A Study of the Effect of the National Science Foundation Course Content Improvement Materials on the School Library

Eleanor R. McKinney

Western Michigan University

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A STUDY OF THE EFFECT OF THE
NATIONAL SCIENCE FOUNDATION
COURSE CONTENT IMPROVEMENT
MATERIALS ON THE SCHOOL LIBRARY

by

Eleanor R. McKinney

A Project Report
Submitted to the
Faculty of the School of Graduate
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of the
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In structural materials packages have come into prominence in the school curricula within the past six years over the United States because it brings to the classroom teacher a fresh, new subject matter approach, well-written material, and a wide variety of media which have been thoroughly tested and revised. The revolution which started in 1952 with new math instruction has spread from the science, foreign language and English curricula to the Arts and Humanities, the music, the school health, and the social studies areas. Students are now exposed to audiovisual media, to direct observation of phenomena, and to the opportunity to solve problems independently with reorganized, updated content.

The development of packages of instructional materials has been so great that the Kettering Foundation has funded an experimental program for thirty-six schools in the United States whose administrators wish to involve their faculty members in writing packages in various subject areas. 1 Goodlad states that "in virtually every field the focal point for teachers and students alike is an instructional materials packages." 2

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1 Interview with Royal Tritch, Principal, East Noble High School, Kendallville, Indiana, May 12, 1967, in which he stated that his school was a participant in this project.

This innovation in education has caused administrators to worry about these new developments and their implications for the responsibility of local schools in planning their curriculum. It has caused school librarians to be concerned with the function of the library in schools which have adopted the new media of instruction. The purpose of this study is to determine whether the use of instructional media produced with support of the National Science Foundation programs tends to increase or decrease the need for the school library program at the secondary level in the area of science instruction.

The investigator has limited the study to the Course Content Improvement Projects because they have been the subject of the pioneer effort in the development of self-contained units; they have involved scholars and teachers in their production and evaluation, and they have reflected the experience of five years of classroom teaching.

It is not the purpose of this writer to judge these programs or any other similar media as to their value in the school curriculum. According to recent literature, these programs are well-entrenched in many school systems and new additions are looming on the immediate horizon. This writer will examine the contents of the nationwide science program to ascertain what role the school library might play as it endeavors to support and enrich the science curriculum in schools which have adopted the Course Content Improvement Projects developed with support of the National Science Foundation.

From this study generalizations should show the interdependence between the school library and the science department in schools which have adopted the new science curricula if both of the agencies are
competent. Methods may be evident which teachers and librarians may employ to gain the most efficient and knowledgeable service from both areas of the school.

The writer expresses appreciation to three science teachers for their kindness in sharing their opinions of the recent science innovations: Mrs. Jacqueline Mallinson, Western Michigan University Science Department; Robert Poel, former Science teacher at Grand Rapids High School (Michigan) and Donald Stowe, Science teacher, Portage Central High School (Michigan). Much gratitude is due the members of the Science Department at Portage Northern High School, under the chairmanship of Mrs. Alta Lahner for pretesting the three questionnaire forms.

Particular acknowledgement is made to the school library consultants in the three states of Michigan, Illinois and Indiana for their help in identifying the eight school systems used in the study: Mary Ann Hanna, Head School Consultant, Michigan State Library; Vera Fredenburg, Director, Division of School Libraries and Teaching Materials, Department of Public Instruction, State of Indiana, and David O. Cooprider, Regional Supervisor, Title II, Department of Public Instruction, State of Illinois.

The fine cooperation and willing participation of teachers and librarians in the following school systems who assisted in the survey by filling in questionnaires and submitting to interview are gratefully acknowledged. These are: William A. Wirt High School, Gary, Indiana; Munster School Township, Munster, Indiana; East Noble High School, Kendallville, Indiana; Grosse Pointe High School, Grosse
Pointe, Michigan; Garber High School, Essexville, Michigan; Bentley High School, Livonia, Michigan; Lake Forest High School, Lake Forest, Illinois; and Carbondale High School, Carbondale, Illinois.

Finally, we express special appreciation to three members of the faculty at Western Michigan University who were of inestimable help in giving advice and suggestions throughout the writing of this project: Dr. Jean Lowrie and Dr. Laurel Grotzinger of the Department of Librarianship; and Dr. Dorothy McCuskey, Department of Education.

We thank Ken McCall, Head of the Science Department, Hanover Park High School, Hanover, New Jersey, for starting it all because he interested one school librarian in these programs developed with support of the National Science Foundation.
TABLE OF CONTENTS

PREFACE ......................................................... ii
LIST OF TABLES .................................................. viii

CHAPTER

I INTRODUCTION AND STATEMENT OF THE PROBLEM ................................. 1
Survey of Related Literature ........................................................................ 7

II SCIENCE IMPROVEMENT PROJECTS AND THE SCHOOL LIBRARY: COMMON GOALS AND CONTENT .............................................. 8

III METHODOLOGY OF THE STUDY .................................................................. 16
Collection of Data ......................................................................................... 16
Description of the Communities .................................................................. 17
Research Technique ..................................................................................... 23
Design of the Questionnaire ......................................................................... 24
Distribution of Questionnaires .................................................................... 31
Interviews ..................................................................................................... 31
Treatment of Data ....................................................................................... 32

IV FINDINGS OF THE STUDY ........................................................................... 37
Factors in the Science Projects which Affect the Use of the School Library ................................. 37
Need for Material ......................................................................................... 37
Time Factor .................................................................................................. 40
Accessibility ................................................................................................ 45
Summary ....................................................................................................... 46
Importance of Library Materials in Teacher Planning and Pupil Use ................. 47
Status of Library in School ........................................................................... 47
Importance in Science Teaching .................................................................... 49
Personal Use of Library by Teachers ........................................................... 55
Importance of the Library to Science Students ............................................. 56
Summary ....................................................................................................... 63
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors in the School Library Program</td>
<td></td>
</tr>
<tr>
<td>Affecting Library Instruction</td>
<td>65</td>
</tr>
<tr>
<td>The Science Collection</td>
<td>65</td>
</tr>
<tr>
<td>Accessibility of the Science Collection</td>
<td>76</td>
</tr>
<tr>
<td>Instruction in the Use of the Library</td>
<td>77</td>
</tr>
<tr>
<td>Extent of Cooperation between Science Teachers and Library Staff</td>
<td>78</td>
</tr>
<tr>
<td>Ideas for Cooperation</td>
<td>79</td>
</tr>
<tr>
<td>Summary</td>
<td>81</td>
</tr>
<tr>
<td>SUMMARY AND IMPLICATIONS</td>
<td>82</td>
</tr>
<tr>
<td>Summary</td>
<td>82</td>
</tr>
<tr>
<td>Implications</td>
<td>85</td>
</tr>
<tr>
<td>Conclusion</td>
<td>87</td>
</tr>
</tbody>
</table>

BIBLIOGRAPHY | 92 |

APPENDICES | 96 |

Appendix A - List of Biological Sciences Curriculum Study Publications | 98 |

Appendix B - Copies of Three Questionnaires. Letter Sent to Participating School Personnel | 104 |
# List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>School Population, Number of Students Taking Science, Grade Levels, Number of College-Bound Students</td>
<td>17</td>
</tr>
<tr>
<td>2.</td>
<td>Number of National Science Foundation Courses Taught in Each School with the Year of Adoption</td>
<td>34</td>
</tr>
<tr>
<td>3.</td>
<td>Number of Questionnaires Returned and Number of Interviews in Each School</td>
<td>35</td>
</tr>
<tr>
<td>4.</td>
<td>Number of Materials in Science Catalogued in the School Libraries</td>
<td>36</td>
</tr>
<tr>
<td>5.</td>
<td>Teacher Question Number 4</td>
<td>37</td>
</tr>
<tr>
<td>6.</td>
<td>Student Question Number 10</td>
<td>39</td>
</tr>
<tr>
<td>7.</td>
<td>Student Question Number 5</td>
<td>40</td>
</tr>
<tr>
<td>8.</td>
<td>Teacher Question Number 6</td>
<td>41</td>
</tr>
<tr>
<td>9.</td>
<td>Student Question Number 1</td>
<td>43</td>
</tr>
<tr>
<td>10.</td>
<td>Student Question Number 2</td>
<td>43</td>
</tr>
<tr>
<td>11.</td>
<td>Student Question Number 3</td>
<td>44</td>
</tr>
<tr>
<td>12.</td>
<td>Student Question Number 11</td>
<td>44</td>
</tr>
<tr>
<td>13.</td>
<td>Teacher Question Number 16</td>
<td>45</td>
</tr>
<tr>
<td>14.</td>
<td>Teacher Question Number 8</td>
<td>49</td>
</tr>
<tr>
<td>15.</td>
<td>Librarian Question Number 3</td>
<td>50</td>
</tr>
<tr>
<td>16.</td>
<td>Teacher Question Number 5</td>
<td>51</td>
</tr>
<tr>
<td>17.</td>
<td>Teacher Question Number 9</td>
<td>53</td>
</tr>
<tr>
<td>18.</td>
<td>Teacher Question Number 12</td>
<td>56</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.</td>
<td>57</td>
</tr>
<tr>
<td>20.</td>
<td>58</td>
</tr>
<tr>
<td>21.</td>
<td>59</td>
</tr>
<tr>
<td>22.</td>
<td>60</td>
</tr>
<tr>
<td>23.</td>
<td>61</td>
</tr>
<tr>
<td>24.</td>
<td>62</td>
</tr>
<tr>
<td>25.</td>
<td>66</td>
</tr>
<tr>
<td>26.</td>
<td>67</td>
</tr>
<tr>
<td>27.</td>
<td>68</td>
</tr>
<tr>
<td>28.</td>
<td>70</td>
</tr>
<tr>
<td>29.</td>
<td>70</td>
</tr>
<tr>
<td>30.</td>
<td>72</td>
</tr>
<tr>
<td>31.</td>
<td>75</td>
</tr>
<tr>
<td>32.</td>
<td>75</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Since 1952 when concerned mathematics specialists started thinking about involving able mathematicians and classroom teachers in a reorganization of the mathematics courses for both elementary and secondary school students, there have been programs in almost every area of the curriculum using this pattern to change the content from "the felt needs" of the child to subject matter disciplines. Perhaps the program with the greatest effect to date on the nation's schools is the one which is concerned with science and is funded by the National Science Foundation. At least one part of the science curricular program, the Physical Science Study Committee Physics (PSSC), is being used in approximately 50 per cent of the high schools in the United States.¹ The new curricular programs, as they are referred to in the literature, have been developed and tested within a research framework prepared by the finest scholars available in each subject matter field and under revision since 1960.

Negative criticism as well as praise has been leveled at the new approach to learning, mainly because of the imbalance in the curriculum and the lessening of local involvement in determining the actual material to be taught. However, school boards which have adopted

¹Physical Science Study Committee, "A New Physics Program for Secondary Schools" (Watertown, Mass.: Physical Science Study Committee, 1965, p. 4. (Mimeographed.)
these programs have done so because they realize that they have neither the local staff, the materials resources, nor the money to secure the services of scholars who were employed by the government-sponsored organizations to produce excellent material.

The various units of instruction have been published by a variety of firms in the form of instructional packages containing textbooks, teachers' guides, films, laboratory materials and workbooks, paperback books, and in some cases, exhibits. A teacher who uses these units has at his fingertips all of the information which has been collected by specialists and is constantly trying to sort from them the most valuable portions for this particular situation.¹

Is the service of the school library relevant where these units are in use? Can a student spend many hours in laboratories, working out problems, hearing lectures, "which occasionally mentioned books which might be of interest to students and could be found in [the library]" and still have time for pursuing his own interests or those subjects assigned by the teacher? There was enough to cope with in the textbook and in all the problems and practical work, and anyway it was clear that extra reading was really outside the syllabus.... Libraries and education often have little to do with each other."² In many school situations the teacher says the library is a fine thing, of

inestimable help, but he is confined by the educational strait-jacket of too much material to cover to use it regularly. The library is an optical extra for either very advanced students or for slow pupils who cannot keep up with the regular work. Unfortunately, librarians tend to "adjust themselves to the pressures which compel their libraries to be excrescenses on the body educational rather than vital organs."\(^1\)

They do not see themselves as innovators or even as playing a major part in education. They respond when demands are made, but are often too preoccupied with the mechanics of librarianship to go out and seek educational opportunities with the faculty.

The science area is one in which the modern school librarian, who realizes the vast educational potential in library resources both for the teacher and the student, finds much challenge. It is one area where he must work constantly to keep up with science methodology, to search for ways to teach students the best science research techniques. The wide use of the library in this area has been of concern regardless of the type of curriculum used. With the advent of the self-contained instructional packages this problem will assume greater proportions unless the goals of each area are understood by all personnel.

Two authorities involved in developing programs supported by the NSF have given their opinions of the importance of the use of the library in the teaching of science in general and of the packaged science curricula in particular. Brakken, in replying to an inquiry concerning the need for library material in addition to the PSSC

\(^1\)Roe, p. 14.
Physics Curriculum wrote:

In regard to your question concerning the effect of the "package" curriculum, my experience has been that such an approach requires more general library material than has been required in the case of traditional programs. Students typically are involved in more activities without complete textual direction and thus must seek out reference materials to help them in courses like PSSC Physics. This course does not give them all of the answers which they may seek.¹

The principal authority in the CBA movement, Strong, believes that library materials and wide reading are necessary for students because of the spirit of inquiry built into these curricula.²

Two instances of classroom teachers' opinions on the importance of the use of the library in science teaching are given below. An opinion based on experience with the traditional science curriculum is given by the head of the science department at the high school in Whittier, California:

One of the major objectives of science education concerns the scientific approach to problem solving. The student is often left with the impression that the gathering of data requires an elaborate array of glassware, chemical compounds, and costly apparatus. ...To combat such false impressions science teachers emphasize that professional scientists turn to the library first in their attempt to solve problems. Only after all the available literature is exhausted and no answer has been found, do they bother to assemble apparatus.

The scientist looks at the modern library as a tool which supplements his laboratory. He knows he can count on the library to supply breadth and depth in coverage in its reference books. He makes use of the

¹Letter from Earl W. Brakken, Director of Research and Development, Glenbard Township High Schools, Glen Ellyn, Illinois, November 18, 1966.

²Letter from Laurence E. Strong, Division of Science, Earlham College, November 5, 1966.
current science journals and publications in order to keep in close contact with the frontiers of science. The scientist knows that the library provides aids for locating needed materials and a skilled and understanding librarian.

A teacher who has been active in his use of the school library in teaching the Yellow Version of the BSCS for one year and who has been teaching science at Lake Forest High School (Illinois) for six years comments on the need of students for extensive library materials:

When students use the library materials in researching topics in the science area, they are frequently confronted with conflicting facts and findings in their research. This is an area in which the "facts" change through new findings in experimentation, observation and research. Here, more than in any other area of our academic program, students can be made keenly aware of the importance of "keeping up to date" with the authorities in the field. Herein lies one of the great values of extensive library use in the science program. The sciences gear students for change.

The present study is based on the problem of the use of library materials and the need for these materials in the area of science. It also investigates the nature of instruction in use of the materials, where teachers have in complete form a wealth of good information accessible in their classrooms. Does the school library contribute to the learning and teaching process in the sciences in good schools where the science program is strong, where the library program is active, and where facilities lend themselves to innovation and forward-thinking concepts?

The hypothesis for the investigation is stated thus: The school library which is an instructional materials center is a necessary adjunct

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to the learning and teaching process in schools where the Course Content Improvement programs are used. Two terms are defined for clarity. First, the school library which is an instructional materials center, includes books - the literature of children, young people and adults - other printed materials, films, tapes, recordings, transparencies and other media developed to enrich learning. The audiovisual materials owned by the school may be part of the school library collection administered by the school librarian or may be separately housed and administered under the supervision of an audiovisual coordinator. In either case materials are readily accessible and services are developed by the person in charge for use of the entire school. Second, the National Science Foundation-funded projects are units of material written by scientists in the fields of physics, chemistry, biology, and earth science, published by textbook companies and purchased through commercial channels. They are written at the secondary level for varying student abilities.

The hypothesis is based on the following assumptions: (1) The library should serve every area of the school; (2) teachers and librarians should work together for better teaching; and (3) use of many different kinds of media is essential in modern educational methods of teaching.

In order to test this hypothesis, the investigation was designed to try to determine the following: (1) how important do the teachers using these science units consider the library services; (2) what factors in the packaged media affect the school library program; (3) what factors in the school library program determine its contribution to the science department; and (4) how can science teachers and librarians assist each other in enriching science instruction and learning?
Survey of Related Literature

A search of the research studies written in this area has revealed no studies dealing with the specific effects of the science improvement projects on the use of the library. In the NEA study in 1958 the majority of science teachers thought it was their responsibility to give library instruction to their students and did give assignments requiring use of library resources.¹

It is evident that science teachers in the traditional teaching of science have considered the library of some importance in curricular needs. Is it important to the teachers using the National Science Foundation programs?

The following chapter will describe the content and goals of the Course Content Improvement Materials² for the sciences with a comparison of the content and goals of the school library. Subsequent chapters will examine the methodology of the study as to collection and treatment of data, report on the findings of the study, and form generalizations from the data.


²Term used by Dr. Neville Bennington, Director of Pre-College Education in the Sciences, National Science Foundation, telephone interview, December 5, 1967.
CHAPTER II

SCIENCE IMPROVEMENT PROJECTS AND THE SCHOOL LIBRARY: COMMON GOALS AND CONTENT

To realize the implications of the science improvement projects for the school library program, an understanding of the following is needed: (1) the goals, (2) the type of materials included, (3) the strengths and weaknesses as seen by science teachers. The latter point is significant in this study in order to specify ways of working with the package and adapting them to the best possible use for each local school system. In addition, the goals and content of the school library are examined in order to show the relationship to those of the programs developed with support of the NSF.

Blackwood has spelled out the goals of the newer science curriculum:¹ (1) renewed attention to developing a clear rationale based on teaching concepts and structure of disciplines; (2) teaching of the methods, procedures, and skills of scientific investigation, with students doing their own investigations and evaluating evidence; blocks of laboratory research involving students over extended time periods, with the students responsible for their own learning; outlining appropriate and significant questions for students to research with opportunities for them to work like scientists; (3) provision for depth learning over a period of years, beginning with the elementary years; (4) production of authentic resource material which is readily

available for use with the superior written material; (5) attempts to synthesize the sciences, with specialists in each science developing up-to-date resource materials for neglected areas such as geology, astronomy, and oceanography; (6) encouragement of diversity among projects, with different emphasis in each text (such as the three versions of BSCS); (7) development of material for both slow and advanced learners; (8) movement for reform in science teaching at the college level, and (9) development of a new type of in-service training in the form of institutes for the special preparation of science teachers.

More than in the past, it is apparent that curriculum development and teacher preparation are inseparable.

Barnard states that each new project was a "fresh new look at what should be taught from a scientist's point of view....Each project got down to the extremely difficult and time-consuming task of developing specific learning experiences for teachers to use with their students."\(^1\) In both PSSC Physics and the BSCS curricular program, students observed, manipulated, reasoned, and experimented, hopefully with the resultant understanding of the subjects because of the degree of personal involvement.

Another stated goal of the National Science Foundation is to increase the number of scientists and engineers available. One-fourth of our present engineers do not have college degrees. Seventy thousand graduate engineers are needed each year for the existing

vacancies. If the United States is going to produce enough engineers in the future, recruitment should be started at the high school level. Trytten indicates that "among our greatest unused potentials for scientific personnel are women and graduates of small high schools."¹

With the wide gap between the rate of training personnel and the growth in the need for scientists, schools of all kinds must make every possible effort to encourage able students to enter the field. In addition, scientific knowledge is of paramount importance to all educated people in our science-oriented society.

The consensus of opinion regarding goals in all of the science improvement programs appears to be summed up in Anatole France's philosophy, "Let our teaching be full of ideas. Hitherto it has been stuffed with only the facts."² The builders of these programs have stuffed them with ideas and materials which should make the student want to learn and explore.

What have the scientists and classroom teachers who worked on these programs put into them in order to achieve the aforementioned goals? Illustrations of several of the project contents should be given to show what kinds of material are included.

The Physical Science Study Committee (PSSC) Physics textbook


emphasizes quantum approach and wave mechanics, omitting technologi-
cal application found in the traditional high school guide, and in-
cluding a kit of apparatus, achievement tests, paperbound books
(Science Study Series) and teachers' guides.¹

The Biological Sciences Curriculum Study (BSCS) places empha-
sis on investigation of principles and universal rather than applied
aspects of biology. There are three texts, or versions, all different
in content which contain many kinds of materials from numerous sources.
One specific unit requires six weeks for student involvement, not nec-
cessarily related to class discussion. Individual research is required
in all versions. An addition to one version (1966) was included for
the students who do not achieve a satisfactory degree of success. A
Special Materials publication for teachers of these students is avail-
able. Other parts of the kit are similar to the physics package, ex-
cept that single concept films and pamphlets on specialized topics are
included. The Laboratory Blocks can be used with other biology text-
books besides the BSCS text.² "Take Home Laboratories" designed for
the student to do outside classroom for extra assignments or on his own
initiative have been added to the available materials.

Chemistry units are represented by two programs, the Chemical
Bond Approach (CBA) and the CHEM Study. The CBA organizes chemistry
around one central theme with a strong laboratory approach where
students collect data and apply ideas to them. Mental models are used

²H. G. Liebherr, "Biology for the Academically Unsuccessful,"
by a group of professors, high school science teachers, industrial engineers, and scientists under the direction of the Engineering Concepts Program. Five New York City schools tested it in 1965-66, using computers, instruments and machines.\(^1\)

What is the status of the science programs in the schools today?\(^2\) Figures are available on two of the programs which show a substantial number of teachers and students involved in using the kits. In 1965-66 CHEM Study had 350,000 students who had access to its materials,\(^3\) while PSSC had 200,000 during the year 1964-65. The growth in use of these packaged media in other subject areas points to continual acceptance rather than rejection of the newer curriculum.

The science programs are strong in these directions: (1) a fine grade of material with a variety of formats, (2) competition in production with no set requirements by national organizations which schools must adopt, (3) student acceptance of the programs as stimulating and interesting, with opportunities for self-confidence and self-discipline in planning individual work and study, and (4) the value placed on the "experience of the hunt, not the finishing of the book."\(^4\) Weaknesses pointed out by critics include: (1) packaged format which limits the wide use of other sources, (2) articulation

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\(^2\)The science projects available at the present time are listed in Appendix A.

\(^3\)Goodlad, p. 46.

with other courses, (3) vast amounts of material which the teacher
tries to cover completely or has to make decisions on what to
eliminate,¹ (4) difficulty of level of material, (although since 1966
this has probably been alleviated by the development of new materials
for the slower learner) and (5) the cost of the programs are out of
balance with what is needed for other curricular areas of the school.

Goals of the school library program are compatible with those
of the programs supported by the NSF. Science instruction involves
learning the skills and procedures of science investigation, while
the library program involves the acquisition of skills and procedures
for the investigation in all fields. The good library instruction
program introduces to the student the tools which enable him to pursue
knowledge at every level and at his own pace. The student is en-
couraged to work independently with these tools so that he can eval-
uate evidence, as the scientist does. Research methods taught in both
the science and library areas implement the desire to prepare the
student for efficient and in-depth methods of study and investigation.

The science program planners wish to provide depth learning
over the entire span of the years of school attendance. The library
program is geared for continuity of instruction and growth from the
kindergarten through the secondary school, with enrichment of all areas

¹In a letter by Felix Blackwood, cited in Ervin H. Hoffart,
ed., p. 3, he states, "I find that it is possible to get through
Chapter 34 by June by adhering to a rather rigid time schedule and
avoiding all or most of the interesting side trails that suggest
themselves as the panorama of physics begins to unfold."
with materials and services. Both programs strive to have an abundance of source material readily available for the superior student and the slower learner. The library provides hundreds of magazines, transparencies, slides, recordings, photographs, microfilm, reference books, and trade books which transcend subject matter boundaries. When material is needed which cannot be purchased with local funds because of lack of funds or infrequent use, it is borrowed on inter-library loan from state, county, or industrial libraries for use of the high school student or teacher.

The science and the library programs have as their mutual goal the learning of skills in using multi-media for better comprehension and retention. The modern library provides the audiovisual center for the use of these media; the science teacher knows that he can come to one source and find the equipment and material he needs.

In-service training for teachers is a vital goal in both programs. While the planners of institutes for science teachers hope to prepare the teacher for his task of understanding and to help interpret the material before him, the librarians and principals also prepare the teachers of all subject areas to broaden their knowledge and techniques of teaching through in-service library workshops and meetings.

Organizations at the national level in both fields are working with universities and colleges to reform the programs preparing their students to be better representatives of their professions.

In summary, the goals of the library which correlate with those of the science department are stated by the American Association of School Librarians as: (1) provide boys and girls with the library
materials and services most appropriate and most meaningful in their growth and development as individuals, (2) help children and young people to become skillful and discriminating users of libraries and of printed and audiovisual materials, (3) work with teachers in the selection and use of all types of library materials which contribute to the teaching program, (4) research or reference work—teaches students to analyze, evaluate and interpret, and (5) students use the school library as a laboratory for reference and research in which they locate specific information and audiovisual materials. They also formulate a lifetime habit of library usage, one which they will need if they are going to make any contribution to science after graduation.

CHAPTER III

METHODOLOGY

The purpose of this chapter is to describe the schools used in the study, the design used for collection of the data and the treatment of the data.

Collection of Data

The investigation of the problem started with the attempt to identify nine high schools of approximately 900 - 1500 student population in the three-state area of Indiana, Michigan and Illinois. It was important to select schools representing a medium sized school population so that the findings would be applicable to a larger number of schools. Schools were to be identified as having included two or more of the programs developed with support of the NSF in their curriculum and also having well-organized, active library programs with competent librarians acting in the role of instructional media supervisors. State school library supervisors in the three states were asked to identify the best schools in their states within this design. After a list of these schools was submitted to the investigator, an administrator in each proposed school was contacted to confirm the existence of these qualifications. Upon further investigation, it was found that the design should be changed to incorporate schools with larger population, since there were not enough schools in the 900 - 1500 range to meet the requisite criteria. Therefore, schools selected ranged in student population from 700 to 3,000. This change made the
conclusions more meaningful to a larger group of schools. Conditions found on the day of visitation warranted elimination of one school from the study because it no longer met the necessary criteria for inclusion. Therefore, the findings represent the data from eight schools instead of the nine specified in the original design of the study.

Description of the Communities

A brief picture of each of the communities visited by the investigator seems necessary at this point, to provide information on the type of schools in the survey.¹ (See Table 1)

<table>
<thead>
<tr>
<th>School</th>
<th>Population</th>
<th>Grade Levels</th>
<th>Percentage of College Bound</th>
<th>Students Taking Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,324</td>
<td>7-12</td>
<td>80</td>
<td>433</td>
</tr>
<tr>
<td>B</td>
<td>1,068</td>
<td>7-12</td>
<td>65</td>
<td>234</td>
</tr>
<tr>
<td>C</td>
<td>2,946</td>
<td>10-12</td>
<td>85</td>
<td>995</td>
</tr>
<tr>
<td>D</td>
<td>1,157</td>
<td>7-12</td>
<td>65</td>
<td>290</td>
</tr>
<tr>
<td>E</td>
<td>856</td>
<td>9-12</td>
<td>50</td>
<td>329</td>
</tr>
<tr>
<td>F</td>
<td>744</td>
<td>10-12</td>
<td>30</td>
<td>162</td>
</tr>
<tr>
<td>G</td>
<td>2,200</td>
<td>10-12</td>
<td>50</td>
<td>208</td>
</tr>
<tr>
<td>H</td>
<td>1,400</td>
<td>9-12</td>
<td>85</td>
<td>610</td>
</tr>
</tbody>
</table>

Community A - This community has a population of 12,581,² the highest percentage of which are business executives and professional

¹Information on the communities herein described is based on printed material provided by the administrators in each school.

people. It is located twenty-five miles from the metropolitan area, with direct access to cultural activities. Within its access are four large public libraries and two universities. The total school enrollment is 3,210, with 700 students in grades ten to twelve. Students are housed in three elementary, one junior high, and one senior high school which opened in 1966. The high school faculty numbers thirty-five. The curriculum is comprehensive. Sixty-five per cent of the students go to college.

The high school building is air conditioned, modern in every respect, and has facilities for large and small group instruction. The library is called the Resource Center, with students assigned to carrels for their independent study periods. The library staff includes one librarian, who also supervises the other school libraries in the district, and one clerk.

Community B--The school in this community is located in an industrial area in a rural agricultural belt, with a population of 25,000. A university serves a wide area in this part of the state. A strong public library also adds to the cultural advantages in the community. The student population of 1,068 is racially mixed; of this number sixty-five per cent attend an institution of higher learning after high school graduation. One hundred teachers staff the high school, with two librarians and one full-time and one part-time secretary hired for the library.

The library is housed in a newly constructed, air-conditioned, carpeted separate building, equipped with automated carrels for dial access to tape recordings.
Community C.—This residential district is made up of five suburban communities covering thirteen square miles and having a total population of 65,000. Twelve thousand pupils attend fifteen schools, ten elementary, three junior high, and two senior high schools. The population represents a high percentage of professional, technical and business executives living in single dwellings which are well above the average economic level. The district is near a large city with cultural advantages of two universities and large libraries. The high school which was a part of this survey has a student body of 2,950 students, grades ten to twelve, of which eighty-five per cent continue their education after graduation. It offers a comprehensive curriculum. Advanced placement courses are provided in five subjects, including chemistry. One hundred fifty teachers are on the staff, of which five are librarians. Four clerical personnel are employed in the library.

The library contains 13,000 square feet and seats 267 students. An audiovisual suite includes a projection room, a workroom, and control room. A central instructional materials center in another building services the entire school system with equipment and materials.

Community D.—This community covers an area of forty-two square miles in which there are 120 industries. The school is one of eight high schools in the city. The city itself adjoins a large metropolitan district. The population of 179,000 has access to many services, such as reading clinics, planned recreational programs, and strong public libraries. There are several colleges and universities available within commuting distance. The income median is above average, with most of the people in the surrounding area pursuing careers of business or
the professions.

The student population in the high school is 1,157 in grades seven to twelve. Sixty-five per cent go to college. The library staff consists of two professionals and one secretary, with one hundred faculty members on the school staff.

Community E.—This township school district covers a rural area devoted to productive truck farming. The school is located in a small town with homes representing average to high incomes. This section of the state is closely connected to commercial and power companies which bring in financial resources for public education. It is one hundred miles from a metropolitan area.

The school itself is three years old. The curriculum from kindergarten through twelfth grade is non-graded. Fifty per cent of the graduates attend college. There are 856 students in the junior-senior high school program.

The library contains a study area for one hundred pupils; it houses four conference rooms and sixty-four carrels for individual study and audiovisual machines. The library staff consists of one professional librarian and two clerical personnel, with another clerk on a four-day a week schedule. The audiovisual section of the library is staffed with two qualified audiovisual staff members.

Community F.—This is a consolidated school district made up of three towns. The town in which the school is located has 6,765 residents. A prosperous farming area surrounds the community of medium-income families. There are no major industries nor cities within close range.
The high school population is 744 in grades ten through twelve. The curriculum is an innovative one, formed in 1966 when the school was built. Flexible, modular scheduling operates in four subject matter areas: English, mathematics, science, and social studies. Students are engaged in large group, small seminar group, and independent study instruction. Teachers have close connections with a large university in the implementation of their new program.

The library staff numbers one librarian and one paraprofessional, with two half-time audiovisual personnel in charge of the non-book material. The library seats 92 in a carpeted 4,000 square feet of space.

Community G.—This school district is the third largest in the state in which it is located, and is also the fastest growing with a population of 66,702. Its student population has grown from 1,500 to 35,000 in 12 years. The area covers 39 square miles located in a metropolitan setting. Taxpayers live in above average homes of the suburban type. Industry is located in an industrial park area.

The school system emphasis is on experimental programs. The public supports its schools well, as is evident by the fact that it has voted bond issues of thirty-eight million dollars in recent years. The students are located in 31 elementary schools, 9 junior high schools, and 3 high schools.

The high school visited in the survey has 2200 students in grades ten to twelve, with fifty per cent college-bound. The high school teaching staff is made up of 120, with three librarians and two secretaries assigned to the library. The library itself seats 200 in 10,000 square feet of space. It includes four conference rooms and

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library classrooms, a graphics room and a teachers' workroom in the complex.

Community H.--The predominately middle class, culturally privileged homes in this school district house a population of 20,000 with two other towns contributing to the school population. The area is primarily residential, with no major industries. It is located thirty miles from a large industrial city.

The high school contains 1400 students and 84 teachers. The curriculum is academic, with Honors and Advanced Placement courses. The percentage of college-bound students is 85. The library staff consists of two professional librarians, two clerk-typists, and teacher supervision for 86 per cent of the day. The audiovisual department is separately administered by a director qualified in this area.

The library in this school is in new quarters built in 1966. It is carpeted and air-conditioned, with seating capacity for 150. The audiovisual area contains a dial access installation.

Each of the school libraries visited had the following qualities in common:

1) Libraries contained the essential elements of instructional materials centers which are:

a) Study area for individuals, small groups, and large groups.

b) Conference area for group discussion, listening and viewing, and teacher preview of material.

c) Office area for receiving and distribution.

d) Production area for graphics, three dimensional articles, tapes. In three schools photography facilities were
(2) Libraries were attractive, spacious, well equipped, and accessible to other parts of the building.

Research Technique

The survey method was used in the collection of data, with the questionnaire-interview as the instrument. The investigator constructed the questionnaire to prepare the respondents for the interviews, and to gain basic information common to all situations. The interview technique was adopted in order to: (1) delve more deeply into the questions of types of research and reading skills necessary to the science program; (2) to determine the methods used by the librarians in working with teachers; (3) to determine actual use of library materials. Clarification of terms, observation of attitudes and value judgments, and time for discussion of problems were also goals of the personal interview.

Four areas of concern were identified in deciding on the type of information needed from cooperating schools. The first area selected for study was the need on the part of students and teachers for a wider range of instructional materials than was included in these science improvement programs. Did the teacher really need the materials in the school library? If so, what kinds and what type of services given by the library staff were desired by both science teachers and students? Also to be determined was the extent to which time to cover more material and to use the services of the school library was a real factor in the teaching of science. What weight
does the factor of built-in accessibility carry when teachers are deciding whether or not they will use the school library?

The second area of concern dealt with the investigation of the importance to teachers and students of using the library as a means to better science teaching and learning when the science improvement programs are a part of the curriculum. The third area concerned the degree to which existing factors present in the school library program contributed to or hindered its goal of enriching the science program of the school. The three factors considered were material, accessibility and instruction. Finally, the fourth concern was the determination of the extent of cooperation existing between science teachers and the library staff, with implications sought for the improvement of relationships where it was needed.

The questionnaires were constructed in three separate parts: (1) unstructured questions for science teachers employed in schools using two or more of the science improvement programs; (2) unstructured questions for the head librarian in these schools; and (3) a short, structured, factual questionnaire for students selected at random from the science classes. The student information was designed to cover a time span of three months, from January 1 to April 1, 1967. This was a short enough period to allow for reliable recall and was research assignments in high school courses.

Design of the Questionnaire

Questions were designed for each of the questionnaires which would apply to each of the four areas of concern previously
Factors in the Science Projects

Material.--Since the programs developed with support of the NSF are often self-contained units of instruction, teachers were asked if they needed the facilities and materials in the school library to teach their science courses; if they did, they were to indicate in what ways they had received help from the library. They were asked if their students showed evidence of using materials other than the textbook, laboratory books and supplementary text materials to complete their science assignments. Students were questioned as to their specific assignments requiring the use of science reference or related books in the school library. Librarians were asked if pupils did use the science tools (reference) in the library.

Time factor.--The teachers' questionnaire asked whether the science packaged material provided time in the schedule of teaching for library assignments and if so, what kind of assignments. Students' opinions were needed on the amount of time they spent on assigned and unassigned science work. Did they spend all their time on the textbook and laboratory assignments without the opportunity to use other materials in the school? It was necessary to determine whether time was available to students to pursue inquiry into facets of science motivated by the new approach in the National Science Foundation-funded programs.

Accessibility factor.--A third factor built into the

Copies of each questionnaire are included in Appendix B.
media was that of immediate accessibility to a wide selection of materials. The questions prepared for teachers' response attempted to determine whether teachers had other supplementary materials immediately accessible to them, if they used their departmental budgets for these or depended on the library collection, and how the teachers felt about accessibility of library materials. These questions were based on the rationale that the school library materials must be as accessible as the material in the National Science Foundation package in order to be as useful. If teachers are using their own money for purchasing supplementary materials or are using departmental allotments for these materials, they are building classroom collections which are inaccessible to the school as a whole, needlessly duplicating materials, and sacrificing the opportunity of accurate and efficient organization of materials.

**Importance of Library Materials and Services in Teacher Planning and Pupil Use**

The librarians' questionnaire was directed toward determination of whether the librarian was working directly with the teacher in developing and utilizing instructional materials, and was teaching students the efficient use of library tools through integration with their science courses. Investigation was made of the status of the librarian in the school by asking if he occupied a position on the curriculum committee.

Teachers' opinions were solicited in questions based on an evaluation of the importance of the library to the total school instructional program, and its importance to the science teaching program. Teachers were asked to list the ways in which the library staff
and facilities had aided them in their presentation of subject matter. In addition they were to comment on their use of the library for their own purposes. Presumably, teachers who find the library personally useful are much more inclined to find it important for their students. They were also asked to ascertain how often they recommended library use of materials or services to their students.

Students' use of the school library for science activities may signify the amount of importance the science teachers place on the library. In the student questionnaire, items were included which related to science-associated assignments as well as to library visits for other purposes. If the students did not use the library, the questions were designed to discover the degree to which the factors in the science program and in the library program were responsible.

Questions on the specific location of students' studying for science homework were used to determine how important the library is in the preparation for daily science assignments. It was assumed that students will use the materials most easily available and that the majority will do their assignments in the materials assigned without searching for additional work. If the teacher assigns work from the text only, this condition would probably be reflected in students' library attendance. The kinds of materials students use in completing assignments show how much emphasis is placed on the importance of the newer media in learning and variety of presentation in class. Newer methods of teaching call for use of more than traditional materials.

Existing Factors in School Library Program

The Science Collection--If the school library program is
going to serve the curricular needs in any subject area, the collection of material must be "well balanced, well-rounded in coverage of subjects, types of materials, and variety of content." Material must be in plentiful quantity for good service and easy accessibility.

Questions of opinion on the adequacy of the collection were included in the teachers' questionnaires. The teachers' responses to the question of their responsibility for assisting in choosing the collection should indicate their opportunity to build the kind of library useful to them. Again, it was assumed that the teachers' professional experience and training enable them to evaluate materials for their own needs. Students also were asked about their ability to obtain materials in the school library. If they could not get what they needed, they were to indicate where they did find material for science. This question hopefully would show whether the classroom information was sufficient and the packaged media the only resource used.

Accessibility.--Accessibility within the context of this paper includes three parts: (1) the extent to which materials and services are easy to obtain, (2) the subject coverage and range in difficulty, and (3) the organization of materials for ease of use. The determination of accessibility of science materials was left for the personal interview with teachers because of the difficulty of a common understanding of the term. Question 8 on the questionnaire for students was planned to cover specifically their view of availability of materials as well as the importance of the library.

1 American Association of School Librarians, Standards, p. 74.
Students' opinions on their enjoyment in using the library was important to the investigator in order to understand whether this was a factor in the amount of library use. Students probably will not use a library if they are made to feel unwelcome, uncomfortable, or unhappy. In the philosophy of today's schools, attendance in the library is voluntary.

**Instruction in the use of materials.**—The investigator wanted to determine how much instruction in the use of science reference tools and the library collection was given and who was responsible for the instruction. This knowledge and skill on the part of the student in using technical literature and all types of material is essential for accuracy, speed, and understanding of the subject. The school library Standards state that, "Using a library and its resources is an important means, but still a means, to some ultimate goal—the synthesis of information, the extension of knowledge, the analysis and solution of problems..."\(^1\)

A point important to determine was the identity of the personnel who gave the library instruction to the science students. According to the Standards referred to above, the librarian as a specialist in materials should introduce appropriate books and audio-visual materials to classes, as well as to suggest ways of approaching assignments.\(^2\) The teacher as the specialist in the subject matter continues the instruction either with or without the librarian's assistance.

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A vital aspect of involvement in library skills is the student need for learning a scientific approach to writing and the elementary forms of good written research. Mallinson states that college students do not know how to write reports in an intelligent and clear form.\textsuperscript{1} This instruction is often left to the English teacher to cover, in spite of the fact that scientific writing involves a different type of technical skill than that required in English composition.

On the questionnaire form, teachers, librarians and students were asked who gives the instruction to the students. Teachers were asked if its value is apparent in the work of the students.

\section*{Extent of Cooperation Between Science Teachers and Library Staff}

The final area of concern was covered in items on each of the librarians' and teachers' questionnaires asking for indication of communication between librarian and teacher regarding the contents of the National Science Foundation program. Several questions pertained to assistance the library staff had asked for in ordering materials, using the materials and recommending them. One question was designed to give the teacher the opportunity to list ways in which the library had been of valuable assistance and ways in which it might be made more useful.

An attempt was made in the student questionnaire, through two attitudinal questions, to find other factors which might be present in determining use or non-use of the library. The question, "If you do not use the school library, please check the reasons listed" and

\begin{flushright}
\textsuperscript{1}Interview with Jacqueline Mallinson, Science Department, Western Michigan University, November 15, 1966.
\end{flushright}
"Do you enjoy using the school library?" were designed to bring out comments which re-check the effect of the factors built into the National Science Foundation program and of those in the library program.

Distribution of the Questionnaire

The questionnaires for each group of respondents were pre-tested and revised with the help and advice of the science department members and library staff in one high school in the vicinity of the investigator's residence. The interview technique was tested on the staff members in a second high school.

The questionnaires were mailed to each of nine administrators previously contacted. Instructions were given both by telephone and by letter. Science department heads agreed to administer the questionnaire to twenty-five science students selected at random from representative classes. The same number was given to each school regardless of the population size, with the exception of one school, where the science teacher specifically asked for thirty. Even though the small number of twenty-five was not a representative percentage of the students taking science in the larger schools, the fact that the data were all treated as a whole made a reasonable sampling for the study.

Thirty-five questionnaires were mailed for teachers' consideration, nine questionnaires went to the head librarians and two hundred copies of the student questionnaire were distributed on May 2, 1967.

Interviews

During May, 1967, the investigator spent one day at each of
the schools selected for the study. At that time the head librarian and a majority of the science teachers concerned with the National Science Foundation courses were interviewed separately at some length and their comments tape-recorded to eliminate omissions and faulty recall on the part of the interviewer. The interviewer observed the work being done in the library by students, teachers and librarians. Investigation was made of the resources and facilities in the parts of the school and the library concerned with the teaching of science in order to help form generalizations which might be significant for further study. (See Table 2.)

**Treatment of Data**

The number of replies from teachers totaled 33 out of 35, or 94.28 per cent. One hundred ninety-one students' questionnaires were usable out of the 225 distributed to the science teachers, a percentage of 84.88. A 100 per cent return was received from librarians. The fact that the investigator collected the questionnaires at the time of the visit no doubt was responsible for the high percentage of return. Table 3 gives the number of respondents to the questionnaire in each category. (See page 35.)

**Identification and Treatment of Questionnaire Items**

Results of each school's responses were tabulated by school but identified only by letter so as to protect anonymity. Categories were formed from answers received.

By combining answers to related items on the questionnaire form and in the recorded interviews, responses fell into the four
prescribed areas of concern presented in a previous section of this paper. Percentages given in each table represent only the tabulations from the questionnaires. Comments from interviews were included as separate items under the appropriate headings.
TABLE 2  
The Number of National Science Foundation Courses Taught in Each School, and the Year of Adoption

<table>
<thead>
<tr>
<th>School</th>
<th>National Science Foundation Courses</th>
<th>Year of Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1961*</td>
</tr>
<tr>
<td></td>
<td>Physical Science Study Committee (PSSC)</td>
<td>1965</td>
</tr>
<tr>
<td></td>
<td>CHEM Study</td>
<td>1964</td>
</tr>
<tr>
<td>B</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>Physical Science Study Committee (PSSC)</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>CHEM Study</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>Special Materials</td>
<td>1963</td>
</tr>
<tr>
<td>C</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1964</td>
</tr>
<tr>
<td></td>
<td>Physical Science Study Committee (PSSC)</td>
<td>1966</td>
</tr>
<tr>
<td></td>
<td>CHEM Study</td>
<td>1965</td>
</tr>
<tr>
<td></td>
<td>Chemical Bond Approach (CBA)</td>
<td>1963</td>
</tr>
<tr>
<td>D</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1961</td>
</tr>
<tr>
<td></td>
<td>Physical Science Study Committee (PSSC)</td>
<td>1961</td>
</tr>
<tr>
<td></td>
<td>CHEM Study</td>
<td>1961</td>
</tr>
<tr>
<td>E</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>CHEM Study</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>Introductory Physical Science (IPS)</td>
<td>1966</td>
</tr>
<tr>
<td>F</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1966</td>
</tr>
<tr>
<td></td>
<td>Special Materials</td>
<td>1966</td>
</tr>
<tr>
<td>G</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1964</td>
</tr>
<tr>
<td></td>
<td>Physical Science Study Committee (PSSC)</td>
<td>1960</td>
</tr>
<tr>
<td></td>
<td>CHEM Study</td>
<td>1962</td>
</tr>
<tr>
<td></td>
<td>Earth Science Curriculum Project (ESCF)</td>
<td>1964</td>
</tr>
<tr>
<td>H</td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1966</td>
</tr>
<tr>
<td></td>
<td>Blue Version</td>
<td>1966</td>
</tr>
<tr>
<td></td>
<td>Biological Sciences Curriculum Study (BSCS)</td>
<td>1966</td>
</tr>
<tr>
<td></td>
<td>Yellow Version</td>
<td>1966</td>
</tr>
</tbody>
</table>

*Dropped in 1964. No laboratory equipment was purchased; therefore only the texts in combination with others are used.
TABLE 3

Number of Questionnaires Returned and Number of Interviews in Each School

<table>
<thead>
<tr>
<th>School</th>
<th>Teacher Questionnaires</th>
<th>Student Questionnaires</th>
<th>Teachers Interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>29</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>9</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>G</td>
<td>3</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>H</td>
<td>4</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
<td><strong>191</strong></td>
<td><strong>25</strong></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Biology</td>
<td>523</td>
<td>124</td>
<td>292</td>
</tr>
<tr>
<td>Chemistry</td>
<td>139</td>
<td>30</td>
<td>138</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>120</td>
<td>40</td>
<td>223</td>
</tr>
<tr>
<td>Physics</td>
<td>169</td>
<td>37</td>
<td>174</td>
</tr>
<tr>
<td>Filmstrips</td>
<td>96</td>
<td>..</td>
<td>224</td>
</tr>
<tr>
<td>Films</td>
<td>36</td>
<td>b,c</td>
<td>223(^b)</td>
</tr>
<tr>
<td>Magazines</td>
<td>23</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Slides</td>
<td>500</td>
<td>..</td>
<td>e</td>
</tr>
<tr>
<td>Exhibits</td>
<td>15(^d)</td>
<td>..</td>
<td>e</td>
</tr>
<tr>
<td>Tapes</td>
<td>a</td>
<td>a</td>
<td>..</td>
</tr>
<tr>
<td>Transparencies</td>
<td>225</td>
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<td>..</td>
</tr>
<tr>
<td>Microfilm</td>
<td>..</td>
<td>..</td>
<td>..</td>
</tr>
</tbody>
</table>

\(^a\)No count given  \(^b\)Loops  \(^c\)Rental  \(^d\)Plus Lab Kits  \(^e\)At Central Office  \(^f\)Not in library
CHAPTER IV

FINDINGS OF THE STUDY

In this chapter the findings of the study are tabulated and summarized. Implications for each of four areas of concern are drawn in the following chapter.

Factors in the Science Projects which Affect the Use of the School Library

Need for Materials

In consideration of the factor of need of materials other than those contained in the science programs themselves, the answers from the teachers' questionnaires indicated that nineteen teachers out of thirty-three (58 per cent) needed the facilities and materials in the school library (TABLE 4, page 36). Nine (27 per cent) said they did not. Five teachers (15 per cent) needed it for some types of materials, specifying visuals, films, and magazines. These percentages are shown in Table 5.

TABLE 5.--Teacher question 4: Do you need the facilities and materials in the school library to teach your science courses?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>19</td>
<td>58</td>
</tr>
<tr>
<td>No</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Some Types of Materials</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>..</td>
</tr>
</tbody>
</table>

37
When discussing the need for other materials in the interview, five BSCS teachers indicated that they used additional advanced reference material both in book and in periodical form. One teacher stated that he needed the facilities of the library to a greater extent because the package program is more rigorous. He needed more resources for his own study, in addition to visual material. Another biology teacher using the Yellow Version of BSCS needed materials with various levels of reading difficulty and secured fifty to sixty books for the unit on evolution. The use of *Scientific American* or reprints from it was mentioned by four teachers. Two CHEM Study teachers used more than the text because they needed more visuals for individual students and felt that the text materials were too "teacher directed".

In the same school (School A) in which the two BSCS teachers used a great many more books than the text, the chemistry teacher stated:

I don't use the library a lot - mostly just suggesting books to students, supplementary for kids who need help. Chem Study sticks pretty close to the text. I'm not as ambitious as the biology teachers are.

Another chemistry teacher (School C) did not need any other material.

The teacher can teach the whole course with the material of the National Science Foundation. Students need to learn principles and concepts within the courses themselves which takes all the time available. The library can be used for bright pupils who can do unassigned reading in paperbacks.

A teacher of Special Materials in the BSCS said that all material needed is within the covers of the package and it only takes more unnecessary time to do other projects. A second-year teacher of biology (School B) sums up the judgment of those satisfied with the amount of materials included in the National Science Foundation.
programs: "Students are getting what they need in the BSCS package. They couldn't get any better background."

Another indication of the teacher's need for library materials is the frequency with which he assigns the use of the material he has ordered through the library. Replies from four librarians affirmed that their teachers do assign this material. Three said "to some extent" and one replied in the negative. This indicates that the majority of the teachers do recommend, and receive, and make assignments from pertinent material.

The student responses show that 117 (TABLE 6) or 61.25 per cent say that they can succeed in daily science assignments using only the text and laboratory books. Approximately 50 per cent say they have no specific assignments requiring them to use science reference or related science materials in the school library (TABLE 7). There is a question of how students define success but it is assumed that they mean at least average accomplishments in the subject.

TABLE 6.—Student question 10: Is it possible to use only your science text to succeed in daily science assignments?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>117</td>
<td>61.25(^a)</td>
</tr>
<tr>
<td>No</td>
<td>68</td>
<td>35.60</td>
</tr>
<tr>
<td>No ans.</td>
<td>6</td>
<td>3.14</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
<td>..</td>
</tr>
</tbody>
</table>

\(^a\)The succeeding percentages have been figured to the second decimal only; therefore they all do not total to one hundred per cent.
TABLE 7.--Student question 5: Do you have specific assignments in science requiring you to use science reference or other science books in the school library?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>95</td>
<td>49.74</td>
</tr>
<tr>
<td>No</td>
<td>95</td>
<td>49.74</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td></td>
</tr>
</tbody>
</table>

The Time Factor. Replies from the teacher questionnaires show (TABLE 8) a total of thirteen respondents (39.39 per cent) who said that the science package does not leave time for library assignments; eight (24.24 per cent) said that time was available and seven replied with "some", or "very little". Negative comments included, "No, I have to modify the course to include anything of this nature"; "No, but we use it anyway". Others simply said "No need". Those who indicated yes made qualifying statements such as "for better students"; "for individual research"; "for extra credit reports"; "for audiovisual materials"; and "resource center for supplementary books".

The investigator discovered in the interviews with teachers that in all but two cases out of twenty-five it was the opinion that the National Science Foundation program does not provide for time to use the library except for films. One teacher (School B) who has taught BSCS for three years said that it did retard the use of the library except when the library is the audiovisual depository. Another comment regarding the BSCS program in the same school was, "It takes so much time to set up laboratories that there is no time for library use."
TABLE 8.—Teacher question 6: Does the science package leave you any time for library assignments?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>8</td>
<td>24.24</td>
</tr>
<tr>
<td>Some</td>
<td>2</td>
<td>6.06</td>
</tr>
<tr>
<td>Very little</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td>No</td>
<td>13</td>
<td>39.39</td>
</tr>
<tr>
<td>No ans.</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

A teacher in School A observed:

With any package, you tend to rush to finish it. Bibliographies in BSCS are rich, but very few students get through the chapters let alone involved in the material in the bibliography....A lot depends on the teacher.

A comment from School B was made to the investigator:

I used to assign reports and papers. Now I do not take time and the knowledge is the same. I have to work at using more material and be able to organize it. It takes time to devote to outside reading.

Chem Study teachers agreed with their counterparts. In Schools A, D and E the opinion was voiced that too many subjects were included to allow for reference and research work [in the library]. The students are too busy to do more than "stick to the text and laboratory work" but some students do refer to college texts on bonding and similar topics.

Two minority opinions were expressed by chemistry teachers in School G and in School A, where they said:
Students are prepared for hard work. They hand in work on time and know what is in the course. We get good reports from those in college. There would be time if they wanted to [use other materials]. They aren't spending that much time on the subject.

(School G)

I have seven and one-half hours a week in PSSC and laboratory every day. I still do not get through the book, but I put in extra material . . . . which comes from other books. First semester I assign outside reading. We have two copies of each reading for everyone of the Science Study Series so they can read them or pick their own. I tell them about the books in the library so they can get other authors' viewpoints. I do some heat exchange problems not in the PSSC book. I don't feel that I have to finish the book. The first year I rushed. Now I have time to do every laboratory and my own additions.

(School A)

Opinions on the student questionnaire corroborate the opinion that students would have more time to spend on science than they do, if it were required (TABLE 9). Of 191 students responding to the question of how much time daily they spend on science, eighty-four or 43.97 per cent admitted to thirty minutes or less. Seventy-three (38.22 per cent) spent forty-five minutes to one hour. Only twenty-six (or 13.61 per cent) spent more than one hour. The majority of the time is spent on the textbook and workbook, while experiments take up the time of thirty-nine (14.93 per cent) pupils. Additional readings from books, magazines, and other materials were listed sixteen times. (TABLE 10). As far as unassigned science work is concerned, 50 per cent do none, but of the 50 per cent who do voluntary assignments, 21.9 per cent spend more than one hour daily, showing sustained interest on the part of the science-oriented student (TABLE 11). One-hundred-sixteen students or 60.73 per cent signified that they had opportunity to do extra work in science outside of school hours. Of
### TABLE 9.—Student question 1: How much daily work outside of class do you do in science?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 minutes or less</td>
<td>84</td>
<td>43.97</td>
</tr>
<tr>
<td>45 minutes to 1 hour</td>
<td>73</td>
<td>38.22</td>
</tr>
<tr>
<td>More than 1 hour</td>
<td>26</td>
<td>13.61</td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>1.04</td>
</tr>
<tr>
<td>No ans.</td>
<td>5</td>
<td>2.61</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
<td>..</td>
</tr>
</tbody>
</table>

### TABLE 10.—Student question 2: What kind of science work do you do outside of class daily?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>159</td>
<td>60.91</td>
</tr>
<tr>
<td>Workbook</td>
<td>47</td>
<td>18.00</td>
</tr>
<tr>
<td>Experiment</td>
<td>39</td>
<td>14.93</td>
</tr>
<tr>
<td>Other readings from books, magazines, reference material</td>
<td>16</td>
<td>6.13</td>
</tr>
<tr>
<td>Total</td>
<td>261</td>
<td>..</td>
</tr>
</tbody>
</table>
TABLE 11.—Student question 3: How much unassigned science experimental or study work do you do per week?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 minutes or less</td>
<td>25</td>
<td>13.08</td>
</tr>
<tr>
<td>45 minutes to 1 hour</td>
<td>28</td>
<td>14.65</td>
</tr>
<tr>
<td>More than 1 hour</td>
<td>42</td>
<td>21.98</td>
</tr>
<tr>
<td>None</td>
<td>96</td>
<td>50.20</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
<td></td>
</tr>
</tbody>
</table>

The seventy-five students or 39 per cent who said no, thirty-three (17.22 per cent) said they had no interest in it, therefore took no opportunities (TABLE 12).

TABLE 12.—Student question 11: Do you have the opportunity to do any extra voluntary work in science outside of school hours?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>116</td>
<td>60.73</td>
</tr>
<tr>
<td>Have no interest in it</td>
<td>33</td>
<td>17.22</td>
</tr>
<tr>
<td>No</td>
<td>42</td>
<td>21.98</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
<td></td>
</tr>
</tbody>
</table>
Accessibility Factor

The access to materials in the classroom is a factor built into the science package. Only five or 15.15 per cent of the teachers used books and materials cataloged in their classroom collection which were in the library (TABLE 13). Fourteen (42.42 per cent) indicated that all their supplementary science materials were purchased from a separate department budget or were their own property. Eight teachers (24.24 per cent) stated that their classroom collections represented both library and department ownership.

TABLE 13.—Teacher question 16: 'If you use materials from the collection in or adjacent to your classroom, are they purchased from a separate department budget or from the library budget?'

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate or Personal Collection</td>
<td>14</td>
<td>42.42</td>
</tr>
<tr>
<td>Library Budget</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td>Both</td>
<td>8</td>
<td>24.24</td>
</tr>
<tr>
<td>No answer</td>
<td>6</td>
<td>18.18</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>..</td>
</tr>
</tbody>
</table>

Science teachers who discussed this access liked the fact that in this kind of media the material was on hand when they needed it. One department head (School D) prefers all materials in his own area, as his teachers are too busy in preparation for classes and laboratory experiments to visit the library. He does borrow books from the
library for the classrooms and says this service is encouraged. Several teachers state that science books are kept in the classroom because they are not needed or wanted in other departments. A teacher of BSCS (School H) keeps reference books in the classroom because the librarian, unless he is science-oriented, "does not know how to use books of a technical nature".

Another BSCS teacher (School B) says:

Why have materials (filmstrips) in the audiovisual department when you can have them in the science room? Every year we would have to help inventory them [in the library]. Now students can come in to the science room and look at them but they cannot take them out.

In one of the schools the entire science section of the library is in a separate portion of the library. The teacher still wants his books in his classroom so that he will not have to "run to the library". He also complained that the librarians schedule the room for other purposes instead of "saving it for science". Even though it may remain empty during large portions of the day, he thinks it should remain the province of the science department.

Summary

Completeness of the science instructional package with its text, laboratory manuals, and supplementary text materials accessible in the science classrooms is an important factor in the use of the school library collection. The majority of teachers (58 per cent) indicate need for the school library resources, both for their own learning needs, supplementary materials for students, use of science magazines, and for audiovisual materials. However, students do not show evidence of wide use of materials other than those in the program.
Half of the students reporting have had no school library assignments to do in science.

Teachers indicate that the amount of the material in the National Science Foundation programs makes it difficult to assign work which requires library use outside of the textbook-laboratory media, with the exception of the use of films. Approximately 44 percent of the students state that they do not spend more than thirty minutes per day on daily science assignments. Slightly more than 38 percent spend no more than one hour. About 61 percent do have the opportunity to do science work outside of school hours if they so choose.

The majority of teachers are supplied with supplemental science library material purchased from a separate science budget, personal budget, or with a combination science-department-library budget. A very small minority keeps a library collection near their classroom area. Accessibility of these materials is of utmost importance to all respondents, and they do not acknowledge that the school library is the most accessible location.

Importance of Library Materials and Services in Teacher Planning and Pupil Use

Status of Library in School

The librarian's questionnaire included a request for a statement of the school library's relation to the total instructional program. In all but one of the responses the library was described as the extension of the classroom, "Intertwined extensively and intensively" (School G) with all activities and as an integral part of the
academic and vocational program. In a single case (School F) the librarian noted that the library was a "non-restricted area for study and free reading with emphasis on academic areas." This philosophy was borne out in conversations with the librarian, the principal, and two of the teachers interviewed. In six out of eight schools the librarian has department head status.

In five out of eight of the survey schools the librarian was not part of the school curriculum committee. Three of the librarians reported that they were deeply involved (Schools A, B and G) and met regularly in planning and implementation sessions.

Even though involved in curriculum planning, only two librarians (Schools C and G) admitted acquaintance with the contents of the National Science Foundation programs. Two others were vague in their understandings and four said they knew nothing of the contents. In only three cases did the Chairman of the Science department discuss the curriculum with the librarian before this survey was instigated. (Schools A, C and G) In School F the librarian in the interview said: "I get a little bit of a hint of what teachers are working on through students' questions. Teachers come in and browse."

In School B the librarian reported that the administrative philosophy demands that every type of material be dispersed from the central library. Heavy use comes from regular programs of in-service training during the two hours of released time every month. With a recently-acquired dial access system in the library the school curriculum is audio-geared.

The importance of the school library in the school as a whole was rated as "high" by 69.69 per cent of the teachers of science.
Five teachers (15.15 per cent) rated it as of little importance while four (12.12 per cent) teachers thought it took a medium position of importance (TABLE 14).

TABLE 14.--Teacher question 8: How would you rate the library's importance to the total school instructional program?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>23</td>
<td>69.69</td>
</tr>
<tr>
<td>Average</td>
<td>4</td>
<td>12.12</td>
</tr>
<tr>
<td>Poor</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td>No ans.</td>
<td>1</td>
<td>3.03</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

The library's specific importance to science teachers involved in National Science Foundation programs is evidenced by the replies to Question three wherein librarians listed ways in which teachers used the library. This is shown in TABLE 15 and is discussed in the following paragraphs. (See page 50.)

Importance in Science Teaching (Teachers' Opinions)

When the teachers were asked to judge the amount of use made of the library and its facilities before and after the adoption of the Science Programs, only two teachers indicated much use (School A). They are at present teaching a modified version of BSCS. Their students are required to meet in the library daily for library assignments. Twelve (36.36 per cent) of the respondents reported that they used the
TABLE 15.—Librarian question 3: In what ways do the science teachers use the library?

<table>
<thead>
<tr>
<th>Subject</th>
<th>Biology</th>
<th>Physics</th>
<th>Chemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Reserve readings</td>
<td>Reserve readings</td>
<td>Reserve readings</td>
</tr>
<tr>
<td></td>
<td>Film use</td>
<td>Film use</td>
<td>Taped lessons</td>
</tr>
<tr>
<td></td>
<td>Filmstrips</td>
<td>Teachers' own information</td>
<td>Films</td>
</tr>
<tr>
<td></td>
<td>Special reports</td>
<td></td>
<td>Filmstrips</td>
</tr>
<tr>
<td></td>
<td>Preparation of lab lectures</td>
<td></td>
<td>Teachers' own information</td>
</tr>
<tr>
<td></td>
<td>Tapes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Magazines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pamphlets</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book talks by librarian</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
library to an "average" or "to some extent" in the traditional science courses for source material, reference, reading assignments, special reports, materials for Science Fairs and for personal science reading. After the adoption of the National Science Foundation curricula, four people (12.12 per cent) said they used it a great deal for audiovisual materials, and fourteen (42.42 per cent) used it from "average" to "some extent". The total percentage was raised by one school (School C) where five teachers said they used it moderately for outside reading assignments, for film previews and use of film loops (TABLE 16).

TABLE 16.--Teacher question 5: What use did you make of the library in the science area before the National Science Foundation programs?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
<td>9.09</td>
</tr>
<tr>
<td>Some</td>
<td>9</td>
<td>27.27</td>
</tr>
<tr>
<td>Little</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
<td>6.06</td>
</tr>
<tr>
<td>Does not apply</td>
<td>8</td>
<td>24.24</td>
</tr>
<tr>
<td>No ans.</td>
<td>6</td>
<td>18.18</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>.</td>
</tr>
</tbody>
</table>

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Question 9 asked the teachers to list ways in which they had been aided in teaching methods or materials. Out of thirty-eight ways listed, eleven (28.93 per cent) were related to audiovisual materials, seven (18.41 per cent) were concerned with provision of supplementary reading books, five (13.15 per cent) with resource material. Periodicals were listed two times (5.26 per cent). Of the traditional help usually associated with libraries, that of providing subject bibliographies, the use of professional libraries and personal help by the librarian were each mentioned by only one teacher (TABLE 17).

Specific ways in which teachers were using the school libraries were brought out in the personal interviews. Again the greatest emphasis was on the audiovisual area. In three schools, teachers described methods of using tape recordings of BSCS lectures in the library for students who wished to hear them again or for students who were making up absences. (Schools A, E and F) In these schools the following audiovisual materials were used regularly: films, slides (many made by the science department assisted by staff members), microfilmed materials, and transparencies. The library staff made photocopies of magazine articles from Scientific American so that students could have them available for assignments.

Teachers in two schools mentioned owning 8 mm film loops, twenty in one school's biology program, and CHEM Study films on triple beam balance and the bunsen burner. One school owns thirteen CHEM Study films which are used as study films. Two others have immediate access to films through the large instructional materials centers for the school system. The CHEM Study teacher in School E pre-tapes
TABLE 17.—Teacher question 9: In what ways has the library aided you in teaching science?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audiovisual Materials</td>
<td>11</td>
<td>28.93</td>
</tr>
<tr>
<td>Supplementary Reading</td>
<td>7</td>
<td>18.41</td>
</tr>
<tr>
<td>Resource Material for Projects</td>
<td>5</td>
<td>13.15</td>
</tr>
<tr>
<td>Diverse Materials of All Kinds</td>
<td>4</td>
<td>10.52</td>
</tr>
<tr>
<td>Opportunity for Individual Research</td>
<td>2</td>
<td>5.26</td>
</tr>
<tr>
<td>Periodicals</td>
<td>2</td>
<td>5.26</td>
</tr>
<tr>
<td>Prepared Bibliographies</td>
<td>1</td>
<td>2.63</td>
</tr>
<tr>
<td>Professional Library</td>
<td>1</td>
<td>2.63</td>
</tr>
<tr>
<td>Librarian's Help</td>
<td>1</td>
<td>2.63</td>
</tr>
<tr>
<td>Duplicating Service</td>
<td>1</td>
<td>2.63</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>
laboratory instructions which are checked out of the library by students either ahead of time or for make-up work. Because of the excellent resources in this school for taping, this activity is easily accomplished. The library staff in School B tapes lectures on weather and water at the teacher's request and puts them on the dial access system for a period of the assignment. They have also made two to three hundred slides for the science area.

Other types of teacher use of the library include projects and assignments for students. In the **Special Materials** curricula in School C the teacher assigns additional reading in books on a wide range of reading levels through magazine articles on bacteria and cells. Another teacher of BSCS in the same school uses magazines for background reading with writing assignments to encourage students to express opinions. In School H, BSCS (Blue Version) Freshmen give oral reports with written bibliographies attached and are learning to use the library "even though they go a bit heavy on [the lighter science journals] rather than on technical journals."

In the area of student reference and research work three teachers stressed the need for students to be able to look up critical data in reference books. One gives students practice in CHYM Study classes (School B). In School H the teacher of the Blue Version BSCS assigns a research project from which he hopes students gain the ability to recognize proper forms of science documentation. He carries out the idea of inquiry, requiring the ability to come to a logical conclusion which is stated by the students in both written and oral form. Working from a hypothesis, students go into study leading them to related fields of chemistry and physics which require wide use of
library materials to get information. A similar assignment in School F gave students a chance to pursue an individual interest such as one by a BSCS student who was studying the effect of pep pills on laboratory animals. Because she had no chemistry background, she had to delve into the field and use many books not specifically related to the BSCS program. Biology students of average ability in School G are required to do a major project including ten or more references outside of the classroom collection. This teaches them to use independent sources wherever they can be located. Another teacher (School B) finds the Special Materials too difficult for many students and uses library materials. He taught the BSCS Blue Version previously and did not assign library material.

Among the eight teachers who reported little or no use of the library materials, the investigator found one who said he made no assignments in CHEM Study as there was no need to use other than the extensive laboratory materials (School C). The Introductory Physical Science package at School E provided every student with his own kit and the teacher said, "I use the library for seating space only. I don't know myself what's here in the library."

Science teachers in School D do not use the library except for tapes and for Science Fair projects.

**Personal Use of Library by Teachers**

Twenty-two teachers (66.66 per cent) use the library for some personal purpose and eleven seldom or never use it. Those who answered in the affirmative use it in preparation for science lectures and also for the latest information on science in periodicals and pamphlets.
Several indicated the need for more time to browse through materials, one teacher stating that he did not have the luxury of the leisure needed to find library materials (TABLE 18).

TABLE 18.—Teacher question 12: Do you often use the school library yourself for any purpose?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22</td>
<td>66.66</td>
</tr>
<tr>
<td>Seldom</td>
<td>6</td>
<td>18.18</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
<td></td>
</tr>
</tbody>
</table>

A much higher percentage of teachers stated that they recommended library materials to pupils than actually used them personally. Thirty-two out of thirty-three teachers (96.96 per cent) said they periodically suggested collateral library reading, the use of materials from the library collection, or use of library services. TABLE 19 indicates the frequency with which teachers mentioned these materials to students.

**Importance of the Library to Science Students**

To determine library importance to students, they were asked to estimate how many times they had used the library for science assignments and for any other purpose during the last three months. TABLE 20 (page 59) shows that sixty-two (32.46 per cent) students went once a month for science purposes; and the same percentage (32.98 per cent)
TABLE 19.--Teacher question 13: Do you recommend library materials to pupils?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>32</td>
<td>96.96</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>3.03</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33</td>
<td>..</td>
</tr>
</tbody>
</table>

How frequently?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a Week</td>
<td>9</td>
<td>27.27</td>
</tr>
<tr>
<td>Constantly</td>
<td>3</td>
<td>9.09</td>
</tr>
<tr>
<td>Start of a New Unit</td>
<td>7</td>
<td>21.21</td>
</tr>
<tr>
<td>Occasionally</td>
<td>7</td>
<td>21.21</td>
</tr>
<tr>
<td>No Ans.</td>
<td>7</td>
<td>21.21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33</td>
<td>..</td>
</tr>
</tbody>
</table>
rarely or never had a science-related library assignment. Twenty-four per cent estimated once-a-week use. The school library was used for other assignments, as 38.74 per cent replied that they did go to the library every day, and 35.07 per cent attended once a week (TABLE 21, page 59). These findings indicate that during one of the heaviest periods of the school year for assigned projects and term papers, over half of the surveyed students did not consistently use the library for science to any appreciable degree. Of the portion of students who do not use the library, twenty-five (29.06 per cent) liked to use public or college libraries, while nineteen (22.93 per cent) said teachers do not require it. Fourteen (16.27 per cent) replied that they had no time in their schedules; twelve (13.95 per cent) were more interested in other things; ten (11.62 per cent) did not need it; and six (6.97 per cent) said they could never find what they wanted. The small number who do not use the library indicates that this is not a major problem in subjects, as a whole, but the fact that the virtually 23 per cent who listed "teachers do not require it" is apropos in the present discussions. Thirty-eight (19.89 per cent) of the students never look in the library for materials. Comments typical of student response are taken at random, as follows:

CHEM Study  "The school library is helpful in history and English but in CHEM Study there is no need to use it."

"Sometimes I go there, not for science, but I end up reading science."

"The textbook has always been sufficient."

"I don't use the library for science."

"All materials needed are given to us by the teacher."
TABLE 20.—Student question 12: Since January 1, 1967, estimate how many times you have gone to the library for science-related assignments.

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a Week</td>
<td>46</td>
<td>24.08</td>
</tr>
<tr>
<td>Every Day</td>
<td>6</td>
<td>3.14</td>
</tr>
<tr>
<td>Once or Twice a Month</td>
<td>62</td>
<td>32.46</td>
</tr>
<tr>
<td>Never or Rarely</td>
<td>63</td>
<td>32.98</td>
</tr>
<tr>
<td>Indefinite Ans.</td>
<td>14</td>
<td>7.32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>191</strong></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 21.—Student question 13: Since January 1, 1967, estimate how many times you have used the school library for purposes of studying and reading in any subject.

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a Week</td>
<td>67</td>
<td>35.07</td>
</tr>
<tr>
<td>Every Day</td>
<td>74</td>
<td>38.74</td>
</tr>
<tr>
<td>Once or Twice a Month</td>
<td>25</td>
<td>13.08</td>
</tr>
<tr>
<td>None</td>
<td>18</td>
<td>9.42</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>3.66</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>191</strong></td>
<td></td>
</tr>
</tbody>
</table>
Biology  "There are many books that go into more specific areas than our textbook. Also there are up-to-date references."
"There are reference materials at home."
"There are books in the science room we usually use."
"We do not have any outside assignments that require other material and if so we have the materials in class."

In reply to Question four, regarding the facilities utilized in completing homework assignments, 50 per cent of the students said they did homework in both school and at home. Twenty-five students (13.08 per cent) said they worked only at school. When asked about the specific location, 191 students gave 258 votes as follows: (TABLE 22)

TABLE 22.—Student question 4A: Where do you do your daily science homework or science reading?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Library</td>
<td>19</td>
<td>7.44</td>
</tr>
<tr>
<td>Study Hall</td>
<td>73</td>
<td>28.29</td>
</tr>
<tr>
<td>Classroom</td>
<td>20</td>
<td>7.82</td>
</tr>
<tr>
<td>Home</td>
<td>141</td>
<td>54.64</td>
</tr>
<tr>
<td>Public Library</td>
<td>5</td>
<td>1.93</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>258</td>
<td><strong>..</strong></td>
</tr>
</tbody>
</table>

These figures indicate that students are doing most of their science assignment work at home.

Question nine asked students about the types of non-book
materials utilized in assignments. Slightly more than 50 per cent of the students are using materials other than books. Out of 152 checks on items listed the investigator found this breakdown, as shown in TABLE 23.

**TABLE 23.**--Student question 9: What kinds of materials, besides books, do you use in completing science assignments or for recreational science projects?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magazines</td>
<td>59</td>
<td>39.47</td>
</tr>
<tr>
<td>Science Equipment at Home and/or School</td>
<td>46</td>
<td>30.25</td>
</tr>
<tr>
<td>Pamphlets</td>
<td>21</td>
<td>13.81</td>
</tr>
<tr>
<td>Tapes, transparencies</td>
<td>11</td>
<td>7.17</td>
</tr>
<tr>
<td>Other people</td>
<td>8</td>
<td>5.26</td>
</tr>
<tr>
<td>Newspapers</td>
<td>4</td>
<td>2.63</td>
</tr>
<tr>
<td>Radio-television</td>
<td>2</td>
<td>1.31</td>
</tr>
<tr>
<td>Films</td>
<td>1</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>152</strong></td>
<td>..</td>
</tr>
</tbody>
</table>

Films which are part of the packaged media are evidently used by teachers in class and not by individual students.

**Importance of Student Use in Teachers' Opinions**

One item in the questionnaire was directed specifically to teachers and considered student use of material other than the science
package material (TABLE 24). Only one teacher indicated that his students often show evidence of using extra project material. In School H the teacher of BSCS develops and assigns research projects which demand the use of more media. Twenty-two (66.66 per cent) teachers see little or no evidence of student use of other material. This correlates with the student replies. (See TABLE 5, page 37).

TABLE 24.—Teacher question 17: Do the students you teach show evidence of using materials other than the textbook, laboratory books, and supplementary text materials to complete their science assignments?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often</td>
<td>1</td>
<td>3.03</td>
</tr>
<tr>
<td>To a Moderate Extent</td>
<td>10</td>
<td>30.30</td>
</tr>
<tr>
<td>Occasionally</td>
<td>11</td>
<td>33.33</td>
</tr>
<tr>
<td>Seldom</td>
<td>11</td>
<td>33.33</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

During each interview the teacher was asked his opinion of whether his students could and should be encouraged to do more library work. The majority favored the idea that the better student should be given extra assignments, as stated by a CHEM Study teacher in School E, "for pupils ahead of schedule, not for those fighting to keep up. The average just stick to the texts." Two teachers mentioned the need to give poorer students a chance to use easier materials found in the
library. A teacher who has taught both the non-National Science Foundation and the BSCS biology makes the statement that the good student in either course will be interested in doing more work. One teacher in CHEM Study in School D observed, "Students must be assigned extra work. They do not pursue science on their own. They are too grade conscious...Studying interrupts their schedule so they resist a lot of work."

In no case did teachers mention that because of the inquiry approach in the National Science Foundation pupils were inspired to do more reading or viewing.

Summary

Teachers indicated that the school library is very important to the school as a whole and the surveyed libraries evidently have status as an integral part of the school program. One-third of the librarians are involved in formal curriculum building, but only two are acquainted with the National Science Foundation programs. Only one-third of the science department heads discussed the curriculum with the librarians.

The librarian in six out of eight of the schools has department head status, which indicates that the library is part of the total school program.

Actual use which is made by teachers of library materials and services is reported by both librarians and teachers. After adoption of the National Science Foundation Curricula, 39.39 per cent or thirteen teachers indicated at least average use of library materials, as compared with twelve before. This was largely in the audiovisual area,
with little use of the traditional facilities of the library. Some teachers assign projects and term papers, seeing their value in scientific writing and in the development of interest in science.

Eight teachers (24.24 per cent) find no need for library assignments because of extensive laboratory material in the program, amount of material and some difficulty of getting magazine reprints.

A majority of teachers use the library themselves to help with preparation for classes and keeping their information up-to-date. Practically all teachers recommend materials from the library for student use.

A total of 32.46 per cent of the students do not use the library oftener than once a month for science and 32.98 per cent never or rarely go for science work; 19.89 per cent never look in the school library for material; 74 per cent do visit the school library for other purposes of studying and reading at least once each week. Of those who do not use the library, 22 per cent say the teachers do not require it.

Students do not consider either the school or public library as an important place to complete science homework assignments. Their assignments are evidently such that they can take them home or prepare them in study hall. Other than textbooks and supplementary reading, magazines are popular for doing science-related work, with science laboratory equipment rating second place. Since the BSCS programs are laboratory-oriented this is not surprising.

The majority of teachers believe that students show little or no evidence of using materials other than the science program. It is their feeling that the better students can profit from library assignments and in some few cases the child with lower ability can gain
better understanding from easier reading material.

Factors in the School Library Program Affecting Science Instruction

There are three factors existing in the school library program which determine its contribution to the teaching of the National Science Foundation programs: (1) the science collection, (2) accessibility, and (3) instruction in the use of the science collection.

The Science Collection

The number of science materials actually cataloged in the library in each participating school is shown in TABLE 4, page 36. It represents the figures given on the questionnaire filled out by the head librarian. The teachers were asked to indicate their evaluation of this collection. Eighteen (54.54 per cent) replied that the collection was above average. Six per cent representing two different schools rated it "excellent"; fifteen per cent (15.15 per cent) in three schools labeled their materials "average"; and one to two teachers (21.21 per cent) in six schools judged their school collection inadequate. No one in schools A and E rated their science collection as inadequate (TABLE 25). These schools were both recently constructed and had excellent budgets. In School E, a microfilm reader printer is available and four science magazines, Science News Letter, Science, Science Digest, and Scientific American are purchased on microfilm. In School D where the materials were rated as inadequate by two of the three science teachers, the two teachers were those who never used the library. This was listed as a comment also by the librarian, who added that in this school the science teachers did not respond to notices
nor ask for materials.

TABLE 25.--Teacher question 14: What is your general evaluation of the science collection in the school library? (Include all types of media.)

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>2</td>
<td>6.06</td>
</tr>
<tr>
<td>Above Average</td>
<td>18</td>
<td>54.54</td>
</tr>
<tr>
<td>Average</td>
<td>5</td>
<td>15.15</td>
</tr>
<tr>
<td>Inadequate</td>
<td>7</td>
<td>21.21</td>
</tr>
<tr>
<td>No ans.</td>
<td>1</td>
<td>3.03</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

Nearly eighty-two per cent of the teachers gave a strong (81.81 per cent) "Yes" to Question 11, concerning their requests for library material to be purchased. Only 18.18 per cent said that they did not suggest materials for purchase (TABLE 26). In School B two teachers reported that they had tried for two years to have titles ordered, but they had not received the books so they eventually stopped ordering. Three teachers in School C had been turned down on requests, but this was the only case reported as 88.88 per cent of the teachers not only found it possible but were urged to submit requests regularly.

Comments from interviews about the adequacy of materials include:

All the teachers helped with the selection of the material. We went through the AAAS Science book list and bibliographies.
in other science lists. (BSCS - School F)

The library has many materials to use with the Special Materials course. (BSCS - School C)

We have many transparencies and magazines on microfilm.

Special mention of the availability of the Scientific American was made by several schools. In School B the teachers appreciated the length of time these reprints were kept.

The inadequacies in the various collections were listed as too few physics films, an inadequate professional collection, and a beginning collection in a new school.

TABLE 26.—Teacher question 11: Have you ever asked for science materials to be purchased for the school library collection?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>27</td>
<td>81.81</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
<td>18.18</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

Did you get the materials?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>24</td>
<td>88.88</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>11.11</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Of the six ways in which science teachers would like more help from school library staff, the request with the highest percentage
(33.33 per cent) was for more materials: magazines, books and programmed material. More diversity in selection was named by 9.09 per cent and more audiovisual materials were desired by another 9.09 per cent (TABLE 27).

**TABLE 27.—Teacher question 10: How could the library help you?**

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need More Materials</td>
<td>11</td>
<td>33.33</td>
</tr>
<tr>
<td>More Diversity of Materials</td>
<td>3</td>
<td>9.09</td>
</tr>
<tr>
<td>More Audiovisual</td>
<td>3</td>
<td>9.09</td>
</tr>
<tr>
<td>Demand Correct Use of Library</td>
<td>2</td>
<td>6.06</td>
</tr>
<tr>
<td>Keep Magazines Longer</td>
<td>1</td>
<td>3.03</td>
</tr>
<tr>
<td>More Bibliography Work</td>
<td>1</td>
<td>3.03</td>
</tr>
<tr>
<td>No ans.</td>
<td>12</td>
<td>36.36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
<td></td>
</tr>
</tbody>
</table>

All librarians did not agree that teachers helped select material. Five librarians indicated full cooperation along this line; one said none of the teachers gave suggestions and one admitted she had not asked them to do so. The third said teachers would help if the librarians would take the initiative.

One teacher said he did not "have the luxury of reviewing books
on hand" and since he preferred books in the classroom he was not concerned about helping to select or evaluate the library collection.

In answer to Question 7 regarding the adequacy of the science collections, 49.21 per cent of the students replied that they could get what they needed and 23.56 per cent said "Sometimes". Thirty-eight (19.89 per cent) never looked for material. Only 6 per cent answered "No" or "Rarely" (TABLE 28). Forty-four per cent of the students answering Question 8 indicated that they get some of their material at the public or college library. Several of these commented on their use of neighboring college and university library services. Seven per cent of the students said, "I can never find what I want [at the school library]" (TABLE 29).

All the survey school libraries were open continuously through the day and at least one hour after the last class with two open in the evenings. (Schools B and C) Seating capacity in each library was reported adequate, according to the librarians' interviews; thus the accessibility factor, as far as these items are concerned, was positive.

The question of accessibility of materials for the science teachers was not included on the questionnaire but was discussed with each teacher personally. As previously indicated, a number of the teachers prefer their materials in the classroom. In two schools the teachers were happy with their situation. In the one case the teachers' offices were immediately outside of the library and the teachers had two planning periods each day. In the other instance one end of the library was reserved for science:

All the physics, chemistry, biology books and units are there. Magazines and pamphlets are included. The librarian pulls books for reserved shelves and any books we need are put on reserve for any student. This saves us time and trouble. (BSCS - School A)
TABLE 28.--Student question 7: Does the school library usually have the material you need in science?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>94</td>
<td>49.21</td>
</tr>
<tr>
<td>Sometimes</td>
<td>45</td>
<td>23.56</td>
</tr>
<tr>
<td>Never Look</td>
<td>38</td>
<td>19.89</td>
</tr>
<tr>
<td>Rarely</td>
<td>10</td>
<td>5.23</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>1.04</td>
</tr>
<tr>
<td>No ans.</td>
<td>2</td>
<td>1.04</td>
</tr>
</tbody>
</table>

Total: 191

TABLE 29.--Student question 8: In the above questions, if you checked anything but yes, please indicate where you get your materials for science assignments.

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Libraries</td>
<td>44</td>
<td>43.56</td>
</tr>
<tr>
<td>Home</td>
<td>24</td>
<td>23.76</td>
</tr>
<tr>
<td>Books in Science Room</td>
<td>6</td>
<td>5.94</td>
</tr>
<tr>
<td>Textbook and Notes</td>
<td>18</td>
<td>17.82</td>
</tr>
<tr>
<td>Other People</td>
<td>9</td>
<td>8.91</td>
</tr>
</tbody>
</table>

Total: 101

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In another school, a large separate science collection in a room within the library area was available for the use of science classes, but the teachers were unhappy because it was often scheduled for other classes during the day. The librarian reported that if science teachers did not use it and others needed it, they were allowed to schedule it.

Accessibility was measured by students in terms of their ability to find materials elsewhere than the school library. Question 8 on the students' questionnaire, established the locations where students found materials for science if not in the school library. Out of 101 replies, 43.56 per cent of the students found material in the public library, 23.76 per cent found books at home, and 5.94 per cent used the books in the science room. It is interesting to note the large percentage which used the public library when they did not use the school library. Limited access is indicated in Question 14 when 16 per cent said they had no time in their schedules to use the school library. This appears to be a common condition in crowded student schedules.

Students, when asked in Question 15 if they enjoyed using the school library, replied as illustrated in TABLE 30. These figures indicate that the majority of students do like to use the library. Comments were made on many of the student questionnaires indicating that the library material was well-organized, easy to find, and in a public place. Two students complained that magazines kept in the classrooms and not in the library were causing inconveniences. The fact that audio-visual material housed in science departments could not be used elsewhere which disturbed others.
TABLE 30.—Student question 15: Do you enjoy using the school library?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Much</td>
<td>51</td>
<td>26.70</td>
</tr>
<tr>
<td>Average</td>
<td>75</td>
<td>39.25</td>
</tr>
<tr>
<td>Sometimes</td>
<td>42</td>
<td>21.98</td>
</tr>
<tr>
<td>Not Much</td>
<td>15</td>
<td>7.85</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>2.09</td>
</tr>
<tr>
<td>Never Go</td>
<td>3</td>
<td>1.57</td>
</tr>
<tr>
<td>No Comment</td>
<td>1</td>
<td>1.16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>191</strong></td>
<td></td>
</tr>
</tbody>
</table>

Instruction in the Use of the Science Collection

Are the students taught to use the science materials in the school library? One-hundred per cent of the librarians said the students used the science reference materials. Five librarians said they gave instruction to science classes on the use of this material. Three librarians reported that both the teachers and the librarians were involved in various aspects of the training and one said the teachers did the instruction. During the interview, one librarian said:

As soon as a unit starts the teachers ask me to come in and help. I haven't had to do it with the science teachers, so evidently they are working on their own instruction. I find out from students. In other classes I go in and talk for periods of time. The science teachers have not asked for instruction. Every student gets orientation through library instruction. Who teaches the technical books? I don't know.
In order for the investigator to determine the adequacy of library instruction given, teachers in answering Question 7 rated students' ability to use the library in independent science study. Results showed that in the opinion of 48.48 per cent of the teachers the students rated poor, 27.27 per cent rated them good, and 21.21 per cent judged the ability as fair.

Fifteen teachers (41.66 per cent) said in answer to Question 15, that teacher direction was the method in which students obtained information in learning how to use science tools and materials in the library. Six (16.16 per cent) listed orientation through the visits by English classes at the beginning of the school year. In five (13.88 per cent) cases the library staff was involved in providing some instruction, although one teacher answered, "I assume", indicating no real knowledge of how pupils became acquainted with the science collection. In another instance the answer was, "They don't." (TABLE 31)

Results of interviews with teachers produced these common opinions: (1) that students are often getting orientation instead of library instruction, (2) that they need library instruction in science, and (3) that the science teacher needs to do the instruction because of the knowledge of subject matter. The following comments in each area are typical:

Advanced BSCS classes have an orientation the first two weeks. (BSCS - School B)

The teacher orients the class by taking them on a tour of the library. (BSCS - School C)

Students need instruction on how to use the room properly. (BSCS - School E)

Some do quite well at writing up lab reports. I get only the better students. (Chem Study - School A)
Lessons in depth are given to the BSCS class by the librarian. They are motivated by the assignments and are ready to go by the time projects are assigned. (BSCS Blue Version - School H)

The librarian offers to help but the subjects are not known to the librarian. I question whether the librarian knows each particular science area. (BSCS - School G)

Nothing is done by the science teacher about learning to write term papers scientifically at the high school level. It's up to the English teachers. (Chem Study - School C)

The librarian does not teach specific science tools. It's better for the science teacher to do it. Students take it better from teachers. (BSCS - School C)

From a study of the answers to Question 17 of the teachers questionnaire, (TABLE 24, page 62) it may be deduced that students show a lack of training in the importance of other media than that contained in the science program.

Student responses to Question 6 reveal that 40.59 per cent feel they have no formal instruction. Seventy six (37.62 per cent) said the teacher gives it; 17.82 per cent give the librarians credit for it and 3.96 per cent get knowledge of materials from other students. One hundred ninety-one students made 202 responses indicating that several students get help from more than one source (TABLE 32).

Summary

**Science Collection**

A scant majority of the science teachers considered their library collection in science to be above average and generally adequate. In one school where the majority judged the collection as inadequate, the librarian reported that none of the teachers used the library in teaching science.
TABLE 31.—Teacher question 15: How do pupils become acquainted with this collection?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>15</td>
<td>41.66</td>
</tr>
<tr>
<td>Direction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation in English Classes</td>
<td>6</td>
<td>16.66</td>
</tr>
<tr>
<td>Librarian</td>
<td>5</td>
<td>13.88</td>
</tr>
<tr>
<td>Pupil Himself</td>
<td>5</td>
<td>13.88</td>
</tr>
<tr>
<td>Assignment in Library</td>
<td>1</td>
<td>2.77</td>
</tr>
<tr>
<td>Do Not Become Acquainted</td>
<td>1</td>
<td>2.77</td>
</tr>
<tr>
<td>No ans.</td>
<td>3</td>
<td>8.30</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 32.—Student question 6: Who gives instruction to you in the use of reference books in science?

<table>
<thead>
<tr>
<th>Possible Answer</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>76</td>
<td>37.62</td>
</tr>
<tr>
<td>Other Students</td>
<td>8</td>
<td>3.96</td>
</tr>
<tr>
<td>Librarian</td>
<td>36</td>
<td>17.82</td>
</tr>
<tr>
<td>No One</td>
<td>82</td>
<td>40.59</td>
</tr>
<tr>
<td>Total</td>
<td>202</td>
<td></td>
</tr>
</tbody>
</table>
About eighty-two per cent of the teachers asked for science material for the school library and received it. With some regularity they all recommended library material to pupils and 66.66 per cent needed the library facilities for their own use. Teachers wanted the libraries to provide more materials of every kind. Forty-nine per cent of the students indicated they can obtain the materials they need for science in the library. Only 49.21 said they need the school library for their assignments. Over 39 per cent used magazines; 13.81 per cent used pamphlets. Almost twenty per cent of the students never look in the school library for science material. Six (6.97 per cent) replied that they rarely or never found material and in a similar question the same percentage gave this as a reason for not using the school library.

From these figures the investigator concludes that library materials for science are generally adequate and teachers believe in their importance enough to recommend them. Students are using a wider selection of media than the traditional books and are getting them anywhere they are accessible. Roughly half of the students are finding the school library a source of good science material.

Accessibility of Collection

A most important factor in school library service is an accessibility of collection and services. The majority of science teachers who were interviewed wanted material in their classroom, whether it came from the library or not, but if conditions are such that they can reach the library easily and conveniently they accept and use materials in one central location.
Students wanted materials well organized, in a central location and easy to find. Sixty-six per cent enjoyed using the library at least to a moderate degree; 16.27 per cent found the school library inaccessible because of schedules. From these figures it is apparent that students are not kept from the use of the libraries because they are inaccessible or are unpopular. The classroom collection did not play an important role in the students' search for materials other than the laboratory and text since only 7.82 per cent list this as a source. Students did not do their daily homework in either the school or public library; and the majority listed either home or study hall as the main location for study.

Instruction in the Use of Science Collection

While librarians report that students are using science reference books and other materials, half of the teachers indicate that students did not know how to use the library in independent science study. What the students did know, 41.66 per cent of the teachers stated, came from teacher instruction. About 17 per cent said English teachers gave the instruction while 16 per cent reported that students were self-instructed or assigned to the library where they get some knowledge by contact. Fourteen per cent indicated that the librarians gave the instruction. Presumably teachers are competent to give library instruction in science because they have the technical knowledge of the subject matter, but most of the instruction is merely orientation. Most students agreed with teachers that they either did not receive instruction or the teacher gave the instruction as part of the science class.
Extent of Cooperation Between Science Teachers and Library Staff

It was planned that items 1 and 4 on the librarians' questionnaire and items 13 and 10 on the teachers' questionnaire would identify services given to teachers by librarians and assistance to librarians given by teachers. Items 10 and 13 on the teachers' questionnaire were also used in the survey to ascertain the adequacy of the material collection. In addition they reveal the amount of cooperation that exists. Responses to item 1 on the librarians' questionnaire show that one-third of the chairmen of the Science Departments informed the librarians of the type of curriculum being taught in the sciences.

Item 4 brought out two comments on the problems of ordering materials for the sciences:

Many loop films could have been obtained last year if the science teachers had turned in lists but the athletic department got ahead of them.

Teachers do not respond to notices to ask for materials. (Librarian - School D)

Librarians cut our magazine requests and refused to order some science magazines. (Chem Study - School C)

Librarians did not order books in science after we made out the orders. (BSCS - School B)

Books should not be sitting on the workroom shelves waiting to be cataloged. Teachers need books ready. (BSCS - School H)

Regarding the extent of cooperation, two teachers commented:

We're given the opportunity to pick our own books [for purchase]. On the unit outlines I've made up I've gone through all the books here and picked out the best ones and mentioned them in class. The librarian has been part of our teaching team, both she and the audiovisual specialist are responsible for helping us - we couldn't
have done it without them. (PSSC - School A)

The librarian wants students to come in by class
groups and welcomes them. (BSCS - School C)

Problems of the materials collection and lack of cooperation
are evident in these interview comments:

The librarians get too possessive an attitude; they
want everything in their libraries, want the whole world
to revolve around their materials, but this isn't always
possible. They are actually doing more harm than good
by insisting. (School H)

The science department won't give up filmstrips long
enough for us to classify them. The audiovisual man
is taking a library course but he is cataloging for
Audiovisual, not for us. The materials are not in the
catalog by subject. (School F)

Each librarian in our school has a subject specialty
and the science librarian selects books and may ignore
the teachers' wishes. (School C)

The librarian has to be a magician to work with teachers
in each area. (Chem Study - School C)

The ideal librarian should have a degree in science,
English and mathematics. The librarians will have to
change their minds about science. (School B)

Idea for Cooperation

In asking for ways in which the library staff could help the
science teacher to enrich his program, teachers were given the oppor-
tunity in Question 10 (TABLE 27, page 68) to present ideas for improve-
ment. In addition to asking for more materials, one teacher asked that
magazines be kept for a long period of time; three asked for better
control of discipline in the library; two mentioned more annotated
bibliographies which would help teachers know what was in the collec-
tion. One asked for the purchase of single concept films which the
students could observe in the library and check in and out like a book.
The interviewer asked each science teacher about the feasibility of requesting librarians to give book talks in the classroom, and to describe new and exciting materials of all kinds. Approximately 80 per cent replied that this was a fine suggestion. All of the group evidenced surprise that this might be possible, and said they would welcome the librarian's appearance several times during the year. A BSCS teacher stated his reasons:

The librarian should come in and tell them about the biology books. They have unlimited reading possibilities in the Blue Version. I can stand there all day and tell them where to get books and a lot of it goes in one ear and out the other. If a librarian comes in, it would mean a different person and a different viewpoint which might be much more valuable. (School B - BSCS)

The minority opinion was voiced in two ways. Ten per cent or three teachers did not want the librarians to introduce books to students but preferred to do it themselves:

It is our job to do the motivating ourselves - to sell this type of thing. It falls more on our shoulders. It is possible for the librarian to come in and show how to locate materials, but actual materials should be the teacher's job. (PSCS - School A)

One suggested that the librarian and teacher select the books, the teacher doing the work of promotion with his class. Ten per cent of the teachers said they would not want to give up any class time for this activity; it would take up unnecessary time from the students laboratory work and would not be valuable enough to justify the time spent.

The majority of science teachers praised the librarians in their schools and appreciated the prompt service in supplying materials when needed. Many commented on the time-consuming activities in which the librarians were engaged and wished for the advent of more
automation to help with some of the routines. However, they realized that in their schools which had become materials centers, they had many advantages over the traditional school in equipment, quarters and staff. Because of these advantages they could do a better job of science education.

Summary

The answers from librarians on basic information about the curriculum which they should obtain from the Science Department chairman, showed that three out of eight librarians did not receive help in learning of what the National Science Foundation programs consist and what their goals are. Some librarians also had problems in getting teachers to turn in lists and requests. Teachers made comments indicating a lack of cooperation such as refusal to order certain items and failure to order or process materials fast enough. Librarians desired to keep materials in one center. They lacked background in the sciences. Librarians complained about teachers not being willing to give up departmental materials for cataloging purposes so that they could be accessible to everyone.
CHAPTER V

SUMMARY AND IMPLICATIONS

Summary

The problem as stated in the introduction of this study deals with the effect of the National Science Foundation curricula on the need for the school library materials and services. The hypothesis stated that the school library was a necessary adjunct to the science program prescribed by the National Science Foundation courses. Data were collected by the investigator from a survey of eight secondary schools. The survey included three forms of questionnaires, which were answered by eight librarians, thirty-three science teachers, and 191 science students selected at random. Data consisted also of information gathered from interviews with twenty-five of the thirty-three teachers who answered the questionnaire. Eight head librarians furnished additional information and their own opinions.

A summary of the data indicates the following information:

1) The majority of teachers interviewed consider the school library an asset to the science program because they use it for audiovisual materials and equipment. They think that the library is an important part of the school program.

2) The National Science Foundation programs require much teacher preparation time in setting up laboratory equipment. The material to be covered in each course is so extensive that it is not possible to include all of it in
one year's work. Therefore, teachers do not feel that they have the time to incorporate library materials or library instruction in the use of these materials unless they decide it is vital that the students have this material. Students' work shows little evidence of the use of supplementary materials not included in the science media.

3) Eighty-two per cent of the 191 students surveyed spend no more than one hour per day on science assignments which for the most part consist of textbook instruction. One-half of them have no assignment requiring the use of the library, as is borne out by the fact that only 19 per cent do their science assignments in the library. Sixty-one per cent have the opportunity to do unassigned work in science if they so choose. Sixty-six per cent of the students use the library less than once a month for science and 20 per cent never look there for material. Seventy-four per cent use it, however for work in other courses.

4) Science teachers have made use of the library to approximately the same extent as before the adoption of the National Science Foundation programs, but for different purposes. The traditional science reading assignments from library books has been replaced by the use of audiovisual materials housed and circulated from the library. Approximately 24 per cent of the teachers do not give any library assignments because of extensive laboratory material and the difficulty of getting library material. The
majority of teachers interviewed agree that the better student should be given library assignments. Several teachers see it as useful for students with less ability who need books of easier reading comprehension. Sixty-seven per cent of the teachers use the library themselves; 90 per cent suggest readings to the students.

5) The science collections in the survey libraries are above average, according to the results of the questionnaire. Teachers help select library materials and the majority are asked to do so. One-half of the students find adequate material. Teachers find library material not as accessible as either their own material or that in the packaged media. Materials in the classroom are very important to them, while students signify that they would like to have all materials in a central place, well organized and easy to find. Sixty-six of them enjoy using their school libraries to a moderate degree but are not using them for frequent science assignments.

6) Library instruction in science, when it is given, is taught by 42 per cent of the teachers. Teachers would rather instruct students themselves because of the technical aspects of the subject matter, but at present most of them are giving only orientation to the library. The librarian in one school said she was giving no library instruction to science classes. Students admit and teachers agree that students do not receive enough instruction.

7) The majority of librarians do not know the objectives of
the National Science Foundation Course Content Improvement Materials and the science department heads have not thought it important to discuss the programs with them. Both librarians and teachers have complaints as well as praise for each other. Specific suggestions as to the improvement of relationships between the two areas are listed by the respondents in the preceding chapter.

The writer concludes from the data collected and analyzed that the hypothesis has not been substantiated. The library which is an instructional materials center and which is an active part of the school program, according to the administrators and teachers, is not functioning as an essential adjunct to the science program. It is important to the science program in its role as a service agency for the audiovisual materials such as films and tapes, but not in the other aspects of library service.

Implications

Generalizations are drawn at the conclusion of this study for the librarian, for the science teacher, and for the administrator. From the data presented in the preceding chapters, certain implications are evident.

The librarian should be conversant with and knowledgeable about the objectives and contents of the National Science Foundation curricula if he is going to fulfill his obligations as a resource consultant. If he is going to make the science collection in the library a necessary part of every teacher's preparation of units and provide the media appropriate for students to use in connection with assignments, he needs to know the

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methodology of the science programs. The references listed in the kits as recommended reading should be purchased and circulated. Materials must provide students with intellectual challenge commensurate with their capabilities.

The library collection should be made more accessible to both students and teachers. If the National Science Foundation Programs are going to provide easier access to materials than the library staff does, the library will make no significant contribution to the science program. If the library rules and regulations are not flexible enough to allow teachers to have continual and reasonably quick access to related science materials and audiovisual equipment, again the library will probably be bypassed in favor of classroom or teachers' personal collections. After materials are purchased, the librarian should, through constant communication and knowledge of the classroom activities, provide access to these materials by short or long-term loans of all materials needed by the classroom teacher. Interlibrary loan policies need to be implemented with public, college, and university librarians in neighboring communities.

Many teachers mentioned audiovisual materials as being useful in the sciences. Librarians should capitalize on this interest and make available every listening and viewing device possible within the library quarters, in the science area, and for home use. Direct dial access to tape recordings provides the library with a new dimension of service for the sciences.

The librarian should take the initiative in planning with the principal and science teachers an integrated program of instruction in the use of science reference materials and basic research techniques geared to the
sciences. As cited earlier in this paper, authorities in the field of science say that college students do not know how to use references efficiently nor how to write good science research papers or laboratory reports. Unless they receive instruction in the use of their science tools and library tools in science before they are admitted to college, they will lose both valuable time and energy.

This study indicates that teachers realize that students are not now able to employ independent science study methods in the library. They also admit that their students do not use much learning material outside the text; perhaps the students do not know how to use other sources and media to the best advantage. When only forty-two per cent of the teachers and fourteen per cent of the librarians give instruction in the use of science reference materials and the remainder of both teachers and librarians leave instruction up to chance, the science department and library staff are not fulfilling their obligations to the student.

The teacher's failure to plan access to the library for the experience of learning research techniques and independent study habits is a real cause of apprehension in considering the values of the science programs. If the teacher crowds his lesson plans with all of the materials in the packages and does not make provision for his students to use reference books and tools of research, he is forfeiting the opportunity to assist those students who are going to college toward easier adjustment and higher achievement. Only by practice and the guidance of knowledgeable teachers can students acquire this kind of skill. Goodlad points out that teachers "are being asked to preside over a fundamentally different kind of learning-
teaching process" in the new science philosophy. Too often they leave
students to flounder because they lack the time and energy to supervise
study skills as well as all the individual projects. By asking the li-
brarian to assist in that part of the training best suited to his skill,
the teacher could use his own talents to better advantage.

The librarian can enrich the science curriculum by cooperative
planning of in-service training and provision of a good professional li-
brary. In-service training in audiovisual materials and methods is as
necessary for the librarian as it is for the teacher. A professional library
full of curriculum guides from good school systems which are using innova-
tive methods may provide inspiration for better teaching practices. Up-
to-date reading materials will also help close the gap between traditional
practices and new knowledge.

Conclusion

The production and use of coordinated teaching and resource ma-
terials to support and parallel the curriculum is the philosophy of both
the library and the newer science education. Personnel in both areas be-
lieve that the responsibility of learning lies with the pupil. Both areas
employ many different media with each playing its own role. Both are built
on concepts of constant change, with new techniques and methods replacing
old ones in the effort to grow in knowledge of subject matter and self-
realization.

A report of the Educational Policies Commission states that em-
phasis in science education is on the use of comparative methods, use of
concepts to analyze data, development of a critical attitude toward existing

\[1\] Goodlad, p. 103.
knowledge, use of methods of inquiry from the disciplines, use of primary source material, and guidance of students to do original studies.¹ The library is the part of the school where methods of inquiry, use of primary source material, and original thinking can be carried on to the best advantage after the teacher has set the stage and provided motivation. School libraries have lagged behind in information storage and retrieval practices because of lack of vision, money, research, and small units of organization.

As more instructional material centers are established with more available money, reference services for science departments can be extended. In the school library there will be a science librarian. Demand for this service must be built by proving that the program of instruction must have good materials and good consultant service.

The expense of the packaged media may take a disproportionate amount from the total budget. The librarian need not apologize for the size of the budget request of six dollars per pupil in addition to one per cent of the total school budget for audiovisual purposes per year² when he realizes that the cost per pupil of the Introductory Physical Science Materials program as reported by PSSC in 1966 is $27.00, some of this expendable.³ In a school system which is using several of the science packages, the budget would be a considerable item for the taxpayers to accept. If the librarian believes in his program and its

²American Association of School Librarians, Standards, p. 25.

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value to the school, he will have to prove to the teachers and to the administration by the services he provides that the library is as indispensable as the science department. By the same token it is his responsibility to see that there is a balance in service and budget for every department in the school as far as the library is concerned.

Research studies are needed in several areas. Library-based research should be pursued in the following directions:

1) Experiments with techniques of teaching science tools within the framework of the packaged media should be performed.

2) Performance in study skills unique to the sciences by college students who have used school libraries extensively at the secondary school level should be compared with that of the students who have not used the secondary school libraries.

3) Factors in science instruction common to those which have made the library a vital component of instruction in other subject areas, such as social studies and English, should be identified.

4) The value of in-service library training for teachers in the science area where multi-media are used should be measured in order to provide guidelines in planning these programs.

The only blocks to real cooperation and communication between the science teacher using the media packages and the librarian are the attitudes and prejudices of each, and the administrator of the school who supplies the budget. Once these blocks are removed by knowledge
of each area, knowledge of the component parts of the package, what its strengths and weaknesses are, and the contribution which can and must be made by adequate support from the school administration, real progress toward learning can take place. By the time the school is ready to adopt the social studies package, the music kits, and the Arts and Humanities media program, the science department and the school library will have demonstrated the way to enthusiastic and creative use of all materials in the instructional materials center.
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Davis, Jerry B. "BSCS Program's Variable Factor - the Teacher." Science Education, L (April, 1966), 221-222.


Western Michigan University. "School Science and Mathematics; a Report of a Conference for School Administrators." Western Michigan University, April, 1965 (Mimeographed)
APPENDIX A

BIOLOGICAL SCIENCES CURRICULUM STUDY PUBLICATIONS
August, 1967


Version Tests - Quarterly Achievement Tests in two alternate forms for each version are available through the version publishers. Comprehensive Final Examination in two alternate forms and Processes of Science Test (POST): for all versions. New York: The Psychological Corp.


Laboratory Blocks - Plant Growth and Development; Animal Growth and Development; Microbes: Their Growth, Nutrition, and Interaction; The Complementarity of Structure and Function; Field Ecology; Regulation in Plants by Hormones - A Study in Experimental Design; Animal Behavior; Life in the Soil; Genetic Continuity; Physiological Adaptation. Boston: D. C. Heath & Co.


Pamphlet Series - Animal Language; Bioelectricity; Biogeography; Biological Clocks; Biology of Coral Atolls; Biology of Termites; Biomechanics of the Body; Blood Cell Physiology; Cell Division; Cellulose in Animal Nutrition; Courtship in Animals; Early Evolution of Life; Ecology of the African Elephant; Growth and Age; Guideposts of Animal Navigation; Hibernation; Homeostatic Regulation; Metabolites of the Sea; Photoperiodism in Animals; Photosynthesis; Plant Systematics; Population Genetics; Present Problems About the Past; Slime Molds and Research. Boston: D. C. Heath & Co.

Single Topic Films (Super 8mm loop) - Social Behavior in Chickens; Prairies and Deciduous Forests; The Peppered Moth: A Population Study; Mimicry; Water and Desert Plants; Water and Desert Animals; Temperature and Activity in Reptiles; Mountain Trees - An Ecological Study; The Kidney and Homeostasis; Phototropism; Convergence; Australian Marsupials; The Intertidal Region; Life in the Intertidal Region; Predation and Protection in the Ocean; Mating Behavior in the Cockroach; An Inquiry - The Importance of the Nucleus; Mitosis; An Example of the Biological Significance of Color; Grouse - A Species Problem. Boston: Houghton Mifflin Company; Chicago: Rand McNally & Co.; New York: Harcourt, Brace & World, Inc.

Techniques Films (16mm sound or 8mm loop, silent) - Bacteriological Techniques; Culturing Slime Mold Plasmodium; Genetics: Techniques Handling Drosophila; Histological Techniques; Measuring Techniques; Neurospora Techniques; Paper Chromatography; Removing Frog Pituitary; Smear and Squash Techniques; Weighing Techniques. Colorado: Thorne Films.
APPENDIX B

QUESTIONNAIRE FOR SCHOOL LIBRARIAN IN SCHOOLS
USING THE NATIONAL SCIENCE FOUNDATION PROGRAMS

Name of School:

Date:

Please fill in data asked for:

Number of total staff:

Library staff (both professional and non-professional adult)

Enrollment: ______ Percent college bound ______%

Library quarters:

Relation of library to total school program:

Other library facilities in community:

Science collection: According to the latest reports made to the North Central Association, or other figures:
(Include those cataloged in library)

Number of books in biology: ______

Number of books in chemistry: ______

Number of books in earth sciences: ______

Number of books in physics: ______

Filmstrips (total) science: ______

Films: ______

Magazines: ______

Slides: ______

Exhibits: ______

Other: ______

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Please answer the following: (Your answers will be treated confidentially)

1. Did the chairman of the Science Department discuss the science curriculum with you before January, 1967?

2. Are you acquainted with the contents of the National Science Foundation curricular package? If so, how did you become acquainted with it?

3. In what ways do the science teachers use the library? (Please enumerate by subject area if possible)

4. Do they ask you to purchase science materials of all kinds for the school library collection?

5. Do they assign these materials for pupil use?

6. Do pupils use the science tools (reference in the library? 

7. Who teaches the use of these tools?

8. Are you on the school's curriculum committee?

9. Please list any interesting or unusual projects carried on by the science department in connection with library materials:
QUESTIONNAIRE FOR SCIENCE STUDENTS

Date:__________________________ Grade:_______________________

Name of science course:______________________ School:______________________

This questionnaire deals with your science assignments and voluntary reading in science. Please answer as carefully as possible. No names of students or teachers are needed.

1. How much daily work outside of class do you do in science?
   Time:________________________ (in hours and minutes)

2. What type of work? _____________________________________________________
   (Workbook, textbook, experiments, other)

3. How much unassigned science experimental or study work do you do per week?
   Time:________________________ (in hours and minutes)

4. (CHECK APPROPRIATE ANSWER)
   Do you do your daily science homework or science reading in school?______ Where in school______ Where out of school______

5. Do you have specific assignments in science requiring you to use science reference or other science books in the school library? Yes______No______

6. (CHECK APPROPRIATE ANSWER)
   Who gives instruction to you in the use of reference books in science?
   Teacher____ Other students____ Librarian____ No one____

7. (CHECK APPROPRIATE ANSWER)
   Does the school library usually have the material you need in science?
   Yes____ Sometimes____ Never look____ No____ Rarely____

8. In the above question, if you checked anything except yes, please indicate where you get your materials for science assignments:

   ___________________________________________________________________

   ___________________________________________________________________

9. What kinds of materials, beside books, do you use in completing science assignments or for recreational science projects?

10. Is it possible to use only your science text to succeed in daily science assignments? Yes____ No____
11. (CHECK APPROPRIATE ANSWER)
Do you have the opportunity to do any extra voluntary work in science outside of school hours?
Yes______ Have no interest in it______ No______

12. (CHECK APPROPRIATE ANSWER)
Since January 1, 1967, estimate how many times you have gone to the library for science-related assignments:
Once a week____ Every day____ Once a month____ Never____
Other____

13. (CHECK APPROPRIATE ANSWER)
Since January 1, 1967, estimate how many times you have gone to the school library for purposes of studying or reading in any subject:
Once a week____ Once a month____ Every day____ None____
Other____

14. If you do not use the library please check the reasons below:
No time in schedule_____________
Can never find what I want_____________
Teachers do not require it___________
More interested in other things__________
Do not need it__________________
Like to go to the public library___________

15. (CHECK APPROPRIATE ANSWER)
Do you enjoy using the school library? (General attitude)
Very much____ Average____ Sometimes____ Not much____
No____ Never go____ (Comment on reasons if you wish:)

________________________________________
________________________________________
________________________________________

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QUESTIONNAIRE FOR SCIENCE TEACHERS
USING NATIONAL SCIENCE FOUNDATION PROGRAMS

School: ___________________________ Total number of pupils in classes______

Please answer freely the questions below: (Your answers will be treated confidentially.)

1. How long have you been in your present position?_________

2. When were the National Science Foundation courses adopted by the Board of Education?

3. Who was influential in their adoption?

4. Do you need the facilities and materials in the school library to teach your science courses?

5. a) What use did you make of the library in the science area before the National Science Foundation programs?
   b) After they were adopted?

6. Does the science package give you any time for library assignments?
   What kind?

7. How would you rate the majority of your pupils on their ability to use the library in independent science study?

8. How would you rate the library's importance to the total school instructional program?

9. In what ways has the library aided you in teaching science?

10. How could it help you?

11. a) Have you ever asked for science materials to be purchased for the school library collection?
   b) Did you get them?

12. Do you often use the school library yourself for any purpose?

13. Do you recommend library materials to pupils?___How often?___

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14. What is your general evaluation of the science collection in the school library? (Include all types of media.)

15. How do pupils become acquainted with this collection?

16. If you use materials from the collection in or adjacent to your classroom, are they purchased from a separate department budget or from the library budget?

17. (PLEASE CHECK APPROPRIATE ANSWER)

Do the students you teach show evidence of using materials other than the textbook, laboratory books, and supplementary text materials to complete their science assignments?

Often_____ To a moderate extent_____ Occasionally_____ Seldom_____ Never_____
The purpose of the enclosed questionnaire is to determine the extent of active use of the school library by members of the science department where the National Science Foundation programs, such as CHEM Study, CBA, PSSC, Earth Sciences, or BSCS are part of the curriculum. This use can be in any form, direct or indirect, and should include use of audio-visual materials as well as other kinds.

Another purpose of the questionnaire is to isolate the factors in the packaged science media which affect the demands made upon the school library. We wish to determine what, in your opinion, is the relative importance of the library in teacher planning and use as far as the science department is concerned.

This questionnaire will be picked up on__________________________ when I come to visit the school and discuss this project with you personally.

Eleanor R. McKinney
Investigator
Specialist Project

Home address:
3226 Tamsin Ave.
Kalamazoo, Michigan
49001

Enclosures:

- Questionnaires for students
- Questionnaires for science teachers
- Questionnaire for librarian