynolds, Dean
College of Liberal Arts
Florida State University
Tallahassee, Florida

Dr. Morris Meister, President
Bronx Community College
120 East 184 Street
Bronx, New York

Dr. Fletcher Watson
Professor of Science Education
Graduate School of Education
Harvard University
Cambridge, Massachusetts

Dr. Robin Anderson
Professor of Chemistry
University of Texas
Austin, Texas

Dr. Paul Saltman
Professor of Biochemistry
School of Medicine
University of Southern Calif.
Los Angeles, California

Dr. Theodore F. Andrews
Professor of Biology
Kansas State Teachers College
Emporia, Kansas

Dr. John W. Breukelman
Professor of Biology
Kansas State Teachers College
Emporia, Kansas