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ABSTRACT

The 1959 National Science Foundation Summer Science Training for High-Ability Secondary School Students Program contained 117 programs offered by 105 institutions in 37 states and Puerto Rico. For this report, 11 of the 117 programs were selected for visits by an observer highly trained and experienced in mathematics and/or science education. In addition, two questionnaires were administered to the students attending the 11 sample programs. The backgrounds of these 418 high-ability students are described. The programs, which were designed by the institutions with little NSF involvement, incorporated both classroom and laboratory experience and covered the biological and physical sciences and mathematics. In general, the observers were impressed by the interest and enthusiasm displayed by the students and staff. Plans and recommendations for future programs are discussed. Sample student questionnaires are included. (BB)

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 and Co., Inc., New York, N.Y.

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PART A - INTRODUCTION

In October 1958, in its effort to encourage the scientific interests of high-ability secondary school students, the National Science Foundation offered to support a number of programs designed to provide opportunities for such students to study and work with experienced scientists and mathematicians during the summer of 1959. Proposals for these programs were to be drawn from colleges, universities and other non-profit research and higher educational institutions. No fixed pattern for the proposed programs was prescribed. The proposing institutions were encouraged to develop their own methods for achieving the desired results. A wide variety in the proposals was anticipated such as classroom courses, field trips, orientation lectures, laboratory visits, and research participation. For each program the National Science Foundation was prepared to support:

1. Some or all of student participant room, board, travel and related expenses.

2. Direct costs of the sponsoring institutions, such as salaries, necessary expenses, and supply costs.

3. An allowance to cover indirect costs to the institution. (1)

In its announcement of the 1959 "Summer Science Training Program for High-Ability Secondary School Students," the National Science Foundation listed 117 programs offered by 105 institutions in 37 of the 50 United States and in Puerto Rico. These programs represented potential training for more than 5,700 high-ability students. As was anticipated, the programs varied widely in fields covered, durations, methodologies used, administrative arrangements, and the like. (1) The following statement from the National Science Foundation Announcement summarizes the broad purposes of the program: "The training offered by this program is designed to provide the superior high school student with educational experiences in science and mathematics beyond that normally available

(1) Statistical summaries of the 117 programs listed in the National Science Foundation Announcement are presented in Appendix A as Charts A-1 through A-7. Information is given relating to fields of study, geographical distribution, duration, numbers of students, research and non-research programs, commuter and non-commuter programs, and proposal ratings.

in high school courses. It will permit superior students to take advantage of the resources of colleges and universities through special programs developed by these institutions and conducted by their faculties. The Foundation program is intended to supplement and encourage numerous efforts, private and public, previously carried out on a limited scale in order to provide nationwide opportunities for this type of summer training to high-ability secondary school students."

Since the program was essentially experimental, the National Science Foundation was interested in gathering objective evaluations of the separate programs and of the effectiveness with which the expressed goals were achieved. To this end, the Foundation requested evaluative information from three sources to assist it in determining future policy:

1. The host institutions were asked to supply the Foundation at the close of their programs with reports covering their activities, evaluations of educational achievements, and financial accountings.

2. The National Science Foundation staff was asked to carry out an extensive visiting program to the grantee institutions. In these visits staff members were to be especially alert to problems of program policy and the administration of the program as it affected the grantees.

3. Outside consulting organizations were employed to make independent evaluations of the summer science programs and to plan and recommend detailed schemes for the continuing and long-range evaluation of such programs.

The report which follows presents the findings and recommendations of one of the consulting organizations so employed.

PART B - THE PLAN OF STUDY

The National Science Foundation requested two basic reports from its outside consultants:

1. A preliminary evaluation of the effectiveness of the 1959 summer program.

2. A detailed plan for the continuing and long-range evaluation of this and subsequent programs.

In the consulting organization a Principal Investigator and supporting professional staff were assigned to the project. In addition, an Advisory Committee was formed to provide expert advice and counsel to the Principal Investigator throughout the study. The composition of this Advisory Committee was as follows:

Position	Specialty
Dean - College of Arts and Sciences	Genetics
Professor of Mathematics Education (2)	Mathematics
College President - ex-High School Principal	Physics
Professor of Science Education	Astronomy
Professor of Mathematics (3)	Mathematics

In addition, members of the National Science Foundation attended all of the Advisory Committee meetings, and thereby became valuable additions to the advisory body.

At the initial meeting of the Advisory Committee in June 1959, the entire projected program was examined and evaluation techniques discussed. The following procedure was selected for the study:

1. Sample. A sample of eleven programs would be selected from the 117 offered throughout the country. The sample would be so selected as to be representative of the 117.

(2) Advisor only.
(3) Observer only.

2. Observer Visits. Each of the eleven sample programs would be visited by an Observer - a man highly trained in science and/or mathematics and in education, and possessing extensive experience in those fields. As noted on page 3, four Observers were actually used.

The Observers generally spent two full days at each school. Although they were free to look into any phase of the program they thought appropriate, they were provided with an "Observer's Schedule" (4), outlining areas which were to be examined in systematic fashion. A copy of the Observer's Schedule was sent to each school in advance of the Observer's visit to inform the Director and his staff of the scope of the topics to be observed and discussed.

Before each visit, the Observer was supplied with all available information and materials concerning the school and its program. After the visit, using the Observer's Schedule as an outline, the Observer made a full report of his findings. In preparing these reports, the Observers recorded their observations on dictating machine tapes.

Each Observer was also asked to interview at least two randomly selected students during his visit. The areas covered in these interviews were left to the Observer and were reported as adjuncts to his general observations.

3. Student Questionnaires. In order to obtain statistical descriptions of the students attending the eleven sample institutions and some idea of their attitudes and opinions towards the program, two questionnaires were administered to all the participating students in the eleven sample institutions:

The "RBH Personal History Questionnaire for High School Boys (Form A)" (5) was used to obtain general background information on the students. This questionnaire also yielded a "social acceptability" score for which normative data were available.

A "Summer Science Program Student Questionnaire" (5), especially designed for the study, tried to get at more specific characteristics of high-ability science students

(4) A copy of the "Observer's Schedule" is included in Appendix B.
(5) Copies of these two questionnaires are included in Appendix B.

and ways in which such students reacted to their summer experiences. To this end "write in" responses were widely encouraged in this questionnaire.

These sources - Observer reports and student questionnaires - were to provide the basic data for the preliminary evaluation of the 1959 program.

The results of the preliminary evaluation affected to a large degree the development of the plan for continuing and long-range evaluation. Early in the study, however, work was begun on the construction of a "Student Performance Description." It was hoped that such a forced-choice performance check-list would prove useful in "before" and "after" studies of the participating students and their controls. The construction of this form and the development of the long-range evaluation plan is described in "A Recommendation for the Long-Range Evaluation of the National Science Foundation's 'Summer Science Training Program for High-Ability Secondary School Students.'" This report - which sequentially constitutes the last Part of this study - has been published and distributed separately.

In mid-October 1959, a final meeting of the Advisory Committee was held. The purpose of this two-day meeting was critically to review the Observer findings and to discuss in detail considerations bearing on the design and implementation of a continuing, long-range follow-up evaluation plan.

This report in large describes the results of the preliminary evaluation of the effectiveness of the 1959 summer science program. The detailed plan for continuing and long-range evaluation is to be found as stated above in a separate report.

PART C - THE SCHOOL AND STUDENT SAMPLES

I The Schools

In selecting the sample of eleven schools to be studied, major emphasis was placed on choosing a group whose programs would be representative of the kinds of programs being offered throughout the nation. Secondarily, factors such as residence - non-residence and research - non-research were balanced as closely as possible. Lastly, for administrative and economic reasons, the geographical area of the sample was restricted to the Eastern seaboard of the U. S. That this limitation was not overly restrictive may be judged by the fact that these Eastern seaboard states offered 48 programs or 41% of the total sponsored by the National Science Foundation program.

The following tabulation summarizes the procedure of selecting the sample:

Subject Matter of Program	Residence	Non-Residence	Total	Select	Total E. S'b'd	Final Selection
Physical Sciences	16 (3)	11 (1)	27 (4)	3	11 (2)	2
Biol. Sciences	12 (3)	8 (1)	20 (4)	2 (1)	10 (4)	2 (1)
Mult-Sciences	18 (1)	1	19 (1)	2	6	2
Mixed Science plus Math	12	2	14	1	4	1
Mathematics	8 (1)	3	11 (1)	1	3	2
Mixed Sciences	8	1	9	1	7	1
Physical Science plus Math	4	4	8	1	2	1
All Others	8	1	9	-	5	-
Totals	86 (8)	31 (2)	117 (10)	11 (1)	48 (6)	11 (1)
Select	8 (1)	3	11 (1)	X	X	X

NOTE: The figures in parentheses denote number of research programs which are included in the totals.

Actually, two school samples were drawn: a preferred sample and an alternate sample. The alternate sample closely matched the preferred sample and was to be substituted in those cases where the preferred schools could not be studied. The final sample studied was as follows:

Name of School	Location	Type of Program	Number of Students
Stetson University	Deland, Florida	Mathematics	59
Assumption College	Worcester, Mass.	Mathematics	40
Rutgers University	New Brunswick, N. J.	Physical Sci-Math	60
Roswell Park Memorial Institute (R)	Buffalo, New York	Biological Science	25
University of Bridgeport	Bridgeport, Conn.	Multiple Sciences	35
Bennett College	Greensboro, N. C.	Mixed Sci-Math	97
University of Florida	Gainesville, Florida	Multiple Sciences	25
Hunter College (C)	New York, N. Y.	Biological Science	22
New York University (C)	New York, N. Y.	Physical Science	15
Howard University	Washington, D. C.	Mixed Sciences	20
Columbia University	Camp Columbia, Conn.	Physical Science	20
		TOTALS	418

(R) Research program (C) Commuter program

The school sample, then, was selected on the basis of data contained in the Foundation's Announcement of the 1959 program. It should be noted, however, that the information contained in the Announcement was not always complete or correct. For example, in relation to only this sample of eleven schools, the following discrepancies were noted on receiving the Observer's comments:

1. The Rutgers program was not a combination of physics and mathematics. If anything, since it was sponsored by the School of Agriculture, it should have been classified as biological science or multiple sciences.
2. In addition to Roswell Park Memorial Institute's program, the program of Rutgers University, University of Florida, New York University and Howard University were also basically of the research participation type.
3. Although not so listed, the Roswell Park Memorial Institute and Howard University programs were, for all intents and purposes commuter programs.
4. Although not so listed, the Assumption College, Rutgers University, University of Bridgeport and Columbia University programs were for boys only.

In view of these differences, therefore, it is not possible to be certain how accurately the sample reflected the total span of programs. Assuming that the characteristics of the non-sample schools varied as widely as those of the sample schools, however, it may be valid to assume that the eleven schools selected were representative of the total program.

II. The Students

A total of 418 students were in attendance at the eleven institutions included in the study sample. Of these 293 (70%) were boys and 125 (30%) were girls. In the pages which follow the backgrounds of these students will be described in some detail. Since little or no comparative data are immediately available, the background information on these high-ability students will of necessity be largely descriptive in nature.

The 418 students represented 313 different high schools throughout the country. Some 83% of these high schools were represented by one student only. In the remaining 17%, each school was represented by anywhere from two to sixteen students - 9% by two students, 4% by three students, 2% by four students, and 2% by five or more students. It is thus quite apparent that in making their selections the program Directors succeeded in getting a rather broad coverage of the high schools in their areas, (see Chart C-1).

About 27% of the student participants attended programs held in their home towns, 47% attended programs held within 100 miles of their homes, and 26% were attending institutions located more than 100 miles from their homes. In this connection it was interesting to note that only seven of the participants attended high schools which were not located in their home towns. (See Chart C-2.)

The average age of the students was 16 years - the girls being slightly older on the average than the boys (16.1 years). Twenty-three percent of the group was 15 years of age or less while 77% was 16 years of age or more. The absolute ages ranged from 12 years to 19 years. (See Chart C-3.)

The high school grade levels (last grade completed) of the students involved ranged from the eighth grade to twelfth grade. A total of 2% were graduating eighth graders, 3% had just finished their freshman year, 14% sophomore, 69% junior, and 12% had completed their senior year. Thus the majority (88%) were scheduled to return to their high schools after program attendance. In one program, 13 juniors however, indicated that tenative plans had been made to enter college on a one year early admission basis. The two earliest grade levels mentioned consisted of boys enrolled in a single mathematics program. Five students actually at mid-year status, were included in the following year for statistical purposes - that is, a mid-year junior was counted as having completed the junior year. (See Chart C-4.)

Almost all (99%) of the student participants stated that they were planning to attend college. About 40% of these were to be sent by their parents while approximately 60% intended to pay at least part of their expenses. Only 2 female students indicated that they would probably attend business schools (See Chart C-5).

Anticipated college courses were listed in 98% of the cases - only 2% being undecided or of no opinion. As can be noted in Chart C-6, in 36% of the cases science was the proposed study, in 17% mathematics, in 14% engineering, in 12% medical science and, in 18%, other studies. Where specific sciences were mentioned, physical science was the preference in 77% of the cases and biological science in 23% of the cases. As might be expected the girls tended to shy away from engineering studies - showing a more marked preference for the less technical programs (See Chart C-6).

In connection with Chart C-6, almost 30% of the students listed two or more contemplated college programs. If these double choices are plotted, some rather interesting findings result:

Anticipated College Course of Study

Double Listing	Males	Females	Total
Science-Math	44%	35%	41%
Science-Engineering	19	-	12
Science-Science	6	19	11
Science-Other	8	23	13
Math-Engineering	12	-	8
Math-Other	2	9	5
Engineering-Engineering	1	-	1
Engineering-Other	4	-	2
Other-Other	4	14	7
Totals	100%	100%	100%

From the above tabulation the following may be noted:

1. There was a marked fluidity in the choice of either science or mathematics.

2. A significant proportion of the boys - while liking the idea of "pure" science or mathematics - also listed engineering as a sort of economic "ace in the hole."

3. A good deal of fluidity existed from science to science - i.e. either physics or chemistry.

4. The girls showed a marked tendency to list an "other" field of study in addition to a science or mathematics, indicating less certainty on the part of girls regarding college studies in science or mathematics.

Approximately 11% of the students were quite sure of the work they planned to take, 71% were in the process of decision, and 18% had made no decision. These proportions were characteristic of both the boys and the girls (See Chart C-7).

Next the students were asked to list the first and second occupational areas which they were planning to enter. Although the details are given in Chart C-8, a convenient summary is as follows:

Occupation	First Choice	Second Choice
Pure or Applied Science	29%	29%
Pure or Applied Mathematics	8	10
Research or Applied Medicine	22	9
Engineering	20	17
Other Occupations	21	35
Totals	100%	100%

(Excluded here are the "undecided," "don't know" and "no answer" responses. As might be expected these were more frequent in listing secondary occupational choices.)

As is noted above, proportions of students contemplating careers in science, mathematics, and engineering remain fairly constant whether a first or second choice is involved. Not many students, however, list medicine as a second choice while significant numbers shift from science-math occupations to essentially non-technical preferences.

Comparing occupational preferences with anticipated college studies, it appears that a number of students have shifted their objectives from pure science or math programs into the more concrete areas of medicine or engineering.

It can be noted that almost half of the students interested in science, mathematics and medicine in their first choices showed a preference for "pure" or research work. In the second choices even a higher percentage (60%) was indicated. This desire to engage in research work was most marked for the science occupations (89%), less so for the mathematics areas (33%) and least for the medical occupations (14%).

In the engineering fields, interest was mainly in the electrical, electronic, chemical and aeronautical fields. Very little interest was shown in business occupations. It is important to note, lastly, that students showing a preference for the teaching profession -- especially popular with the girls - intended to be science or mathematics instructors. (See Chart C-8.)

Chart C-9 illustrates the rather marked fluidity displayed by these students in relation to first and second occupational preferences. (See Chart C-9.)

As a final method of probing occupational intention, the students were asked "If you could do just as you please, what would you really like to be doing ten or fifteen years from now?" Interestingly enough - where the responses were serious and could be classified - the activity envisaged agreed with the first occupational preference listed in Chart C-8 in 93% of the cases. In only 7% of the cases was the long-range activity associated with the second choice.

If all responses are taken into account, it can be seen in Chart C-10 that in 57% of the cases agreement was with the first choice, 4% with the second choice and 39% showed agreement with neither the first or second choice or were facetious in nature. Some examination of the kinds of responses given, however, is of interest in that it sheds some light on the kinds of things that the students are thinking about for the future:

1. In the majority of responses the glamor of research pervaded the long-range activities of the future. The activities themselves tended to be of the "20th Century" variety, that is, atomics, chemistry, biochemistry, electronics, computers and so forth.

2. Allied with the "space age" aspects of the "20th Century" were desires to be associated with the Air Force as jet pilots, rocketmen or space scientists.

3. Many of the activities anticipated were motivated by high idealism - such as "To benefit mankind," "For the good of the human race," and the like.

4. More materials aspects, on the other hand, were sometimes mentioned. Activities insuring good pay and future - usually involving association with "a large business corporation" - were noted. A few students announced that they would like to be "retired" in ten or fifteen years.

5. Other students, apparently impressed with the academic life, expressed desires to be Professors in famous institutions of higher learning - usually teaching scientific or mathematical subjects.

6. Specific, unexpected occupations were: "politician," "baseball player," "entertainer," "writer," or "foreign service employee." A few students also showed serious intentions of entering careers in the field of religion.

7. Very significantly, 42% of the girls stated that they would like to be married and raising families ten to fifteen years from now. In about half of these cases the intention was to devote full-time to the job of wife and mother.

Before leaving the subject of future occupations, the following two comments may be worthy of note:

First, concreteness of career plans - as might be expected - was quite directly related to grade level. Thus the younger students seemed to be much hazier concerning career plans than were their older fellow students. (Most of the more idealistic or fantastic responses came from the younger group.) This being the case, it would seem that special vocational counseling attention should be directed to these students as early as possible - both in the home high school and in the course of the Summer Science Program.

Secondly, it was noted that many of the students planning careers in electrical or electronic engineering were from the New England states. Since the parents of these students were apparently not generally employed in the electrical or electronic industries, the possibility is suggested that the presence of a major industry in the home area may be a rather potent motivating force in deciding future careers in the more applied areas of endeavor. (See Chart C-10.)

That the student group was an outstanding one academically cannot be doubted. Over three-fourths of the students placed themselves in the top 5% of their high school classes and 97% at least in the top 25%. As might be expected, their high school grade averages tended to confirm these rankings. (See Charts 11 and 12.)

In their earlier school histories the students also tended to excel. Some 43% estimated that they had progressed through grammar and high school more rapidly than most students, while only 1% stated that their progress had been slower than that of others. In the eighth grade, further, the pattern of relative class standings was only slightly less impressive than that for present class standing. (See Charts 13. and 14.)

In some 28% of the cases the students indicated their school marks were equally good in all subjects, in 42% of the cases the best marks were obtained in science and/or mathematics, and in the remaining 30% of the cases the best marks were obtained in English, foreign languages, the social studies or other subjects. Where marks were not equally good in all subjects, the differences were accounted for as follows:

1. The student studied harder in some subjects than in others.

2. Some students liked one subject more than another.

3. In spite of equal application and interest, the student had greater aptitude for certain subjects than others. (See Chart 15.)

Charts C-16 through C-21 summarize the high school mathematics and science courses which the students have already taken, grades reported and the courses which they expect to take in the future. As would be expected:

1. These students tend to take more than the normal amount of science and mathematics courses.

2. Their grades in such courses are generally superior.

3. The girls tend to take somewhat less science and, especially, mathematics, than do their male counterparts.

4. Considerable experience and interest in advanced math and science courses is in evidence. (See Charts C-16 through C-21.)

In connection with the entire question of grades and science and math courses taken, the following qualitative observations may be of interest:

1. The general "goodness" of the grade averages of the student participants in one or two programs appeared to be significantly below those in other programs. In these exceptions the program Directors seemed to take scientific interest, motivation, and dedication into account more strongly than grades in their selection of borderline cases. Apparently, further, those students who were borderline in grades were doing quite well in their summer work. The problems involved, here, therefore, are:

(a) How will these highly motivated but relatively poorly graded students fare in their college work, where ever-increasing emphasis is being placed on grades, and,

(b) in selecting students for programs of this sort what relative weight should be placed on school grades and what on drive or aspiration?

The question is posed here because the definite impression is gained from study of the program as a whole that in a significant number of cases too much weight was given grades and not enough placed on motivation or interest in making student selections.

2. Course offerings in high school science and mathematics seemed to differ from area to area and within areas throughout the geographical region sampled. Thus in some high schools offerings - especially in the sciences - were limited. For example, perhaps only biology - and not zoology and botany - was offered. In like manner, the availability of advanced or "honor" courses was variable. In many cases offerings of this type appeared to be pretty much up to the initiative and enthusiasm of individual teachers working on their own time. The order in which the sciences - particularly chemistry and physics - were taken also seemed to vary. In view of the caliber of students such as those involved in this study, the rigidity of progression of such courses may be questioned - especially since they are frequently reversed from area to area.

3. The majority of the student participants had had a course in "General Science." Again in view of student caliber, it might be questioned whether or not this year of science study might not be more profitably devoted to more specific science courses.

In carrying out their studies, 5% of the students did most of their work at school, 20% divided it more or less evenly between school and home, and

67% did most of it at home. Some 8%, on the other hand, reported that they did very little studying. As regards distribution of study time, of those who gave specific responses, the tendency was to spend most time on subjects where poor marks were most likely. Fewer students stated that they spend equal amounts of time on each subject and fewer still that considerations such as teacher strictness and subject preference governed study habits. (See Charts C-22 and C-23.)

Ninety-seven per cent of the students received marks which were either as good as or better than they expected. Only 3% received grades which were not up to expectations. Of the students obtaining good marks, more than half received such marks with "little" study involved. (See Charts C-24 and C-25.)

In rating high school studies liked most, science and mathematics were tied for first place. In a rather close race for second place appeared English, foreign languages, and history. The boys tended to like science somewhat more than the girls while the reverse - surprisingly enough - was true of mathematics. Girls consistently showed a stronger preference for non-science courses than boys. On the least liked side, first place was taken by history, foreign languages, and English. Social sciences came next in order, and then sciences and mathematics. Of special interest here was the fact that several students had won honors or awards in courses that they listed as "least liked!" (See Charts C-27 and C-28.)

When asked which school subjects had influenced them most, the students tended to follow the patterns established for subject interest. Science and mathematics were rated as being most influential, and English and foreign languages somewhat less so. Next in line came art and/or music - entering as potent influences yet not listed as strong "likes." In their school careers, lastly, the students were apparently quite concerned about taking specific courses. Even on entering high school over 85% of those students who had a choice were most interested in certain courses. The remaining 15% of the more naive students were apparently not at all or mildly interested in initial make-up of their high school programs (See Charts C-29 and C-30.)

As will be noted throughout this study, the high school teaching staff exerts a very strong influence on this type of student - for good or evil. Thus the present group stated that in 75% of the cases their teachers had aroused their interest in a certain subject. Since the favorite subjects of these students were science and math, therefore, it was apparent that in a good number of cases these students were first interested in these fields by their high school teachers. On the other side of the coin, however, other teachers instilled a dislike of a certain subject in 32% of the cases. Overall, in summary, 52% of the students reported that they preferred teachers who took interest in their personal affairs. Some 29%, on the other hand, preferred teachers who didn't take special interest in their personal affairs while 19% apparently had not had extensive experience with either type of teacher approach. (See Charts C-31 and C-32.)

As might be expected of this "cream of the crop" student, almost all had won special honors, prizes and scholarships during their high school careers. As may be appreciated from examination of Charts C-33 through C-36 these kudos involved scholarship generally and in specific areas, scientific achievement, leadership ability, writing ability, athletic prowess and the like. In short, in addition to being top-notch science and math students, these Summer Science Program participants were also in most cases the leaders of their schools' extracurricular activities. Their achievements, lastly, measured up quite impressively with their aspirations in this particular area of endeavor. (See Charts C-33 through C-37.)

In the field of foreign languages, 94% of the students had studied one or more. Some 60% had studied one foreign language, 30% two, and 4% from three to six foreign languages. French and Latin were the two most widely studied languages, with Spanish and German falling lower down the list. Some students had apparently studied Hebrew in connection with religious training. The few students who studied Russian should be commended since most of them apparently did so on their own initiative. When these language studies are translated into the more practical test of reading ability, however, the impressive figures cited above tend to crumble. In spite of the courses taken, almost half of the students felt they could not read a foreign language readily, 44% that they could read one, 6% that they could read two, and 1% that they could read three or more. French was the language most commonly read, with Latin, Spanish, German and Hebrew following on the list. (See Charts C-38 and C-39.)

Although not directly concerned with science and mathematics, the foreign language picture painted even by these superior students seems somewhat disturbing. Out of 96% of the students who have studied a language only about half can read such a language even passably. (Some liberties were undoubtedly taken with the phrase "read readily"). At the same time, about half of the students had studied two or more languages! In view of this situation the following possibilities seem to suggest themselves:

1. Require that students devote all of their foreign language time to one language so that at least a working knowledge of one language may result.

2. Cease all "dabbling" in languages, and devote the students' time to other advanced subject matter areas - such as in science and/or mathematics.

The fathers' of the student participants were U. S. born in 89% of the cases, naturalized citizens in 9% of the cases, and foreigners in 1% of the cases. A last 1% of the students were not sure of their fathers' citizenship status. Some 19% of the students were only children, 41% had older brothers and/or sisters, and 77% younger brothers and/or sisters. Of those students having brothers and/or sisters, about half spent a good deal of time with their siblings while the rest did not, due to differences in ages or interests. The activities which the students carried on with their parents, brothers and sisters - individually or as a family group - appeared to be those that would be expected of normal high school students. A good deal of time was apparently spent in discussing problems with parents. In these discussion, future plans, school marks, school affairs, religious problems and adjustment problems were frequent topics of conversation. Least discussed were items such as choice of friends, personal or family financial problems, local politics and school sports. A striking number of the students seemed to come from broken homes where the parents were separated, divorced or remarried. Many seemed to be members of families which moved about the country quite frequently.

Chart C-40 gives the occupations of the fathers and mothers of the student participants. As will be noted, 18% of the fathers were professionals and 10% educators. While less mutually exclusive the rest were mainly employees in industry, commerce or government. Many fathers in these jobs were supervisors or managers. Almost 20% were wage-hour workers. Somewhat over half of the mothers were housewives. Those mothers who held them held jobs mainly in the teaching, clerical and factory operator areas. (See Chart C-40.)

The educational levels of both the fathers and the mothers ranged all the way from some grade school work to the Ph. D. Of the fathers, 40% held college or advanced degrees, 13% had had some college work, 44% had less than college educations, and 3% were of unknown educational level. Of the mothers, 29% were degree holders, 20% had had some college, 48% had less than college educations, and 3% were of indeterminate level. For the fathers who had less than college educations, the following breakdown gives some idea of the non-college levels involved:

Did not complete 8th grade	23%
Had some high school work	38
High school graduate	39
Total	100%

It would thus appear that the student participants came from families whose average educational level was well above that of the general population. (See Chart C-41.)

In connection with stimulating factors associated with the family, the students were asked whether or not any of their relatives were "scientists." Three-fourths of the students stated that they had no scientists in their families, 23% that they did and 2% neglected to answer the question. As might be expected the scientists cited were generally male relatives: 35% were uncles, 25% fathers, 19% cousins, 9% grandfathers, and so forth. Many students interpreted "scientist" to mean persons working as engineers, medical doctors, science teachers, nurses, or the like. If only scientists were counted, therefore, the total number of "scientists" would be approximately 45. (Included here would be the occupations of plant pathologist, medical researcher, color television researcher, inventor, mathematician, entomologist, physicist, professor of science and research chemist.)

Even with this restriction, however, it can be seen that at least 10% of the students had had close family relationships with people who were doing creative work in the fields of science and mathematics. (See Charts C-42 and C-43.)

In attempting to identify the person or persons who were most influential in developing the students' interests in science and mathematics it can be seen that in 60% of the cases the high school science or math teacher was the person. This tends to bear out an earlier inference, and again points to the important role the high school teacher plays in moulding student interest and motivation. The next most potent influence in the development of scientific interest was the student himself (14% of the cases) followed closely by parents (12% of the cases). In 6% of the cases other persons were influential, and in 8% no specific answer was offered. (See Chart C-44.)

On entering high school, on the other hand, choice of subjects was generally made by the student himself. Much less influential here were grade school teachers or counselors (16%) or parents (15%). This situation again tends to suggest that perhaps vocational or educational counseling should begin earlier in the student's career than is now generally the case. (See Chart C-45.)

In spite of the interest influence patterns, parents were named as being most influential in the career decision area. Farther down the line were the student himself, teachers or counselors and family friends. In like manner, vocational ambitions are discussed most frequently with parents, quite frequently with various friends, and rather infrequently in the schools. This rather marked disparity between school-influenced interest formation and home-influenced career goal formation is disturbing. Although parental counsel and advice is always needed, ideally it would seem that more follow-through from interest formation through career goal formation should be in evidence as stemming <u>from the high schools.</u> (See Charts C-46 through C-48.)

During their free time the students exhibited behavior patterns which were quite typical of normal high school students. They studied, spent time with friends, read, watched television, did chores, engaged in sports, and worked on hobbies. In helping out around the house their activities were also those to be expected: helping with meals, keeping the house and yard in order, caring for brothers and sisters and pets, and tending to the family automobile. In the evenings study required three-fourths of their time while the rest was devoted to reading for pleasure, visiting friends, working on hobbies, or talking with parents. (See Charts C-49 through C-51.)

In hobbies or pastimes, the students averaged from two to three such proclivities regularly. Sports, music, scientific studies, stamp or coin collecting, photography, reading and "do-it-yourself" electronics were most popular. In the sports category, emphasis was on individual sports (for example, tennis, bowling, swimming and golf) as opposed to team or contact sports sports (football, basketball or hockey). Over three-fourths of the sports activities named were of the individual type. In the music category two-thirds of the activity was of the active type (playing an instrument or singing in a choir) while one-third was of the passive type (listening to records jazz or concerts). In the "Games" category, it was noted that a considerable percentage of the students were chess players. (See Chart C-52.)

As has already been seen, many of the student participants were leaders of extracurricular activities. Chart C-54 summarizes briefly the kinds of activities in which the students were engaged - both in their earlier careers and during the summer. As will be noted, both boys and girls averaged three regular activities - formerly and at present: Sports, math or science clubs, musical activities, school publications, general school clubs and Science Fair activities were the extracurricular activities most frequently mentioned. In the sports field, again, about 37% of the activity was of the team contact type (such as football), about 40% was team non-contact (such as baseball) and about 23% individual (such as tennis). Of the students who took part in Scouting activities, 26% reached Cub or Tenderfoot status, 22% Second Class, 26% First Class and 26% an even higher rank. Interest in extracurricular activities was self-initiated in 61% of the cases, and generated by friends in 22% of the cases. Parents and teachers were of fairly minor importance in influencing extracurricular activities. Only 4% of all students stated they did not take part in any achool activities. It was apparent, however, that at least several of these students had recently relocated and thus had not been at their new schools long enough to join the extracurricular activities offered. (See Charts C-54 through C-58). Before leaving the topic of extracurricular activities, the following points may be of interest:

1. The variety of extracurricular activities available from high school to high school tended to vary quite widely. In some schools, in fact, it appeared that not even science or math clubs were available.

2. Larger proportions of students taking part in Scouting activities seemed to be characteristic of high schools in which extracurricular offerings were limited. This tends to suggest that Scouting was often embraced for lack of anything better to do. The fact that not one student mentioned Scouting or Scout Masters as factors influencing interests and aspirations seems to indicate that this experience has not been too powerful a stimulus to the students.

3. Several students stated that they had worked as Laboratory Assistants or on "Science Squads" in their high schools. This would indicate that at least some schools are making intelligent use of these high-ability students.

4. Some 16% of the students had been engaged in religious groups or activities. Running throughout the study is the feeling that these students were, perhaps, more deeply religious in outlook than the average high school students.

Another impression running throughout the study is that these particular students are avid readers. Charts C-59 through C-64 summarize the newspapers, magazine and book reading habits of the student participants and the sources from which these reading materials come. (See Charts C-59 through C-64.)

As to the books read, the following observations are of interest:

1. Under "Recent Fiction", tales of adventure, war stories, (Civil War to present), novels with religious themes, and works of satire and gloom were most popular. In the latter category, works by such authors as Wiley, O'Neill, Maxwell Anderson, Erskine Caldwell, Hemingway, Tennessee Williams, Steinbeck, Aldous Huxley, Orwell, Faulkner, Sinclair Lewis and Edna Ferber are included. In addition to these, a good many of the books read tended to be of a type critical of the U. S. and its way of life - for example, The Ugly American and The Hidden Persuaders.

2. Under "Classical Fiction", in addition to the "real classics", a marked interest in the great Russian writers was in evidence. Interest in Russia and Russian affairs was also noted in some of the books categorized under "General Non-fiction". Jules Verne and Edgar Allen Poe also proved to be quite popular with these students.

3. Under "Biography or Autobiography", the notables involved were generally figures from science, the military or sports.

4. The "Textbooks" cited were generally on advanced subjects and apparently utilized in home study.

5. The most popular aspects of "Popular Science" continued to be atomics, relativity and astronomy.

6. The "Technical" category included "do-it-yourself" items with heavy emphasis on radio, television, hi-fi and other electronic subjects.

7. As might be expected, the girls tended to prefer somewhat ligher fare than boys - such as romances.

Exactly half of the students reported that they were building their own home science libraries. Although most were modest in size, some appeared to be quite extensive. In some of the very large libraries, however, it may be supposed that parents' books (medical and/or engineering texts) and pamphlets and abstracts were also counted. Regarding home laboratories, on the other hand, only 23% of the students indicated that they had such installations. This figure seems low - but may be explained by the fact that some of the students may not have calssified modest collections of chemicals and the like as "laboratories". (See Charts C-65 through C-68.)

A last bit of information on the student/participants was yielded by one of the two questionnaires used in the study. This questionnaire, "The RBH Personal History Questionnaire for High School Boys (Form A)," when scored with the proper key gave a score which indicated "social acceptability" of adolescent boys among their fellows. As such, the score was an estimate of personal development in dealing with people. In the construction of the scoring keys the following criterion classifications were used:

High - Students considered as desirable as companions by their fellows.

Middle - Students not chosen as either desirable or undesirable as companions.

Low - Students considered as undesirable as companions by their fellows.

In interpreting the scores, lastly, the following expectancy table may be used:

Social Acceptability Score	Per Cent Expectancy
100 or above	95% High; 5% Middle; 0% Low
80 to 99	66% High; 18% Middle; 16% Low
50 to 79	27% High; 32% Middle; 41% Low

As can be noted from the mean scores tabulated in Chart C-69, the student participants on the average (88.4 for boys and 84.0 for girls) tended to be well above the mean as regards social acceptability. Although no real differences were noted from one type of program to another, the boys tended to score somewhat higher than the girls. This difference, however, was probably due more to the fact that the questionnaire was designed primarily for use with boys, rather than to any real sex differences in social acceptability. As might be expected, lastly, the older students tended to score somewhat higher in social acceptability than did their younger fellows. (See Chart C-69.)

PART D - SUMMARY OF THE OBSERVERS' REPORTS

1. Program Objectives

In its invitation to submit proposals, the National Science Foundation indicated only that the programs submitted "provide opportunities for high-ability secondary school students to study and work with experienced scientists and mathematicians."

The design of the various programs and the objectives to be met were thus left to the discretion of the proposing institutions. In attempting to evaluate the effectiveness of the summer science program as a whole, therefore, the first step was to examine the goals which the institutions set for their programs. Without this criterion no evaluation of achievement or lack of achievement could be carried out.

In the sections which follow, the program objectives will be examined from the points of view of the students involved, the high schools or colleges to which the students return or will soon enter, the host institutions and the faculty members participating in the programs. An examination of the institutions' motives for presenting the programs, their reasons for selecting the particular areas covered and their choice of teaching methodologies will then be described.

A. Objectives: For the Participating Students

The following data is based mainly on information gathered by the Observers in discussions with program Directors and staffs. Where the proposals from the institutions tended to supplement these observations, this information has also been included.

As might be expected the objectives cited by the institutions for their particular programs overlapped to a considerable degree. The following four goals, however, seemed basic in varying degrees to all of the programs.

1. Supplementation or Enrichment of High School Program

The attempt was to broaden and/or deepen the student's knowledge and understanding of selected topics only generally covered in the high schools.

The stress was on approach: modern versus traditional, participation versus lecture, individual versus group, and the like. Examination of basic concepts and of the interrelationships among mathematics and the several sciences, were emphasized over mere mastery of facts. In practically all of the programs there was an evident effort to avoid duplication or repetition of work normally covered in the high school program.

2. Inspiring Interest In and Motivating the Student Participants

The materials presented and the methods by which they were presented were designed to inspire the students with greater interest in science and to motivate them more strongly towards a career in science. It was hoped that this inspiration and resulting interest and motivation would be more intense than that normally engendered in the high schools - with correspondingly more intense reactions as a result.

3. Student Participant Orientation and Guidance

As a complement to the interest and motivation engendered, the programs were also expected to provide the students with valuable career orientation and guidance. Through the programs the students had a chance to see what college-level or professional science was like and thus develop more realistic attitudes towards science and scientists. In most cases a better understanding of the relationships between pure and applied science should have been forthcoming. The student's performance in the program, lastly, should have led him to a more accurate appraisal of his scientific aptitudes and interests. In short, through his experiences in the program, the student should have been in a better position to elect or reject science as a career and, in cases where the decision was positive, to have a clearer idea of the specific areas into which his talents should be directed.

4. Laboratory and/or Research Experience

In all except the two mathematics programs an effort was made to show "what a scientist does when he does it "by actual prolonged exposure of the students to the science laboratory environment. Although the sophistication of this exposure varied widely from program to program, the level above that was probably generally encountered in high school science courses. The more traditional

Although the sophistication of this exposure varied widely from program to program, the level above that was probably generally encountered in high school science courses. The more traditional exposures attempted to provide the students with a better understanding of experimental method, more refined laboratory skills, more effective methods for treatment of data collected, and the like. In the "research apprenticeship" approach, on the other hand, the students actually worked with professional scientists on original research studies, and, in a few cases, designed and carried out serious research projects with only occasional professional guidance and direction.

In addition to theses basic objectives, the following more specific objectives characteristic of certain programs might be cited:

1. Introduction of Students to a New Science and Its Techniques.

In this type of program, sciences which are not offered at the high school level or, if offered, infrequently taken were presented in accelerated fashion with heavy emphasis on the special laboratory or field techniques involved. Here, aside from the additional knowledge and skills acquired, the intent was to interest the student deeply in the science concerned in hopes he might elect the science as a career. In the present study, the two fields involved were physiology and earth science.

2. Contacts Among Students With Similar Interests and Abilities.

Although present to some degree in all of the programs, only one or two institutions cited inter-student interaction as a program objective.. In these cases it was the opinion of the institutions that much stimulation and inspiration could be generated among these high-ability students merely by providing them with sufficient opportunity to get together to discuss their present work, their past experiences, their future aspirations, and the like.

3. Early College Admission or Advanced Standing

In at least one program early admission to college and/or advanced standing in college was cited as the major objective of the program. In contrast, most of the other programs played down this possible result. Almost all, in fact, took pains to make it clear to their students that not even high school credit was envisaged as an outcome of their programs.

B. Objectives: For the High Schools to Which the Students will Return or the Colleges Which They will Soon Enter

Since some 88% of the 418 students included in the present sample were non-Seniors, it would appear that the host institutions concentrated in their selection procedures on students who would be going back to their high schools. As anticipated by the program Directors, the influence of the student participants on their home high schools would be something as follows:

1. The returning students would be more highly stimulated and motivated than when they left. They would also have acquired new knowledge and skills. Some would have demonstrated to themselves and others that they were capable of performing even at the post-graduate university level. In spite of these stimulations and accomplishments, most of the group would have developed a better attitude towards high school science. Almost all would be more serious and responsible students.

2. Once back in the high school science classrooms, these students would perform better than most of their fellow students in both classroom and laboratory work. They would tell their friends and their teachers about their summer experiences. In and out of class by the heat of intellectual excitement these students might lack tact in revealing their superior knowledge and skills and might ask difficult and even embarrassing questions. One thing is certain: these students would have changed - and both their teachers and their peers would be made well aware of these changes.

3. Out of such interaction between post-program student and teachers and peers the institutions feel improved high school science programs and science instruction would grow. The general tone of science education and teaching would be raised. Indeed, reaching beyond the high school, effects of the same interactions might reach into the community at large - focusing

public attention on the problem of dealing properly with the gifted student.

The institutions freely admitted that the process described above was a vague one. Some even doubted seriously whether any such chain-reaction - even a minor one - would occur. Their responses did imply, however, that something would happen. What the Pandora's Box thus opened might yield, they felt, was a topic worthy of close study in the immediate future.

As regards students who were going or would soon go on to college, the institutions were more positive. Here they felt these students would be much better prepared than the average student, more serious and, therefore, they would perform better in their college science studies - especially in laboratory work. Secondarily, as the influx of such well-prepared students increased, it would be hoped that better college courses would result. At least one institution hoped that having observed the quantity and quality of work which such students were capable of performing might induce some colleges to be more flexible in their policies regarding the granting of advanced standing to qualified applicants.

In summary, from the comments gathered by the Observers it appeared that the host institutions had not really devoted much time to ponder what, if any, effects their programs might have on either the high schools or the colleges. When questioned, however, program Directors and staff members foresaw greater impact on the high schools than on the colleges. Since the end-product of these impacts was seen to be better high school science programs, it might be asked why more adjustment of college programs to accomodate the better students emerging from these improved high school programs was not predicted.

C. Objectives: For the Host Institution ~~and Its~~ Participating Faculty Members

The Directors in most cases were quick to admit that one of their prime objectives in sponsoring such programs was to attract this superior individual to the host institution as a permanent post-high school student. In some cases, it was felt that this program would serve a public relations purpose in acquainting superior students with the institution's facilities in general. In others, the public relations effort was concentrated on a single science or faculty within the institution. Even when the institutions were sure their summer students had already selected other universities for their college work, it was hoped that these superior students would serve as effective "word spreaders" among their friends, teachers and acquaintances.

In a few cases, the host institutions had had past experience with such programs and were anxious that they be continued. In one or two cases these programs had been developed in conjunction with affiliated institutions at the preparatory school level.

A last general and usually sincere objective was a "missionary" feeling on the part of the host institutions that they should actively assist in any effort designed to make better provision for the high-ability science student. That the interest in this objective was a real one is deduced from the fact that many of the scientists participating in the programs were giving up valuable research time, receiving lesser salaries than they might be receiving in other summer work, and the like, in order to lend their talents to the programs. In pursuing this last objective, one or two Directors felt that better university-high school liaison might well be produced as an important by-product.

Insofar as faculty-centered objectives were concerned, three general goals could be discerned:

1. In several of the host institutions the staff realized that working with these gifted students was both stimulating and challenging. Many also had strong personal interest in observing how such students think, react and evince their superior ability. Extending this thinking in logical fashion, several of the participating instructors were anxious to learn what new methods, techniques and knowledges had to be developed to deal with students of this caliber.

2. In one or two cases the staff was frankly interested in discovering how far and how fast such students could go "at full stretch". Several were apparently highly impressed with the distances and speeds involved and were encouraged that such students might soon be members of their regular classes.

3. In at least three institutions the staff was actually conducting experiments in education. In one, the use of "modern methods" in the teaching of mathematics was tried out. In some part at least, the institution's future instructional methods at both the high school and college levels depended upon the outcome. A second school was testing "team teaching" techniques, in which college and high school instructors shared teaching duties. In this particular experiment, it was hoped that teachers at both levels could absorb valuable knowledges and techniques from observations of the other's performance. In a third institution "teacher-counselors" were being used. These "teacher-counselors" - actually outstanding high school science teachers - were present not only to relieve some of the host staff of routine counseling and question-answering duties but also, through careful observation, to learn techniques which would be of value to them in their teaching duties at their home high schools.

A fourth benefit - reaped somewhat inadvertently by the host institutions - involved the use of graduate students as instructors or research supervisors. In some of the programs high school students were assigned to post-graduate students who were in the process of carrying out summer research projects. Although "teaching" effectiveness probably varied widely, the Directors and Observers felt that enthusiasm for this type of activity was high among the graduate students involved and that this type of experience might serve as a powerful trigger to steer some of these graduate students into the teaching profession.

D. Objectives: Reasons Institutions Selected the Particular Programs Involved.

The motives underlying the selection of the types of experimental programs presented by the several institutions naturally closely reflected their formal (as submitted in the National Science Foundation proposals) and informal (as expressed to the Observers) objectives. Since this was frequently one of the first questions put to the Directors by the Observers, however, a tally of the rather brief responses may give a better picture of the institutions' motivations. A "popularity poll" of motivations in choice of programs was as follows:

1. Giving students a supplemented or enriched science or mathematics program. Included here would be research experiences and programs designed essentially to give students a foretaste of college-level science.

2. Orientation and guidance of students regarding careers in science and mathematics.

3. The general feeling that something had to be done for superior students. (Two expressions of this sentiment came from the two negro institutions included in the sample. The Directors of these programs felt that science teaching in negro high schools tended to be below average and therefore it was important to give promising students in these high schools something better. The consensus was that too few negroes enter science as a career and that a great deal of scientific potential was thus being lost. The hope was that these programs might catch some of these negro students who might otherwise be lost to science.

4. Developing greater interest in science in the students; desire to draw this type of student to the host institution permanently; desire to continue past or on-going programs of similar scope and to attempt to improve high school programs "effects" provided by returning post-program students.

5. Desire to experiment with new teaching methods; desire to help students to begin their college work a year early; desire to make use of college facilities which would otherwise be idle; desire to see just how far and how fast such high school students could go.

E. Objectives: Reasons Institutions Selected the Particular Areas of Study Included in Their Programs.

The reasons the various institutions selected the particular areas of study they did were fairly strictly limited by the following three factors:

1. Availability of instructors in a given department or departments.

2. Availability of facilities - especially laboratory or research facilities - in a given department or departments.

3. Interest of the available instructors in a given department or departments in the program and willingness to participate in the program.

Actually, in all of the institutions selection of areas of study in the programs was determined by varying combinations of the three limiting factors described above. As at least one Observer pointed out, it is no mean feat to recruit professional assistance and the parallel facilities for such a program from science or mathematics faculties normally fully occupied with their own researches. This is particularly true where the program is a large one in terms of the number of students involved and where the program is new to the campus.

In line with this, it could be inferred from the Observers' reports that staffing and general administrative difficulties were fewer in those institutions where the same or similar programs had been offered in the past. It would seem reasonable to assume, therefore, that in the event programs of this type were continued in the future, the institutions would find their jobs increasingly easier as experience and better staff acceptance was gained.

It was interesting to note, lastly, that in program selection no mention was made by the Observers of formal university-high school contacts being effected during the planning stages of the programs. One or two Directors, in fact, were emphatic in stating that local high schools had not been contacted on the matter. As has been mentioned, it was further apparent that the institutions involved took great pains to avoid duplication of high school work in their programs. This apparent lack of formal, "official" contact seemed to be palpably present throughout the study. Since both the colleges and the high schools are inextricably involved in the same basic problem it would appear that closer liaison and cooperation between the two systems would be of mutual benefit to all concerned.

F. Objectives: Reasons Institutions Selected the Particular Teaching Methods Used.

In the majority of cases the teaching methods used were those which were traditionally used by the host institutions and therefore based on their past experiences. In practically all of the programs there was a heavy stress on the individual approach - not only in the research participation programs but also in the more traditional classroom programs. Use of discussion and conference techniques was also maximized, where feasible. Reading between the lines, however, it was apparent to the Observers that the rather heavy emphasis on the laboratory-research approach and the equally marked lack of emphasis on the classroom approach was attributable at least in part to the host institutions' efforts to avoid conflicts with normal high school programs.

Several institutions moulded their teaching methods to the facilities and staff available. The Earth Science program held in a special summer camp could be an example of the first type while the true research participation programs would be representative of the second type of limitation.

Lastly, as has been mentioned, three or four institutions were carrying out distinct educational experiments. The "modern methods" in mathematics, "team teaching" and Loomis School approaches are examples of experimentation which were encountered by the Observers.

II Programs

The initial sample of schools was selected in such a manner that it would provide representative cross-section of the kinds of programs being offered. Proposals to the National Science Foundation, National Science Foundation bulletins served as source data in drawing the sample. It soon became apparent, however, that descriptions of the programs as included in the original proposals and the National Science Foundation bulletins were not completely accurate. In spite of these shortcomings, it was felt that the sample drawn did fairly represent the various programs.

Analysis of the eleven programs included in the present sample revealed three major breakdowns in the kinds of programs offered: classroom programs, classroom-laboratory programs and laboratory programs. Each of these programs will be discussed in some detail below.

A. Classroom Programs

Two programs - both in mathematics - were classified in this category. Although mathematical research or laboratory work is possible - especially in the field of computer application - such was not the case in these programs.

As the category implies, classroom learning was the basic factor in these programs. Course material was covered in lecture-discussion fashion by the instructors, and practice and facility was gained through "homework" assignments. In one program, heavy emphasis was placed on "modern methods", while in the other only partial emphasis was placed on this new development in the teaching of mathematics. Since coverage included topics at both the high school and college levels, both high school and college texts and references were used. In both programs, the numbers of students in a given section were quite small and ample opportunity for discussion and individual help existed. This was especially true in one program which used the "team teaching" technique. Classes ran from 5 to 7 hours a day and teaching was paced according to student ability. The Observer rated one program as being from "average college freshman" level to "above the level of an average course in an average college." In the other program, due to the presence of a large number of younger students down to eighth grade, the general level of difficulty was probably not as high. In both programs individual projects or special reports were required of the students and oral and/or written expositions of findings were planned.

While one of the programs described above was devoted entirely to mathematics, the other used approximately 60% of total student time in non-mathematics work - in this case, English and Reading Skills. The reason for this inclusion of non-math and non-science topics was that the mathematics program was only one portion of a larger program being sponsored by the school in question.

B. Classroom - Laboratory Programs

Four of the programs were classified in this category. Essentially they were science "courses" in which part of the work was of the classroom type and part of the laboratory skills type.

In one program students were required to take one course in mathematics plus two courses in the following sciences: Chemistry, Physics or Biology. In another program no mathematics course was required and the previous selection of sciences was expanded to include Electronics. In this case only one science was selected by the student. In the last two programs only one science was offered (Physiology and Earth Science) in each program and students had no option.

In the classroom work, objectives varied. In the single course programs, the intent was to cover up to two or more semesters of college level work. In the others - especially in the program requiring two sciences in addition to math - only selected highlights were covered. Usually these highlights were selected to illustrate important concepts, interrelationships, and the like, and to tie in closely with the presentation of laboratory methods or techniques. The teaching in these classrooms was apparently on as an advanced and sophisticated level as student capabilities allowed, and texts and references were in the majority of cases at the college or even post-graduate level. Again, thanks to small class size, there was much opportunity for class discussion and individual attention. An average of 33% to 50% of student time was spent in classroom work.

In the laboratory work the approach was fairly traditional - that is, performing pre-determined experiments. In all of the programs, however, the techniques and equipment utilized were much more refined than those normally encountered in high school. This was particularly true of the single-science programs. Although some opportunity was available in these programs for doing really creative work, little work of this type was actually accomplished. In one program, in fact, creative work was actively discouraged on the theory that true creativity cannot be achieved until the student has mastered the fundamentals. An average of 50 to 67% of total student time was spent in laboratory activities.

Lastly, field trips, lectures, and the like, were used freely in these programs to supplement and reinforce classroom and laboratory experiences.

C. Laboratory Programs

Five of the programs were classed in this category. The main feature of these programs was the assigning of high school students to professional researchers or graduate students who were working on real research studies. This experience was considered the "meat" of the program. The purpose, of course, was to allow the students to observe how real scientists operate - to see "science in the making". In addition, it was hoped that these students would be allowed and encouraged to take an active part in the research insofar as this was feasible.

Actual active participation in the on-going research varied widely both within a given program and from program to program. This variation, further, was a function of both student capability and nature of the program and of its participating researchers. In some cases participation was limited mainly to watching the researcher perform and asking him questions regarding the observed performance: At the other end of the scale were cases in which students were carrying out basic research of their own design with little or no professional direction. That this work was "real" research was attested by the fact that the results of several such studies had been published and are now a part of the scientific literature. On the whole, according to the Observers, the majority of the students in this type of program had ample opportunity to get a taste of "real" research. The professional researchers apparently went to great efforts to work their assigned students actively into their researches. As might be expected, since these were actual on-going research projects, these student experiences could not be conveniently classified as Physics, or Chemistry, activities. Instead they ran the entire gamut of pure and applied research.

In at least three of these five programs, the research participation experience was supplemented by a variety of group work. The variation here was again considerable - ranging from rather elementary "shop" courses to required attendance at lectures presented for the professional staff of a medical research institute. In general, however, good use was made of lecturers and post-lecture discussions in an attempt to bring the high school students together periodically. In general, these lectures were given by noted authorities and were usually at a high level of both depth and sophistication. In at least one instance, little or no attempt was made to supplement the students' experiences or to bring them together in seminars or lectures. Student time devoted to laboratory work thus varied from approximately 50 to 100% in this type of program.

D. Special features of the Programs

In a very real sense each program was, in itself, a "special feature". The following, however, are approaches used in the various programs which the Observers characterized as special features. Since various combinations were used in different programs no attempt is made to show in which particular combinations each was used.

1. Breadth or depth with which subject matter covered.

2. Presentation of unusual or non-high school courses (Geology, Physiology, Glass Blowing, Electronics, etc.)

3. Use of scientific laboratory apparatus not usually encountered in high schools.

4. Use of the "science apprenticeship" approach - that is, research participation.

5. Wide variety of research programs from which to select (approximately 500 in one institution).

6. Opportunities for students to initiate and carry out their own experiments or research projects.

7. Inclusion of non-science subjects in the program.

8. Use of new or experimental teaching methods.

9. Use of the "full stretch" approach to test how far and how rapidly high-ability students can go.

10. Use of the individual or tutorial approach in teaching.

11. Use of conference and seminar techniques.

12. Use of lecturers (of the advanced type actually used).

13. Use of advanced field trips tied in closely with program content.

E. Extracurricular Aspects of the Programs

In the opinion of the Observers the recreational and extracurricular facilities were more than adequate at all of the institutions visited. Depending upon the program these included: all types of sports, communal meals, movies, TV, theatricals, student lounge facilities, parties, dances, picnics, weekend trips home, visits to Professors' homes and trips to town. According to one Observer spontaneous "bull sessions" among high-ability, like-minded students were perhaps the favorite type of "recreation".

A few of the recreation programs were required activities - most were voluntary. As would be expected, organized programs were less common in the commuter programs than in the non-commuter schools. Even in the former, however, some activities were arranged and participation encouraged. In practically all the programs all the students had at least one opportunity to "get together" daily - for example, at lunch.

In general the Observers felt that acceptance of these recreational and extracurricular activities by the students was about that to be expected - enthusiasm on the part of some and less enthusiasm on the part of others. The following, however, were some of the more interesting reactions:

1. Most students felt enough - or even too much - recreational opportunity was present. Being genuinely conscientious, they felt they could not take time from their studies to participate. Thus the presence of a great variety of activities "free for the taking" tended to tempt and therefore annoy them.

2. In line with the above, some students resented the required programs. They felt too much time was being taken from their studies for sports and the like. They would apparently have preferred the activities to be on a voluntary basis.

3. Some resentment was noted concerning curfews. Many students felt them to be unrealistic - particularly some of those prevailing on week-ends.

4. Where dissatisfaction with recreation was present, the demand was usually for more social activities - for example, picnics, parties, and dances. Boys in the non-co-educational programs were especially desirous of having more opportunity to associate with the fair sex. In at least one co-educational institution, lastly, overly-rigid segregation of the sexes was rather widely resented as an insult to student intelligence and morals.

III. The Staffs

The characteristics of the individuals making up the staffs of the various programs tended to vary greatly from program to program and within a given program. The following summaries, therefore, are of necessity general.

A. Training, Qualifications and Experience

The program Directors and their Assistants were frequently men with advanced degrees in Education whose undergraduate work was in science. Typically these men had had some teaching experience and many years of experience in school administration. Several had been high school Principals, college Deans, Guidance Directors, and the like. Others, particularly those in the laboratory programs, were typically research scientists at the PhD. level - with or without extensive experience in school administration.

The level of the instructors and research supervisors varied widely from program to program and within programs. In general, however, level tended to increase from classroom to classroom-laboratory to laboratory type programs. Thus the two classroom-type programs were staffed almost entirely by high school teachers holding the Master's Degree while the laboratory type programs utilized research scientists at the PhD.

level almost exclusively - except in one program where post-graduate students were used. The amount of teaching experience also tended to vary widely - all the way from none to 40 years. In general, however, the great majority of the staffs involved - whether of high school or university backgrounds - had spent many years in the teaching profession. Although mainly from academic backgrounds, a fair number of the staff participants - especially those in the research areas - had had considerable applied research experience in government, government agency, military and industrial work.

Most of the institutions utilized special counselors or guidance personnel in their programs. These counselors were in most cases professionals with many years of experience in dealing with the guidance problems of high school students. In a few cases high school science teachers of exceptional ability were employed for this purpose.

B. Overall Ratings of the Staffs

As a part of their general observations, the Observers were asked to rate the overall quality of the Staffs involved. Although each Observer obviously had his own personal criteria, the following were the results of the ratings:

Superior or Excellent	3
Unusually or very good or high	5
Good	2
"Disturbing"	1
Total	11

In the one program rated of "disturbing" quality (not one of the classroom type programs) the Observer felt the instructors lacked clear insight into the fundamental characteristics of the areas they were teaching. Although 4 out of the 5 instructors in this program were high school teachers, the Observer seemed to imply that the lack of excellence was perhaps due to the somewhat aloof role played by the Director of the program - for example, one of the teachers had to assume the major operational responsibilities.

In summary, one of the important things the Observers' ratings seemed to say was that the number of PhD's on the staff was not necessarily directly related to the quality of teaching to be encountered in a given program.

C. Past Experience and Present Interest in Dealing with High School Students

The high school instructors employed in the various programs naturally had had a good deal of experience in dealing with high school students. Most of the counselors had also had extensive experience with the same group. Among the permanent college staffs and graduate students, however, only a small percentage had had more than smatterings of teaching high school students. Exceptions to this rule were in those cases where the institution had had past experience in similar programs for high school students.

What the staffs lacked in experience they apparently made up for in interest and enthusiasm. The Observers were uniform in their characterizations of interest on the part of staff members in the students as "extremely high", "intensely" and "enthusiastically". At least two Observers, in fact, reported they had never seen greater interest, enthusiasm and rapport among instructors towards their students than they had observed in the particular programs involved.

Probably the best proof of staff interest, however, was the fact they were participating in the program at all. As pointed out, many of these talented and busy men made real sacrifices in terms of time, effort and money in order to participate in the programs.

IV. Teaching Methods and Procedures

A. Methods

In the classroom and classroom-laboratory programs, the teaching method used was basically the lecture and discussion approach. As might be expected, more individual instruction was possible when the groups were working in the laboratories. In the laboratory programs instruction was basically on an individual basis - with student and researcher working together closely. In all types of programs lectures, discussions and seminars were used freely to supplement or pull together materials presented in the course or experience proper.

The following tabulation summarizes briefly the amount of time devoted to each type of activity:

Type of Program	Class-Lecture	Lab.-Research
Classroom Program	100%	0%
Classroom-Lab. Program	33 - 50%	50 - 67%
Laboratory Program	0% - 50%	50 - 100%

Work in both the classroom and classroom-laboratory programs was essentially organized-directed activity. In the laboratory program the type of activity varied widely depending both upon the capabilities of the students and the nature of the research programs. In short, activity varied from entirely organized-directed to almost entirely self-initiated.

B. Coverage of Subject Matter

In the classroom and classroom-laboratory programs coverage of subject matter was of two types. In both mathematics programs and in the two single science programs the emphasis was on completing spelific units of work. Such units may have been the equivalents of "An Introduction to Modern Mathematics", "Advanced High School Algebra and Trigonometry", "Physiology", "Geology I and II", as listed in hypothetical high school or college course catalogs. In the others, no attempt was made to cover full course units systematically. Instead, special topics were selected and presented in order to point up concepts and interrelationships and to tie in closely with laboratory experiments and techniques which were to be covered. Naturally this type of program was structured so that a certain continuity or unity was achieved - but "course coverage" in the traditional sense was not a goal.

In the laboratory programs no real "courses" were involved so no "course coverage" was planned. Even here, however, differences were discernible. In one program, the intent was to expose the student to at least one complete segment of a larger research study. In another the intent was to have the student complete an entire research project. In still a third program the intent was to have the student plunge into an on-going project with no particular regard for the status of the project when it came time for the student to leave. In most of these laboratory programs, however, some effort was made to tie the experiences together through the use of lectures or seminars.

C. Information Sources

According to the Observers, college level texts and reference materials were used almost exclusively in the programs. High school materials were usually used only in cases where a student's prior preparation demanded it or for "fill-in" material for students who lacked certain courses which would be of immediate benefit to him in his program work.

In the laboratory programs where texts were not usually used, the reference materials and journals required were on the college or graduate level.

All types of visual aids were used freely in the various programs - movies, film strips, slides, models, and maps. As might be expected, use of such aids was less frequent in the laboratory programs. Slides were used very frequently by staff or visiting lecturers.

D. Teaching Load

In the opinion of the Observers, teaching loads - with two exceptions - were not excessive. Most of the instructors had adequate relief and assistance. The use of full-time counselors and teacher-counselors, further, relieved the instructors of a good deal of the routine question-answering and counseling duties. Most of the participating staffs, lastly, had no regular summer teaching responsibilities to load them down.

The two exceptions mentioned involved instructors who had heavy teaching loads which were heavily sequential in character. In both of these cases a great deal of subject matter had to be covered in a limited amount of time and no relief or assistance was available. In both cases, however, the Observers felt the instructors were so well qualified and so interested in what they were doing that despite the heavy loads they were enjoying themselves.

E. Size of Classes

In those programs where classroom teaching was employed, class size ran from 10 to 20 students per class. In one program where almost 100 students were enrolled, however, class size occasionally rose to 30 to 40 students per class.

Presentations by outside lecturers, naturally, were generally given with the entire program group present.

In the laboratory portions of the classroom-laboratory programs and in the laboratory programs generally, work groups averaged 1 to 4 students. In the true research participation programs, further, only one student was generally assigned to a given researcher.

According to the Observer reports, no over-crowding was observed in any of the institutions. In one or two cases, on the other hand, the Observers felt that more students could have been handled, especially in the classroom work. The Observer who visited the program experimenting with "team teaching", lastly, tended to feel that the benefits accrued through this method did not justify the additional costs involved.

F. "Home work" Required

In both of the mathematics programs from 2 to 3 hours per day of homework was required in mathematics. In both of these programs, also, much of this study was done in supervised study halls. In addition, at least in the program which included other non-science studies, a great deal of study had to be done outside the three-hour study hall.

In 3 of the 4 classroom-laboratory programs a great deal of homework was required and the students put in long hours of study after classes and laboratories. Apparently in all of these programs this work was non-supervised and carried out in the student's room or in the library. In the fourth program the Observer rated the amount of homework required as being "not much".

Homework as such was required in none of the five laboratory programs. The students apparently did, however, a great deal of reference reading, studying, and report preparation in connection with the researches with which they were associated. Some of this work was apparently suggested by the research supervisor while the rest was done at the student's own initiative. It would appear, therefore, that the amount of "homework" done in this type of program was pretty much a function of the individual student's interest and industry.

G. Use of Lectures and Field Trips

Formal lectures were used in 9 of the 11 programs to further interest, stimulate and orient the participating students. Generally the lecturers were authorities invited from the outside. In some instances faculty members from the host institutions were invited to make these presetations. On an average, probably one lecture per week was presented at each of the 9 institutions cited.

Student reception of the lectures was generally good. Naturally some were enjoyed more than others. The most popular lectures appeared to be those which dealt with the very latest aspects of modern science and those which most nearly coincided with the general interests of the student group involved. In most cases, apparently, the lecturers were instructed - or chose to - make no effort to "speak down" to the students. As a result several lectures went largely over the heads of the students. Interestingly enough, however, several students felt that this was not a bad idea. In visiting several of the programs, however, the general implication of the Observers seemed to be that perhaps at least some of the lecturers tended to over-estimate the knowledges and backgrounds of the student audiences. Some interesting examples of student interest in these lectures were as follows:

1. In one program at least part of the lectures were designed for teachers attending a parallel National Science Foundation Teacher Training program running concurrently at the same institution. The high school students attended the first lecture and enjoyed it very much. Through a mix-up, however, the high school students apparently failed to receive notice of two other lectures. The students were apparently genuinely disappointed over this error of omission.

2. In a similar institution where a National Science Foundation Teacher Training program was running concurrently, the lectures were followed by a discussion period. According to the Observer the high school students took a much more active part in these discussions than did the high school teachers and, in general, "really spiced it up."

3. In a number of visits the Observers noted that many of the students would remain after the lectures to ask questions of the speakers.

Three of the programs made no use of field trips, another three made limited use of them, and five made rather extensive use of field trips. The extensive use of field trips appeared to be more common in the combined classroom-laboratory program than in either of the other types. Although some programs had special days set aside for field trips in their schedules, others made little use of them due mainly to the sheer weight of course materials to be covered.

Where used, field trips were generally carefully planned to fit into or supplement course materials or laboratory projects being covered. In other cases trips were made to nearby points of interest which would be of obvious interest to the students (museums, planetaria, atomic energy installations.)

H. "Round-Table" or Student-Teacher Conference Opportunities

As mentioned elsewhere the discussion approach was emphasized in almost all of the programs studied - in the class, in the labs, or after lectures. Due to the small size of classes and other work groups, this was both possible and effective. In the research participation program, naturally, student-teacher conference went on continuously - though on an informal basis.

At least four programs included formal student-teacher discussion periods. In these sessions students met periodically with their instructors to discuss progress and problems. At least one of the research participation programs also scheduled this type of activity.

In the dormitories, cafeterias, and lounges, lastly, there was ample opportunity for the students to discuss mutual problems, plans, and philosophies. Since many of the instructors ate with their students or even lived with them in the dorms, they were often included in these discussions. As suggested by one of the Observers, these impromptu "bull sessions" were perhaps one of the most popular features of the various programs.

I. Quality and Sophistication of Teaching

Although inevitable variation was noted by the Observers, in only two cases were ratings other than "high", "very high", "superior" or "excellent" of the quality of teaching noted. In those cases where some reservation was held, the reservations did not involve competency - but rather the inspirational quality of the teaching involved.

Sophistication of teaching, of course, had to be judged from the point of view of the level of the students involved. Generally speaking the Observers rated sophistication of teaching high - comparing it frequently with that to be expected at advanced college levels. In the case of some of the research participation programs, further, sophistication was extremely high, that is, graduate level or even beyond.

V. Facilities Available

A. Classrooms. Where applicable, completely adequate in all cases.

B. Study Facilities. All adequate, many excellent. Libraries were usually conveniently situated and open to the students.

C. Libraries. All library and reference facilities were good - especially from the point of view of the users. The great majority of the texts and references available to the students would not be available in their home high schools. In one or two cases Directors noted that additional copies of heavily used texts and references would have to be purchased in the future to minimize "waiting list" problems.

D. Laboratory Equipment. Where used, laboratory equipment was rated from fair to the best that money can buy. In the case of the "fair" rating the judgment was a professional one. To the students this "fair" equipment was better than any they had ever been exposed to. In the research participation programs, especially, the equipment available was the latest and best to be had. All of the Observers agreed that practically none of this equipment would be available to the students in their home high schools.

E. Living Arrangements. In those programs where students lived on the campus, living arrangements (rooms, food, basic services) were judged to be adequate. (In one or two cases rooms were described as "adequate but austere" or "satisfactory but not gaudy"). The Observers also had the opportunity to test the cafeterias used by the students and felt them to be adequate. (In one commuter program a problem over lunches arose, but was quickly settled to the mutual satisfaction of all concerned).

F. Recreation Facilities. As has been pointed out, recreational facilities and opportunities were adequate in all programs where they were required. Even in some of the commuter programs recreational facilities were placed at the disposal of the students. As might be expected, less emphasis on this activity was noted in the research participation program than in the other two types.

G. Off-Campus Facilities. Off-campus facilities were used freely for field trip purposes. In at least two programs, further, off-campus facilities affiliated with the host institutions were most effectively utilized. In at least one case arrangements were made for the participating students to use the library and reference facilities of a private organization.

VI. Recruitment and Selection

A. Recruitment

The prime method of recruitment used by the host institutions was to send a descriptive brochure and covering letter to the high schools. Generally all high schools in a restricted geographical area were informed plus selected high schools lying outside the given area. Materials were also sent to any other high school on request. The descriptive materials were sent either to the principal, the head of the Science Department, the Guidance Director, science teachers or to a combination of these. In at least one case the materials were also sent to county School Superintendents. In only one case were the materials not sent directly to the high schools. In this case the materials were sent to the area Superintendent of Schools for distribution to the high schools. Apparently this experiment in diplomacy was not successful since secondary distribution was delayed considerably by the Superintendent's office. In one case materials were also sent directly to selected high school students and in another to students who wrote in requesting information. In most cases, however, contacts were strictly through high school channels.

Another inadvertent source of recruitment were bulletins and releases sent out by the National Science Foundation itself. These announcements of the general program in several instances brought requests and applications from students from distant parts of the country.

News releases by the host institutions to the local press were also utilized. It was not clear, however, how effective these were in the recruiting effort.

One school, lastly, had had a program for several years and planned to continue it even without a National Science Foundation grant. In this special case recruitment and selection had already been completed by the time most of the others were just beginning.

In all cases - except two in which on-going programs were to be carried out with or without a grant - recruitment efforts could not be started until the grant was approved by the National Science Foundation. For this reason recruitment was initiated anywhere from mid-March to mid-April - with late March or early April being an approximate median date. The deadline for the receipt of applications was generally set in early May (usually May 1) but frequently had to be extended. In some cases extensions reached well into the month of June. Dates for the announcements of awards varied widely but presumably took into account both the time needed to process the applications and make final selections and the reasonable lead-time required by the students selected to make their final decisions, travel arrangements, and the like.

In all cases recruitment efforts were limited to fairly specific geographical areas. In the case of the commuter programs this was generally a necessity. Thus efforts were concentrated on a certain city, a certain state or a certain group of states. Where applications were received from distant points, however, they apparently were given consideration since students from Washington state, Texas and Arkansas were noted in the various East-coast programs.

Although the reasons for these geographical restrictions were not made clear, the following factors were probably contributing:

1. Limited budgets for student travel. (Travel allowances to students were generally limited to certain maximum amounts.)

2. The desire to foster good public relations both with the surrounding communities and with local or state Boards of Education.

3. The probability that the majority of regular full-time students would be drawn predominantly from the area to which recruitment was restricted.

4. Ease in handling participating student follow-up activities.

In summary, although the schools realized the program was a new one, many of the institutions were critical of the National Science Foundation for being so tardy in the announcements of grant approvals. They felt this delay impaired their recruitment and selection efforts. They suggested a better job could be done in the future were they given more time in which to carry out these important activities.

B. Applications Received.

As reported by the Directors, approximately 4,000 students applied for admittance to the eleven programs. Of these, 418 or roughly 12% were accepted.

As will be seen in a later section, in most cases the applications had been quite thoroughly screened even before reaching the host institutions (through basic requirements by science teachers, principals, etc.) For this reason the Directors stated that the applications received were in most cases those of high quality students. In many cases, further, final selections were made by the host institutions only with extreme difficulty. There were, in short, too many superior students and not enough spaces for them.

The following tabulation breaks down the "acceptance rate" in somewhat more detail:

Percent of Applicants Accepted	Number of Institutions
0% to 5%	1
5% to 10%	4
10% to 15%	3
15% to 20%	1
20% or more	2
Total	11

According to opinions gathered by the Observers, interest of the students in the particular courses or programs being offered was probably the strongest factor influencing the decision to apply. Closely following this was the active encouragement of the students' high school science and math teachers. Somewhat less potent stimuli were the stipend offered and the reputation of the institution. Factors such as closeness or convenience to home, better chance for college admission and convenience of the particular dates of the program were also mentioned as influencing student applications.

C. Selection Procedures

Actually the selection procedures used in the case of the entire program are only partially known. A good idea of how the host institutions went about screening applications is at hand. Just what kind of screening went on in the high schools, however, is largely unknown. What is certain is that a good deal of screening did go on in the high schools.

1. Student Supplied Information

In this category would fall completed application blanks, transcripts of grades and written expressions of interest in science and science activities. All of the institutions made heavy use of this source of information. Only the transcript of grades, however, was a potent factor in selecting or rejecting - that is, on the basis of general academic excellence, excellence in science and/or math, meeting pre-set minimum course requirements, and the like. The written expressions of interests and experiences in science were also quite valuable in providing helpful clues regarding the student and his capabilities.

2. High School Recommendations

These were form or written evaluations or recommendations prepared in the high schools on the applying students. They were also used by practically all institutions. Again, while apparently not potent as selection or rejection factors, important clues and leads frequently were derived from them. This type of data, further, was frequently used as a cross-check to authenticate student statements.

3. Test Scores

Scores on a rather wide variety of general intelligence, achievement and science aptitude tests were used by at least six of the eleven schools. In most cases, together with high school grades, these test scores were potent factors in selection or rejection - especially in the rough screening stage. (In some cases grades provided the first rough screening, in other cases test scores were used first). In most of the institutions where tests were used, the institutions arranged for their own special testing to be done. In other cases standard test scores already available in the student's high school records were used. In at least one program, lastly, test scores were used to help place accepted students in program courses where more than one subject area was being offered.

4. Interviews

Two or three institutions did interview all or some of the applicants. Several institutions had planned to use interviews but were prevented from doing so by lack of time. All agreed that the interview would be a most effective tool in the selection procedure.

Actually, in spite of the variety of institutions involved, selection procedures were generally similar - with differences involving mainly emphases given to the information sources.

Grades and test scores were probably the most heavily wieghted factores since they tended to show past performance and future potential. The other sources were used secondarily - but importantly - to get at strength of student interests, motivations, lab skills, creativity, and work habits.

The host institutions in many cases were not completely satisfied with their selection procedures. Aside from short-cuts necessitated by lack of time, several have suggested ways in which they may do a better job in the future. Although standardization of selection procedures would probably be both impossible and undesirable, it would appear that interchange of ideas among institutions, concerning this problem would be of considerable benefit to all concerned.

At least two unanswered questions in this area are worthy of further study:

1. What are the selection factors used by the high schools and how effective and equitable are they?

2. What is the effect upon a superior student who is rejected mainly due to lack of space in the program? (At least one institution worked out an ingenious scheme for tactfully handling this problem).

Of interest was the fact that pre-set sex ratios were intentionally or necessarily in operation in 7 or the 11 programs. Four of the programs accepted boys only. Of these one was held in a boy's denominational prep school and one in a summer camp environment - both apparently not adaptable to the needs of female students. In the other two cases the Directors admitted frankly that for the present at least they did not want to have the added responsibilities attendant on having girls present in their programs. In the three programs where both boys and girls were involved, the ratios were as follows:

1. On a 50% - 50% basis for no particular reason.

2. On a 70% - 30% basis on the principle that in the long run the better investment is in the male students. The girls, however, should not be completely left out.

3. In one case, only one girl was included in the program. The Director has planned on selecting at least two girls so that they would have the pleasure of each other's company, but this did not materialize.

Grade and/or age level overlap, did not prove to be a problem at all. In allbut one program there was little overlap to begin with and, where there was, no problems were involved insofar as performance or adjustment was concerned. In the one program where there was an overlap of four grade levels, the students were placed in sections of varying difficulty as was the original plan. In at least one of the research participation programs, the Director indicated that overlap might be a problem in that students too young socially or emotionally could not get maximum benefit from such an experience.

By way of summary, the following tabulations show the number of students involved in the programs under study in terms of both sex and high school grade completed:

By Sex

Sex	No.	% of Total
Male	293	70.1%
Female	125	29.9%
Total	418	100.0%

By High School Grade Completed

Grade	No.	% of Total
8th	10	2.4%
9th	14	3.4%
10th	57	13.6%
11th	287	68.7%
12th	50	11.9%
Total	418	100.0%

VII. Student Performance

A. Quality of Performance

Although a certain amount of variation was noted from program to program and within a given program, the Observers were generally quite favorably impressed by what they saw of student performance. For the most part the groups were able, serious and responsible, willing and eager to put in long hours of hard study. They stuck to it tenaciously, used their time effectively, and were happy with what they were doing. As one Observer put it, they didn't act like high school students. Their performance was more like that of college people. Where performance was occasionally questioned, an excess of enthusiasm was generally at the root of the problem - for example, taking on projects which were not authorized or beyond present ability, or irrepressible "bullsessions" which distracted from studies. In one or two cases, lastly, it was apparent that students were just not interested in certain portions of the programs and, as a result, performance fell off.

Discipline was not a problem in any of the programs. Little failure to conform to rules was noted and when it occurred - usually early in the program - a week-end "campusing" was sufficient to correct the digression. In the opinion of the Observers the students were just too busy to get into trouble.

As might be anticipated in view of the selection factors involved, the Observers were quite unanimous in the feeling that the initiative and resourcefulness displayed by the students was considerably above that to be expected in the average high school student. The Observers pointed out at the same time, however, that in reality the opportunities to demonstrate real initiative and resourcefulness was limited pretty much to the research participation programs.

B. Indices of Quality Performance

In suggesting possible indices by which student performance in the programs could be judged, the Observers listed the following:

1. Test or Work Reports. This type of quantitative index was felt to be a most tangible one.

2. Anecdotal Reports. While qualitative rather than quantitative, this would in many cases be the most accurate index available - especially in the research participation program.

3. Excellence of Student Reports. The quality of written or oral reports prepared by the students was believed to be a good index of performance. Several Observers, in fact, remarked about the high quality of student reports they had read or heard during their visits.

4. Excellence of Laboratory Work. This criterion would be restricted to programs involving laboratory work and would be partially included in 3, above. Here, however, the Observers had in mind the interest, intelligence and efficiency with which students approached their laboratory work. Examples of good grasp and depth of approach were observed during the visits - for example, actual publication of student research papers, and absence of "griping" on the part of graduate students regarding the presence of the high school students in their laboratories.

5. Readings. Interest in readings and amounts done might be another criterion. In their visits the Observers often commented, on the tremendous amounts - frequently extra- of reading done and the above-normal check-out rates in the libraries.

6. Approach to Work. Business-like approaches to the work at hand and closeness of attention to work, could be used as another index of performance.

7. Nature of Group Participation. Another criterion might be the degree and goodness with which students take part in and respond to group discussions or seminars. Several of the Observers noted, in particular, the nature of questions asked in such group activities. They felt the questions asked frequently revealed the range of interests, depth of thinking, or logical analysis of the students - both individually and collectively.

8. Work Habits. General work habits might constitute a last index of performance. As an example, one Observer commented on the unique subterfuges which the students in one program would use to extend their study time after "lights out" or before "reveille." He took this to be a rather striking illustration of intense study habits.

Actually, due to the experimental nature of the various programs, no real standards were set regarding rate and degree of accomplishment. The general feeling was that no such standards were really required. The students were a highly motivated group who knew that a high level of performance was expected of them and they accordingly strove to live up to those expectations. In like manner spontaneous competition kept standards high as did future rewards - such as easier college entrance or possibilities of college scholarships. In the research participation programs, lastly, the establishment of standards was a nebulous proposition at best.

In six programs some form of anecdotal records were maintained. In five, both test or work and anecdotal records were kept. In only one program, apparently, were no records of performance of any kind maintained. Staff reasons for maintaining records were as follows:

1. Test or work records were maintained to keep staff members aware of the relative standing of the students, to assist in the preparation of anecdotal reports or for use in research studies. (In one program a rather complex study was in progress in which selection tests scores were being correlated with performance scores.)

2. Anecdotal reports were generally prepared to keep the staff - especially the Directors - informed of student progress and for record purposes. In the research participation programs, of course, this was the only type of record which could be prepared effectively. In several cases the intention was to send copies of these anecdotal reports to the student's home high schools, and in some cases, to their parents. They were also to be kept on file for reference purposes - for example, college reference checks. In a last case a Director was holding carefully maintained anecdotal reports over a period of years as data to be used in planned student follow-up studies.

A last bit of evidence indicating quality of student performance involves Observer ratings of the proportions of students who were really benefiting from the programs. In all but one instance these estimated proportions were 90% or better - with five being 100%. In the one program - which was rated "half or more" - the Observer felt that some of the students were not profiting fully due to the fact that they were being "lost" in the research lab through lack of "bridging" or the tying of all the loose ends together. The Observers indicated, further, that the students were benefiting in many cases not only intellectually but also emotionally and socially. Although a few inevitable misfits were encountered, lastly, the fact that only one student "drop-out" among 418 starters was noted seems to point strongly not only to excellent selection but also to high quality performance. (It should be noted that this "drop-out" was non-voluntary and motivated by non-academic factors.)

C. Guidance and Use of Counselors

As has already been stated the students had ample opportunity to discuss their work and problems with members of the staff. This was especially true in the laboratory or research programs. In addition, at least six programs had experienced counselors included on their staffs and in at least five of the seven non-commuter programs these counselors lived in the dorms with the students and were therefore constantly available.

Although the pattern varied from program to program, on the whole the students made rather frequent use of these counseling facilities. Based on reports gathered from the counselors and the instructors the problems most frequently brought up in such contacts involved the student's work in the program - for example, questions of fact, requests for advice, or discussion of projects. Closely following this in frequency were questions and discussions involving high school or college plans and career possibilities. Discussion of purely personal problems was fairly infrequent. Questions concerning health arose in a few cases and at least one institution had its hands full with a spate of homesickness in the early stages of the program.

D. Evidences of Program Impact on the Students

Although difficult to observe in the course of a short visit, the Observers in their discussions with Directors, staff and students did note the following evidences of program impact:

1. A strengthening of student interest in a given field or a change of interest from one field to a different or related one.

2. Statements on the part of students indicates real changes in attitudes towards science or revealing clear insights into what the program was accomplishing. An example of the latter would be recognition by the student that he was not only learning new facts and theories - but that he was at the same time acquiring valuable skills such as facility in laboratory or research methods, or "know-how" as regards the use of libraries and reference materials.

3. A stronger desire, on the part of students to go on to college or enter college early. Tentative ideas regarding changes in college plans. Interest and initiative in seeking out the advice of counselors and discussing with them college and career aspirations.

4. Extreme interest in attending the same or similar programs in the future.

5. General "hints" of strong interest and high level performance. For example: absence of disciplinary problems, preferring to study rather than indulge in recreations, penetration of questions asked, and laboratory performance.

In addition to these positive effects, the Observers noticed several potential negative effects which might result from the summer experiences. Most of these involved problems connected with the student's return to the home high school. As envisaged, the high schools would probably not be able to supply suitable courses for these students due to the lack of adequate facilities and properly qualified teachers. When therefore, these highly talented and excited students are faced with programs of little interest or challenge - the effect may be to throw them out of kilter with the science program specifically and the entire educational program generally. A suggested remedy here would be to use these students as Laboratory Assistants or in other special tasks to give them a feeling of leadership and prevent them from simply marking time till college entrance. A second envisaged danger is that some of these students may have developed "big heads" with the result that they may tend to be overly critical of their teachers or smart-alecky and thus create problems in the high school classrooms. Oddly enough, these potential pitfalls were more frequently predicted for students in the classroom and classroom-laboratory programs than they were for those in the more advanced research participation programs.

For students in the latter type of program a special problem was foreseen. One Observer felt that some of these students were being "thrown in over their heads" without the benefit of much assistance or guidance. As a consequence deep discouragement frequently resulted. In the minds of the Directors and staffs, however, this type of treatment might be a good thing for this caliber of student. In at least one program, in fact, a deliberate effort was made not to "spoon feed" the students so that independence of study would be developed rapidly. In the opinion of the Director of this program this "sink or swim" approach has worked well and with great benefit to those who survive the treatment.

E. Estimates for the Future

As regards the student who should attend this program, the Observers were in solid agreement on two prerequisites:

1. The student must be a superior one of high ability and future promise.

2. The student must be strongly interested in science and highly motivated towards it. He should have a strong desire to attend such a program.

Student need, emotional maturity and manipulative ability were also mentioned as prerequisites. The last item was judged especially important in the research participation program. In this type of program, further, some indication of initiative and creativity would also be desirable. (At least one program used participation in Science Fairs as a criterion of this last characteristic.)

One Director asked an interesting question: "How about the highly able but unmotivated student?" This man felt that something should be done for this type of student. He could offer no real suggestions as to how this student could be identified and induced into attending such a program. The thought, however, was an intriguing one.

Another estimate made by the Observers involved the percentage of an average high school class who could <u>really</u> profit from this program. A second estimate made was based on only average 11th and 12th graders. Actually, the percentage estimates in both cases were similar, with perhaps a little more optimism noted for the Junior-Senior groups.

The first reaction, of course, was that practically all students would profit to some degree from such a program. <u>Marked</u> benefit, however, would probably accrue to only those students in the top 10% of their high school classes. Although 10% was the most frequent estimate, some Observers and Directors limited the range even further - from the top 5% to the top 2%. The fact was also pointed out that the percentages would tend to change if a distinction were made between general students and college preparatory students. As might be expected, lastly, percentages tended to be smaller for estimates related to the research participation program than those for the other two kinds of program.

One curious feature of the data was that Directors tended to be much more liberal in their estimates than did the Observers. Some Director estimates ranged as high as 33% or even 50%.

A last problem was brought up by one of the Directors: "What can be done with the less able group of students?" This again, was a fascinating question and worthy of serious prolonged thought.

As regards the student grade level most desirable for inclusion in such programs, the following were the tabulated estimates gathered in terms of grade completed:

Sophomores and Juniors	2
Juniors	4
Juniors and Seniors	3
Seniors	1
Any grade level	1
Total	11

Limiting factors or criteria used in qualifying these judgments were as follows:

1. In one program where Eighth Graders have been included, the staff felt some of the greatest enthusiasm came from these young students. In another program, of course, greatest enthusiasm was noted among the Seniors.

2. An unavoidable limit was sometimes imposed by implicit or explicit course prerequisites. Thus programs desired students who had completed two or three years of math and a certain amount of science. More often than not, unless an accelerated program was involved, these minimum requirements would not have been met until the Sophomore or Junior years.

3. In one program it was felt that social or emotional maturity was not directly related to student age. In this program where homesickness was something of a problem, the difficulty involved the older students and not the younger ones.

4. In some cases Seniors tended to be rejected on the basis that it was important for student participants to return to their high schools after their experiences. The motive here was that influence upon the high schools was one of the basic goals of the programs.

5. In the research participation programs, lastly, preferences were for Seniors and Juniors. In these more advanced programs the Directors felt that younger students could not be expected to do what was required of them, would lack course prerequisites, and would lack the emotional maturity necessary for optimum profit.

Frequency of attendance at such programs was fairly well agreed upon by the Directors, Staffs and Observers. The basic feeling was that one exposure was sufficient to provide the desired triggering action. Students could undoubtedly profit from such experiences summer after summer, but the big impact would come with the first experience and thereafter the excitement would be reduced. In one program, at least, several students were attending the same program for the second time.

VIII. Special Problems

A. For the Students

Since they will in a way be "different people" when they return to their high schools, some of the students will face real adjustment problems. As more serious and more mature individuals they may find high school less congenial and their science and math programs inadequate. They will resent being treated as children after their adult-level summer experiences. "Cocky" attitudes and "know-it-all" reactions may also cause problems.- but this is not anticipated widely. Since most of the programs avoided overlap of course materials as much as possible, this should not be a problem. Where overlap does occur, however, boredom and resultant undesirable effects may result.

Many of these potential problems, lastly, may be avoided by skillful handling on the part of the high school staffs and by adult behavior on the part of the returning students.

B. For the Home High Schools

Providing suitable courses, teachers and equipment is clearly the general problem to be faced. In such a brief time, however, little in these broad directions will be accomplished. The teachers will be exposed to some embarrassing questions and expectations from these students, and, no matter how hard they try, they will probably suffer in comparison with summer experiences. Diplomacy in handling these situations and sincere attempts to use these students constructively should do much to minimize the problem. (Oddly enough it was felt that participants in the research type programs would raise the fewest problems for the high schools. This feeling probably stems from the fact that in these programs "courses" were not covered in the usual sense of the word.)

C. For the Colleges the Students Will Attend

Although not too much comment was elicited in this area, some suggestions were put forth that colleges may have to - or should - take pains to place these students carefully when they enter so as to avoid duplication of work already covered. In short, more flexibility in placement is urged as is deemphasis of the "now we'll do it right" remedial approach often characteristic of college placement. In the case of the research participation students, lastly, the feeling was quite unanimous that no problems would be involved. Instead, the colleges should feel most fortunate to receive such excellent students with this background.

D. Evidences of Changes in the Schools

In the opinion of most of the Directors, Staffs and Observers it is still too early to look for changes resulting from this program. In the high schools, there is some evidence that the entire problem is at least under study. Enthusiasm on the part of high school science teachers, principals or even members of the Board of Education cannot, however, be interpreted to mean that basic changes are in store in the immediate future. The fact of the programs themselves, however, is bound to influence the high schools in the long run - but how and in what direction only time will tell.

Evidences of change in the colleges are even more nebulous. The major impact thus far has actually been on the participating faculties themselves. Many of these men were genuinely amazed at the ability of these students and enthused over the quality and quantity of work done. Many who entered the programs with negative feelings or misgivings are now extremely enthusiastic over the whole concept. This, again, in the long run is bound to have some effect on the colleges, themselves.

E. Effect on Community or Public Opinion

While again too early to tell, in about half of the cases it was felt the programs were having little or no effect on community or public opinion. The amount of publicity given the programs varied in the different communities and perhaps not enough was done in this area. The feeling was that the public should know more agout these programs and their importance for its is ultimately from that public that financial support is derived.

Where some effects were noted, they took the following forms:

1. Allaying of fears that the Federal Government was "sticking its nose" into public education.

2. Increased interest in the host institution on the part of the community in general and local industry specifically.

3. Better high school-college relations.

In two cases, lastly, the programs had been in effect in the past and so good community and public relations had already been established.

F. Other Approaches to the Problem

Other methods which might be used in dealing with superior science or math students were as follows:

1. "Honors" programs or "special sections" could be set up in the high schools themselves for high-ability students.

2. Saturday or afternoon "honors" programs could be sponsored by local colleges and universities. Actual experience with this type of program has shown that the longer assimilation

time is beneficial but that the additional loading of already busy students is not particularly desirable.

3. The use of "team teaching" could be instituted in the high schools in order to give more attention to the individual student.

4. Changes in methods and emphases could be injected into high school curricula.

5. Experimentation with even younger students than those included in the present programs could be tried out.

6. Closer and more cooperative contacts between the high schools and the colleges could be established.

7. Inclusion of non-science courses in the summer programs might be desirable. Already being done by one institution, this suggestion was made quite frequently by Directors and staffs.

8. Allow selected students to pursue minor research projects in the high school laboratories.

9. Modify present summer programs themselves.

One possibility definitely not recommended was to have the high schools take over the summer program activity. The Observers felt that the high schools lacked the staff (including researchers), facilities and general atmosphere necessary for an effective program. Although at first glance of apparent less import, the atmosphere factor was felt to be essential in these programs - that is, the glamour and prestige and a taste of college had a marked impact on the participating students. The use of highly qualified high school teachers in college-sponsored programs, however, was deemed a good possibility. High school teachers were used, in fact, in three or four of the programs included in the present study.

G. Applications in Other Subject Matter Areas

While the Observers agreed that the summer program approach could be effectively used in dealing with gifted students in other subject matter areas, they felt that the sciences and mathematics presented the most unique applications for the method and that present needs were greatest here. As stated previously, however, a number of Directors felt that some non-science work should be injected into some of the present programs.

Among subject areas which would be amenable to the summer program approach were the following: languages, social sciences, writing, music, arts, foreign affairs, humanities, English and reading improvement. As is common knowledge many summer programs involving several of the above areas are already in operation.

H. Administrative Problems Encountered

According to the Observers no really major administrative problems arose which could have affected the achievement of the desired goals. Some minor problems of a local nature naturally presented themselves, but these were quickly settled. The delays caused by the lateness of announcing awards by the National Science Foundation, as stated previously, might be classified as a major problem during this particular program season.

IX. Financing

In at least 6 of the 11 cases the host institutions expressed complete satisfaction with the National Science Foundation's part in the financing. In the other cases two situations occurred which caused some discontent. In some cases the schools were too low in their estimated budgets - with the result that a good deal of the overage had to come out of institutional funds. This, naturally, was not held against the National Science Foundation. In other cases the National Science Foundation apparently granted only part of the amounts requested. In these cases the programs presumably either had to be cut back or the differences made up by the host institutions.

Generally speaking the costs were split between the host institution and the National Science Foundation. In two cases additional grants or facilities were obtained from other foundations or sources. In one case the students paid approximately half of the costs involved. Although the National Science Foundation costs are clear-cut, those of the host institutions are not because their estimated budgets did not reflect many hidden costs - for example, pricing researcher time or depreciation of equipment and facilities. Direct comparisons between the amount contributed by each are therefore difficult to make. In several instances, however, the estimates were that host institution contributions were often far larger than the grants received from the National Science Foundation.

In looking to the future the consensus was that in the immediate years practically all of the schools would require financial assistance of the kind offered by the National Science Foundation if they were to continue with such programs. In the more distant future as the programs develop and as experience is gained, perhaps some of the financial burden could be shifted to state governments, local governemtns or to the students themselves.

In examining what was furnished to the students it was noted that in all cases cost of instruction, room and board was provided either directly or through a stipend or allowance. The following varied from program to program:

1. Transportation. In some cases none waspaid. In others it was limited by geographical area, total amount or distance.

2. Services. In some cases these were provided wholly or in part and in other cases they were not.

3. Recreational and Cultural Expenses. In some cases these were free of charge. In other cases students had to pay for tickets to plays, concerts or baseball games.

4. Books and Expendables. The manner in which these expenses were handled is not completely clear. Presumably they were provided for in some programs and not in others.

When asked whether the students should assume some of these expenses the responses of the Directors, staffs and Observers were generally negative. Most felt that any significant financial burden places on the students would have a rather serious effect on recruitment. As one Observer put it "Recruitment and selection would be even more on the basis of parental income than it is now". A further objection to changing student costs was that the programs are not yet well enough established to warrant such changes. Perhaps in the future when the true worth of the programs has been demonstrated, some of the costs can be shifted over to the participating students. Even realizing the possible effects on recruitment and selection, meal and transportation costs were mentioned as items which might be assumed by the student should be necessary.

X. Overall

The Observers characterized the "feel" or "spirit" of the various programs as being generally good. They were impressed with the enthusiasm the students displayed towards their work and the similar enthusiasm and interest the staffs showed towards their students. The students were serious and morale was high. Student spirit could be summed up by "I'm glad I came, I'm going to recommend that my friends come and I would like to return again next year". Although the "feel" of the total program in the case of the research participation institute was more difficult to characterize, based on the zest of theindividual students and the dedication of their supervisors, the "spirit" here was also judged very high.

Final assessment of how well the programs lived up to their aims and purposes must, of course, be reserved for the future - since many of the aims and purposes involve the future. With this in mind the Observers rated the various programs as follows:

1. 1/3 were achieving their goals admirably and even going beyond those goals.

2. 1/3 were meeting their objectives very successfully and effectively.

3. 1/3 were living up to their aims only "fairly well". Analysis of the types of programs involved in the above ratings reveals no particular pattern.

Although many drawbacks and problems have already been discussed, the following are examples listed by the Observers of ways in which certain programs tended to fail to live up to purposes or objectives.

1. Social. The students did not have enough time to get to know each other and talk things over. The atmosphere was "a bit too intense".

2. Teaching methods were not as modern or stimulating as desirable.

3. Too little opportunity or encouragement to do creative work was present. Too much emphasis was placed on course content.

4. Activities were left too open. Students selected unwise or unrealistic projects with resultant waste of time.

5. Portions of programs failed to interest the students or fell below their level.

6. The short duration of a program limited the effectiveness of its impact.

7. Where student choices of courses or projects were involved, these could not always be met perfectly - with resultant disappointment in several cases.

8. Some students expected more course work in the research participation programs. Where this occurred there was some unhappiness.

9. Some programs could have been more effective had more seminars and conferences been used to pull them together more tightly.

10. The projects to which some students were assigned offered much depth but no breadth.

Several of the institutions mentioned "tough" problems which came up during the course of the programs. These were all specific to the citing institutions. Problems which might be common ones were as follows:

1. Students wearing themselves out or lacking sleep.

2. The almost inevitable "problem" student.

3. The teaching load in view of the caliber of students taught.

4. Initial selection of students.

5. "Housekeeping" problems.

6. Getting enough time from busy Professors and researchers.

Overall, the Observers felt a very good job was done in most of these programs. In one or two cases some reservations were expressed and certain portions of given programs were rated higher than others. In view of the newness of the programs and the experimental aura surrounding them, however, the results as observed were to be commended.

XI. Plans for Follow-Up

A. Anticipated Follow-Up Programs

Only eight of the eleven program Directors had apparently considered the possibility of following-up their summer students in an effort to evaluate the impact of their programs on the students and on their home high schools. Only two of these eight, further, had really laid out specific follow-up programs. The majority, motivated mostly by a general interest in the problem, were programs still largely in the "armchair" stage.

Listed roughly in order of importance to the responding Directors, the envisaged follow-up programs would be directed in general at the following:

1. The general reaction of the high school to the returning post-program student. More specifically, Directors would be interested in the student's acceptance by his teacher and the teacher's reaction to the student.

2. The contributions which the returning student could afford his high school as a result of program attendance.

3. Reactions of fellow students to the returning post-program participant.

4. Progress of the program participant throughout his college career.

5. Impact of the returning student on the community at large.

To secure information which would provide answers to these questions, the Directors suggested the following data sources might be used. The sources are again listed in general order of frequency of mention.

1. Questionnaires sent to the high schools. These would generally be filled out by the science or mathematics teacher.

2. Periodic letters to the ex-program students eliciting the students' reactions, achievements and future plans,

3. Visits by the Director and members of his staff to selected high schools of the post-program participants.

4. Letters to high school teachers asking for reactions to the returning students, problems which have arisen.

5. Periodic reports submitted by the high school or the college on the post-program student.

Phrasing the question somewhat differently, it appeared that only four of the eleven Directors had established plans for "keeping in touch" with the student participants. The remainder had either made no such plans or had not thought too much about the desirability or utility of establishing such contacts.

B. "Effects" to be looked for in Judging Summer Science Programs.

Neither the program Directors nor the Observers were entirely sure regarding the areas in which "effects" or impact could be anticipated. The following changes which might be expected in the students as a result of program attendance were, however, listed:

1. Better achievement or accomplishment not only in science and mathematics but in learning in general. Continuing self-study and a faster, deeper grasp of course materials. Evidences of the ability to defend and interest in defending personal views more skillfully. A more critical approach generally.

2. Increased enthusiasm for and interest in high school studies. Demand for and interest in getting all the facts. A better attitude towards progress in science specifically and in scholarship generally.

3. Increased seriousness of purpose.

4. Heightened interest in educational and career problems. Seeking out the advice of guidance counselors regarding school and vocational plans. Changes in high school program or career choice.

5. Changes in the college selected and success in being admitted to college or choice. Success in college career.

As to post-program student impact on the high schools themselves, suggestions were even less specific. The following were the areas most frequently mentioned:

1. High school teacher reaction to the returning student was an area deemed worthy of very special attention. Depending on the

teacher, reactions here could either be constructive or destructive. The Directors and Observers hoped that the high school teachers would take special interest in these returning students and help to sustain their enthusiasm and interest by using them as laboratory assistants, project leaders or tutors.

2. A certain amount of criticism on the part of the post-program students regarding past teaching in the high schools was anticipated. A certain demand on the part of these for better teaching was also to be expected. If properly handled by the students and teachers involved, Directors and Observers felt that such interaction might serve to generate better all-around teaching in the high schools.

3. Again, if handled tactfully by the parties concerned, it was predicted that the returning students could be of real help and encouragement to their high school teachers. In like manner they might serve as academic bellwethers to their fellow students.

PART E - STUDENT COMMENTS AND REACTIONS TO PROGRAM

1. Sources through which students first heard of the Summer Science Program (Chart E-1).

As explained in the Observer's Summary, recruitment was handled almost entirely through high school channels. Bearing this out was the fact that in 74% of the cases students indicated that they first heard of the program through their home high schools. Almost half received the news from their teachers, 13% from their guidance counselors, 4% from their principals and 8% from other high school sources. Over 10%, further, first heard of the program through articles in local or out-of-town newspapers. An equal percentage, lastly, received word through their friends, parents or relatives.

According to the students, the most common method of passing on information concerning the program was for the science or mathematics teacher to announce receipt of or read the bulletin or announcement to the entire class. In other cases, a general announcement was made by the school principal during an assembly or over a public address system. In still other cases, apparently, contacts were made individually with selected students by the science teacher, the guidance counselor or the principal. Bulletin boards were not too effective as information sources.

The rather high frequency of students who first heard of the program through their newspapers is of interest, and suggest that this medium might be used more extensively in the future.

Receipt of information through hearsay or other second-hand sources is not desirable and should be corrected through better coverage in the high schools and in the press in the future.

2. Reasons for selecting the particular host institutions involved (Chart E-2).

Over one-fourth of the students stated that the general program or the specific offerings of the programs were what motivated them most strongly to apply. An almost equal proportion, however, admitted freely that they applied only because it was the only program of which they were aware. A last significant segment applied because the institution was close or convenient to their homes. (A few applied for the contrary reason, that is, to get away from their homes.)

Although not serious in terms of numbers of students involved, the "only one aware of" motive was the cause of several unfortunate placements. What apparently happened was that a student interested in, say, physics applied to a certain school offering a biology program - because he wanted to attend a summer program and that was the only one of which he was aware. Subsequently he was not happy with the program because it was not in his field of interest. The unhappiness became acute when he learned a physics program was being offered in the near vicinity. What is needed here, apparently, is a better student (and teacher) orientation regarding the full scope of the National Science Foundation program so that student applications could be more effectively directed to the appropriate host institutions.

Under "duration or timing," two factors were evident. First, the students seemed to be attracted most strongly by the programs of longer duration. Secondly, where the student was obliged to earn some money during the summer, such students preferred programs that either began soon after the close of high school or ended just before the opening of high school. In this way, apparently, they felt they could still get in a few weeks of paid work.

The eligibility category contains the responses of freshmen and sophomores. Apparently many programs automatically excluded students who had not completed their junior year thus limiting the range of choices open to this level of student.

In approximately 1% of the cases the students did not do the selecting - the home high school did. This apparent practice seems questionable and probably should be discouraged.

3. <u>Person most influential in making up student's mind to apply to a Summer Science Program (Chart E-3).</u>

As another instance of the influence which the high school exerts upon the student it can be noted that in 41% of the cases the decision to apply stemmed from the high school. The teachers - almost entirely science and mathematics teachers - were most potent here, followed by a surprisingly strong influence from guidance counselors.

Parents were apparently influential in about one-fourth of the cases. Where a specific parent was mentioned, the mother exerted the greater influence in 70% of the cases (65% in the case of male students and 82% in the case of females). The "other relative" category, on the other hand, was made up mainly of male relatives, for example, brothers and uncles.

The student himself, lastly, felt he was the deciding factor in another one-fourth of the cases. In view of the general caliber of the group, this indication of independence of thought and action should come as no surprise.

4. How the student felt he was selected (Chart E-4).

In reviewing the responses to this question it appeared that many students were not aware what selective factors were most important at the time application was being made. It seemed as though the importance of factors such as scientific interest and motivation were made known to the students only after they had been in attendance at the programs for some time. In listing factors used in his selection, therefore, the student tended to list items he knew to be part of the application procedure, for example, test scores, recommendations, grades, "an application blank," "by a committee" and so forth.

5. Factors which the student felt were most important in his selection (Chart E-5).

When asked to name the factors most important in actual selection or rejection, the students were somewhat more positive - naming grades, test scores and recommendations as the three most important factors. As will be noted, this represents a reordering of the factors listed in Chart E-4 and quite accurately identifies the factors actually used by the Directors as reported by the Observers.

That a significant number of students did not know what factors were deemed important by the host institutions may be inferred from the large proportion of students falling in the "don't know" or "no answer" categories. This should not reflect adversely on student perspicacity, however, since it will be recalled that the program Directors themselves were not always certain as to the most potent factors in final participant selection. Although requiring time and experience, naturally, it would appear that benefits would accrue to both the students and the host institutions were the relative importance of the various selective factors spelled out more concretely in advance. Once spelled out, further, such information should be included in the program brochure or announcement.

6. Why student wanted to attend a Summer Science Program (Chart E-6).

In approximately 53% of the cases the students wanted to attend a Summer Science Program to obtain training in science which would not normally be available to them. In addition to a general desire to broaden scientific knowledge or exposure, many students were specifically interested in finding out just what scientific research involved. Another 26% were motivated generally by college-centered desires. Many were interested in qualifying for early college entrance or advanced placement. (Most of these were concentrated in one program where this was a specific objective of the program.) Others felt the programs would better prepare them for college work or provide them with a real taste of what college would be like. Still others felt that successful attendance at a program might help them obtain college scholarships or other assistance.

Some 8% of the students felt program attendance would help them to learn more of the occupations in which they were tentatively interested and thus assist them in making well-grounded college or career decisions. Since guidance or orientation seems to be one of the fundamental objectives of the National Science Foundation program, it would appear that at least a part of the participants realized the availability of such assistance and took advantage of it in rather adult fashion.

Of the remaining motives, one particularly should be mentioned. It appeared, unfortunately, that some 9% of the students looked upon program attendance merely as a worthwhile way to spend the summer.

Although interesting in and of themselves, responses to a question such as this would have been much more valuable had the question been asked before the student had had any contact with the program. Such a procedure would have provided a less contaminated answer to the question of "What do the students want to get out of the programs?" In the light of answers to such a question, modifications as a result of program attendance and final student evaluations of the degree to which the program had lived up to expectations - valuable operating clues might be forthcoming. For example, "To what degree should the student be told what he may expect to get out of such a program?" "Should the benefits to be accrued be outlined for the student - or should he discover them for himself?" "Which method is most effective in producing the desired end results?" Other possibilities are equally evident.

7. Financial hardships encountered by the student in attending the 1959 Summer Science Program (Chart E-7).

A total of 84% of the students stated that they had encountered no financial hardships. Some 13% stated that they had. In connection with those students who experienced hardships, the following qualifications should be noted:

(a) Almost 40% of these hardship cases were concentrated in one program. In this program mathematics constituted only 40% of the program - with two non-science courses making up the difference. The host institution, therefore, requested only 40% of the total cost of the program from the National Science Foundation and financed only 40% of the student expenses. The students thus had to finance 60% of the costs on their own.

(b) Most of the hardship expressed was of a negative variety - that is, attendance at the program prevented summer earnings, thus constituting a possible future financial hardship.

Of the positive problems expressed, the following were the most frequent:

(a) Expenses connected with the program itself. High-priced laundry service, transportation expenses to and from the institution or daily commutation, necessity for buying luggage and costly entertainment (tickets to plays or baseball games).

(b) Lack of summer earnings - apparently a necessity for many students who were planning to attend college. Also the use of or eating into savings already earmarked for college expenses.

(c) Hardship on parents or others who had to "foot the bill." In several cases students had to negotiate loans in order to attend and in at least one case a community collection provided the necessary funds.

All in all, therefore, it appears that student hardship due to financial problems was minimal. Some cases of real hardship, however, were noted. The unknown quantity in the whole question is the number of qualified students who did not apply or did not attend if accepted due to anticipated financial problems.

8. <u>Anticipated effects of increased students costs on Summer Science Program attendance (Chart E-8).</u>

According to the 1959 participants only about half would have attended the program had they been required to pay their general expenses. The proportion would drop to [illegible]% were payment of both expenses and tuition required. In like manner 38% indicated that they would not attend if expenses had to be borne and 65% would decline if tuition were also required. The remaining students gave "maybe", "not sure" or no answers.

The pattern of responses described above must be taken with a grain of salt since it was apparently responded to differently by different students. That is, some students responded only after careful thought while others took a more superficial "if it's not free, I don't want it" attitude. As an example of the former reaction, one student who experienced considerable hardship even in the 1959 program would have been willing to make even greater sacrifices in the form of paying his own expenses. Paying tuition, however, was apparently more than the traffic would bear. The rather consistent pattern of potential drop-out does, however, suggest that any revision upward of charges to the student would have a direct effect on the decision to apply and/or attend a Summer Science Program.

A last consideration in this connection is the fact that the program is an experimental and therefore unestablished one. Probably for this reason many students looked upon it as a one-time novelty of only limited importance. Were the program to be continued and its obvious worth clearly established, responses to the above question gathered in future years would probably show a quite different pattern.

9. Probable student summer activity had a Summer Science Program not been attended (Chart E-9).

Somewhat over half of the 1959 participants indicated that they probably would have secured summer jobs had they not attended a Summer Science Program. Some 61% of the boys and 44% of the girls would have worked.

Of those who did not plan to work, almost 20% would have spent the summer in other intellectual pursuits - for example, attending a regular summer school, another Summer Science Program, studying at home or reading. Almost 10% planned to travel or visit friends or relatives - a particularly popular activity for the girls. A last 8% really had no definite plans and just planned to "loaf" the summer away.

As may be noted in Chart E-10, this pattern of summer activity is generally characteristic of earlier years also. As might be suspected, however, in the younger years summer jobs tend to be less frequent, while less specific activities such as "sports," "camp" and "loafing" become more frequent.

10. Ways in which students earned money (Chart E-11).

As can be seen in Chart E-11, the ways in which the student participants normally earn extra money - either during the summer or after school - are fairly typical of what might be expected of an average group of high school students. The fact that this was not an average group of students, however, is disturbing. It would have been more satisfying to report that many of these students had had summer experiences working in hospitals, laboratories and research institutions. By actual count, however, it appears that only 2-3% of the entire group has had such experience. The above-average quality of the group did tend to show itself, nevertheless, in the fact that over 10% had had experience as counselors or leaders in a summer camp.

In our country today there is a tremendous amount of research work going on almost everywhere. Flowing from the laboratories, however, is an increasing stream of opinion to the effect that we are falling behind, do not have enough scientists, etc. In view of the reportedly outstanding performance of most of the participating summer students, therefore, it would seem that industry, government and education could do more towards working out a program whereby these excellent students could be utilized more fully as special trainee assistants in these vast and varied research activities.

11. Parental feeling concerning Summer Science Program attendance (Chart E-12).

The most common reaction of the parents of the participating students concerning program attendance was very favorable. In 93% of the cases, descriptions such as "proud," "delighted," "very encouraging," were typical. In 6% of the cases, parental attitude might best be described as neutral - they neither encouraged or discouraged attendance. In an last 1% of the cases, the parents were initially against attendance. In these few cases financial problems or the health of the student were motivating factors.

12. What the students liked best about the Summer Science Program (Chart E-13).

As can be seen in Chart E-13, the laboratory or research work was easily the most popular feature of the program as a whole. Although non-existent in the Classroom-type program, this was the favorite feature for 40% of the students in the Laboratory-type program. Closely associated with and included in this category would be the enjoyment of the special equipment and apparatus actually used in the work.

The second most frequently mentioned "like" was expressed as an appreciation for the whole concept of the summer program. Here, in 20% of the cases, the students liked the courses, the opportunities and variety offered, and, in short, the whole rationale of the program.

Next in line in popularity were the teachers and/or the teaching methods used. The students seemed especially to appreciate the individual attention received and the opportunity to work under the guidance of "real" scientists. This kind of freely elicited comment concerning teachers and teaching from students of this general grade level would seem to provide clear testimony of the effectiveness of the staffs concerned.

"Just being together" with students of similar abilities and interests seemed to be most important for the participants. Apparently many of the students involved had never met other students who were as able or interested as they. The result of such interaction seemed to be mutual stimulation leading to increased though friendly competition. In many cases, further, real "growing up" - in the sense of learning to get along with others more smoothly - was experienced. As mentioned previously, "bull sessions" were apparently one of the most thoroughly enjoyed by-products of the entire program.

The pure acquisition of new knowledge seemed to be stimulating for many students - something to be looked forward to day after day. In the same category are those responses which indicated that the students had learned how to study for the first time and were enjoying the new experience.

A last heavily mentioned category seemed to involve an appreciation of the general academic or intellectual atmosphere which served as the environment for the summer program. What the students seemed to enjoy most here, basically, was the adult approach which provided what the students considered to be a real foretaste of college life.

As will be recognized in Chart E-13 the categories included are by no means mutually exclusive. It must be pointed out, nevertheless, that the most desirable responses were not too frequently mentioned. By "most desirable" responses is meant: responses showing appreciation of being given responsibility, feelings of independence, or being able and required to think for oneself. The fact that such responses - more directly related to the several program objectives - were not more frequently noted may be due to the fact that, although the impact was present, the students did not verbalize it as such in their responses.

Lastly, as was anticipated by the Observers, it can be seen that in the students' minds recreation or extra-curricular activities were a very minor part of the program. Only about 1% of the total group mentioned these as aspects which they liked most about the program.

13. What the students liked least about the Summer Science Program (Chart E-14).

Since these responses may provide clues useful in future planning, they will be examined in some detail in order of decreasing frequency of mention.

1. Course or Program. As might be expected, certain students basically disliked certain courses or phases of the various programs. More typically, however, dissatisfaction was with:

(a) Limited selection of courses or projects to be chosen or having no choice of courses or projects - that is, courses or projects assigned by staffs.

(b) Absence of formal courses. This type of objection came from students in the research participation program. A rather surprising number of these students, while enjoying the research work, felt that some formal course work should be provided to tie the loose ends together.

Although not always explicitly stated, the root of some of the dissatisfactions cited in this category lay in the original program brochure or announcement sent out by the host institution. In several cases the exact nature of the program apparently was not spelled out for the student - or was spelled out in terms which the student did not fully understand. In at least one case the brochure definitely misrepresented the facts. In short, in a significant number of cases, the students apparently came expecting one thing and got another.

2. Organizational Problems. This category contained "gripes" which were basically criticisms of program organization and/or administration. They were quite specific to specific institutions and were to be expected in the light of the newness of the whole program and its concepts. One problem which did recur in two or three schools, however, involved the libraries. Apparently in these institutions heavy reading assignments were required in certain books. Sufficient quantities of the assigned books, however, were not available "on-reserve" in the library. As a result waiting and "scrambling" occurred which apparently was quite annoying to the heavily-worked students.

3. Discipline. Although of course necessary, the students tended to react quite strongly to what they considered overly-rigid discipline. This "regimentation" variously involved mandatory study halls, curfews and strict segregation of the sexes. As regards the latter, in at least one program this segregation appeared to be excessive - mixed couples were not allowed to sit on campus benches together, and the boys and girls were rigidly separated on bus rides during field trips.

Since this was an above-average group of students being treated in most ways as adults, the reaction noted above may have stemmed from the contrast between the adult treatment received on the one hand, and the juvenile treatment apparently received on the other. Always a difficult problem, just how far discipline and regulation could be loosened to accommodate students of this caliber remains an unknown (but perhaps experimental) quantity.

4. Lack of Time. There seems to be little doubt that almost all of the student participants were working very hard and within tight time limits. What seemed to bother students, however, was not the hard work - but rather the feeling that they were not getting "closure" due to lack of time. In other words the students felt they did not have sufficient time to "do a good job," or to "get the details." Lack of sleep, pressure, tension and strain - actually listed as separate categories - were basically symptoms of the same complaint. The fact that the students felt they could not spare the time to take advantage of recreational facilities offered, to look after personal problems, also tended to cause some discontent.

5. Field Trips. This category consists almost entirely of comments elicited from the students in one program. In this program an entire week was apparently set aside for field trips. In such concentrated fashion, therefore, whether true or not - the students tended to look upon the trips as uninteresting or poorly planned. Since, as can be noted in Chart E-13, field trips were among the most popular aspects of several programs, this particular reaction serves well to illustrate what can happen when a basically effective tool is utilized unskillfully.

It should be noted that 6% of the students could list nothing that they really liked least about their particular programs. Instead they "liked it all."

6. Recreation. Although some of these comments were directed against specific aspects of the various recreational programs, the most frequent dissatisfaction was with mandatory recreation. This objection seemed to stem from:

(a) the students felt they could not spare the time from their studies, and,

(b) they apparently resented being told "now is the time for your exercize, children."

7. Outside Lectures. As has been noted, lectures were used quite frequently in almost all of the programs. In general these were enjoyed, but in some instances the students apparently regarded certain ones as uninteresting, too long, too frequent or too "deep" - that is, over the student's head.

The remaining categories of dislikes outlined in Chart 14 are increasingly minor in terms of numbers of students involved and are largely self-explanatory.

14. Anticipated effects of Summer Science Program attendance on high school work. (Chart E-15).

Oddly enough, although the question referred specifically to program effects on high school work, roughly 60% of the responses involved effects bearing on college entrance and performance. This would seem to indicate that the students in the program tended to think of the programs' impacts in college terms rather than high school terms.

The students felt very strongly that summer attendance would make them better qualified for college entrance and enhance their chances of receiving scholarships or other financial aid. In like manner they considered that Summer Science Program participation would make them better qualified to carry out college-level work successfully. Among a rather restricted group, lastly, early college admission or advanced college placement was viewed as a distinct possibility.

The high school effects predicted in the remaining 40% of the responses involved mainly the three following areas:

(a) Academic performance would be of better quality and easier to achieve. Some of this improvement would be due to the development of better study habits and the more efficient and judicious use of free time.

(b) The students would return to the high schools with a better understanding of and increased interest in science. They predicted that these factors would probably serve to increase their participation in high school science activities, Science Fairs, and the like.

(c) Their exposure to science would have led most students to a better understanding of their educational and vocational objectives. As a result, considerable further thought would be given to these problems and some changes might be expected.

15. Anticipated effects of Summer Science Program attendance on the student personally (Chart E-16).

Of the possible program effects on the students themselves, orientation benefits are reflected in over one-third of the responses. Thus the students felt they had emerged with a better understanding of their educational and vocational goals. Also, importantly, many of them felt that they knew themselves better and, as a result, were more highly motivated, more mature and generally more serious people than when they had entered.

Almost another one-third of the students considered that the acquiring of new skills had been the most important personal effect. Very interestingly, the development of better reading skills and habits was mentioned in 17% of the cases. As has already been noted, changes in study habits and time utilization were deemed important by many students. The acquisition of new basic knowledges - including research skills - was mentioned, but perhaps in a somewhat smaller proportion of cases than might have been expected.

New friendships or changes in social skills were effects deemed of major importance in 15% of the cases. This kind of impact - which has been observed again and again throughout the study - apparently emerged with the realization on the part of many students that their ability, interest in and dedication to science was by no means unique. Out of the new friendships thus formed apparently grew a generally increased interest in and understanding of people on the part of many of the students concerned.

Heightened interest in science and science activities, was apparently experienced in approximately 11% of the cases. Since the majority of these students were already interested in science, the effect appeared to be a broadening and/or deepening of the existing interest. Along with this change in interest ran the feeling that a more basic understanding of science and its operations was gained with a resultant desire to apply this new comprehension in new activities, hobbies and projects. The 4% of the students who reported that the programs would have little or no effect on them personally were, in most cases, students who were basically not satisfied with their programs as a whole. Most common here were those students who "came expecting one thing and got another."

It is interesting to note, finally, that the trends mentioned seem to hold quite constantly no matter the type of program involved. Although small differences from Classroom to Classroom-Laboratory to Laboratory programs can be noted, in general these differences are small.

16. Degree to which programs lived up to student expectation (Charts E-17 and E-18).

(Since this was a "write-in" question, responses had to be arbitrarily classified. In this question, and the six which follow, therefore, the following rough classification was used:

(1) A response was classified as yes or favorable if the entire response was positive or favorable.

(2) A response was classified as yes and no or favorable-unfavorable if the response contained some negative or unfavorable comment. It should be carefully noted that response were so classified even though the bulk of the response may have been favorable or positive in content.

(3) A response was classified as no or unfavorable if the entire response was negative or unfavorable.)

As may be noted in Chart E-17, 61% of the students felt that the program had lived up to or surpassed their expectations, 27% had some reservation concerning the programs or parts of the programs and 10% seemed to feel that the programs had not met their expectations. A last 2% either did not answer the question or gave answers such as "I did not know what to expect of the program."

It is also apparent in Chart E-17 that the degree to which expectations were met seemed to be related to the type of program involved. Thus satisfaction was greatest among participants in the Classroom type of program, somewhat less among Classroom-Laboratory students and least among Laboratory or research participation students.

The "yes" or favorable responses were of the following type: "A golden opportunity for insight into scientific methods," "The best thing that ever happened to me." On the negative side the following seem to be the major areas - in decreasing order of importance - in which dissatisfaction with the programs was expressed:

1. Discontent with course or content. In this varied category were complaints such as: coverage too limited, progress too slow or not advanced enough, too much routine work, repetition, lack of variety, or not enough learning. As may be noted in Chart E-18, criticism of this type was particularly heavy among students in the Laboratory program. Whether expressed concretely or not, the "gripe" here was most frequently that there was no "course" involved.

2. Work Load. Very heavy work loads, large amounts of "homework" and continuous pressure were judged excessive by many students. Concentrated mainly in the two Classroom type programs, these complaints are less common among the Classroom-Laboratory participants and negligible among the Laboratory program students.

3. Insufficient laboratory or research work. Again most characteristic of Laboratory program students, the complaint here was generally one of two types:

(a) Students were not allowed to do work on individual, self-designed projects.

(b) Students did not have enough opportunity actually to participate in the on-going projects to which assigned. As one student assigned to a program in which this was a frequent complaint put it, "There should be more doing and less watching."

It is interesting to note, lastly, that even in the two Classroom programs - both involving mathematics - some research or project work had been anticipated by the participants.

4. Dissatisfaction with lectures and/or field trips. Discontent was with lectures in the Classroom programs where the lectures were sometimes either not interesting or went over the students' heads. In the Laboratory programs the dissatisfaction was with field trips - and concentrated almost entirely within a single program.

5. Lack of time. Most characteristic of programs involving classroom work, the complaint here was that the students did not feel that they were doing a good job because of lack of time. Thus they were not "griping" so much about the amount of work to be done - but rather that they were not being allowed enough time to do the job thoroughly.

The remaining areas of criticism are less important and self-explanatory.

In summary, it would seem that a large majority of the students came to the programs not knowing quite what to expect - but consciously or unconsciously anticipating something common to their past high school experience. For a great many students, therefore, relative satisfaction with the programs seemed to increase as program experiences increasingly paralleled past high school experiences.

17. Student opinion concerning general program facilities (Charts E-19 and E-20).

General program facilities were rated favorably by two-thirds of the participants. In 28% of the cases some criticism was registered while in 5% of the cases the reaction was entirely negative. Dissatisfaction with the general facilities offered was least in the Laboratory-type programs and of equal strength in the other two kinds of programs.

Library facilities came under a surprising amount of criticism in the Classroom and Classroom-Laboratory programs. Here the criticisms were mainly in the following areas:

(a) Reference facilities in specialized subject areas were not as extensive as some students would have liked.

(b) Sufficient copies of heavily used "on reserve" books were not made available to meet student demand.

Laboratory facilities came in for some criticism - especially in the Laboratory programs. Physical condition of equipment, quantity available and space in which to work were most often criticized.

Some dissatisfaction with living arrangements, physical plant, and recreational facilities, was also in evidence.

18. Student opinion concerning fellow students (Charts E-21 and E-22).

Almost 80% of the participants were completely favorable in their ratings of their fellow students. The following comments give some of the flavor of these favorable ratings: "Most are smarter than I am," "Versatile," "Interested and interesting," "Outstanding," "High ability," "Friendly and congenial," "Competitive," "I expected 'eggheads' - but these are not," "Hard-working, wonderful people," "The greatest."

Some 15%, on the other hand, had some reservations concerning fellow students, and 2% took a definitely unfavorable attitude. A last 4% either omitted the question or offered an inapplicable response. The rather large proportion of this type of response among Laboratory program students was characterized by comments such as: "Students work separately," "I don't know - we don't work together" and "I would like to know the others better."

Comments of students having reservations concerning their fellows ordered themselves as follows in frequency of mention:

1. Ability. Some students of only average ability were included - or ability of the group varied so widely that dissatisfaction resulted.

2. Sociability. In almost every program there were apparently certain students who didn't "get along" or "fit in." These students were frequently described as immature or unsociable. Classified here were also those termed "self-centered."

3. Application to study. Again in practically every program were a few students who loafed, "fooled around" or "goofed off." Their antics were apparently not at all appreciated by their more serious fellow students.

4. Teamwork. Non-existent in the Laboratory programs, comments concerning lack of teamwork were most frequent in the two Classroom programs. In many instances here keen competitiveness was apparently often construed as poor teamwork. In like manner students classified as "self-centered" in category 2 above may include some of these highly competitive individuals.

5. Interest. Student interest in science generally - and in the specific program sciences particularly - apparently tended to vary widely. These variations in interest and resulting enthusiasm disturbed some of the participants.

6. "Exceptions." Classified here are those unelaborated comments such as "One or two were poor" or "Some were not up to par."

In general, the participants were quite sensitive to the behavior of their fellows and looked with sharp disfavor on those who did not obey the written or unwritten rules. Since in one or two cases comments were apparently directed against a single student, even one poor student can exert a negative effect on the program as a whole.

19. Student opinion concerning teaching (Charts E-23 and E-24).

In two-thirds of the cases the students were favorable in their ratings of teachers and teaching, 22% had some criticisms and 5% were thoroughly critical. In 6% of the cases responses were either omitted or not applicable. The rather large percentage of this type of response from Laboratory program students represented comments which stated in one way or another that no teaching in the usual sense was done.

The areas of criticism seemed to fall into the following categories - again listed in order of decreasing frequency:

1. Pace and/or level. Many students felt they were being fed information at too rapid a pace or at a level which tended to go over their heads. Others, however, thought the pace too slow and the level too low.

2. Methods. Generally responses might be summed under the reaction "It's not the way we get it in high school!" The rather widespread dissatisfaction with methods in the Classroom programs is also of interest since in these two mathematics programs extensive use was made of the "modern" or "discovery" method for the teaching of mathematics.

3. Individual attention. Most frequent in the Laboratory programs this criticism centered on the fact that the students were not allowed to participate fully in the on-going research studies and that not enough real "teaching" was going on. As a result, several complained they were not kept as busy as they would have desired.

The rest of the categories are, again, self-explanatory, and of lesser importance. As was the case with ratings of fellow students, unexplained criticism of "one or two" or "some" teachers was quite common. As might be expected due to the large number of "teachers" (researchers) involved, and the close individual contacts and relationships required, this type of critical comment was most frequent among students in the Laboratory programs.

20. Student opinion concerning texts, library facilities and lectures (Charts E-25 and E-26).

Some 61% of the students were quite satisfied with their texts, library facilities and lectures; 23% had some complaints, and 8% were basically dissatisfied. Again the 8% of "omit or not applicable" responses involved Laboratory program students who pointed out that no texts were used in the programs in which they were participating.

The criticisms broke down as follows:

1. Library and references. Repeating that already noted, inadequate reference facilities in specialized fields and lack of sufficient "reserve" books were the most common complaints. Among the Laboratory program students the complaint was not directed against the reference facilities *per se* - but rather against the research supervisors for not assigning more reference readings.

2. Texts. In those programs where text books were used, a good deal of criticism was directed against the text or specific texts being used. Level of difficulty, clarity and interest were factors which came under consideration.

3. Lectures. The lectures offered in the course of the various programs were also criticized by some of the students. Frequency, level of difficulty, and interest were areas on which comment was based.

21. Student opinion concerning the program in general (Charts E-27 and E-28).

Two-thirds of the total student group again reacted favorably to the program as a whole, 18% had mixed feelings, and 9% responded negatively. A last 6% either did not respond, or felt that, as high school students, they were not qualified to judge a university-level program. As may be noted in Chart E-27, students in the Laboratory programs tended to be significantly more critical of their experiences than were the students in the other two kinds of programs.

Specific criticisms - listed in order of decreasing frequency of mention - were as follows:

1. Courses. Some students felt the choice of courses or projects offered was not wide enough or that important courses had been omitted. In some cases, further, the students apparently did not get their first choice of course or project where an option was possible. Many of the complaints in this category - as previously pointed out - may be traced to student misunderstanding of the program prospectus or to incorrect information in the prospectus. Lastly, this particular complaint was especially characteristic of students in the Laboratory program.

2. Pace. The importance of pacing and time limits is again evident. Many students felt too much was attempted in too short a time. Several students suggested that the durations of their various programs ought to be extended in the future. As would be expected, this complaint was most frequent in those programs where course work was involved.

3. "Improvements." A number of comments suggested that programs could be improved, better organized, coordinated or made more interesting. Just how these improvements were to be effected, however, was not explained.

4. Lectures and field trips. Basic discontent with some phases of the lecture and field-trip features of the programs was in evidence.

5. Emphasis. A category of mixed reactions: some students wanted more concentration in a certain subject while others wanted broader exposure to a variety of subjects. Some students wanted more abstract, theoretical work - while others desired more detail or "fact" work.

6. Laboratory. In those programs where laboratory or research work was involved, the students complained that not enough time

was devoted to such work and not enough individual attention received.

7. Course inclusion. Some 10% of the criticism of Laboratory programs felt that courses should be included in such programs. Although enjoying the laboratory or research work, some students apparently felt that some means should be devised to tie the individual activities into a more meaningful whole.

22. Student opinion concerning entertainment (Charts E-29 and E-30).

Only slightly more than half of the students apparently were completely satisfied with the recreation or entertainment provided. Some 22% of the total had some criticism to offer, and 10% were more or less displeased with the entire situation. A total of 15% either did not respond or stated that no entertainment had been experienced thus far and that no entertainment had been anticipated.

The following summarizes the areas in which criticism of entertainment was noted:

1. Time limitations. The most frequent criticism did not involve the entertainment itself - but rather time limitations which prevented the students from enjoying that which was offered. Being very busy, many students apparently felt they could not take time from their work to take advantage of the entertainment offered.

2. Amount. While not criticizing the entertainment which had been provided, some students felt that not enough had been offered.

3. Social activities. As opposed to sports and games, dances, cook-outs and other affairs were apparently not too frequent. In all-boy schools - and even in co-ed programs - opportunities to get together with members of the opposite sex were also apparently fairly limited.

4. Rules and regulations. In this category would fall curfews regulating entertainment activities and week-end restrictions. The majority of the comments, however, reflected a fairly wide-spread resentment of mandatory participation in extra-curricular activities.

5. Variety. As with amount, a certain percentage of the students felt that the variety of entertainment offered was limited.

6. Non-specifics. As with other aspects of the program which have already been discussed, various students merely rated the entertainment provided as "not being good" or "not up to par." Just how or where the entertainment fell short of expectations was not revealed.

23. Reasons why friends of students could not attend a Summer Science Program (Chart E-31).

Chart E-31 summarizes the reasons given by student participants as to why their friends who wanted to attend a summer program could not attend. Although most are self-explanatory, the following are worthy of comment:

1. Some 27% of the total responses are non-specific - throwing no real light on the true reasons for non-attendance. These responses were of the "They were not accepted" and "They were not qualified" variety.

2. Approximately 16% of the friends would have been eliminated by one or a combination of the three most important selection factors - that is, poor selection test scores, poor grades and/ or poor recommendations.

3. According to the participants 10% of their friends could not have attended due to financial problems. In almost all cases this involved the necessity for the student to work during the summer in order to earn money for his high school, college or personal expenses.

4. Approximately 10% of the potential attenders would have been eliminated due to program administration which was faulty. Included here would be those cases in which:

(a) Word of the programs was received too late for application or after other summer plans had already been made,

(b) The potential attender was not aware of the existence of the program.

(c) The friend would not have been accepted due to grade level. (He might have been directed to another program by an alert teacher or guidance counselor.)

24. Improvements the student would recommend in running the program next year (Chart E-32).

By way of a "round-up" one of the last questions asked of the participants was "What improvements would you recommend in running the program next year?" The recommendations elicited are presented in the following pages in approximate order of importance or frequency of mention. Although in large repetitious, they are presented in detail as a summing-up of student attitudes towards the weaknesses in their various programs.

1. Administrative changes. The majority of these recommendations involved timing problems. The duration of the programs should be longer and scheduled early or late in the summer so that chances for summer employment would not be entirely nil. The program day should be shorter or more conveniently scheduled. No Saturday classes nor mandatory activities on Sundays should be held. Reschedule class periods. Have longer class periods. Have breaks and/or a physical move between classes. Change meal hours. Devote more time to individual projects. Have more classes, lab or research.

Other suggestions were basically criticisms of program coordination and planning. The students felt more attention should be given to planning, and a tighter schedule should be worked out and strictly adhered to. In this manner less time would be needlessly wasted.

A good deal of interest was expressed in making the programs more coeducational. Particularly true of the boys-only programs, even in coeducational programs suggestions were made that the male-female ratios be more nearly equalized in the future.

Some comment regarding the use of study halls was also noted. Suggested changes involved lengthening or eliminating such study halls.

Miscellaneous administrative suggestions noted were: provide for more awards so that more students might attend the programs; allow students to attend other summer programs in future years; work out procedures whereby high school or college credit might be earned for the summer work; have all students live on the campus; provide for one or more home visits during the summer program; place students more carefully according to background and ability.

2. Program Modifications. Offer a wider variety of courses from which to choose. Have fewer courses. Add or drop certain courses or programs.

Give more attention to a certain subject or change emphasis given it. Make courses broader or more advanced. Have more course work and less lab - or vice versa.

Cut down on the amount of homework required. Require more homework and fewer papers and projects.

Allow students more latitude in choosing their courses, laboratory work or research projects. Encourage more laboratory participation and more individual projects.

3. Time availability. Here concern centered mainly on the feeling that not enough time was available for study, library work, classes, laboratory work or research projects.

Various suggestions involving changes in "lights-out" and "reveille" schedules, or the spacing of activities, which might have alleviated the situation, were advanced.

In like manner, students implied dissatisfaction with time alloted for "getting ready," meals, and the like. Personal free time was apparently scarce in several of the programs - especially related to off-campus opportunities. Lack of sleep, lastly, in at least one program was apparently a rather serious problem in view of the feelings of pressure and depression thus engendered.

4. Recreation. Suggestions here were mixed, but the general feeling was that mandatory recreation - especially sports - was frowned upon. Apparently the students would prefer to have such activities on a voluntary basis. Quantity-wise, suggestions ranged from "more" to "none." Quality-wise, the desire was for more activities of a group or social nature - with members of both sexes participating.

5. Field trips. Most of these comments originated in one program where an entire week was set aside for concentrated field trips. This heavy dosage was apparently not too popular with the students as evidenced by the following kinds of comments. "Should have fewer, shorter or no field trips." "Trips should be more interesting and better scheduled." "Smaller groups of students should go on a given trip and less time should be spent on the bus than at the site itself."

6. Rules and regulations. In several programs some suggestions centered about the problem of rules and regulations. Although a difficult

problem - especially in the co-educational programs - the students apparently felt they were not treated in as mature a manner as they might have been. They suggested that more freedom be allowed and that rules and regulations be loosened and made less stringent. They tended to resent "police work" and regimentation. A general reorientation of the rules of conduct was desired.

7. General facilities. Most comment in this area involved living arrangements. Better food, better rooms, maid service, and the like was desired. Opportunity to select one's own roommate was desired. (In one program a rather serious luncheon problem arose. This problem was, however, rapidly solved.) Other suggestions implied criticism of the quantity and/or quality of laboratory apparatus and equipment available.

8. Books and library. Aside from some comment regarding better texts and lecture summary materials, the bulk of the recommendations involved access to "reserve" books required for assignments. Apparently some of the host institutions did not have sufficient copies of certain texts and references "on reserve" in their libraries. As a result, students often experienced delays in obtaining these materials in the libraries and were further frustrated by the fact that such "reserve" materials could not be removed from the libraries for home or dorm study.

9. Teachers and teaching. Various comments were noted regarding the teachers themselves; certain ones should be dropped, more were needed, instructors should be more sincere, and the like. Most suggestions, however, involved methods and procedures. Materials should be covered in a more detailed (general) manner, pace of teaching should be slowed, (accelerated), class discussion should be more widely used. The "cramming" approach should be discouraged. Less emphasis should be placed on grades, test scores or credits.

10. Recruitment and selection. Announcements of programs should be made earlier, and the announcing brochures should give the applicant a fuller, clearer picture of the program. More publicity in general should be given to the programs.

In the selection itself either better or fewer students should be selected. Some changes, lastly, should be made regarding the psychological tests used in the selection procedure.

11. Lectures. Some students felt more lectures should be given - others fewer. Most felt selection of topics could in many cases be improved -

with particular effort being made to tie the lecture to the subject areas being studied in the program itself. Perhaps more interesting topics could be selected if students were allowed to make their own suggestions. Some students, lastly, did not appreciate lectures which were pitched too high over their heads.

12. Communications. Although probably present to some degree in all of the programs, communications seemed to be a problem mainly in the Laboratory or Research participation program. Here the desire was for more conferences, seminars and teacher-student get-togethers. The possibility of more group work was suggested. Better institutional orientation early in the program was deemed necessary. In short, where these students were working for the most part only with their research supervisors, the strong desire was to get the student group together now and then to see what each other was doing.

13. Financing. This last category included several miscellaneous suggestions involving directly or indirectly a liberalization of the stipend granted - for example, payment of transportation costs on visits home, increased amount of stipend, or allow student to keep laboratory materials and apparatus.

PART F - SUMMARY AND CONCLUSIONS

The impact of the 1959 Summer Science Program is only beginning to make itself felt on the student participants and on their schools, their teachers and their fellow students. Presumably, this impact will continue during the years to come. In a very real sense, therefore, a complete appraisal of the value of the program would require a controlled follow-up of the participating students through their academic progress and on to their careers and achievement. Hence this report must be limited to what was observed and inferred during the summer of 1959, with, perhaps, a modicum of "Monday morning" philosophizing.

The 1959 Summer Science Program, based on the institutions sampled, was a striking success. Taking into account the almost complete absence of operational guide-lines, the carte blanche approach to program design and content and the generally exploratory nature of the undertaking, the results were impressive. The several institutions, through as many distinct programs, defined their own goals and met them with singular effectiveness. For this achievement, the program Directors, their staffs and their students deserve most sincere congratulations.

As is the case with any new and ambitious undertaking, some things are done very well and others are not as well done. It is not until the experiment has ended, however, that these pluses and minuses can be totalled, carefully evaluated and used constructively in future planning. Most of the comment presented here is the result of a two-day critique of the program by the Advisory Committee held in October 1959. Other inferences and conclusions are drawn directly from the reported experiences of the Observers, Directors, staffs and students themselves.

I. Program Objectives.

In the 1959 program each host institution in effect set its own objectives. These various goals tended to combine into two or three major ones, which, with minor variations, served as a core common to the program as a whole. In attempting to estimate how well these programs measured up to expectations, the National Science Foundation, as the program sponsor, asked two questions:

1. What should the National Science Foundation's basic objective be?

2. Should the National Science Foundation program be a temporary or permanent one?

Since the answer to the first question depends on the answer to the second, the latter problem will be discussed first.

The concensus seems to be that for planning purposes the program should be thought of as a permanent, continuing one. The fact that such a program is needed at all raises questions regarding the high school system. That system in the past has apparently devoted more effort to the less gifted than to the gifted. Normally the high schools might have been expected to gradually close this gap. Some evidence is available, in fact, that high schools are taking some steps in this direction. According to leaders in science education, complex changes and developments are occurring so rapidly in the subject matter and teaching methods of scientific and mathematical subjects that the average high school teacher has serious difficulty just trying to keep up with them. In dealing with the gifted science student, therefore, something more will be required. That "something more" will apparently have to be sponsored by an organization outside of the high school system and operated by personnel at the university level. In short, this need, not filled by the high schools, should be answered - whether by the National Science Foundation or some other sponsoring agency.

With regard to the National Science Foundation's basic objective, the tentative answer seems to be: "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 as follows:

1. Future scientific manpower requirements will emphasize quality rather than quantity. The need will be to produce better scientists and not necessarily more scientists. The goal of the National Science Foundation is thus 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 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 mere fact of application to such a program as that sponsored by the NSF serves as an excellent indication of scientific or mathematical interest. Assuming that proper identification can be made, therefore, the objective is to provide those students selected 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.

This, then, is what the Advisors feel should be the basic goal of the National Science Foundation program. In the discussion of objectives, a number of points were made:

1. Some Advisors were disturbed over the concept of delaying a negative decision regarding science. They felt that such postponement might complicate the students' lives - especially in college - and in the end represent pure recruitment.

2. In this connection, some concern was expressed regarding the degree to which the summer programs would motivate students towards specific fields or occupations of science. Some felt it would be a mistake to lead students into specialties before they had been exposed to the broad view. At the same time, it was pointed out that students as a whole do not care for general decisions but prefer the specific. The combination, in the minds of several Advisors, was potentially a risky one.

3. The basic objective outlined above is in terms of impact on the student. Impact on the participants' teachers, peers, and schools in general, was somewhat neglected in the discussion. All Advisors felt, however, that these secondary impacts should be carefully watched - especially in the high schools. Both potential benefits and dangers were forecast, which might, in the future, warrant shifts in program objectives. Program Directors and staffs were also somewhat hazy about these secondary impacts and felt that they should be carefully watched.

4. In this connection, it was pointed out that one impact of the returning summer student on his peers might well be that of recruitment - that is, interesting fellow students in careers in science.

5. It was felt that using early college admission or advanced standing as a program objective might be developed as a feature of a program, but in all cases such should be subordinate to the basic objective.

6. The impact of the 1959 program on the participants was not always in line with the stated basic objective. As perceived by the students, however, their programs had important effects of orientation for them - particularly in terms of college plans. As was suggested, further, student responses may not have stated too clearly the desired but evasive nature of the impact. It may be questioned, indeed, whether the students should be able to perceive and describe "effects" of this variety at all.

II. The Programs.

In the design of their individual programs, the host institutions should use the following guide-lines:

1. The key to the program should be challenge and inspiration. The program should be designed to instill in the student a lasting, long-term interest in science. It should provide him with a new way of looking at science and the ways in which scientists tackle problems. As such the program must be made up of strong, exciting, rewarding components.

2. Subject matter or information to be presented should be novel and represent an increase over that received in high school. It should be supplemental to and non-interfering with that of high school insofar as is feasible. As will be recalled, this was effectively accomplished in the 1959 program.

3. The program should provide the student with exposure to new resources not found in the high school - such as scientists, libraries and laboratories. For this reason, almost by definition, the program should be carried by university-level institutions and personnel.

4. The program should provide the student with an opportunity to do creative work. Without actually doing a hard piece of work student interest will not be obtained and sustained.

5. In the indoctrination both breadth and depth should be stressed. The danger of developing too narrow a point of view should be avoided.

6. Program aids such as lectures and field trips should be very carefully planned and carried out in order to insure maximum effectiveness.

7. The general administrative details of the program should be planned with extreme care so as to avoid even minor snags. As was seen in the 1959 program even minor administative problems can assume huge magnitude in the minds of the students and disrupt the entire program.

8. In apparent contradiction, the program should provide some interference with the high school curriculum. The product of this marginal interference should be to enliven teaching in the high school. Only in this way may students demand and receive high school programs and teaching geared to suit their needs.

As may be inferred from these program criteria, the Advisors tended to feel that the project-centered type of program was more effective in meeting the stated objective than the course-centered program. By type of program, the pros and cons were as follows:

Short Survey Program

Opinion was not favorable about the short survey program. While possibly serving as a trigger or a "jab in the arm," the Advisors felt that the long-range impact of such "quickies" would not be impressive. In their judgment a program to be effective must give the student material to "chew over" and with which to "get involved" generally. They considered the short survey would not accomplish this, nor would it provide the student with an idea of what would be expected of him in college. If held at all, at least such survey programs should include rather heavy readings and some seminar work.

Course-Centered Program

The Advisors tended to favor this type of program only in relation to the amount of laboratory work included. They felt that merely giving students courses - even if at an advanced level - would not generate the desired interest. They suggested, in short, the more doing, the better. In this connection, it is interesting to note that the 1959 summer students seemed to favor the relationship in the reverse order - that is, the more course content the better. (At the same time, it should be pointed out that other students complained of the limited opportunity offered to demonstrate initiative, resourcefulness or creativity.) As has been suggested, however, this preference may be due more to the fact that this represents what the students expected than to basic shortcomings in the programs. Preference, at any rate, cannot be equated with impact in this particular connection.

Project-Centered Program

As may be deduced, the closer the design of a program approached pure research participation, the more effective the Advisors considered it would be. Even with this endorsement, however, some qualifications are to be borne in mind:

(a) Although the "sink or swim" approach might be effective for some particularly able students, others would need (and apparently did need) some planned work to tie the loose ends together. Thus, even in this type of program, some effort should be made to give structure to the experience.

(b) Particular care should be exerted in assigning students to this type of program. Indications were that only the "cream of the cream" would be likely to benefit fully from this experience.

(c) At least one Director questioned the degree to which students could be expected to participate in and benefit from research work without the basic fundamentals. He felt that without these basic fundamentals, participation in on-going research studies would lack real meaning.

In the discussion of program design, the following points of interest were also raised:

1. Should the NSF indicate to potential host institutions what it considers "successful" approaches to the solution of the problem? The concensus seemed to be that the NSF should not appear to dictate program design. Circulation of available information, impartial evaluations, and the like, would, however, be both prudent and of real assistance to the schools and institutions involved.

2. The interaction of high-ability students with fellow students of similar abilities and interests produced rather potent impacts during the 1959 experiment. By and large, this had been largely unpredicted by the parties involved. For this reason, some attention was given to the problem of residence versus commuter programs. Most of the Advisors agreed that the residence program was to be preferred since it provided the optimum amount of interpersonal contact. Commuter programs, nevertheless, could provide good opportunities for this interaction. Therefore, the residence program should not be favored over the commuter program in an attempt to satisfy this single objective, even where financial considerations are involved, which might limit the number of student grants available. In this connection it was pointed out that opportunities for student interaction were likely to be most limited in project-centered programs. For this reason, it was suggested that special consideration be given to this interaction in project-centered programs.

3. With regard to program proposals, announcements, brochures, and the like, it was suggested that the content of these be steadily improved as experience is gained. As much pertinent information as possible should be included in the proposal - particularly in those portions bearing on objectives and type of program involved. Descriptions of programs sent out to the schools or individual students should be as clear and specific as possible to avoid misleading applicants.

4. The degree to which the summer programs "interfere" with high school programs, lastly, deserves some comment. While some such interference is necessary to achieve the desired impact on the high schools, too much interference, duplication or overlap would certainly do disservice to both the high schools and the students involved. It was strongly suggested, in fact, that much more communication take place between the host institutions and the local high schools in order to determine the limits of this overlap. Put more strongly, if a student has to repeat subject matter covered in the summer programs in his high school work, perhaps it would be better that he not attend the summer program in the first place. Thus degree of overlap is important not only in program design but in student selection.

III. The Staffs

The program Director was seen as needing the skills of a jack-of-all trades - administrator, teacher and counselor. He should be fully acquainted with all administrative details, have sole charge of the program, be physically available at all times, and have direct access to financial and physical resources.

The instructors, whenever possible, should be recognized scientists and mathematicians. The Advisors believe that the effect on the students would be directly proportional to the degree to which this criterion is met. The instructors should also devote full-time to the program. This was recognized as being not possible to achieve in many cases. For reasons of glamor or prestige, the use of high school teachers as program instructors should be discouraged. Due to their excellent knowledge of high school students, however, high school personnel should be worked into the programs - where eminently qualified - as assistants or counselors to provide advice and guidance in the handling of teenagers.

At least one full-time counselor should be associated with each program. Where feasible, further, this counselor should have other roles in the program and not be isolated from the main currents of activity. The counselor should be able to handle the following assignments skillfully:

(a) Advise students regarding their educational programs. Here the counselor should be able to provide information about the mechanics of college admission, the possibilities involved in choice of institution, the scope of courses offered, and the like. He should also be able to inform students how and where to seek financial or scholarship assistance.

(b) Counsel students on their vocational aspirations. Here he should be able to explain not only what skills and activities are involved in a given occupation but also what kinds of jobs are open to persons of a particular background.

The opinion of the Advisors was that such counseling personnel, in order to meet the high qualifications required, would have to be drawn from college sources. High school counselors, it was felt, are not familiar enough with many of these areas to answer the needs of students of the caliber involved.

That counseling facilities are needed was evident from the 1959 experience. As may be recalled, the students in these programs eagerly sought this information from the staffs and the available counselors.

Before leaving the subject of program staffing, a serious potential danger should be mentioned. The staffs of the 1959 programs were worked very hard by their students, and, although enjoying the experience, were not certain they would like to participate in a repeat performance. Other potential losses of program manpower would be:

(a) Constant demand from competing summer programs such as those sponsored by the National Science Foundation and other private organizations.

(b) Unimpressive renumeration in view of the work load involved and what might be earned in other activities.

(c) Loss of time from research or writing. As was pointed out, that status or reputation involved with participation in a Summer Science Program does not compare with that associated with publishing original research or other materials. Like it or not, however, academic personnel must keep this "publish or perish" principle in mind.

Should the pool of instructors decrease in the future, therefore, the following alternatives may have to be considered:

1. Utilize more fully the staffs of research institutes. These people generally enjoy the teaching experience and might welcome the opportunity to take part in such a program.

2. Utilize less well know scientists and mathematicians drawn from the smaller colleges.

3. Utilize well-qualified high school science and mathematics teachers.

IV. Facilities Available

As has been seen, opinion was solidly in favor of holding such programs in colleges, universities and research institutions and not in the high schools. Besides the obvious lack of equipment and personnel, the high school environment could not provide the students with the professional, sophisticated atmosphere associated with the higher institutions of learning. The impact on the students of the glamor of the college campus and the laboratories where real research was going on was definitely great.

In this connection, the Advisors felt strongly that the students should be exposed to laboratory equipment and apparatus that would not be found in their high schools. In these contacts, further, the "hands off" attitude should be kept to an essential minimum.

Lastly, the students involved in this kind of program are avid users of books and apparently know a good library when they see one. It is imperative, therefore, that the host institutions make available the library and reference facilities which will meet the needs of these talented people. Annoying shortages of frequently used texts and references should also be avoided.

V. Recruitment and Selection

Since recruitment is not a program objective the term here should be taken to mean insuring the attendance of the qualified and desired students. This class of student was judged to involve the top 2 - 5% of the high school population and include those individuals who had demonstrated excellent academic ability and intense interest in science or mathematics. They should also be mature young persons who are able to get along smoothly with others.

Regarding the selection procedure, the following suggestions were advanced by the Advisors:

1. The host institutions should be allowed more time to make their selection. This may have been a problem peculiar to 1959, but should be avoided in the future.

2. Wider dissemination of information regarding the program should be made. More articles in the local press, announcements in science teacher publications and wider brochre distribution were mentioned.

3. The host institutions should develop closer contacts with the high schools in their areas - especially during selection. Not only could the high schools provide excellent advice regarding selection techniques, but the host institutions could learn more concerning the screening processes in the high schools prior to formal student application. As will be remembered, this was a "grey area" in the 1959 study upon which more light was needed. Through better communication, further, the host institutions would gain a clearer picture of the impacts which their programs made on the high schools.

4. Continued attention should be given to formal selection techniques. In the 1959 program some Advisors felt that too much attention had been given to high school grades and test scores in student selection, and not enough to interest, drive and dedication. Both the Directors and the Observers felt that wider use of the interview would be useful in determining the genuineness of interest and the strength of motivation. Although not recommending a standardized selection procedure for all, lastly, the Advisors considered that real help could be offered the host institutions in suggesting kinds of tests helpful in selection and similar aids in applicant screening. Interest in tests which might reveal creativity (rather than pure memory) was especially strong.

5. Based on their personal observations, the Advisors noted that the more project-centered the program, the greater the care needed in student selection. Apparently success in a pure research participation program depends more on intangibles than on the concrete criteria of grades and test scores.

6. Some comment was advanced that preference in selection should be given to students in the smaller, rural high schools. The feeling here was that such students would have had fewer opportunities than their counterparts in the large urban schools where programs are more varied and generally better in quality.

7. It was noted that only 30% of the 418 students included in the study sample were girls. The feeling was, therefore, that a wider participation of girls might be encouraged. Since co-educational programs apparently involve special problems, it was suggested that more all-girl programs in girls' colleges be established.

8. At the close of the discussion, the frequency with which students should be allowed to attend such programs was questioned. As will be recalled, both program Directors and Observers felt that the real impact of such programs would come with the initial experience. Thereafter, although benefits would continue to be reaped, the effects of repeated exposures would be diminishing in nature. Other considerations were:

(a) The supply of student grants available and the number of individuals demanding them would have to be considered. In 1959 it was evident that there were many more qualified applicants than there were grants to accommodate them.

(b) Since the objective of the program implies a "one-time" exposure, it would be difficult to justify the use of funds of the Federal government to provide certain students with repeated exposures.

(c) Should additional exposures be deemed useful, other agencies might be interested to share part or all of the added burden.

VI. Student Performance and Communications

The general lack of effective host institution -high school communication has been noted. The specific problem of feeding back information concerning participant performance to the home high school has been discussed thoroughly. The Advisors agree such "feedback" is most important and would involve the following:

1. Although the specific records kept by the host institutions concerning student performance would of necessity vary from program to program, at least an anecdotal report on each student's summer performance could and should be prepared. Since course or other credit is not usually involved in the summer programs, the anecdotal report could represent the only real record of student attendance at such a program.

2. To be of value, this record should be circulated. Copies should be sent to the high school principal, the student's science teacher and to his parents. The high school staff involved should be encouraged to make this record a permanent part of the student's personal file. As experience is gained, this record then may make its way to the college admissions office, perhaps to the student's college Advisor and possibly even to his professors. This, basically, is the desirable channel of communication for this important document.

3. The important motive for the circulation of this anecdotal report is to call attention to the special student. In addition to serving as a generator of interest and stimulation, the fact of program attendance could and should be used to provide the student with some valuable "downfield blocking." If the fact of program attendance can open otherwise closed doors or attract attentions not otherwise possible, then it should be allowed and encouraged so to do.

VII. Financing

Throughout the present study, it was evident that even the modest costs to the attending students produced hardships in some cases. It was also noted that the number of students who did not apply or could not attend for financial reasons was an unknown. With this in mind, therefore, the Observers and Directors felt strongly that increased costs to the students should be avoided. Only in this way could the difficult "ability to pay" factor be kept at a minimum in recruitment and selection.

In the 1960 program the National Science Foundation is planning to absorb only 50% of student expense costs. In order to keep this cited danger to a minimum, therefore, the following actions might be taken:

1. The host institution might allocate student expense money in terms of student need. Thus, instead of granting each student 50% of his expenses, the grantee might pay 100% of the expenses of less well-to-do students and 0% of the expenses of students from more affluent families. The immediate objection to this scheme, however, would be that the National Science Foundation award is basically an honor and that the magnitude of the honor should not be dependent on parental income.

2. The host institutions might absorb the additional costs. Based on the comments of the Directors of the program sampled in 1959, this is an unlikely possibility.

3. The additional costs might be contributed by local industries, businesses, civic groups and the like. Such organizations might "sponsor" one or more students in the form of paying the extra expenses involved. Although feasible, such a scheme would involve a promotion and organization for which the host institutions might not have time or personnel.

VIII. Follow-up

Considerable interest in and concern for follow-up study of the 1959 program was evidenced by the Advisors. They felt plans for this activity were lacking in the 1959 program and should be stressed in 1960. Emphasis here was on long-range follow-up. The suggestion was offered that, in considering financial rearrangements, special consideration be given to this facet of program operation in any future evaluation of program-study impact.

APPENDIX A

Charts A-1 through A-7

CHART A-1

National Science Foundation Summer Training Programs
For High-Ability Secondary School Students By Field of Study

Field of Study	No. of Programs	Per Cent of Total
Physical Sciences	27	23.1%
Biological Sciences	20	17.1
Multiple Sciences (1)	19	16.2
Mixed Sciences + Mathematics	14	12.0
Mathematics	11	9.4
Mixed Sciences (2)	9	7.7
Physical Sciences + Mathematics	8	6.7
Applied Sciences (3)	7	6.0
Biological Sciences + Mathematics	1	0.9
Multiple Sciences + Mathematics	1	0.9
Totals	117 (4)	100.0%

(1) Listed only as "Multiple". 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, Thermodynamics and Forestry.

(4) Excludes two programs run on a one-day-per-week basis during regular academic year.

CHART A-2

National Science Foundation Summer Training Programs
For High-Ability Secondary School Students
By Geographical Distribution

Geographical Area (1)	No. of Programs	Per Cent of Total
Me., Vt., Mass., Conn.	11	9.4%
N.Y., N. J., Penn.	20	17.1
Md., Va., D. C., W. Va.	5	4.3
N. C., Tenn., Miss., Ga., Fla., Ark., La.	20	17.1
Wisc., Ill., Mich., Ind., Ohio, Ky.	17	14.5
S. D., Minn., Kans., Mo., Okla.	13	11.1
Tex., N. Mex., Ariz., Calif.	22	18.8
Ore., Mont., Utah, Colo.	6	5.1
Alaska	1	0.9
Puerto Rico	2	1.7
Totals	117	100.0%

(1) 13 states had no programs. The number of programs per state ranged from zero to 16 (New York). Median number of programs per state was 1.4.

CHART A-3

National Science Foundation Summer Training Programs For High-Ability Secondary School Students By Duration

Duration (1)	No. of Programs	Per Cent of Total
2 weeks	11	9.4%
3 weeks	5	4.3
4 weeks	15	12.8
5 weeks	15	12.8
6 weeks	32	27.4
7 weeks	8	6.7
8 weeks	14	12.0
9 weeks	11	9.4
10 weeks	5	4.3
11 weeks	1	0.9
Totals	117	100.0%

(1) Median duration: 5.9 weeks.

CHART A-4

National Science Foundation Summer Training Programs For High-Ability Secondary School Students By Number of Students

No. of Students (1)	No. of Programs	Per Cent of Total
1- 10	7	6.0%
11- 20	21	18.1
21- 30	33	28.5
31- 40	20	17.2
41- 50	7	6.0
51- 60	8	6.9
61- 70	1	0.9
71- 80	5	4.3
81- 90	1	0.9
91-100	5	4.3
101 and Over	8	6.9
Totals (2)	116	100.0%

(1) Number of students ranged from 2 to 420. Median number of students per program was 29.6.

(2) Number of students not given for one program.

CHART A-5

**National Science Foundation Summer Training Programs
For High-Ability Secondary School Students
Research Vs. Non-Research**

Type of Program	No. of Programs	Per Cent of Total
Research	10	8.5%
Non-Research	107	91.5
Totals	117	100.0%

CHART A-6

**National Science Foundation Summer Training Programs
For High-Ability Secondary School Students
Commuter Vs. Non-Commuter**

Type of Program	No. of Programs	Per Cent of Total
Commuter	31	26.5%
Non-Commuter	86	73.5
Totals	117	100.0%

CHART A-7

National Science Foundation Summer Training Programs
For High-Ability Secondary School Students
In Terms of National Science Foundation Proposal Rating

Proposal Rating	No. of Programs	Per Cent of Total
A/A	11	9.4%
A/B	29	24.8
B/B	26	22.2
B/C	45	38.5
C/C	6	5.1
Totals	117	100.0%

APPENDIX B

Exhibits B-1 through B-3

Observer's Schedule
RBH Personal History Questionnaire for High School Boys (Form A)
Summer Science Program Student Questionnaire

EXHIBIT B-1:

OBSERVER'S SCHEDULE

SUMMER SCIENCE PROGRAM FOR SUPERIOR

SECONDARY SCHOOL STUDENTS

Prepared by

Richardson, Bellows, Henry & Co., Inc.

I. OBJECTIVES

1. Why did the institution want to present this type of experimental program?

2. Why did the institution select the particular areas of study covered by your present program? (e.g., importance, recommendation of HS or college teachers, availability of teachers, etc.)

3. Why did your institution select the particular teaching methods and program used?

4. What does the institution expect the program to accomplish?

   A. For the students? (e.g., supplement HS program, inspire interest, motivation, get into college sooner, more individual research, broaden participation in science activities, etc. Please be specific.)

   B. For the High Schools to which these students will return? (e.g., better teaching programs, more interest in science, better ties to your science program, etc.)

   C. For the institution? (e.g., making it a center for promoting better science programs, public relations, draw better students, create more faculty interest in secondary programs, etc.)

   D. For the colleges or other educational institutions which these students will soon enter?

   E. For the faculty members participating in the program?

II. PROGRAM

5. Describe the program in detail. (Courses, how presented, special features, degree of sophistication, text books, use of "newer" approaches, scheduling, class periods, opportunities for creative work, etc.)

6. What are the special features of the program?

7. Describe the extracurricular program: entertainment, sports, etc. How well do these "go over"?

III. THE STAFF

8. What was (unless given in materials RBH now has) the academic training and qualifications of the directors, instructors, counselors, administrative assistants, etc.?

9. Characterize briefly the teaching experience of each person mentioned above. Kinds of courses, kinds of schools, other duties, etc.

10. What kinds of non-academic experience have the instructors had? (Note experiences which seem to have no bearing on present job as well as those which are more pertinent.)

11. How do you rate the quality of the teaching staff?

12. What experience have the teachers had in teaching younger students?

13. Do the teachers appear to be really interested in working with younger students?

IV. TEACHING METHODS AND PROCEDURES: Describe and comment on each of the following:

14. Number of students in class, lab group or research unit.

15. How much "teaching load" and other duties does each teacher carry?

16. What methods of instruction and teaching are being used? About what proportion of time is devoted to each?

17. Nature of coverage of course or project materials and concepts.

18. What new methods are being used? Are new techniques being tried out? Is experimentation taking place?

19. Organized-directed student activity versus self-initiated activity.

20. Classroom learning versus laboratory-research experience.

21. "Homework" required and conditions under which it is done.

22. Information sources: textbooks, technical source references, etc. (Are these texts HS, college or other?)

23. How are field trips or visits utilized?

24. Are guest speakers utilized? What is student reaction to them?

25. What kinds of visual aids are utilized?

26. What opportunity is available for "round-table" discussion and teacher-student conference?

27. How do you rate the:

    A. Quality of teaching.

    B. Sophistication of teaching.

V. FACILITIES

28. Describe and comment on each of the following:

    A. Classroom size and arrangement.

    B. Study facilities.

    C. Library and reference facilities.

    D. Quantity and quality of laboratory and experimental apparatus and equipment available.

    E. Off-campus facilities used.

29. What equipment and facilities are available to the student to use that are not available in his home high school?

30. Living arrangements: adequacy of rooms, general living conditions, food and basic services.

31. Recreation: sports outlets, games available, lounge or student center facilities, movie, TV or radio facilities.

VI: RECRUITMENT AND SELECTION

32. What kind of person should attend this summer program?

33. How often should any students attend a summer program?

34. What grade-age level is most desirable?

35. What per cent of a high school class could really profit by this science program? Explain.

36. How was recruiting done? (Brochures, news releases, letter to high schools, be sure we have complete set of copies of materials.)

37. When was recruiting program done? How early was it started? How long continued?

38. From what geographical area were students sought?

39. How many applications were received? (Comments on kind, numbers, quality of applications.)

40. How many selected? ________ (Boys_____ - Girls_____)

41. Was there any pre-set ratio of Boys to Girls? Why?

42. How did you select among the applicants? Describe procedure (if standard tests were used, get name of test, form number and frequency distribution of scores for two groups: those selected and those not selected. Note especially reasons for rejection. Note also the relative importances of scholastic record, school and personal references, etc.)

43. How do you think each of the following factors influenced applications:

Subjects offered

Encouragement of HS teachers

Stipends offered (e.g., inclusion of board, room, travel, etc.)

Reputation of your institution

Specific dates of sessions

Other (specify)

44. Does grade-age level overlap constitute a problem in the selection procedure?

VII. <u>PERFORMANCE</u>

45. About what percentage of a normal High School 11th or 12th grade class might be expected to profit from this type of summer program?

46. About what percent of the students now in this program are really benefiting from it?

47. What are the <u>negative</u> effects resulting from a program of this type?

48. What evidence of good performance can students show: (e.g., examinations - reports - group participation - work habits - reading-paying attention to business.)

49. How are performance standards set and maintained?

50. What records of individual student performance are maintained? If such records are kept, to whom are they sent and what use is made of them?

51. What is the general quality of student work and study habits? Describe. Do they "stick-to-it" or is loafing and horseplay in evidence? Do they ignore prescribed procedure?

52. Is discipline a problem? How?

53. Compared with high school students, to what degree do the summer students in the program display above-average initiative and resourcefulness?

54. What outward manifestations do students show indicating that the program is having an impact upon them? (Attitudes, changes in plans.)

55. Are experienced counselors available to the students and do the students know they are available?

56. To what extent is the advice and guidance of the counselor sought out by the students.

57. What kinds of problems do the students bring up when talking with the counselor?

VIII. PLANS FOR FOLLOW UP

58. What formal plans have been made to study the impact of the program on the students, the schools involved, and the community at large?

59. What provision has been made for "keeping in touch" with students attending the program?

IX. SPECIAL PROBLEMS

60. What "adjustment" problems are the students likely to have to face as a result of attending the summer institute program? (e.g., have covered material of HS courses, think they really know science, etc.)

61. What problems will the high schools to which the students return have as a result of the students' summer institute experience?

62. What problems will the colleges which these students attend have as a result of the students' summer institute experience?

63. What evidence is available indicating that the high schools and colleges are changing their thinking as a result of this type of program?

64. What effect on community or public opinion has the summer institute type of program had?

65. What other methods for dealing with the superior science or math student should be tried? How do these compare with the summer institute approach?

66. Should High Schools take over the summer institute type of activity? Advantages and disadvantages?

67. To what extent should the summer institute approach be used in dealing with gifted students in other subject matter areas? Describe.

68. Are there any comments regarding the financing of the summer institute programs?

69. What problems have arisen, in the administration of the program, which have affected the achievement of the desired goals?

70. What problems are foreseen involving high school or college acceptance of credits acquired through summer institute programs?

X. FINANCING - COSTS

71. Total budget for Program.

72. What is furnished to students? (e.g., board, room, transportation.)

73. Which of the budget items, now supplied to the students should be borne by them? Why? Effect on recruitment?

74. To what extent are each of the following sources of budget for this institute?

Host Institution

NSF

Community

Student

Other

75. How do you see the future financing of this program?

XI. OVERALL

76. Characterize or describe the "feel" or "spirit" of the program.

77. How well does this program seem to live up to its aims and purposes?

78. In what ways does it fail to live up to its purposes?

79. What are the tough problems of this school's program?

80. Overall, how good a job is being done? Give evidence supporting your estimate.

81. What evidence of "effects" should one look for in students and in local HS by which such programs could be judged.

82. What is attitude of HS principals, HS science teachers regarding your program?

"THE RBH PERSONAL HISTORY QUESTIONNAIRE FOR HIGH SCHOOL BOYS (FORM A)"

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EXHIBIT B-3:

SUMMER SCIENCE PROGRAM

1 2 3 4 5
6 7 8 9 10 11

Student Questionnaire

Prepared by

Richardson, Bellows, Henry & Co. Inc.

Date ________

1. Name:
Print in
CAPITAL
Letters ________ (Last Name) ________ (First Name) ________ (Middle Name)

2. Sex ____ (M or F)

3. Home Address ________ (Number and Street) ________ (City) ____ (Zone) ____ (State)

4. Name of Your High School ________ Address of High School ________ (City) ____ (State)

5. Age at Last Birthday ____

6. Date of Birth ____ (Month) ____ (Day) ____ (Year)

7. Grade Completed Spring 1959 ____

8. Grade Entering Sept. 59 ____

9. When do you expect to graduate from High School? ________ (Month) ____ (Year)

10. What course of study do you plan to follow in college or professional school ________

____

11. What occupation do you actually expect to follow?

A. First Choice ________ B. Second Choice ________

12. If you could do just as you please, what would you really like to be doing ten or fifteen years from now? Why? ________

____

____

13. What quality of marks have you earned in High School (Check the highest that applies)

A. In my class, I stand in the: Top 5% ____ Top 25% ____ Top 50% ____ Lower 50% ____

B. What is the average of your High School grades now? ____

14. What Science and Mathematics courses have you had in High School?

Name of Course	Grade Earned	Expect to take
MATHEMATICS		
Algebra, through quads............		
Algebra, beyond quads............		
Geometry, Plane............		
Geometry, Solid............		
Trigonometry, Plane............		

Name of Course	Grade Earned	Expect to take
SCIENCE		
Physics................		
Chemistry..............		
Physical Geography......		
Botany................		
Physiology.............		
Zoology................		
Agriculture............		
Biology................		
General Science........		
....		
....		
....		

15. What studies in high school have you liked <u>least</u>?

16. What studies in high school have you liked <u>most</u>?

17. LIST HERE special recognitions, prizes, honors, and scholarships (e.g. valedictorian, honors in state scholarship contests, National Honor Society, medals cups, presidencies, managerships, athletic awards, science fair honors, etc.)

18. What foreign languages have you studied?

19. What foreign languages do you read readily?

20. What is your father's name and occupation? (If deceased ___, or retired ___, check and state his occupation prior to death or retirement.) ____________________

____

____

21. What college or professional school (if any) did your father attend; and what degree or degrees (if any) did he obtain? If none, write "none". ____________________

____

22. What is your mother's name and occupation? (If deceased ___, or retired ___, check and state her occupation prior to death or retirement.) ____________________

____

23. What colleges or professional schools (if any) did your mother attend; and what degree or degrees (if any) did she obtain? If none, write "none". ____________________

____

24. Have you had any scientists in your family? If none, write "none". If answer is "Yes", give their names, relation to you, and contributions to science. ____________________

____

____

____

____

25. What one person has been most influential in the development of your interest in science or math? ____________________ ____________________

(Name) (Position)

____

(Organization)

____

(Mailing Address)

In what ways? ____________________

____

____

____

26. LIST HERE the hobbies in which you have engaged since entering secondary school (e.g. photography, aviation, cryptanalysis, etc.) ____________________

____

____

27. LIST HERE, and briefly describe any special scientific or professional apparatus or other mechanical devices which you are competent to use. ____________________

____

____

____

28. CHECK HERE the extra-class activities (outside the classroom) in which you have participated, and the organizations to which you have belonged:

Formerly	Now	
______	______	School Publications
______	______	Music (specify) ______________
______	______	Athletics (specify) ______________
______	______	A Mathematics Club
______	______	A Science Club
______	______	A Science Fair
______	______	Science Clubs of America
______	______	Junior Academy of Science
______	______	Boys Clubs of America
______	______	Boy Scouts (give rank) ______________
______	______	Future Farmers of America
______	______	Hi-Y
______	______	Tri-Y
______	______	Quill and Scroll
______	______	Girl Scouts (give rank) ______________

Formerly	Now	
______	______	Campfire Girls
______	______	4-H Club
______	______	Girl Reserves
______	______	Other (specify) ______
______	______	______
______	______	______

29. Give the author and title for each of the last 3 books you have read (not for school)

A. ______

B. ______

C. ______

30. What magazines do you read regularly? ______

______

31. What magazines do you read just once in a while? ______

______

32. Where do you get your books and magazines to read? ______

______

______

33. Do you have a Science Library of your own? ______
No or Yes

34. How many books in your Science Library? ______

35. Do you have a laboratory at home? ______
No or Yes

Describe it briefly ______

______

______

36. How did you first hear about the Summer Science program? ______

______

______

37. Why did you select this particular school? ______________________________

____

38. Who was most influential in making up your mind to apply to the Summer Program? ____________

____

39. How were you selected? ____

____

40. What factors seemed to be most important in your selection? ______________

____

41. Why did you want to attend this summer program? (For example: to get science training not available in my high school, to have something worthwhile to do this summer, to prepare for advanced standing examinations in college, etc.) ______________________

____

42. Would you have attended a Summer Science Program this summer if

(1) You had to pay for your expenses? ________

(2) You had to pay expenses and tuition? ________

What would you have done this summer if you were not attending this program? ____________

____

____

43. Did you experience any financial hardships in attending the Summer Program? Explain:

____

____

44. What were your parents' feelings concerning your attendance at the Summer Program? ________

____

45. What have you done during the summers of:

1958 ____

1957 ____

1956 ____

46. What do you like <u>best</u> about this Summer Program? ______________________________

____

47. What do you like least about the Summer Program?

48. What effect do you expect this Summer Program to have on your high school work? (e.g. earlier graduation, better qualified for college entrance, change in courses or curriculum, entering science fairs, applications for college scholarships, etc.)

49. What effect do you expect this Summer Program to have on you personally? (e.g., changes in hobbies, reading, friends, vocational aims, college plans, etc.)

50. Has Summer Program lived up to expectations? In what ways did it not?

51. In your Summer Program, give briefly your opinion of each of the following: (e.g., how good they are and what makes them good or inadequate):

A. Facilities (space, laboratory, library, etc.)

B. Students (ability, teamwork, etc.)

C. Teaching (quality, methods, etc.)

D. Textbooks, reference books, lecture summaries, etc. ________________

E. Program (courses, content, etc.) ________________

F. Entertainment ________________

52. If you have friends who wanted to attend a Summer Program but could not, explain why they could not attend. ________________

53. What improvements would you recommend in running the program next summer? ________________

54. Please give the name of the Science or Math teacher in your own High School who knows you best?

Name ________________ Subject ________________

Address ________________

55. Give the name of a student in your High School of the same sex, age, class, ability and interests as you, but who did not attend a Summer Science (or Math) Institute.

Name ________________

Address ________________

APPENDIX C

Charts C-1 through C-69

CHART C-1

Student Distributions By Sex In The High Schools From Which Drawn

Male-Female "Mix" No. Males	No. Females	No. Total	No. of High Schools Represented	Total No. of Students Represented Males	Females	Total
7	9	16	1	7	9	16
6	1	7	1	6	1	7
3	3	6	1	3	3	6
5	0	5	1	5	0	5
3	2	5	1	3	2	5
2	3	5	1	2	3	5
4	0	4	1	4	0	4
3	1	4	3	9	3	12
1	3	4	1	1	3	4
3	0	3	4	12	0	12
2	1	3	4	8	4	12
1	2	3	2	2	4	6
0	3	3	1	0	3	3
2	0	2	12	24	0	24
1	1	2	7	7	7	14
0	2	2	11	0	22	22
Single student only			261	200	61	261
Totals			313	293	125	418

CHART C-2

Distance From Host Institution To Student's Home

Distance	Number	Per Cent of Total
Same city	113	27%
Less than 100 miles	197	47
100 or more miles	108	26
Totals	418	100%

Note: Only 7 students attended high schools not located in their home towns.

CHART C-3

Age of Student Participants

Age	Males	Females	Total	Per Cent of Total
12 years	1	-	1	1%
13 years	7	-	7	2
14 years	12	6	18	4
15 years	46	21	67	16
16 years	140	57	197	46
17 years	81	32	113	27
18 years	6	8	14	3
19 years	-	1	1	1
Totals	293	125	418	100%
Average Age:	16.0 yrs.	16.1 yrs.	16.0 yrs.	

CHART C-4

High School Grade Completed

Grade Completed	Males	Females	Total	Per Cent of Total
8th grade	10	-	10	2%
9th grade	13	1	14	3
10th grade	40	17	57	14
11th grade	209	78	287	69
12th grade	21	29	50	12
Totals	293	125	418	100%

Note: (1) 13 students in one program planned to graduate from high school one year early.

(2) 5 students included above were actually at mid-year status. These were counted in the following year -- i.e., a mid-year junior was counted as having completed the junior year.

CHART C-5

Do You Plan To Go To College?

Response	Males	Females	Total	Per Cent of Total
Yes, parents will send	106	65	171	41%
Yes, I will pay part of way	187	58	245	58
Other	-	2	2	1
Totals	293	125	418	100%

CHART C-6

Anticipated College Course Of Study

Course of Study	Males	Females	Total	Per Cent of Total Responding
Mathematics	59	30	89	21%
Science	58	30	88	21
Biological Science	7	17	24	6
Physical Science	61	18	79	19
Engineering	37	-	37	9
Engineering				
Chemical	7	-	7	2
Mechanical	3	-	3	1
Electrical	14	-	14	3
Electronic	7	-	7	1
Aeronautical	2	-	2	1
Other	1	-	1	1
Architecture	5	-	5	1
Medical	43	20	63	15
Liberal Arts	22	14	36	9
Languages	3	6	9	2
Law	10	2	12	3
Teaching	3	8	11	3
Other Studies	14	15	29	7
Undecided, Don't Know	6	7	13	3
Totals	362	167	529	
Ave. No. Responses Per Student	1.2	1.3	1.3	

CHART C-7

Have You Decided What Kind Of Work You Are Going To Take Up?

Response	Males	Females	Total	Per Cent of Total
No	52	21	73	18%
Yes, but uncertain of it	38	17	55	13
Yes, fairly sure of it	176	66	242	58
Yes, don't think I'll change it	27	21	48	11
Totals	293	125	418	100%

CHART C-8

Anticipated Occupation - First & Second Choices

Occupation	First Choice M	First Choice F	First Choice Total	%	Second Choice M	Second Choice F	Second Choice Total	%
Science	19	6	25	6%	25	5	30	7%
Pure	55	16	71	17	40	15	55	13
Applied	6	3	9	2	7	2	9	2
Mathematics	13	7	20	5	14	5	19	5
Pure	2	1	3	1	2	1	3	1
Applied	4	2	6	1	6	3	9	2
Medical-Research	8	3	11	3	4	2	6	1
Medical-Applied	39	30	69	16	9	15	24	6
Engineering	21	-	21	5	16	-	16	4
Electrical	14	-	14	3	6	-	6	1
Electronic	11	-	11	3	5	1	6	1
Civil	2	-	2	1	3	-	3	1
Chemical	7	-	7	2	8	-	8	2
Mechanical	3	-	3	1	3	-	3	1
Aeronautical	5	1	6	1	4	-	4	1
Other	4	-	4	1	5	-	5	1
Architecture	5	-	5	1	2	-	2	1
Law	5	4	9	2	10	4	14	3
Teaching	15	17	32	7	19	22	41	10
Business	3	-	3	1	4	-	4	1
Other Occupations	10	20	30	7	26	27	53	13
Undecided, Don't Know	10	5	15	4	14	7	21	5
No Answer	32	10	42	10	61	16	77	18
Totals	293	125	418	100%	293	125	418	100%

CHART C-9

Areas Of Anticipated Occupation - First vs. Second Choices

Occupational Area 1st choice-2nd choice	Males	Females	Total	Per Cent of Total
Science-Science (same)	15	10	25	6%
Science-Science (dif.)	29	16	45	11
Science-Mathematics	15	2	17	4
Science-Engineering	29	--	29	7
Science-Non-Science	27	30	57	14
Mathematics-Mathematics	6	1	7	2
Mathematics-Science	12	2	14	3
Mathematics-Engineering	2	--	2	1
Mathematics-Non-Science	2	6	8	2
Engineering-Engineering	14	1	15	4
Engineering-Science	22	1	23	5
Engineering-Mathematics	6	-	6	1
Engineering-Non-Science	12	-	12	3
Non-Science-Science	9	10	19	4
Non-Science-Mathematics	2	4	6	2
Non-Science-Engineering	5	-	5	1
Non-Science-Non-Science	10	18	28	6
Incomplete	76	24	100	24
Totals	293	125	418	100%

CHART C-10

Forecast Of Occupational Activity 10 To 15 Years From Now

Relationship To Immediate Plans

Activity 10-15 Years Hence Agrees With:	Males	Females	Total	Per Cent of Total
1st occupational choice	171	66	237	57%
2nd occupational choice	7	10	17	4
No agreement or void	115	49	164	39
Totals	293	125	418	100%

CHART C-11

Present Class Standing

Standing	Males	Females	Total	Per Cent of Total
Top 5% of Class	223	99	322	77%
Top 25% of Class	58	22	80	19
Top 50% of Class	8	3	11	2
Bottom 5% of Class	1	--	1	1
No Response	3	1	4	1
Totals	293	125	418	100%

CHART C-12

Present Grade Average

Average Grade	Males	Females	Total	Per Cent of Total
A	112	44	156	37%
A-	82	47	129	31
B+	51	16	67	16
B	29	10	39	9
B-	5	2	7	1
C+	2	--	2	1
C	1	--	1	1
No Response	11	6	17	4
Totals	293	125	418	100%

Note: Numerical Grade Averages Converted to Letter Averages as Follows:

A : 96-99	B+: 88-91	B-: 80-83	C : 72-75
A-: 92-95	B : 84-87	C+: 76-79	C-: 68-71

CHART C-13

How Fast Have You Gone Through Grammar And High School In Comparison With Other Students?

Response	Males	Females	Total	Per Cent of Total
More Rapidly Than Most	123	56	179	43%
Took The Same Time As Most	168	68	236	56
More Slowly Than Most	2	1	3	1
Totals	293	125	418	100%

CHART C-14

In 8 th Grade, How Did Your Marks Compare With Those of the Rest of the Class?

Response	Males	Females	Total	Per Cent of Total
Top 25% of Class	274	117	391	93%
Second 25% of Class	16	5	21	5
Third 25% of Class	2	2	4	1
Bottom 25% of Class	1	1	2	1
Totals	293	125	418	100%

CHART C-15

In What Subject Are You Getting Your Best Marks?

Response	Males	Females	Total	Per Cent Of Total Responding
Marks About Same In All Subjects	99	60	159	38%
Mathematics	114	24	138	33
Science	87	17	104	25
English	28	22	50	12
Foreign Languages	20	20	40	10
History - Social Sciences	26	10	36	9
All Others	29	12	41	10
Totals	403	165	568	
Average Number Responses Per Student	1.4	1.3	1.4	

CHART C-16

Mathematics Courses Taken In High School

Course	Males	Females	Total	Per Cent Having Taken
Algebra - Through Quadratics	279	114	393	94%
Algebra - Beyond Quadratics	201	72	273	65
Plane Geometry	257	101	358	86
Solid Geometry	36	15	51	12
Trigonometry	80	20	100	24
Advanced Courses	7	--	7	2
Totals	860	322	1,182	
Average Number Courses Taken for Student	2.9	2.5	2.8	

CHART C-17

Mathematics Grade Average

Grade Average	Males	Females	Total	Per Cent of Total
A	143	55	198	47%
A-	71	25	96	23
B+	28	20	48	12
B	17	14	31	8
B-	3	2	5	1
C+	2	1	3	1
C	4	2	6	1
No Response	25	6	31	7
Totals	293	125	418	100%

CHART C-18

Mathematics Courses Yet To Be Taken

Course	Males	Females	Total	Per Cent To Take
Algebra - Through Quadratics	8	2	10	2%
Algebra - Beyond Quadratics	62	16	78	19
Plane Geometry	30	16	46	11
Solid Geometry	180	37	217	52
Trigonometry	175	44	219	52
Advanced Courses	19	-	19	5
Totals	474	115	589	
Average Number Of Courses Yet To Be Taken Per Student	1.6	0.9	1.4	

CHART C-19

Science Courses Taken In High School

Course	Males	Females	Total	Per Cent Having Taken
Physics	116	31	147	35%
Chemistry	152	81	233	56
Biology	242	120	362	87
General Science	195	90	285	8
Other Biological Sciences	21	11	32	8
Other Sciences	28	7	35	8
Totals	754	340	1,094	
Average Number Courses Taken Per Student	2.5	2.7	2.6	

CHART C-20

Science Grade Average

Grade Average	Males	Females	Total	Per Cent Of Total
A	135	48	183	43%
A-	80	36	116	27
B+	22	15	37	9
B	16	16	32	7
B-	3	4	7	2
C+	--	1	1	1
C	--	1	1	1
No Response	37	4	41	10
Totals	293	125	418	100%

CHART C-21

Science Courses Yet To Be Taken

Course	Males	Females	Total	Per Cent Yet To Take
Physics	159	47	206	49 %
Chemistry	132	39	171	41
Biology	17	1	18	4
General Science	3	---	3	1
Other Biological Science	27	15	42	10
Other Sciences	14	4	18	4
Totals	352	106	458	
Average Number Of Courses Yet To Be Taken Per Student	1.2	0.8	1.1	

CHART C-22

When Do You Do Your Studying?

Response	Males	Females	Total	Per Cent Of Total
Mostly at Home	198	84	282	67%
Half At Home; Half During Study Periods	53	31	84	20
Mostly During Study Periods	14	6	20	5
Do Very Little Studying	28	4	32	8
Totals	293	125	418	100%

CHART C-23

How Do You Divide Your Study Time?

Response	Males	Females	Total	Per Cent Of Total
Most Where Likely To Get Poor Mark	98	44	142	34%
Same Amount of Time On Each Subject	54	26	80	19
Most Where Teachers Are Strict	17	11	28	7
Most On Subjects I Like	13	2	15	4
Time Divided In Some Other Way	111	42	153	36
Totals	293	125	418	100%

CHART C-24

Do You Usually Get The School Marks You Expect?

Response	Males	Females	Total	Per Cent Of Total
Yes	266	109	375	90%
No - Lower Than Expected	8	3	11	3
No - Higher Than Expected	19	13	32	7
Totals	293	125	418	100%

CHART C-25

What Is The Relationship Between The School Marks You Get And The Amount Of Studying You Do?

Response	Males	Females	Total	Per Cent Of Total
Good Marks, Little Studying	163	61	224	54
Good Marks, Hard Work	114	50	164	39
Average Marks, Average Amt. of Study	15	12	27	6
Other Responses	1	2	3	1
Totals	293	125	418	100%

CHART C-26

How Often Have You Seriously Considered Quitting School?

Response	Males	Females	Total	Per Cent of Total
Almost never	279	120	399	95%
Seldom	10	2	12	3
All others	4	3	7	2
Totals	293	125	418	100%

CHART C-27

High School Studies Liked Most

Area of Study	Males	Females	Total	Per Cent of Total Liking
Science	237	97	334	80%
Mathematics	227	103	330	79
Foreign Languages	58	43	101	24
History	54	32	86	21
English	70	42	112	27
Social Studies	8	15	23	5
Other Studies	36	21	57	14
Totals	690	353	1043	
Ave. no. of responses per student	2.3	2.8	2.4	

CHART C-28

High School Studies Liked Least

Area of Study	Males	Females	Total	Per Cent of Total Disliking
Science	20	15	35	8%
Mathematics	18	13	31	7
Foreign Languages	98	20	118	28
History	87	41	128	31
English	92	18	110	26
Social Studies	23	21	44	11
Other Studies	43	34	77	18
Totals	381	162	543	
Ave. no. of responses per student	1.3	1.3	1.3	

CHART C-29

Which School Subjects Have Influenced You Most?

Response	Males	Females	Total	Per Cent of Total Marking
Science	236	85	321	77%
Arithmetic or Mathematics	232	82	314	75
English	123	64	187	45
Foreign Languages	114	60	174	42
Art-Music	80	49	129	31
All Others	29	27	56	13
No one in particular	16	10	26	6
Totals	830	377	1207	
Ave. no. of responses per student	2.8	3.0	2.9	

CHART C-30

How Much Difference Did It Make To You What Subjects You Took When You Entered The 9th Grade?

Response	Males	Females	Total	Per Cent of Total
Tried hard to get certain subjects	186	77	263	63%
Mild or little interest	35	10	45	11
Had no choice in school I attended	72	38	110	26
Totals	293	125	418	100%

CHART C-31

In Which Of The Following Ways Has A Teacher Influenced You?

Response	Males	Females	Total	Per Cent of Total Influenced
Caused interest in certain subject	218	94	312	75%
Caused dislike of certain subject	102	33	135	32
Caused dislike of school	18	10	28	7
Influenced high school choice of subjects	55	36	91	22
Teachers had very little influence	46	17	63	15
Totals	439	190	629	
Ave. no. of responses per student	1.5	1.5	1.5	

CHART C-32

What Kind Of Teachers Have You Liked Best?

Response	Males	Females	Total	Per Cent of Total
Teachers taking interest in my personal affairs	167	49	216	52%
Teachers not paying attention to my personal affairs	82	40	122	29
I have noticed little difference in my teachers	44	36	80	19
Totals	293	125	418	100%

CHART C-33

Special Honors, Prizes, Scholarships, Etc., Won

Honor, Prize, Etc.	Males	Females	Total	Per Cent of Total Winning
Award for Scholarship	132	75	207	49%
Award for Citizenship	56	13	69	16
National Honor Society	107	58	165	39
Scholarship winner	68	29	97	23
Science Fair honors	101	27	128	31
Science-Math honors	86	35	121	29
Non-Science-Math honors	111	94	205	49
Officer - Science-Math club	39	5	44	11
Officer - Non-Science-Math club	53	38	91	22
Publication Editor	25	18	43	10
Officer - Student Government	60	23	83	20
Athletics officer or honor	50	11	61	15
Totals	888	426	1314	
Average number per student	3.0	3.4	3.1	

CHART C-34

Have You Ever Won A Scholarship Or Prize?

Response	Males	Females	Total	Per Cent of Total Winning
Yes, for excellence in athletics	55	10	65	16%
Yes, for excellence in grades	194	93	287	68
Yes, for writing or speaking ability	49	34	83	20
Yes, for excellence in art or music	35	22	57	14
Yes, for all-round excellence	67	20	87	21
Yes, for some other reason	123	57	180	43
No, I never did win one	27	8	35	8
Totals	550	244	794	
Ave. no. of responses per student	1.9	2.0	1.9	

CHART C-35

Since In High School, How Many Times Have You Been Elected To Some School Office Or Committee?

Response	Males	Females	Total	Per Cent of Total
Never	74	7	81	19%
Once	57	12	69	16
Twice	44	14	58	14
Three times	27	9	36	9
Four or more times	91	83	174	42
Totals	293	125	418	100%

CHART C-36

Which Of The Following Have You Been?

Response	Males	Females	Total	Per Cent of Total Having Been
Scout patrol or group leader	142	43	185	44%
Captain of an athletic team	71	22	93	22
Manager of an athletic team	32	4	36	9
Manager of publication, play or other non-athletic event	67	39	106	25
President of school or class	86	53	139	33
President of a school club	109	53	162	39
President of a non-school club	94	56	150	36
Secretary or treasurer of any club	151	103	254	61
Chairman of a committee	181	98	279	67
None of these	30	5	35	8
Totals	963	476	1439	
Ave. no. of responses per student	3.2	3.8	3.5	

CHART C-37

Which Things Have You Seriously Wanted To Do Or Be Since In High School?

Response	Males	Females	Total	Per Cent of Total Wanting
Be on the honor roll	157	100	257	61%
Valedictorian	164	85	249	60
Class or school president	152	66	218	52
Member of an athletic team	162	29	191	46
Act in a school play	99	71	170	41
Play in a school band	80	46	126	30
Member of debate team	88	32	120	29
Reporter on school paper	64	44	108	26
Captain of athletic team	92	15	107	26
Editor of year book	60	45	105	25
Member of glee club	50	48	98	23
Editor of the school paper	57	40	97	23
Member of fraternity	61	20	81	19
Be a cheer leader	10	56	66	16
None of these	9	3	12	3
Totals	1305	700	2005	
Ave. no. of responses per student	4.4	5.6	4.7	

CHART C-38

Foreign Languages Studied

Language	Males	Females	Total	Per Cent of Total Studied
French	118	81	199	48%
Latin	135	57	192	46
Spanish	56	21	77	18
German	47	4	51	12
Hebrew	18	1	19	4
Russian	6	3	9	2
Others	8	-	8	2
Totals	388	167	555	
Ave. no. per student	1.3	1.3	1.3	

CHART C-39

Foreign Languages Readily Read

Language	Males	Females	Total	Per Cent of Total Reading
French	62	50	112	27%
Latin	33	20	53	13
Spanish	23	13	36	9
German	21	2	23	5
Hebrew	12	1	13	3
Russian	2	-	2	1
Others	9	3	12	3
Totals	162	89	251	
Ave. no. per student	0.5	0.7	0.6	

CHART C-40

Parental Occupation

Occupation	Father M	Father F	Father Total	Father % Total	Mother M	Mother F	Mother Total	Mother % Total
Science Professional	18	3	21	5%	8	-	8	2%
Non-Science Professional	27	4	31	8	3	-	3	1
Engineer	20	2	22	5	-	1	1	1
Business	93	30	123	29	3	8	11	3
Education	25	15	40	10	52	25	77	18
Government Worker	14	13	27	6	3	2	5	1
Wage-Hour Worker	48	30	78	19	17	17	34	8
Technician	30	7	37	9	2	4	6	1
Clerical	6	7	13	3	35	14	49	11
Military	9	5	14	3	-	-	-	-
Housewife	-	-	-	-	166	51	217	52
Omit	3	9	12	3	4	3	7	2
Totals	293	125	418	100%	293	125	418	100%

CHART C-41

Parental Education

Type of Education	Father M	Father F	Father Total	Father % of Total	Mother M	Mother F	Mother Total	Mother % of Total
Ph. D.	14	5	19	4%	2	-	2	1%
M.A. or M.S.	28	12	40	10	17	11	28	6
B.A. or B.S.	58	19	77	19	56	27	83	20
M.D. or D.D.S.	13	3	16	4	1	-	1	1
LL.B. or LL.D.	12	1	13	3	-	1	1	1
Some College	30	21	51	12	24	26	50	12
Business College	2	1	3	1	15	3	18	4
Teachers' College	-	-	-	-	9	-	9	2
Nursing School	-	-	-	-	8	1	9	2
None	129	57	186	44	151	53	204	48
Omit or Don't Know	7	6	13	3	10	3	13	3
Totals	293	125	418	100%	293	125	418	100%

CHART C-42

Have You Had Any Scientists in Your Family

Response	Males	Females	Total	% of Total
No	222	92	314	75
Yes	69	27	96	23
Omit	2	6	8	2
Total	293	125	418	100%

CHART C-43

Relationship Of Family Scientist To Student

Relationship	Males	Females	Total	Per Cent of Total
Uncle	25	8	33	35%
Father	19	5	24	25
Cousin	11	7	18	19
Grandfather	6	3	9	9
Brother	4	1	5	5
Mother	2	-	2	2
Others	2	3	5	5
Totals	69	27	96	100%

CHART C-44

Person Most Influential In The Development Of Student's Interest In Science Or Mathematics

Person	Males	Females	Total	Per Cent of Total
High school teacher	158	95	253	60%
Parents	43	6	49	12
Student himself	23	5	28	7
Friends	10	4	14	3
Other relatives	8	3	11	3
No one person	21	10	31	7
Omit	30	2	32	8
Totals	293	125	418	100%

CHART C-45

When You Entered The 9th Grade, Who Had Most To Do With Choosing Your Subjects?

Response	Males	Females	Total	Per Cent of Total
Chose them myself	149	64	213	51%
Had no choice	52	22	74	18
8th grade teacher or counselor	48	18	66	16
Parents or guardian	44	21	65	15
Totals	293	125	418	100%

CHART C-46

Who Or What Influenced You Most In Deciding The Work You Are Planning To Take Up?

Response	Males	Females	Total	Per Cent of Total
Parents or guardian	78	40	118	28%
Tried it and liked it	78	30	108	26
A teacher or counselor	68	26	94	22
A friend of the family	14	5	19	5
Not yet decided	55	24	79	19
Totals	293	125	418	100%

CHART C-47

With Whom Do You Discuss Your Vocational Ambitions?

Response	Males	Females	Total	Per Cent of Total Responding
With parents	164	73	237	57%
With various friends	120	37	157	38
In school	41	19	60	14
Others	22	7	29	7
No definite vocational plans	29	12	41	10
Totals	376	148	524	
Ave. no. of responses per student	1.3	1.2	1.3	

CHART C-48

When You Have A Difficult Personal Problem, Which Of The Following Do You Do?

Response	Males	Females	Total	Per Cent of Total Responding
Ask help from parents	66	79	145	35%
Work it out alone	87	20	107	26
Ask advice of close friends	50	25	75	18
Ask help of teachers	37	5	42	10
Other	47	27	74	18
Totals	287	156	443	
Ave. no. of responses per student	1.0	1.2	1.1	

CHART C-49

Apart From Homework, Which Two Things Take Most Of Your Daytime, After School?

Response	Males	Females	Total	Per Cent Response Per Student
Spending time with friends	114	42	156	37%
Reading for pleasure	88	48	136	33
Radio or television	86	40	126	30
Doing chores at home	48	53	101	24
Sports	87	8	95	23
Working on hobbies	66	11	77	18
Special lessons (music, art, etc.)	36	30	66	16
Working for money	36	4	40	10
Other or none of these	25	14	39	9
Totals	586	250	836	

CHART C-50

Which Of The Following Do You Do Fairly Regularly At Home?

Response	Males	Females	Total	Per Cent Response Per Student
Cook, set table, do dishes	329	313	642	153%
Clean house, make beds, wash, iron	335	304	639	153
Tend lawn, garden	328	61	389	93
Take care of siblings, pets	210	85	295	71
Tend to furnace, ashes, etc.	225	57	282	67
Tend to family auto	172	25	197	47
Do what I like	109	21	130	31
None of these	11	1	12	3
Totals	1719	867	2586	
Ave. no. responses per student	5.9	6.[illegible]	6.2	

CHART C-51

Which Two Things Take Up Most Of Your Evening Time?

Response	Males	Females	Total	Per Cent Response Per Student
Studying	215	95	310	74%
Reading for pleasure	100	47	147	35
Spending time with friends	104	30	134	32
Working on hobbies	67	8	75	18
Talking with parents	29	34	63	15
Radio or television	40	10	50	12
Practicing music lessons	26	23	49	12
Painting or drawing	5	3	8	2
Totals	586	250	836	

CHART C-52

Hobbies Engaged in Since Entering Secondary School

Hobby or Activity	Males	Females	Total	Per Cent Per Student
Reading	35	51	86	21%
Writing	15	20	35	8%
Science Studies	80	11	91	22%
Music	68	47	115	27%
Stamp or Coin Collecting	80	10	90	22%
Science Collections	22	2	24	6%
Other Collecting	14	10	24	6%
Science Projects	31	10	41	10%
Creative Arts	19	23	42	10%
Building Models, etc.	43	--	43	10%
Radio, Hi-Fi, Electronics, etc.	57	--	57	14%
Domestic Arts (Sew, Cook, etc.)	1	30	31	7%
Gardening	7	3	10	2%
Working with Cars, "Hot Rods," etc.	15	--	15	4%
Photography	70	17	87	21%
Interpretive Dancing	1	15	16	4%
Speech, Dramatics	14	11	25	6%
Sports	117	37	154	37%
Games	39	2	41	10%
Social Activities	12	6	18	4%
Other Hobbies	7	6	13	3%
No Response	11	13	24	6%
Totals	758	324	1,082	
Av. No. Hobbies per Student	2.6	2.6	2.6	

CHART C-53

Special Scientific Equipment in Which Competent to Use

Type of Equipment	Males	Females	Total	% of Total Using
Microscope	91	20	111	27%
Physics Apparatus	76	9	85	20%
Chemical Apparatus	57	14	71	17%
Electrical Equipment	56	1	57	14%
Biological Equipment	36	16	52	12%
Balances	36	10	46	11%
Slide Rule	35	3	38	9%
pH Meter	18	6	24	6%
Telescope	9	--	9	2%
Computers	7	--	7	2%
None	15	4	19	5%
No Answer	99	15	114	27%
Totals	535	98	633	
Av. No. Responses per Student	1.8	0.8	1.5	

CHART C-54.

Clubs And Extra-Curricular Activities In Which Active

Club or Activity	Formerly M	Formerly F	Formerly Total	Formerly %	Now M	Now F	Now Total	Now %
Sports	129	39	168	40%	183	33	216	52%
Math-Science clubs	99	32	131	31	135	33	168	40
Musical activities	104	53	157	38	99	47	146	35
School publications	62	42	104	25	89	30	119	28
Other clubs	45	27	72	17	67	40	107	26
Science Fairs	91	34	125	30	62	16	78	19
Religious groups	23	10	33	8	50	19	69	16
Scouts	152	46	198	47	33	12	45	11
Student government	23	12	35	8	28	14	42	10
Foreign language clubs	23	12	35	8	21	10	31	7
YMCA-YWCA	27	22	49	12	20	10	30	7
Dramatics	10	9	19	5	18	12	30	7
Science Clubs of America	22	5	27	6	19	9	28	7
Speech or debate	14	1	15	4	20	4	24	6
Service clubs	8	2	10	2	19	5	24	6
Social clubs	6	5	11	3	10	10	20	5
4-H Clubs	10	22	32	8	2	7	9	2
Boys Clubs of America	18	-	18	4	8	-	8	2
Miscellaneous	11	20	31	7	21	37	58	14
None	25	12	37	9	23	20	43	10
No answer	1	-	1	-	1	-	1	-
Totals	903	405	1308		928	368	1296	
Ave. no. responses	3.1	3.2	3.1		3.2	2.9	3.1	

CHART C-55

Changes In Kinds Of Clubs Or Extra-Curricular Activities

In Which Active: Formerly Vs. Now

Change	Males	Females	Total	Per Cent of Total
Increase	126	56	182	44%
Decrease	116	57	173	41
No change	51	12	63	15
Totals	293	125	418	100%

CHART C-56

Who Interested You In The Particular Out-Of-Class

School Activities That You Joined?

Response	Males	Females	Total	Per Cent of Total
Was interested, so looked up groups	178	75	253	61%
Some of my friends got me started	65	27	92	22
My parents got me started	16	13	29	7
My teachers got me interested	18	9	27	6
Do not take part in school activities	16	1	17	4
Totals	293	125	418	100%

CHART C-57

In Which Sports Have You Been On A First Or Second-String Team in High School

Response	Males	Females	Total	Per Cent Participating
Hardball or Softball	61	15	76	18%
Touch or Tackle Football	63	-	63	15%
Basketball	62	25	87	21%
Hockey	5	4	9	2%
Volley Ball	18	21	39	9%
Tennis	29	9	38	9%
Swimming	17	3	20	5%
None of These	169	78	247	59%
Totals	424	155	579	
Ave. No. Per Student	1.4	1.2	1.4	

CHART C-58

How Do You Compare With Your Friends In Athletic Ability?

Response	Males	Females	Total	Per Cent Of Total
Better Than Average	116	32	148	36%
About Average	95	65	160	38%
Below Average	82	28	110	26%
Totals	293	125	418	100%

CHART C-59

On The Average, How Much Time Do You Spend Reading Newspapers Each Day?

Response	Males	Females	Total	Per Cent of Total
Less Than 5 Minutes Daily	33	3	36	9%
5 to 10 Minutes Daily	41	20	61	14%
10 to 15 Minutes Daily	82	36	118	28%
15 to 20 Minutes Daily	68	36	104	25%
More Than 20 Minutes Daily	69	30	99	24%
Totals	293	125	418	100%

CHART C-60

What Parts of the Newspaper Do You Regularly Read?

Response	Males	Females	Total	Per Cent of Total Reading
News Section	241	110	351	84%
Comic Section	216	91	307	73%
Columns and Editorials Page	127	74	201	48%
Sports Section	174	30	204	49%
I Do Not Read Any Part Regularly	18	3	21	5%
Totals	776	308	1,084	
Average Number Responses Per Person	2.6	2.4	2.5	

CHART C-61

Magazines Read

Type of Magazine	Regularly M	Regularly F	Regularly Total	Regularly %	Occasionally M	Occasionally F	Occasionally Total	Occasionally %
Picture	148	82	230	55%	120	38	158	38%
Light Reading	131	64	195	47	102	47	149	36
Popular Science	159	29	188	45	120	25	145	35
News	119	45	164	39	82	41	123	29
Men's-Women's	26	60	86	21	21	38	59	14
Sports	56	3	59	14	39	4	43	10
Advanced Science	30	1	31	7	23	2	25	6
Humor	27	4	31	7	22	1	23	5
Literary	21	8	29	7	27	5	32	8
Religious	5	4	9	2	4	-	4	1
Science Fiction	8	1	9	2	2	-	2	1
Business	6	1	7	2	7	3	10	2
Other	15	10	25	6	16	5	21	5
None	5	3	8	2	4	-	4	1
No answer	4	6	10	2	18	13	31	7
Totals	760	321	1081		607	222	829	
Ave. no. per person	2.5	2.5	2.5		2.0	1.7	1.9	

CHART C-62

About How Many Books Do You Read For Pleasure Each Year?

Response	Males	Females	Total	Per Cent of Total
One or More Per Week	54	32	86	21%
One Every 2 Weeks	77	38	115	27%
One Each Month	102	41	143	34%
One in 6 Months	35	11	46	11%
I Hardly Ever Read A Book For Pleasure	25	3	28	7%
Totals	293	125	418	100%

CHART C-63

Last Three Books Read

Type of Book	Per Cent of Total Read		
	Males	Females	Total
Recent Fiction	42%	52%	44%
Classical Fiction	15%	25%	18%
Popular Science	12%	3%	10%
General Non-Fiction, Philosophy	7%	5%	6%
Biography, Autobiography	4%	6%	5%
Science-Math Textbooks	4%	2%	3%
History, World Affairs	4%	-	3%
Religious	1%	5%	2%
Science Fiction	3%	-	2%
Humor	2%	1%	2%
Advanced Science	2%	1%	2%
Technical ("Do-It Yourself")	2%	-	1%
Sports	1%	-	1%
Mystery	1%	-	1%
Totals	100%	100%	100%

CHART C-64

Sources of Books and Magazines Read

Source	Males	Females	Total	Per Cent Using Source
School or Public Library	224	88	312	74%
Personal or Parent Subscriptions	152	60	212	51%
Buy at Bookstores, Newsstands	125	55	180	43%
At Home	51	32	83	20%
Borrow From Friends	36	15	51	12%
Other	7	2	9	2%
Totals	595	252	847	

CHART C-65

Do You Have A Science Library of Your Own?

Response	Males	Females	Total	Per Cent Of Total
Yes	172	36	208	50%
No	121	89	210	50%
Totals	293	125	418	100%

CHART C-66

Number of Books In Personal Science Library

Number of Books	Males	Females	Total	Per Cent Of Total
1 - 10	45	18	63	30%
11 - 20	51	7	58	28%
21 - 30	30	4	34	16%
31 - 40	12	1	13	6%
41 - 50	14	3	17	8%
51 - 100	12	-	12	6%
101-200	5	-	5	3%
200 or more	3	1	4	2%
Don't Know	-	2	2	1%
Totals	172	36	208	100%

CHART C-67

Do You Have A Science Laboratory At Home?

Response	Males	Females	Total	Per Cent Of Total
Yes	83	12	95	23%
No	210	113	323	77%
Totals	293	125	418	100%

CHART C-68

Type of Home Laboratory Maintained

Type of Laboratory	Males	Females	Total	Per Cent Of Total
Chemical	47	5	52	43%
Electrical-Electronic	35	1	36	30%
Biological	15	7	22	18%
Physical	4	-	4	3%
Astronomical	2	1	3	2%
Others	4	1	5	4%
Totals	107	15	122	100%

Note: "Totals" Entries do not agree with "Yes" Entries in Chart C-65 due to fact that some students listed two or more types of Home Laboratories.

CHART C-69

Social Acceptability Scores On "The RBH Personal History Questionnaire For High School Boys (Form A)"

Student Grouping	Mean	Standard Deviation
Males	88.4	18.5
Females	84.0	13.3
Grades 8, 9 and 10	84.7	18.2
Grades 11 and 12	87.7	16.9
Classroom	87.1	16.7
Classroom - Laboratory	86.1	17.8
Laboratory	88.3	16.8
All Students	87.1	17.2

APPENDIX E

Charts E-1 through E-32

CHART E - 1

Sources Through Which Students First Heard Of The Summer Science Program

Source Of Information	Percent Of Total		
	Males	Females	Total
High School Teacher	53%	38%	49%
High School Counselor	13	15	13
Local or Out-of-town Newspaper	8	16	11
Friends	5	9	6
Parents or Relatives	3	9	5
High School Principal	6	1	4
High School Bulletin Board	3	3	3
Unexplained High School Source	7	1	5
Miscellaneous Sources	2	6	3
No Answer	-	2	1
Totals	100%	100%	100%

CHART E - 2

Reasons Students Selected The Particular Host Institutions Involved

Reason For Selecting	Per Cent Of Total Males	Per Cent Of Total Females	Total
General interest in program or specific courses offered. Facilities or opportunities offered. Chance to obtain early college admission or advanced study.	27%	26%	27%
Only program aware of, or only one being offered in the immediate area.	24	14	21
Closeness or convenience to home. Opportunity to live away from home.	16	18	17
Prestige of institution or staff members.	3	16	7
Only program applied to or accepted by. First program to which accepted.	7	5	6
Desire to attend same school for college. Past attendance at same school. Program offered in home high school.	4	7	5
Recommended by teacher, parent or friend.	3	3	3
Duration or timing of program.	3	-	2
Only program to which eligible due to grade level.	2	1	2
Choice made for student by high school.	2	1	1
Better chance for acceptance due to large number of awards being offered.	1	-	1
Miscellaneous or non-applicable responses	5	5	5
No answer	3	4	3
Totals	100%	100%	100%

CHART E - 3

Person Most Influential In Making Up Student's Mind To Apply To A Summer Science Program

Person Influencing	Per Cent Of Total Males	Females	Total
High School Teacher	30%	33%	31%
Parents	25	28	26
The Student Himself	27	20	25
High School Guidance Counselor	8	7	7
Friends	2	5	3
High School Principal	3	1	2
Other Relatives	1	3	2
No Answer	4	3	4
Total	100%	100%	100%

CHART E - 4

How Student Felt He Was Selected

Selection Factor	Per Cent Of Total Males	Females	Total
Test Scores	30%	31%	30%
Recommendations	20	22	20
High School Grades	17	25	20
Interest and Aspirations in Science	6	2	5
Overall, Global Evaluation	3	2	3
Extracurricular and Science Activities	1	2	2
High School Did Selecting	1	2	1
Character or Personality	1	-	1
Other Factors	1	-	-
"By Application"	5	4	5
"By A Committee"	4	4	4
"By Personal Interview"	2	3	2
Don't Know	4	2	3
No Answer	5	1	4
Total	100%	100%	100%

CHART E - 5

Factors Which Student Felt Were Most Important In His Selection

Selection Factor	Per Cent Of Total		
	Males	Females	Total
High School Grades	31%	26%	29%
Test Scores	21	16	20
Recommendations	12	17	13
Interest and Aspirations in Science	9	9	9
Overall, Global Evaluation	7	7	7
Extracurricular and Science Activities	5	5	5
Character or Personality	1	-	1
High School did Selecting	-	-	-
Other Factors	1	-	1
"By Personal Interview"	-	2	1
"By Application"	-	-	-
"By A Committee"	-	-	-
Don't Know	5	6	5
No Answer	8	12	9
Totals	100%	100%	100%

CHART E - 6

Why Student Wanted To Attend A Summer Science Program

Reason For Attending	Per Cent Of Total		
	Males	Females	Total
Desire to obtain science training not available in the home high school, or to further science knowledge or interests, or to broaden exposure to science.	49%	43%	47%
To qualify for early college admission or advanced college standing.	9	16	11
Desire to be better prepared for college work.	8	14	10
A worthwhile way to spend the summer. Something to do.	8	11	9
To learn more of occupation in which interested. General Guidance or orientation to assist in career decision. To test career interest.	9	5	8
To discover, specifically, what research work in science is like.	7	2	6
To find out what college is like. To test ability at college level.	4	2	3
To increase chances for scholarship award.	2	-	2
To better high school performance. To better study habits generally.	1	1	1
The financial benefits involved.	1	2	1
To meet new friends or interesting people.	1	1	1
Miscellaneous	1	2	1
No Answer	-	1	-
Totals	100%	100%	100%

CHART E - 7

Financial Hardships Encountered By The Student In Attending The 1959 Summer Science Program

"Did You Experience Any Financial Hardships?"	Per Cent Of Total Males	Females	Total
No	84%	85%	84%
Yes	14	10	13
No Answer	2	5	3
Total	100%	100%	100%

CHART E - 8

Anticipated Effects Of Increased Student Costs On Summer Science Program Attendance

Would you have attended a Summer Science program this summer if:	You had to pay for your expenses? Males	Females	Total	You had to pay expenses and tuition? Males	Females	Total
Yes	50%	43%	48%	17%	26%	20%
Yes - Qualified	4	1	3	6	3	5
No	37	41	38	67	63	65
Not Sure	5	4	5	6	2	5
No Answer	4	11	6	4	6	5
Totals	100%	100%	100%	100%	100%	100%

CHART E - 9

Probable Student Summer Activity Had A Summer Science Program Not Been Attended

Summer Activity	Males	Per Cent Of Total Females	Total
Summer Job	61%	44%	56%
Traveling or Visiting	6	16	9
Attending Summer School	7	10	8
Studying at Home	5	7	5
Attending Another Science Program	3	3	3
Sports	3	1	3
Reading	3	-	2
Attending Summer Camp	1	4	2
Working on Hobbies or a Project	1	3	2
Other Activities	1	2	1
Nothing Special ("Loafing")	8	8	8
Don't Know or Undecided	1	2	1
	100%	100%	100%

CHART E - 10

Student Participant Summer Activities Prior To 1959

Activity	1958 M	1958 F	1958 Total	1957 M	1957 F	1957 Total	1956 M	1956 F	1956 Total
Summer Job	3[illegible]%	25%	34%	29%	19%	26%	22%	16%	20%
Traveling or Visiting	15	29	19	16	24	18	16	28	20
Attending Summer School	8	10	9	3	6	4	2	2	2
Attending Camp	7	6	7	11	7	10	18	11	16
Sports	7	3	5	10	6	9	7	5	6
Studying at Home	5	6	5	2	4	3	2	6	3
Reading	3	5	4	3	6	4	3	6	4
Hobbies or Projects	1	1	1	2	1	1	1	1	1
Other Activities	-	3	1	-	3	1	-	2	1
Nothing Special ("Loafing")	14	10	13	20	19	20	23	16	20
Don't Know or Recall	1	2	2	4	5	4	6	7	7
Totals	100%	100%	100%	100%	100%	100%	100%	100%	100%

CHART E - 11

Ways In Which Students Earned Money (Non-Family Jobs)

Activity	Males	Per Cent Of Total Females	Total
Baby Sitting, Care of Pets	16%	35%	21%
Mowing Lawns, Shoveling Snow	19	2	15
Running Errands	11	14	12
Paper Route or Stand	14	3	12
Housework, Window Washing	10	17	11
Helping in a Store	9	7	8
Working on a Farm	5	6	5
Delivery or Messenger Boy	3	-	3
Helping in a Gas Station	2	1	1
Helping in a Factory	1	-	1
Other Activities	6	5	6
None of these	4	10	5
Totals	100%	100%	100%

CHART E - 12

Parental Feeling Concerning Summer Science Program Attendance

Feeling	Males	Per Cent Of Total Females	Total
In Favor	93%	93%	93%
Neutral	6	6	6
Against	1	1	1
	100%	100%	100%

CHART E - 13

What The Students Liked Best About The Summer Science Program

Factors Liked Most	Per Cent Of Total Class	Class-Lab.	Lab.	Totals
Laboratory-research work or experience. Use of special equipment.	-	17.0%	39.2%	21.8%
Courses or program in general. Unique opportunities and variety offered. Library facilities and readings. Work in new and/or advanced areas. Conferences and seminars.	23.0%	23.4	12.0	19.0
Teachers and teaching methods. Individual attention and personal interest. Meeting and working closely with researchers.	13.1	8.9	8.8	9.8
New friendships with students of similar abilities and interests. Industry and unity of purpose towards work. Living, working and learning to get along well with students of equal or higher ability. "Bull sessions."	9.8	8.9	7.8	8.7
New knowledge. Studying and learning in concentrated fashion every day. Learning new study skills and work habits.	20.5	4.7	4.6	8.0
General academic or intellectual atmosphere. Full vigorous schedule of study. Informal, lack of pressure and grades. General facilities offered. Adult approach. A foretaste of college life.	7.4	9.8	5.1	7.5

CHART E - 13 (con't)

Factors Liked Most	Class	Class Lab.	Lab.	Total
	Per Cent Of Total			
The lectures and other presentations.	0.8%	7.7%	9.2%	6.8%
Field trips and learning through same.	-	8.5	2.3	4.4
Organization of program. Class Planning, size, make up and scheduling. Individual help and counseling. Informality and flexibility.	5.7	5.1	1.4	3.8
The challenge of hard work. Responsibility. Competition and stimulation. Feelings of accomplishment.	12.3	0.9	1.8	3.6
Independence. Choosing own subjects and working on own problems. Studying on own and thinking for self. Working at own pace without homework and strict discipline.	2.5	1.7	3.7	2.6
"Everything"	3.3	1.3	2.3	2.1
Recreation, extracurricular activities, etc.	1.6	2.1	-	1.2
Financial rewards. Stipend.	-	-	1.8	0.7
Totals	100%	100%	100%	100%

CHART E - 14

What The Students Liked Least About The Summer Science Program

Factors Liked Least	Per Cent Of Total: Class	Class-Lab.	Lab.	Totals
Courses. Too much homework with too little time in which to do it. Courses not liked or not interesting. Limited selection or lack of choice of courses or projects. Not enough formal courses. Lack of individual project. Too much extra work.	6.2%	22.2%	14.1%	15.6%
Organizational problems. Poor scheduling or lack of adherance to schedule. Lack of teacher variety. No change of classroom or break between classes. Critism of library, athletic, etc. administration - especially insufficient number of heavily used "reserve" books. Too much emphasis on grades. Excessive distances between classes.	12.4	13.8	10.0	12.1
Rigid or unrealistic discipline. Regimentation. Complete segregation of sexes. Required study halls. Strictness. Curfews too early, too late or not enforced. Rearrangement of curfews. Week-end curfews.	5.3	15.8	4.7	9.5
Lack of time. Can't complete assignments, do good job, get to details, etc. "Cramming." No time to enjoy recreational facilities. No personal free time. Too little time for meals, etc. Too little laboratory time.	9.7	10.8	1.8	7.4
Field trips. Uninteresting or poorly planned. Too many at one time. Too much travel time. Not enough time at place visited.	-	1.0	20.0	7.4
Nothing liked least. Enjoyed everything.	7.1	4.9	6.5	6.0

CHART E - 14 (con't)

Factors Liked Least	Class	Class-Lab.	Lab.	Totals
	Per Cent Of Total			
Recreation. Mandatory or too much. Poorly scheduled. Need more recreation - or less. Poor movies. Dull week-ends.	13.2%	3.9%	2.4%	5.6%
Lack of sufficient sleep.	21.2	-	1.8	5.6
Lectures not good, not interesting, too long or too frequent. Go over students' heads.	1.8	4.4	8.8	5.3
Complaints regarding food, services or general facilities.	5.3	3.4	7.0	5.1
Teachers and teaching. Pace too fast or too slow. Too routine or too intensive. Too much emphasis on basics or too narrow a field. Too much memory work. Too many tests. Certain teachers or methods disliked.	1.8	7.4	1.8	4.1
Time wasted due to fau[illegible]y scheduling, on details or through repi[illegible]on of material already covered. Lack [illegible]f work to do.	1.8	2.1	[illegible].0	3.7
Program too short in duration.	0.9	1.5	5.3	2.7
Too much pressure, tension, strain, rush.	8.8	1.5	-	2.7
Long commutation during "rush" hours. Too much time on train. Homesickness.	0.9	3.9	[illegible].8	2.5
Not enough time in lab. Too little participation in research projects. Dislike of work with animals.	0.9	3.4	2.4	2.5
Loss of income through lack of summer job. Inadequate stipend.	-	-	2.9	1.0

CHART E - 14 (con't)

Factors Liked Least	Per Cent Of Total Class	Class-Lab.	Lab.	Total
Inadequate physical conditions: heat, lack of air-conditioning, etc.	1.8%	-	0.6%	0.6%
Miscellaneous criticisms.	0.9	-	1.1	0.6
Totals	100%	100%	100%	100%

CHART E - 15

Anticipated Effects Of Summer Science Program Attendance On High School Work

Anticipated Effects	Per Cent Of Total Class	Class-Lab.	Lab.	Total
Better qualified for college entrance. Better chance to enter college of own choice. Interest in attending host institution.	13.6%	32.3%	21.0%	23.6%
Provide better chance for winning a college scholarship. Increased interest in competing for such scholarships.	13.6	14.2	21.4	16.6
Better qualified for carrying out college level work successfully.	11.9	11.8	8.4	10.6
Better academic performance in high school or college. Make course work easier.	13.6	11.8	6.1	10.2
Increased or wider interest in science and science projects. Participation in high school science or Science Fair activities.	2.2	6.9	15.3	8.8
Early college entrance or advanced standing.	22.0	1.4	1.1	6.3

CHART E - 15 (con't)

Anticipated Effects	Class	Class Lab.	Lab.	Total
	Per Cent Of Total			
Better understanding of science and/or mathematics.	7.3%	3.1%	6.9%	5.5%
Better orientation and understanding regarding vocational objective. Continuing or new interest in science. Increased desire to go on to college. Changes in high school or college plans or career goals.	2.8	3.5	6.9	4.5
Improved study habits. Higher motivation or incentive to do better work. Better budgeting of time. More reading and self-study.	4.5	5.6	2.3	4.1
No effect on high school.	0.6	2.8	3.4	2.5
Possession of knowledges beyond those of the high school level. Laboratory or research ability.	-	2.8	3.0	2.2
Having had a taste of college life. Potential for college tested.	0.6	1.8	1.1	1.3
Gained time for extra study - on own in high school or in advanced or "honors" programs.	4.0	0.3	0.4	1.3
Better knowledge of self and aptitudes. Changes in outlooks and values. Able to get along and work better with others.	1.1	1.4	0.4	1.0
Miscellaneous effects.	2.2	0.3	2.3	1.5
Totals	100%	100%	100%	100%

CHART E -16

Anticipated Effects Of Summer Science Program Attendance on Student Personally

Anticipated Effects	Class	Class-Lab.	Lab.	Total
	Per Cent of Total			
Better understanding of vocational goal. Changes in high school or college plans. Changes in or strengthening of vocational plans.	24%	26%	29%	27%
Better reading skills and habits. Broader reading scope. More technical reading.	18	18	13	17
New friends. More interest in and better understanding of people.	17	15	14	15
Increased maturity and better knowledge of self. Changed opinion and outlook on life. Desire to aim higher and work to improve self. More serious approach to things.	14	5	10	9
Changes in study habits. Better budgeting of time and use of free time. Able to think better and for self.	8	9	4	7
Increased knowledge - including research skills. "Cultural" or "intellectual" changes.	7	4	5	5
Increased interest in and understanding of science and math. Broader outlook on and attitudes towards science.	2	5	6	5
Increased interest in or changes in hobbies and science projects.	2	9	4	6
Better prepared for college. Better idea of what college is like. Better chance to succeed in college. Better chance to enter college of choice. Better chance for early admission.	3	4	2	3
Miscellaneous effects	1	1	1	1
No considerable effects or no effect.	3	4	4	4
No answer	1	-	2	1
Totals	100%	100%	100%	100%

CHART E - 17

Degree To Which Programs Lived Up To Student Expectations

Rating	Per Cent Of Total Class	Class-Lab.	Lab.	Total
Yes	71%	68%	46%	61%
Yes and No	22	18	41	27
No	6	10	12	10
Omit or not Applicable	1	4	1	2
Totals	100%	100%	100%	100%

CHART E - 18

Reasons Why Programs Did Not Live Up To Student Expectations

Reasons	Per Cent Of Total Class	Class-Lab.	Lab.	Total
Dissatisfied with courses or content. Coverage too limited. Too slow or not advanced enough. Too much routine and written work; not enough theory and oral work. Materials repeated. Not enough variety. Uninteresting. Not learning enough.	27%	26%	49%	38%
Work load heavier than expected. Too much homework. Work too difficult. Too much "cramming". Too much pressure. Lack of sleep.	38	20	4	15

CHART E - 18 (con't)

Reasons	Per Cent Of Total Class	Class-Lab.	Lab.	Total
More laboratory or research work expected. Too little individual project work. Should allow more participation in research.	4%	6%	17%	11%
Dissatisfaction with lectures and/or field trips.	11	-	16	10
Lack of time to do work adequately, to pursue personal interests, to relax and enjoy recreation. Quantity instead of quality. Lack of thoroughness.	12	19	3	9
Dissatisfaction with stipend, expenses included, rooms, food, recreation, etc.	8	7	6	7
Overly rigid rules and regulations. Discipline.	-	11	1	4
Criticism of fellow students. Poorly selected or placed. Lack of interest or seriousness. "Goof-offs."	-	4	4	4
Miscellaneous reasons.	-	7	-	2
Totals	100%	100%	100%	100%

CHART E-19

Student Opinion Concerning General Program Facilities

Student Opinion	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Favorable	61%	60%	78%	67%
Favorable-Unfavorable	33	33	19	28
Unfavorable	6	7	2	5
Omit	-	-	1	-
Totals	100%	100%	100%	100%

CHART E-20

Student Criticism Of General Program Facilities

Criticism	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Library too small, lacking in references. No leisure reading books. Not enough books "on reserve". Outdated books. Library poorly located. Noisy, poorly lighted, odd regulations.	58%	76%	9%	56%
Laboratory equipment not adequate in quantity or quality. Equipment old or in poor shape. Not enough lab space.	-	20	76	28
Criticism of general facilities: rooms, noise, heat, size, recreational facilities, age of buildings, lack of transportation, etc.	42	4	15	16
Totals	100%	100%	100%	100%

CHART E-21

Student Opinion Concerning Fellow Students

Student Opinion	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Favorable	89%	81%	68%	79%
Favorable-Unfavorable	11	13	20	15
Unfavorable	-	3	2	2
Omit or Not Applicable	-	3	10	4
Totals	100%	100%	100%	100%

CHART E-22

Student Criticism Of Fellow Students

Criticism	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Some students of only average ability. Wide variety of ability. Students not well-rounded in ability.	-	30%	28%	24%
Unsociable or immature students. Social problems. Self-centered students. Rule breakers. Don't "fit" in.	19%	15	25	20
Students are lazy, fool around; don't try hard, childish, "goof off".	27	18	16	19
Students don't work together as a team	27	18		11
Variability and variety of student interests. Lack of scientific interests.	-	15	3	7
"One or two" or "some" exceptions	27	4	28	19
Totals	100%	100%	100%	100%

CHART E-23

Student Opinion Concerning Teaching

Student Opinion	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Favorable	82%	64%	59%	67%
Favorable-Unfavorable	17	25	23	22
Unfavorable	1	7	5	5
Omit or Not Applicable	-	4	13	6
Totals	100%	100%	100%	100%

CHART E-24

Student Criticism Of Teaching

Criticism	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Teaching too fast or at too high a level. Stay too strictly to schedule. Teaching too slow.	8%	34%	26%	28%
Methods: experimental, inconsistent, different, not appealing. Repetition or boredom. Not familiar with methods for high school students	68	22	16	25
Too little individual attention. Not enough participation. Don't keep busy. Not enough actual teaching.	8	2	22	10
Not enough lab time. Too much or too long lectures. Not enough lectures.	-	13	3	8
Scope not broad enough. Materials out-of-date.	-	4	3	3
Too much extra work or homework assigned.	-	5	-	3
"One or two" or "some" teachers disliked.	8	18	30	21
Miscellaneous criticisms	8	2	-	2
Totals	100%	100%	100%	100%

CHART E-25

Student Opinion Concerning Texts, Library Facilities And Lectures

Student Opinion	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Favorable	68%	55%	63%	61%
Favorable-Unfavorable	29	27	13	23
Unfavorable	2	14	5	8
Omit or Not Applicable	1	4	19	8
Totals	100%	100%	100%	100%

CHART E-26

Student Criticism Of Texts, Library Facilities And Lectures

Criticism	Per Cent of Total			
	Class	Class-Lab	Lab	Total
References: too few or limited selection. Inadequate "reserve". More should be assigned.	17%	49%	29%	39%
Texts: too hard or easy, poor, not interesting, too detailed, not clear. A text disliked.	38	40	12	36
Lectures: too many or too few. Too long. Dull, repetitious, disappointing, boring. Too deep or too technical. Variable in quality.	45	11	59	25
Totals	100%	100%	100%	100%

CHART E-27

Student Opinion Concerning Program In General

Student Opinion	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Favorable	74%	73%	54%	67%
Favorable-Unfavorable	20	13	22	18
Unfavorable	2	5	18	9
Omit or Not Applicable	4	9	6	6
Totals	100%	100%	100%	100%

CHART E-28

Student Criticism Of Program In General

Criticism	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Have a wider choice of courses. Include certain courses. Allow to choose course or project.	10%	14%	36%	26%
Pace too fast or slow. Too much material covered in too short a time. Extend program duration.	35	51	9	24
Program could be improved, better organized or coordinated, made more interesting (how unspecified).	10	14	24	19
Lectures, field trips, movies: not interesting, should be revised, brought down to students' level.	25	-	11	11
Change in emphasis: more or less specialization, less abstract, more detailed, concentrate in one area.	15	7	3	6
Laboratory: more individual attention, more time, more laboratory work.	-	7	7	6
Include regular courses	-	-	10	6
Miscellaneous criticisms	5	7	-	2
Totals	100%	100%	100%	100%

CHART E-29

Student Opinion Concerning Entertainment

Student Opinion	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Favorable	61%	49%	53%	53%
Favorable-Unfavorable	25	26	14	22
Unfavorable	7	14	9	10
Omit or Not Applicable	7	11	24	15
Totals	100%	100%	100%	100%

CHART E-30

Student Criticism Of Entertainment

Criticism	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Lack of time to enjoy entertainment provided.	44%	24%	14%	26%
Amount provided is limited. More should be provided.	13	29	14	22
More social activities should be provided. More coed activities.	3	22	31	20
Rules and regulations concerning entertainment too rigid. Curfews should be relaxed and more week-end and in-town activity allowed. Compulsory attendance at functions resented.	25	8	3	11
Lack of variety.	3	6	10	6
Entertainment "not good", "not up to par.", etc.	3	7	7	6
Miscellaneous or specific criticisms	9	4	21	9
Totals	100%	100%	100%	100%

CHART E-31

Reasons Why Friends Of Students Could Not Attend

A Summer Science Program

Apparent Reason	Per Cent of Total			
	Class	Class-Lab.	Lab	Total
Financial problems	12%	12%	6%	10%
Poor selection test scores	23	11	1	10
Poor high school grades	4	4	8	5
Notice of program received too late	1	6	4	4
Limited number of applications received	-	-	7	2
They were not interested in programs	1	2	4	2
They had made other plans for summer	2	1	2	2
Disqualified due to age or grade level	1	3	1	2
They were not aware of the programs	1	2	2	2
Poor recommendations	1	-	1	1
Parents against the idea	1	-	1	1
They lacked confidence in themselves	-	2	-	1
Miscellaneous reasons	1	-	2	1
They were "not accepted"	9	22	27	21
They were "not qualified"	3	6	8	6
Don't know	2	2	4	2
Had no such friends	15	9	8	10
No answer	23	18	14	18
Totals	100%	100%	100%	100%

CHART E-32

Improvements The Student Would Recommend In Running The Program Next Year

Area of Application	Per Cent of Total			
	Class	Class-Lab	Lab	Total
Administrative changes	22%	31%	19%	24%
Program modifications	10	14	21	16
Time availability	38	14	6	15
Recreation	6	8	8	7
Field trips	-	-	16	7
Rules and regulations	2	10	3	6
General facilities	7	3	5	5
Books and libraries	6	9	-	5
Teachers and teaching	4	5	4	4
Recruitment and selection	-	5	5	4
Lectures	4	-	5	3
Communications	-	-	5	2
Financing	1	1	3	2
Totals	100%	100%	100%	100%