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A Survey of the Attitudes of Biology Teachers in the State of New Mexico Toward the Biological Sciences Curriculum Study Program

Frizelle La-Gretta Aguilar

ATTITUDES OF BIOLOGY TEACHERS

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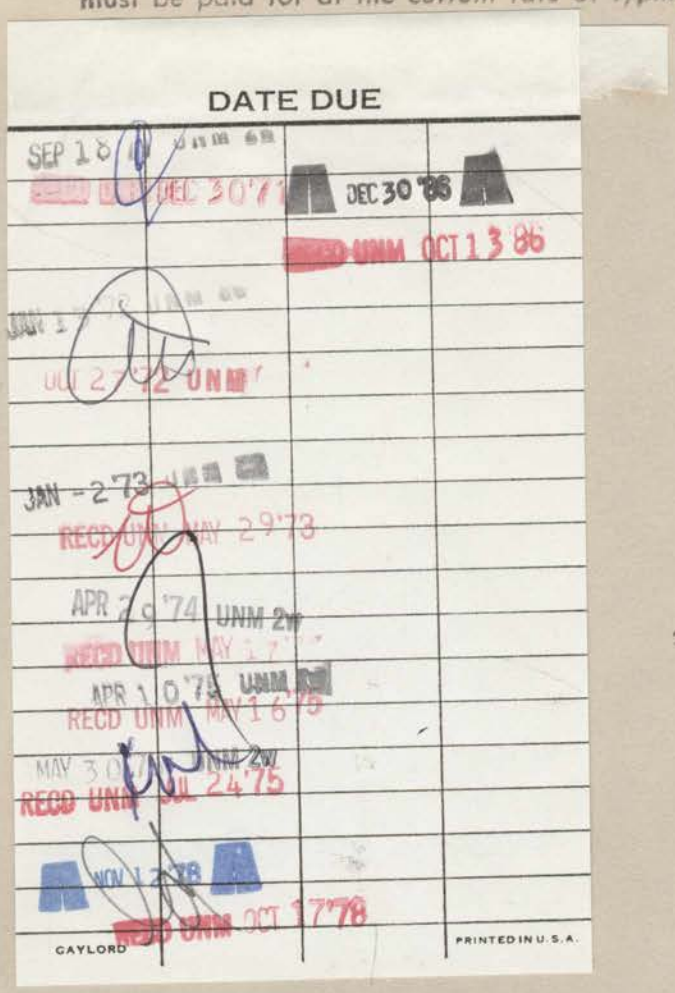

A SURVEY OF THE ATTITUDES OF BIOLOGY TEACHERS IN THE STATE OF NEW MEXICO TOWARD THE BIOLOGICAL SCIENCES CURRICULUM STUDY PROGRAM

A Thesis

Presented to

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Master of Arts in Secondary Education

By

Frizelle La-Gretta Aguilar

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MASTER OF ARTS

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Thesis committee

CHAIRMAN

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CHAPTER I

INTRODUCTION

Let's change the biology curriculum.
Let's do this to the curriculum.
No, let's do that to the biology curriculum.
No, let's omit this and add the other.
Shall we ask the biology teachers?
Why ask the biology teachers?
We are the curriculum developers!
Of course we know what goes on in the classroom, especially since we read about it sometimes.
We do not visit there very often.
Well, some of us have never been there truthfully.
Who needs to ask the teachers of New Mexico, or even tell them about BSCS?
They will read about it somewhere.
Everybody knows about it anyway.[1]

There has been a lot of discussion about the advances in science today and the need for better scientific training at the high school level. During the past decade, there have been research projects developed to up-grade the courses and include more sophisticated materials in the students' biology curriculum at an earlier grade level.

Following are but a few projects involved in current curriculum research:[2]

1. The American Association for the Advancement of Science Commission of Science Education, Washington, D.C.

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[1]Reflection by Frizelle L. Aguilar, May 12, 1964.

[2]Dorothy M. Fraser, Current Curriculum Studies in

Emphasis: Grades kindergarten through third. These materials, written by scientists and teachers, are published in an experimental edition, to be tried in 1963-1964 in twelve centers by about 120 teachers.

2. Biological Sciences Curriculum Study, University of Colorado, Boulder, Colorado. The writers' primary purpose was to prepare high school biology courses, suitable for wide use in the average high school, with average classes; to give students a basic understanding of science and of scientific processes, and in so doing, to build scientific literacy as an aid in the preparation of students for later responsible citizenship.

3. The Chemical Bond Approach Project, of Earlham College, Richmond, Indiana. Purpose: To give students a vital and true picture of Chemistry.

4. Chemical Education Material Study, University of California. Emphasis: Up-grade high school chemistry.

5. The Educational Service Incorporated (ESI) and the Elementary Science Study (ESS) of Watertown, Massachusetts. Purpose: To contribute to the enrichment of American education in physical sciences in the high school and its science curriculum in the elementary schools.

Academic Subjects (Washington, D. C.: National Education Association, 1962), pp. 6-25.

6. The Elementary School Science Project, University of California, Berkeley, California. Purpose: To determine the scientific topics and the quantity appreciated by and appropriate for elementary school children.

7. National Science Teachers' Association (NTSA), of Washington, D. C. Purpose: To improve science instruction at all levels.

8. Princeton University Junior High School Project, Princeton, New Jersey, is designed to lead the student by direct observation and experiment to insights concerning the nature of the physical world they inhabit.

9. The Science Manpower Project of Columbia University, Teachers College, New York, New York, for grades kindergarten through twelve. It was designed to prepare students for the world of today and tomorrow, by providing children and young people with an oppostunity to study science in each year of their formal schooling.

There are a few of the important research projects in the field of science in the school curriculum. These may seem tangential to the problem however, the purpose in listing here is for the reader to realize that the BSCS is only one of many science curriculum projects. It should be noted that it is the only project concentrating all of its efforts in the area of high school biology.

Various educators have written their descriptive

views about the Biological Sciences Curriculum Study however very few biology teachers actually in the classrooms have expressed their opinions and attitudes openly. There is nothing in the literature to indicate that a survey has ever been conducted to ascertain the attitudes of biology teachers in the state of New Mexico toward the Biological Sciences Curriculum Study program.

An attitude and opinion survey was used in this study as an instrument in appraising the status of the Biological Sciences Curriculum Study in the high schools of New Mexico, and possibly to enlighten teachers who are unfamiliar with this research activity in biology.

I. THE PROBLEM

Statement of the problem. The purpose of this study is to survey the attitudes of biology teachers in the state of New Mexico toward the Biological Sciences Curriculum Study. Answers are sought in this study to the following questions:

1. What are the characteristics of schools using the Biological Sciences Curriculum Study?
2. How long has BSCS been used in the schools?
3. What are the effects of BSCS on teachers and students?
4. What are the opinions of biology teachers toward the BSCS program and the three versions of texts involved?

5. What are the advantages and disadvantages of BSCS?

6. Are the original objectives of BSCS being accomplished by the average students involved in this program?

7. Why do biology teachers like or dislike BSCS?

The following hypotheses may be accepted or rejected after analysis of the data:

1. The biology teacher's knowledge about the BSCS is proportional to his scientific background and professional qualifications.

2. The participation in BSCS of the schools is directly proportional to the population of the school-community.

3. Many teachers are in favor of using BSCS but think they do not have adequate facilities, equipment, and student ability available.

4. Many teachers do not qualify to instruct the students in the BSCS program because of their lack of training and inadequate familiarity with the program.

5. Many schools have decided not to use BSCS because of the additional finance involved.

6. Many teachers feel that the three present versions of BSCS are above the ability of their high school students.

7. Many teachers are resistant to change and are satisfied with their present program and methods.

8. Most teachers in New Mexico are not informed about BSCS and therefore are either not using this program or have no opinions concerning it.

Delimitation of the problem. The study includes only public high schols in New Mexico, listed by the State Board

of Education, Santa Fe.

II. DEFINITION OF TERMS USED

BSCS = Biological Sciences Curriculum Study. For a very complete description of the Biological Sciences Curriculum Study see Chapter II of this study.

High school. In this study the term "high school" includes grades seven through twelve, nine through twelve, or ten through twelve. Where junior high schools exist in the larger cities, the high schools include only grades nine through twelve and ten through twelve.

Participating teachers. Throughout this study, the term "participating teachers" applies to those teachers who are officially using the Biological Sciences Curriculum Study materials on a full scale as specified by BSCS and those teachers registered with the Area Consultant appointed by BSCS, University of Colorado. Mr. Marshall S. Floyd of Highland High School, Albuquerque, was appointed as 1964 Area Consultant for New Mexico. The BSCS teachers for 1962-1963 listed in the annual report of the BSCS Newsletter Number 17 were:

1.	Harry L. Bishop	Valley High School Albuquerque
2.	William Z. Dean	Albuquerque Indian School, Albuquerque

3.	Marshall S. Floyd	Highland High, Albuquerque
4.	Virgilio Martinez	Albuquerque High, Albuquerque
5.	Lawrence Modrich	Raton High, Raton

Current unpublished information is on page in the Appendix.

Non-participating teachers. In this study, "non-participating teachers" applies to all teachers of biology who do not fit the specifications of the aforementioned definition.

III. SOURCES OF THE DATA

Primary sources. There are three sources of primary data in this study. Two major sources were questionnaires completed by the chairmen of the various high school biology departments and by teachers who are primarily teachers of biology. The third source was provided by teachers who are not primarily biology teachers, but are teaching one or two biology classes. Since there is only a thread of difference between the three primary sources, one may say that the primary source of data was the responses listed on the questionnaire Forms A and B by the teachers of biology.

Secondary sources. Secondary sources of data were educational journals, reviews, periodicals, and newsletters.

Few texts contain coverage on BSCS because the program was only innovated in 1959. A complete coverage of the literature and publications concerning BSCS materials between 1959 and 1964 is given in Chapter II of this study. The need for a study of this nature was indicated. The history of biology in the curriculum is described to relate both the need for, and the ultimate development of the Biological Sciences Curriculum Study, by the American Institute of Biological Sciences sponsored by the National Science Foundation.

CHAPTER II

REVIEW OF THE LITERATURE

A survey of educational literature revealed several articles expressing the need for a second look at the status of science in the high schools. Such a survey reveals that many factors contributed to the formation of the Biological Sciences Curriculum Study by the American Institute of Biological Sciences with the support of the National Science Foundation. Sources that contribute valuable information to the present inquiry are studies dealing with the following: (1) the history and development of BSCS, (2) the history of biology in the curriculum of American schools, (3) the necessity for a "new" biology program, (4) trends of current educational surveys, (5) literature concerning BSCS, 1959-1964, (6) inferences from the literature.

History and development of BSCS. The Education Committee of the American Institute of Biological Sciences (AIBS) organized the BSCS in 1959. Its function was "to seek the improvement of biology education."[1]

The major support for the BSCS has come from National

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[1]AIBS-BSCS, "About BSCS Biology," BSCS Newsletter, 17:7, March, 1963.

Science Foundation grants totaling in excess of three million dollars as of October 1, 1962, and six million dollars as of May 31, 1964.[2] This figure was obtained from the Director of BSCS by telephone in June, 1964.

According to a Newsletter:

> General policy for the BSCS was established by a 27-member Steering Committee, which includes research biologists, high school biology teachers, science supervisors, and university administrators. The Chairman of BSCS is H. Bentley Glass of Johns Hopkins University. The BSCS Director is Dr. Arnold B. Grobman, formerly at the University of Florida. Official headquarters and offices are on the University of Colorado campus at Boulder, Colorado.[3]

The first writing conference was held during the summer of 1960, to prepare the original materials to be used during the school year of 1960-1961. One hundred and five teachers and fourteen thousand students used this material and submitted their comments and suggestions.

The second writing conference was held during the summer of 1961 for seven weeks to make a thorough revision of the three versions. The three versions are:

1. The Green Version--usually considered ecological in approach.
2. The Yellow Version--considered developmental-evolutionary.

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[2] Ibid., p. 7.

[3] Ibid.

3. The Blue Version--considered physiological-biochemical.

During 1961-1962 the BSCS materials were tested in thirty-five centers, covering nineteen states from Vermont to Hawaii, from Washington to Florida. Three hundred and fifty teachers instructing over thirty thousand students used and tested the revised materials.

The third revision was during the summer of 1962, to prepare books for general adoption.[4] The following BSCS texts are now available through commercial publishers: (1) Green Version--High School Biology, Rand McNally Co., P. O. Box 7600, Chicago 80, Illinois; (2) Yellow Version--Biological Science: An Inquiry into Life, Harcourt, Brace and World Co., 757 Third Avenue, New York 17, New York: (3) Blue Version--Biological Science: Molecules to Man, Houghton, Mifflin Co., 2 Park St., Boston, Massachusetts. Many more publications are now available through commercial publishers for immediate use as a result of the three writing conferences and continuous work by the BSCS group.

The Chairman of BSCS indicates that:

> The aim of the Biological Sciences Curriculum Study is to place biological knowledge in its fullest modern perspective. If we are successful

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[4]Bentley Glass, "Renascent Biology: A Report on the AIBS Biological Sciences Curriculum Study," The School Review, 70:28, Spring, 1962.

> students of the new biology should acquire not only an intellectual and esthetic appreciation for the complexities of living things and their interrelationships in nature, but also for the ways in which new knowledge is gained and tested, eliminated, and an ever closer approximation to truth attained.[5]

> What is the BSCS program that past efforts to improve the science curriculum of the secondary schools were not? One might say two principal things in reply. For the first time in the history of American education we now see a large number of research scientists, from the colleges and universities taking part in a co-operative effort with high-school teachers of science and science supervisors to replace an antiquated body of scientific knowledge and outlook with subject matter and perspective that are truly current.[6]

There were six general points of agreement on major issues prior to writing the BSCS materials:

1. Biology as it was taught in 1960 and even now is twenty years to a full century in arrears. Controversial biological subjects as organic evolution, the nature of individual and racial differences, sex and reproduction in the human species, and the problems of population growth and control will be presented by an appropriate scientific treatment.

2. Science is presented to students as if the knowledge of nature were static and crystallized, or was rapidly becoming so. The failure to teach up-to-date biology is the prevalent sin of teaching the life sciences. Current so-called laboratory work has degenerated for the most part into mnemonic exercises that stress only the names of structures and processes

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[5] Ibid., p. 42.

[6] Ibid., p. 41.

and textbook definitions and explanations.

3. There is no way to organize a high school course in biology. One can take the analytical, physicochemical approach of a biochemist or biophysicist or the organismal approach of the student of behavior or the supra-organismal view of the ecologist who deals with communities and ecosystems. It was therefore decided to explore a variety of approaches and types of organization of the subject matter to be taught.

4. The nature of science as an increasingly important aspect of human history--including the development of science through the correction of past errors, discovery of new evidence, and synthesis of new concepts--is to be stressed. This principle means that the biological themes of the interdependence of structure and function, regulation and homeostasis, the genetic continuity of life, its evolution, the diversity of type together with unity of pattern, the biological roots of behavior, and the relation of organism to environment must be treated at all levels or organization, from the molecular level to the ecosystem, and at all stages of process from the chemical reaction through the growth and development of the individual to the ultimate evolutionary changes with time. To do this is most difficult and has never really been attempted. But to achieve it is fundamental to a modern view of the life sciences.

5. As George Sarton, our greatest historian of science, has said, "It is not at all necessary that the average man should be acquainted with the latest theory of the universe or the newest hormone, but it is very necessary that he should understand as clearly as possible the purpose and the methods of science. This is the business of our schools, not simply of the colleges but of all the schools from the kindergarten up." Only by engaging in the steps of scientific inquiry may a student

become able to discern the true difference between sound experiment that provides evidence and complex instrumentation that offers a show--between evidence and authority, between science and magic. The schools should offer a real participation in scientific inquiry, and as full a participation as possible.

6. A sound biological understanding is the inalienable right of every child who, when adult, will need to cope with individual problems of health and nutrition; with family problems of sex and reproduction and parenthood and with the citizens' problems of wise management of national resources, the biological hazards of nuclear agents in peace and in war, and governmental support of science as the primary source of national strength and well-being in the scientific ear.[7]

A current BSCS Newsletter says:

Each year there are at least 750,000 tenth-graders who either take a special slow-learner course in biology or who are assigned to a rather elementary type of special "general science" course because the school considers them not academically suited for regular biology. There is a large group of tenth-grade students for whom the regular BSCS biology materials are not suitable. The BSCS has taken the position that the basic aim of a course for these students should be the same as that for the average and above-average students in the BSCS biology versions--that is, developing in the students, insofar as possible, the degree of scientific literacy needed by adults in society, using biology as the vehicle for this purpose.[8]

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[7] Ibid., pp. 19-20.

[8] AIBS-BSCS, "BSCS Special Material for the Slow Learner," BSCS Newsletter, 21:36, April, 1964.

The first BSCS Special Materials (SM) Program was developed during the summer of 1963. This BSCS Special Materials experimental edition is ready for classroom use in 1964-65, provided the teachers obtain special preparation at a BSCS-SM Briefing Session.[9] This material is designed for the student who is below the fortieth percentile on the national norms on the Differential Ability Test (DAT) total score (Verbal Reasoning + Numerical Ability). The second writing conference, scheduled for the summer of 1964, revised the existing units for the 1964-1965 school term. However, it did not complete units for one full year course.

There has been developed a second year biology course called BSCS Biology, Second Course. It was used in the 1963-1964 experimental edition and will continue to be used in 1964-1965. In 1965 a commercial edition of BSCS Biology, Second Course will be released for the 1965-1966 school year.

It is easily seen that BSCS is not standing still in its development. It is continually progressing and developing longitudinally and vertically in logical sequence.

History of biology in the curriculum of American schools. Only a brief tracing of the history of biology in the American schools will be given here. The question

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[9] Ibid., p. 37.

concerning the proper subjects for the elementary or high school curriculum hardly existed before the middle of the nineteenth century. Three R's--reading, writing, and arithmetic, with spelling and grammar, were without any rivals. In fact, the average school included only reading, spelling, and English grammar, while whose of a superior sort added writing, arithmetic, geography, and history.[10]

Horace Mann, in 1837, wrote The Common School Revival which helped introduce science into the curriculum. The first subject of scientific character was geography. By 1832, geographies and atlases were prepared for school use. The second scientific subject in the elementary curriculum was physiology. In 1837 the first physiology text appeared. Physiology became compulsory in 1850.[11]

It has been well documented in literature that the curriculum prior to 1800 consisted of a program devoid of biology as we know it today. The following is an example of a high school program: (1) science of numbers, (2) elementary geography, (3) geometry, (4) hand surveying and navigation, (5) domestic literature, rudiments of grammar, oral recitation, (6) ancient literature--Grecian

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[10]Paul Monroe, A Text-Book in the History of Education (New York: The Macmillan Company, 1905), p. 701.

[11]Ibid.

amd Roman, (7) foreign literature--French. This information is from a letter written on July 15, 1816 by Dr. Samuel L. Mirchell of New York, to Governor Nicholas of Virginia and Directors of the Library Fund, State of Virginia, giving advice on a school system.[12]

Noble[13] writes that Herbert Spencer, 1820-1903, one of England's greatest scholars, challenged the classical type of training in his essay on "What Knowledge Is of Most Worth?" He urged general instruction in science and that all might receive training and help for the daily duties of life. His ideas attracted attention in many lands. He concluded that of all subjects, a knowledge of science "was always most useful for preparation for life," and therefore the type of knowledge of most worth.

Noble continues that Louise Agassiz and Thomas Henry Huxley introduced the teaching laboratory in biology, about a century ago, with one primary purpose in mind. Their insight was a simple one: seeing is believing.[14]

Thomas H. Huxley, 1825-1895, an English scientist wrote on "A Liberal Education," in his Science and

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[12]Edgar W. Knight, A Documentary History of Education in the South Before 1860 (University of North Carolina Press, 1953) p. 9.

[13]Stuart G. Noble, A History of American Education (New York: Rinehart and Company, Inc., 1954) p. 347.

[14]Ibid.

Education, as related by Noble:

> That man, I think, has had a liberal education who has been so trained in youth that his body is the ready servant of his will, and does with ease and pleasure all the work that, as a mechanism, it is capable of; whose intellect is a clear, cold, logic engine, with all its parts of equal strength, and in smooth working order; ready, like a steam engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of Nature and of the laws of her operations; one who, not stunted ascetic, is full of like and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of Nature or of art, to hate all vileness, and to respect others as himself.
>
> Such an one and no other, I conceive, has had a liberal education; for he is, as completely as man can be, in harmony with Nature.[15]

John Dewey's conception of education involves not merely learning, but play, construction, use of tools, contact with nature, expression, and activity; and the school should be a place where children are working rather than listening, learning life by living life, and becoming acquainted with social institutions and industrial processes by studying them.[16]

A survey of the high schools in New York State for the period 1896-1900 showed that 82.5 per cent of the

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[15] Ibid., pp. 340-341.

[16] Ibid., p. 486.

schools taught botany, 70 per cent physiology, 42.5 per cent zoology, and 10 per cent biology. During this period American secondary education underwent serious questioning relative to its proper function and purpose.[17]

In the decade from 1900-1910 the high school course in "biology" had its birth. It is sometimes difficult to realize that this course is so relatively young in the curriculum. In 1910, only 1.1 per cent of all high school students were enrolled in biology. The "new" biology then was established to present a unification of botany, human physiology, and zoology, which was actually three sub-courses combined in a one-year sequence.[18]

Along with the great industrial expansion in America, the period from 1910-1920 marked a changing emphasis upon science in the curriculum. Biology became increasingly popular with high school students because the emphasis was upon the teaching of biology for its importance to human welfare--vocations, health, sanitation, avocations, appreciations, understanding of the environment.[19]

During a period of curriculum refinement, 1920-1930, the movement to "humanize" the study of biology, which had

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[17]Paul DeHart Hurd, Biological Education in American Secondary Schools 1890-1960, AIBS-BSCS Bulletin No. 1 (Baltimore: Waverly Press, Inc., 1961), p. 9.

[18]Ibid., p. 27.

[19]Ibid., pp. 30-39.

been gaining momentum during the previous two decades, was by now a generally accepted point of view for curriculum makers. The report of the American Association for the Advancement of Science in 1928 lent further support in this direction.[20]

The economic or social crisis in America during 1930-1940, marking the depression years, also produced a period of questioning of educational practices. Attention of the curriculum developers was focused upon the individual student and his personal, social, and economic welfare. They were also more influenced by the growing importance of science and technology than the committees in previous decades. Their major emphasis was upon science for all young people--meeting their "needs" and "problems"--and set the curriculum in terms of its values for personal and social welfare. The strongest criticism was leveled at the nature of individual student laboratory work and its lack of educational returns for the time spent. The consequence was that double or two-hour laboratory periods in science teaching were dropped by the majority of high schools, which meant that biological experiments and investigations were reduced to a minimum.[21]

World War II and the birth of the "atomic age" marked

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[20] Ibid., p. 51.

[21] Ibid., pp. 70-73.

the next decade. The question of "What the high schools ought to teach?" was still in the minds of the curriculum developers. There were many reports and even more opinions; it was a concensus that all young people should have some knowledge of science as a social force and that this would demand knowing something of the nature of the scientific enterprise.[22]

The committees continued to speak of science and meeting the needs of individuals in various aspects of life, and as being "functional" in the lives of young people. For the first time "scientific attitudes" were referred to as being worthy goals for all students in science courses and at all levels.[23]

8 The general biology course continued to gain in enrollment throughout the 1940-1950 decade. Nearly all the high schools in America were offering the course. In 1950, 21.7 per cent of all high school students were enrolled in a biology class. This was an increase of 20 per cent in fifty years.[24]

The necessity for a "new" biology program. The decade from 1950-1960 has been described as one of

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[22] Ibid., p. 74.

[23] Ibid., pp. 105-107.

[24] Ibid, p. 106.

"confusion and crisis" in science education.[25] The 1940's ushered in a period of biochemical expansion and inquiry that was unprecedented in the history of endocrinology. The period between 1951-1963 has marked the birth of "radiobiology," the newest and most infant development in biology. The use of isotopic tracer methods now relatively new is providing a great store of information that could not have been obtained in any other way. The unifying concepts in genetics, along with the research on DNA, have provided a foundation for the science of "biology." The development of the electron microscope has added new dimensions to biology on the cellular level.

The present decade was ushered in by the space era which will continue to progress in direct proportions to the capabilities of American scientists. Who are the American scientists? The students of today are the American scientists of tomorrow, therefore they must be given the best, up-to-date courses possible. This is the purpose of the Biological Sciences Curriculum Study.

Trends of current educational surveys. Accurate information regarding past trends may be helpful in making future improvements. Viall reported:

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[25] Ibid., pp. 108-109.

> In American secondary schools 69 per cent of the science teachers and 63 per cent of the mathematics teachers are men. They earn salaries from below $3,000 to over $10,000, with a median range of $5,000 to $5, 499. Half of the science teachers are under thirty-five years of age, and all but 1 per cent have bachelors' degrees. Although 75 per cent have had some post-baccalaureate courses, less than 40 per cent have taken such courses in their teaching areas. Twenty per cent have completed at least one National Science Foundation Summer Institute.
>
> The survey sets 18 semester hours as "minimally adequate" preparation in a subject. Seventy-three per cent of biology teachers, 70 per cent of mathematics teachers of grades nine to twelve, 60 per cent of chemistry teachers, and 33 per cent of the physics teachers meet this standard.
>
> A quarter of all physics classes in the country are taught by teachers with less than 9 hours in the subject. Thirty per cent of all the science and mathematics classes in American secondary schools are taught by teachers who spend some or most of their time teaching outside these fields.
>
> The report should convince many that much additional, substantial effort must be put into raising standards for preparation programs, providing additional opportunities for inservice courses in the academic areas, and using the available talent more intelligently.[26]

In 1961, Koelsche reported an interesting study on the status of science equipment and facilities in public high schools and says:

> The adequacy of science facilities and equipment is an important factor in this situation.[27]

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[26] W. P. Viall, "Secondary Science and Mathematics," Journal of Teacher Education, 13:475-476, December, 1962.

[27] Charles L. Koelsche, "Facilities and Equipment

The following generalizations were made along with recommendations:

> The proportion of high school students studying science is greater today than three years ago.
>
> Classrooms and laboratories are inadequately equipped for effective instruction.
>
> A definite relationship exists between the size of the school and status of the facilities and equipment for science instruction.
>
> Time could be obtained for the teachers by eliminating all duties unrelated to science teaching from the assignment of science instructors.
>
> A look at the high schools in which the basic items of equipment for teaching the various science subjects were missing discloses that a greater portion of items were absent in schools enrolling less than 200 students than in those with enrollments of 500 and above. Many investigators, including Dr. Conant, indicate that schools enrolling fewer than 500 students cannot offer the educational opportunities present in the larger schools. Every effort should be made, therefore, to bring about a consolidation of small high school districts thereby broadening the base for adequate financing of the total school program. Equal education opportunities for all American youth would thus move a step closer toward ultimate realization.[28]

The work of the Biological Sciences Curriculum Study has made an effort to improve the science equipment available to the schools and encourage teachers to

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Available for Teaching Science in Public High Schools 1958-1959," Science Education, 45:365, October, 1961.

[28] Ibid., p. 372.

participate in workshops and institutes.

Literature concerning BSCS, 1959-1964. The literature contributing to and commenting on the BSCS is limited because of the newness of the program. A few pertinent articles will be briefly discussed.

Grobman, in 1961, stated that our national survival may depend on our ability to make rapid changes in American education. Dr. Hulda Grobman is the BSCS Newsletter Editor and the wife of Arnold B. Grobman. She poses the following questions and comments:

> Will BSCS be able to change American Education? Can we hasten the process of change? Can we determine what change is needed, and effect this change quickly? Once these now biology programs are generally available, will they influence the mainstream of biology teaching? Will the work of this "commission" have an effect?
>
> To measure the effectiveness of the program, it will be necessary to examine the whole field of biology curriculum and determine what impact, if any, the BSCS materials have had on other biology writers and curriculum workers.[29]

Unfortunately, some biology teachers equate national curriculum study materials with national curricula, and therefore, piously declare that they will have nothing to

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[29] Hulda Grobman, "Study in Educational Improvements," Clearing House, 36:163, November, 1961.

do with them. This tragic semantic error, whether it be real or imagined, may be preventing the students under their care from receiving a superior education.[30]

It was stated by J. Baker,[31] in 1963, that the entire BSCS program was born out of necessity. High school biology was badly out of touch with the frontiers of the field. BSCS has created an enthusiasm for change in high school biology which should have started many years ago. BSCS has done a fairly good job in emphasizing that a teacher's use of BSCS materials does not mean that the course is necessarily excellent. However, with a few exceptions, the promotion writers of BSCS and speakers have not done a good job at all in dispelling the myth that if a teacher does not teach BSCS biology, then he or she must be teaching an old, out-dated, "traditional" course.

Novak[32] stated that one of the significant features of the BSCS "approach" is the emphasis on scientific inquiry. He says that the laboratory experiences would be deliberately designed so that at the end of a year the student has reasonably clear ideas about the role of observations, measurement, experimental design, experimental

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[30]Arnold Grobman, "National Curricula," American Biology Teacher, 24:484, November, 1962.

[31]J. J. W. Baker, "Biology Bandwagon," Science Teacher, 30:74, October, 1963.

[32]Alfred Novak, "Scientific Inquiry in the Laboratory," American Biology Teacher, 25:345, May, 1962.

error, hypothesis, cause and effect relationships, the exponential relationship, and a whole host of concepts which constitute the area of scientific inquiry.

Lee[33] explains and presents the laboratory block authors to give an understanding of how they expect to accomplish the following objectives: (1) to enable students not only to learn the science of biology, but (2) to also practice the science of biology.

Novak and Abraham have postulated certain basic principles to assure successful fulfillment of the objectives of the BSCS laboratories:

> That investigative type laboratories will lead to better understanding of science.
>
> That the objective of each laboratory exercise is valid.
>
> That the biology teacher is adequately trained in the subject and methodology of of laboratory experience.
>
> That a properly equipped laboratory is available to carry out the investigations.
>
> That needed apparatus and materials are readily available.
>
> That sufficient laboratory preparation time or assistance to the teacher is available.[34]

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[33]Addison Lee, "Experimental Approach in Teaching Biology: An Introduction to the BSCS Laboratory Block Program," American Biology Teacher, 23:409, November, 1961.

[34]A. Novak and N. Abraham, "Excellence in Biology Facilities," Science Teacher, 29:14, March, 1962.

They recommended that serious consideration be given to the following points:

> Reduction of assigned teaching duties.
>
> Release from extracurriculum assignments such as lunchroom, hall duty, parking lot patrolling.
>
> Facilitating the ordering of supplies.
>
> Extensive use of non-certified personnel as laboratory assistants.[35]

The importance of the competent teacher is spelled out by Klinckmann,[36] as being a final point in the new curriculum. She says that the teacher is the only model of an educated person with whom many students ever come in contact, therefore, if students are to become truly educated, the teacher must be a model of an educated person whom students can be encouraged and stimulated to emulate. Her description of the competent teacher as an educated person may seem grandiose and unattainable--and in one sense it is. It is an ideal. But it is necessary to remind oneself constantly of such ideals if one is more nearly to approach them.

Lisonbee[37] indicated that plans, during the summer

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[35] Ibid.

[36] Evelyn Klinckmann, "New Curriculum Patterns for Biology Teachers," Yearbook of the American Association of Colleges for Teacher Education (AACTE), 1962, p. 102.

[37] L. Lisonbee, "Teaching Science to the Disadvantaged

of 1964, are to provide material suitable for the disadvantaged pupil, in genetics, ecology, and cellular biology; to challenge, fascinate, and stimulate day to day interest of the students. The developing BSCS program is cognizant of the associated sociological problems--those that relate to the pupil and his cultural background and to the pupil and his teacher.

Lee[38] reported, in 1961, that although the BSCS laboratory block was too sophisticated for some of the groups, and the facilities were too cramped for success, students got something intangible out of the program, in spite of the handicaps--something not measurable by tests. The following is a typical response from a group whose I.Q. was over 130:

> For the first time I have really had to think. I am just beginning to know what science is.

The slow students showed the most improvement in study, preparation, attitude, and the test results following the block.

The use of team teaching in connection with the BSCS program is commented on by Johnson and Shutes:

> The BSCS program came into the picture at the

Pupil," Science Teacher, 30:20, October, 1963.

[38]Addison Lee, "Laboratory Instruction Innovation," Science Teacher, 28:47, October, 1961.

> appropriate time in that it provides a more consistent overall view of biology; and also provides more meaningful laboratory experiences for the students. The course will probably be somewhat different next year and the year after that, but this is a growing, evolving nature that certainly biology, if any course, should subscribe to. Occasionally a nonfunctional-nonessential bump or two will appear, but it is hoped that these will fade away in the evolutionary process, or at least promote a source of curiosity to some observant student. Biology is a becoming thing. What it becomes will depend mainly on the success that teachers of biology have in becoming real biology teachers. And they need time to do this. As I have pointed out, team teaching will go far to help provide this time.[39]

The BSCS principles are praised by Sister Mary Ivo, in a 1962 report which says:

> The BSCS with its emphasis on modern biology contributes to the development of attitudes and skills that are functional, that stimulate conceptual thinking, and that consequently lessen the students' dependence on the teacher.
>
> And have not all students the right to become self-educable? Herein is the dynamic force of the BSCS program: it takes a subject that has been made trite by reliance on outmoded, weak, descriptive teaching techniques and catapults it to the level of a modern experimental science.[40]

This article illustrates a complete acceptance of the BSCS program and agreement with the basic principles of the

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[39] R. H. Johnson and R. Shutes, "Biology and Team Teaching," American Biology Teacher, 24:254, April, 1962.

[40] Sister Mary Ivo, "Catholic High School and the BSCS Program," American Biology Teacher, 24:362, May, 1962.

scientific attitudes, by a Catholic educator.

Klinge[41] encourages teachers to join professional societies and bring in career pamphlets for their students. He describes reading materials such as Scientific American, American Biology Teacher, Science Teacher, and other curriculum aids. He suggests the BSCS texts, laboratory guides, and films. He urges teachers to improve their training by the fifth year program or the National Science Foundation in-serving training.

Frankel quotes Hiden T. Cox, executive director of the American Institute of Biological Sciences:

> The seeds which are now being planted in our school system will be bearing fruit for years to come. No comparable effort in reworking the contents of a curriculum has been made by so many experts in any field.[42]

Frankel goes on to say that it is difficult to estimate the impace of BSCS efforts on biology teaching on the secondary school level nationally.[43]

Weaver suggests that some of the BSCS material can be introduced earlier in the junior high school and upper

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[41] P. Klinge, "Resources for Improving Instruction in Biology," School Life, 45:13, October, 1962.

[42] E. Frankel, "BSCS--Where New Horizons Begin," Science Teacher, 29:47, May, 1962.

[43] Ibid.

elementary grades. He says:

> BSCS became so voluminous, maybe the solution will lie in the direction of a reorganization of the K-12 science program, in identifying and weaving into the earlier years as much of the life-science information as possible, and in offering some degree of selectivity at the upper levels in the type of materials used for the varioys types and interests of students.[44]

Brett gives the following facts about the high schools of today. Eight out of ten students take biology in tenth grade. One-half of the eight never take another science course, and do not want to go to college. Brett adds:

> At the present time it is fair to say that teachers, administrators and parents need further preparation for BSCS courses in biology; the courses need further revision; methods of evaluating the results of these courses need refining; in fact the only ingredient ready for BSCS brand biology is the high school student himself.[45]

An editorial in the London Times Educational Supplement implies that classroom testing has shown that 70 to 80 per cent of grade ten pupils are able to utilize the BSCS materials in a satisfactory manner. The necessity of developing materials for the other 20 to 30 per cent of the students was realized.[46] It is interesting to note that BSCS

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[44]R. L. Weaver, "BSCS--Plus," American Biology Teacher, 25:404, October, 1963.

[45]William J. Brett, "BSCS Biology," Teachers College Journal, 33:139, March, 1962.

[46]Editorial in the London Times Educational Supplement,

materials are being used in at least four foreign countries.

According to Van Deventer,[47] it would be difficult to say which of the three BSCS versions is "best." He claims that all are good, all have the same basic "themes" or cross-cutting ideas. The strongest feature of all in the BSCS material is the introduction of modern approaches in the laboratory. He thinks that the Blue Version gives the best presentation of the methodology of science; the Yellow Version has the best section on microbial life; the Blue Version also gives an excellent treatment of biotic communities and succession. Ven Deventer claims the following outstanding features for the three versions:

Green Version = the most thorough treatment of taxonomy.

Blue Version = the clearest treatment of the origin of life.

Yellow Version = the strongest presentation of evolution.

These are the unifying threads that run through all three BSCS versions, according to Van Deventer:

1. Change of living things through time--evolution.

"BSCS Biology Course--Blue, Green and Yellow Versions," 2502:922, May 3, 1963.

[47]W. C. Van Deventer, "BSCS Biology," School Science and Mathematics, 63:89, February, 1963.

2. Diversity of type and unity of pattern of living things.
3. Genetic continuity of life.
4. Complementarity of organism and environment.
5. The biological roots of behavior.
6. Complementarity of structures and function.
7. Regulation and homeostatis: the maintenance of life in the face of change.
8. Science as inquiry.
9. The intellectual history of biological concepts.[48]

It has been found that 70 per cent of the content of the three biology curricula is identical. All three represent a completely new start based on the most up-to-date thinking. None of the three courses was written for advanced or slow students; all can be taught with equal facility at the tenth grade level to the average youngster. The difference between versions is essentially in the approach to biology.[49]

Inferences from the literature. It appears that the setting and the timing are both right for the development and success of any "new" curriculum in biology. It seems

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[48] Ibid., pp. 93-94.

[49] Editorial, "New Science Curriculums: Biology," School Management, 7:63, June, 1963.

that the Biological Sciences Curriculum Study program has not met any strong obstacles, and that its future success will depend upon the initiative and the cooperation of the school administrators and the teachers of biology.

CHAPTER III

METHODS OF CONDUCTING THE SURVEY

Survey material was mailed to 107 of the public high schools in the state of New Mexico. These schools represented all of the public high schools in the state of New Mexico listed in the Directory of Secondary Schools - 1963-1964, supplied by the State Board of Education in Santa Fe, New Mexico. A letter of introduction, endorsed by Dr. Bonner M. Crawford, Professor of Education, University of New Mexico; Questionnaires Forms A and B for participants and non-participants, respectively; and a stamped self-addressed envelope were sent to the principal for distribution in each school. Each letter had a suspense date of approximately ten days thereon,to expedite the responses.

The subjects were all basically teachers affiliated with the biology department of their particular high school; however, in some instances, where the schools were small, some had various other duties within the school. Their teaching preparation is discussed and categorized in Chapter IV. Their membership in professional, technical, or scientific organizations was requested in the survey questionnaires. Also requested was information concerning

any special training in workshops, the military service, or receipt of any governmental or educational subsidies designed to increase their training.

Because it was not known how many biology teachers would respond, no minimum size of the sample was predetermined. Some of the schools returned only one completed questionnaire; others returned more than one. The actual number of questionnaires received from each of the schools is shown in the Appendix. As the questionnaires were returned, they were posted to the proper chart, graph (see Figure 3-1 and 3-2 in the Appendix), and individual control sheets.

The first dispatch of survey materials was mailed on April 1, 1964. It was hoped that all replies would be complete by May 31, 1964, the end of the 1963-1964 school year. The objective of a 100 per cent response did not materialize, but the investigator discontinued follow-up requests after 82.2 per cent of the 107 schools replied.

The 82.2 per cent response received after four follow-up requests was strongly sought to provide adequacy of sample. Records were kept of all dispatch and receiving dates for all types of communicative contacts with the 107 high schools in the original list of schools. The final receipt of 82.2 per cent returns is considered highly satisfactory.

I. DESCRIPTION OF THE SURVEY QUESTIONNAIRE

FORMS A AND B

Forms A and B differed in that:

Form A--For teachers of biology who are using the BSCS. For participating teachers.

Form B--For teachers of biology who are not using the BSCS materials. For non-participating teachers.

The first twelve questions of both forms were identical and were designed to obtain basic background information about the teacher, the student body, and the school.

Questions numbered thirteen through twenty-eight, on Form A, were designed to obtain the opinions and attitudes of teachers concerning the Biological Sciences Curriculum Study. These questions were of the ordinal scale of measurement and open-ended. Form A included a table for evaluating the effectiveness of BSCS on students participating in the program and to ascertain whether the objectives of BSCS were being accomplished.

Questions thirteen through twenty-eight, on Form B, were designed for the teacher who was not participating in the BSCS or who was not familiar with the BSCS effort to up-grade the high school biology course. The last item on both forms requested the teachers to indicate "yes" or "no," if they desired a copy of the findings of the survey. This

item permitted the investigator to acquire the names of the subjects participating in the study and made possible future correspondence about developments in this field.

The instrument was reconstructed several times, removing items which could be answered from library sources or which did not contribute to its opinion seeking capacity. When trial tested for reliability it was found that the questions were interpreted in the same manner by many people.

II. METHODS OF ANALYZING THE DATA

The numbers of Form A and Form B questionnaires were tallied, and the per cent of each calculated to determine the total percentage participating in the BSCS in the state of New Mexico.

The names of those participating were listed by school along with the number of years participated in the BSCS. Responses of those who were not participating in the BSCS were analyzed and tallied to indicate the probability of future participation.

All answers to the questions on each form were analyzed, compared, and tallied according to the frequency of the item of measurement. The data were tabulated and illustrated. All frequencies were converted to percentages to facilitate comparison. Where the questions were

open-ended the information was tabulated and placed in categories to show the trend of the opinions and attitudes of the biology teachers.

The opinions and evaluation of the three versions of BSCS materials were sought by direct and open-ended questions. The relationship of preferred versions to the most used versions of BSCS text materials was ascertained.

Suggestions offered by the teachers to improve the BSCS were tabulated and grouped according to subject matter content frequency.

It can readily be seen that the magnitude of numbers used in an ordinal scale of measurement has no absolute, but only relative, meanings.[1] The statistical analysis of the data obtained in this survey were to reject or accept the hypotheses set forth in Chapter I of this study. The statistical evidence was presented in tables, and on bar and linear graphs presented in the Appendix on page 97-98.

The frequency distribution tables comprise groupings which illustrate the opinions and attitudes of biology teachers. These groupings are listed below:

For Participants Only.

1. Student achievement in the BSCS.

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[1]William A. Scott and Michael Wertheimer, Introduction to Psychological Research (New York: John Wiley and Sons, Inc., 1962), p. 110.

2. Versions of BSCS materials in use.
3. Versions of BSCS liked best.
4. Versions of BSCS liked least.
5. Suggestions to improve BSCS.
6. Effects of BSCS on the teacher.
7. Government funds for BSCS.
8. Value of BSCS.
9. Benefits obtained from BSCS.
10. Reasons for deciding to use BSCS.
11. General opinion of BSCS.
12. Evaluation of the students using BSCS.

For Non-Participants Only.

1. Current text books used.
2. Attitude toward future use of BSCS materials.
3. Effect of BSCS on the teacher.
4. Opinion of their present biology curriculum.
5. Government funds for BSCS.
6. Value of BSCS.
7. BSCS text most familiar to teachers.
8. Version of BSCS liked best.
9. Version of BSCS liked least.
10. Version of BSCS referred to on the job.
11. Suggestions for improving BSCS.
12. Unfamiliar with the program, therefore no opinion.

The cumulative data of the participating and non-participating teachers in BSCS were then compared and the results indicated.

The data obtained in questions number one, two, four, five and thirteen of the survey forms A and B were analyzed by tabulating the range and calculating the arithmetic mean and the variance. The following formulas were used:[2]

The Mean:

$$\bar{X} = \frac{\sum f_i X_i}{\sum f_i}$$

The Variance:

$$s^2 = \frac{\sum_{i=1}^{N} (X_i - \bar{X})^2}{N - 1}$$

Since the mean does not in itself give a clear picture of a distribution, measures of dispersion, spread or variability were expressed by the variance.

The complete findings, based upon the analysis and evaluation of the data obtained from the survey questionnaires are presented in Chapter IV. The conclusions comprise the fifth and final chapter of this study.

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[2]Wilfred J. Dixon and Frank J. Massey,Jr., Introduction to Statistical Analysis (New York: McGraw-Hill Book Company, Inc., 1957), pp. 18-19.

CHAPTER IV

ANALYSIS OF THE DATA

INTRODUCTION

The sample represents 100 teachers of biology (see map), from 88 (82.2 per cent) of the 107 public high schools in the state of New Mexico. The returns of the 100 questionnaires revealed that 10(10 per cent) of the teachers of biology are participating in the BSCS program, and 90(90 per cent) of the teachers of biology are not participating in this program. Form A contains responses of the participating teachers and Form B gives the responses of the non-participating teachers.

This chapter is presented in three general parts. The first part is concerned with the background of the participating and non-participating teachers, the size of the high schools, the average number of students involved and the population of the various school areas. The consolidation in Table I compares the data of the participants and non-participants where questions were common on questionnaires Form A and B, and a word picture was not necessary. Part two is a complete analysis of each question on Form A which was not included in Table I, indicating the attitudes and other data concerning biology teachers participating in BSCS. Part three examines the data obtained in Form B concerning non-participants in a similar manner.

MAP OF NEW MEXICO INDICATING LOCATIONS OF SCHOOLS AND TEACHERS IN THE SAMPLE

The locations of the eighty-eight (88) high schools and one hundred (100) respective teachers are indicated by this sign (●). BSCS schools = (__).

108 106 104

36 34 32

Aztec
Farmington
Bloomfield
Dulce
Costilla
Raton
Des Moines
Maxwell
Cimarron
Clayton
Taos
Springer
Espanola
Wagon Mound
Cuba
Roy
Amistad
Los Alamos
Santa Cruz
Pojoaque
Las Vagas
Santa Fe
Pecos
Logan
Gallup
Bernalillo
Tucumcari
Ramaha
Seboyeta
San Jon
Zuni
Grants
Albuquerque
Santa Rosa
New Laguna
Moriarty
Grady
Los Lunas
Estancia
Belen
Vaughn
Texico
Encino
La Joya
Fort Sumner
Clovis
Melrose
Floyd
Portales
Corona
Magdalena
Socorro
La Joya
Fort Sumner
Melrose
Floyd
Portales
Corona
Magdalena
Socorro
Elida
Dora
Causey
Reserve
Carrizozo
Capitan
Roswell
Tatum
Ruidoso
Hondo
Dexter
Truth or Consequences
Cliff
Tularosa
Lovington
Artesia
Hobbs
Silver City
Hatch
Lordsburg
Las Cruces
Eunice
Carlesbad
Jal
Deming
Anthony
Animas

MAP OF NEW MEXICO SHOWING LOCATIONS OF SCHOOLS AND TEACHERS IN THE SAMPLE

Scale of Miles
0 20 40 60

The locations of the eighty-eight (88) high schools and one hundred (100) respective teachers are indicated by this sign (o). BSCS schools = (___)

I. BACKGROUND DATA AND COMPARISON OF THE PARTICIPATING AND NON-PARTICIPATING TEACHERS IN THE BSCS PROGRAM

All similar data obtained from the replies of the participating and non-participating teachers are compared to point out trends and correlations where indicated (Table I).

1. In New Mexico, 34 per cent of the total high school student enrollment is taking one course in biology. The schools using the BSCS program show 36.4 per cent of the student enrollment taking at least one course in biology (Table I, Item #1).

2. The total school enrollment of the participants is twice as large as the non-participants (Table I, Item #2) indicating that the BSCS is being used in all sizes of schools.

3. There are more upper socio-economic students among the participants than non-participants (Table I, Item #3) implying that current quality biology is being offered in higher socio-economic communities.

4. There are 6.3 per cent more college bound students in the schools of participating teachers than in the schools of the non-participating group (Table I, Item #4). This could be due to the combination of the high quality curriculum offered and the financial capability of this group.

5. The average community population on Form A is 154,650 and on Form B it is 26,982 (Table I, Item #5). The following teacher versus population ratio was observed:

Participating teacher	Non-participating teacher	Population of school community
297,000	5	8
30,000	1	9
9 to 12,000	3	29
500	1	44
	10 teachers	90 teachers

The following figures represent the 100 subjects versus population of their school communities:

All of the teachers	Range of population
53%	100 to 5,000 people
34%	5,001 to 100,000 People
13%	100,001 to 300,000 people

It was found that 50 per cent of the schools using BSCS are in the top 13 per cent group of teachers, ranging from 100,001 to 300,000 persons; 40 per cent of the schools using BSCS are in the 5,000 to 50,000 population range, and only 10 per cent of the BSCS schools are in the 500 to 1,000 population range. Based on this data no trend can be established relating BSCS teachers to population.

6. The average number of years taught by the participants is 11 years and only 6.7 years by the non-participants (Table I, Item #6). Fifty per cent of the participants and 59 percent of the non-participants are novices with less than 5 years of teaching experience. There are more teachers with less than two years of teaching experience in the non-participating group of teachers than in the participating group. More teacher quality is indicated in the participating group.

7. More participants can apply all of their time to the teaching of biology and chairmanship (Table I, Item #7) indicating that they have more time to concentrate on offering a well prepared presentation of biology.

8. Participants belong to more professional organizations (Table I, Item #8).

9. More teacher preparation in indicated in the participating group than in the non-participating group based on college and university training (Table I, Item #9). The last statement of the aforementioned item indicates that 4 or 3.7 per cent of the teachers have for example : Master's degree with additional forty hours in biology or Bachelor's degree in Pharmacy. These figures indicate that 70 per cent of the participating teachers and 53 per cent of the non-participating teachers majored in biology on the Bachelor's or Master's level. If 18 semester hours is considered as "minimally adequate" preparation in a subject, about 83.1 per cent of the teachers of biology in this sample would meet this standard. This is better than the national findings of W. P. Viall [1] who found that 73 per cent of biology teachers meet this standard.

10. Only 20 per cent of the participants and 44.4 per cent of the non-participants have not had National Science

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[1] W. P. Viall, "Secondary Science and Mathematics" Journal of Teacher Education, 13:475-6, December, 1962.

Foundation Institute training. Again, more quality is implied among the participating teachers (Table I, Item #10).

11. The statistics for total number of BSCS students divided by the combined high school enrollment indicated that only 1.2 per cent of all New Mexico high school students are involved in the BSCS program. In schools where the BSCS program is being used only 6 per cent of the student enrollment is involved in the BSCS biology.

The significance of these comparisons is to show evidence and facts which tend to support hypotheses 1 and 2 of this study. The biology teacher's knowledge about the BSCS is proportional to his scientific background and professional qualifications. The participation in BSCS of the teachers is directly proportional to the amount of teaching experience. It is found that better qualified, trained, prepared and experienced teachers tend to want to use the "new" biology or the BSCS program.

TABLE I

COMPARISON OF PARTICIPATING TEACHERS AND NON-PARTICIPATING TEACHERS IN BSCS

No. * Factors	Form A Participants			Form B Non-Participants			Combined Form A and B		
BACKGROUND DATA	Mean	Per cent	Range	Mean	Per cent	Range	Mean	%	Range
1.a No. of students enrolled in biology in respective schools	504	36.4	16-825	206	33.0	0 to 1,000	236	34	0 to 1,000
b No. of students in these teachers' classes	128		16-164	74		0 to 167	80		0 to 167
c. % of students in BSCS classes		6.0			0.0			1.2	
2. Total high school enrollment	1,381		80-2,400	623		23-2,400	700		35-3,000
3. Socio-economic status of students-- Lower		30.0			27.0			28.7	
Middle		54.0			69.0			65.7	
Upper		16.0			4.0			5.6	
4. Percentage of college bound students		39.8	±6.2		33.5			34.2	5%-80%
5. Population of community	154,650		500-297,000	26,982		100-297,000	38,108		100-297,000
6. No. of years teaching biology	11		2-26	6.7		1-33	7.2		1-33

* Questionnaire questions

TABLE I (Cont.)

COMPARISON OF FORM A AND B

No.*	Factors	Form A (Participants)			Form B (Non-Participants)			Form A and B Combined		
BACKGROUND DATA		Mean	Per Cent	Range	Mean	Per Cent	Range	Mean	Per Cent	Range
7.	School responsibilities:									
	Chm. of Bio.Dept.		13.3	33.3		18.2	21.0			
	None		20.0			2.8				
	Other subj. taught		26.7			31.8				
	Other than academic (clubs)		20.0			27.3				
	Other duties (athletics)		20.0			19.9				
8.	Membership in professional organizations	2.9		0-8	2.3		0-7			
9.	Teacher preparation:									
a	Bach.'s D.--major in Biology		40.0	70.0		34.0	61.0		33.3	54.3
b	Bach.'s D.--minor in Biology		--			22.0			19.5	
c	Bach.'s D.--no major nor minor in Biology		--			5.0			4.6	
d	Master's D.--major in Biology		30.0	60.0		19.0	35.0		21.3	38.9
e	Master's D.--minor in Biology		20.0			8.0			9.3	
f	Master's D.--no major nor minor in Biology		10.0			8.0			8.3	
g	Another category		--			4.0			3.7	

* Questionnaire questions

TABLE I (Cont.)

COMPARISON OF FORM A AND B

No.*	Factors	Form A (Participants) Mean	Form A (Participants) Per Cent	Form A (Participants) Range	Form B (Non-Participants) Mean	Form B (Non-Participants) Per Cent	Form B (Non-Participants) Range	Comments
	BACKGROUND DATA							
+	ATTITUDES							
10.	Special Training:							Again, more quality is implied among the participating teachers.
	a. None		20.0			44.4		
	b. Nat'l Science Fdn.		80.0			33.3		
	c. Other training		--			22.3		
11.	Time familiar with BSCS--(years)	3.7		1-7	2.6		0-7	Participants have been acquainted with BSCS for longer time than non-participants.
12.a	No. Biology classes taught	2.9		1-5	3.1		0-5	
b	No. students/class	27.9		16-32	24.8		0-35	
c	Total no. Biology students/BSCS classes	822 students, 16-150 per teacher						
+ 15A and 26B	Version of BSCS used or referred to:							
	Blue		20.0			27.8		
	Green		10.0			16.7		
	Yellow		70.0			23.3		The Yellow version is most used by participants, and the Blue version is most referred to by the non-participants.
	None		--			14.4		
	Unfamiliar		--			17.8		

*Questionnaire questions

TABLE I (Cont.)

COMPARISON OF FORM A AND B

No.*	Factors	Form A (Participants) Mean	Per Cent	Range	Form B (Non-Participants) Mean	Per Cent	Range	Comments
	BACKGROUND DATA							
+	ATTITUDES							
10.	Special Training:							Again, more quality is implied among the participating teachers.
	a. None		20.0			44.4		
	b. Nat'l Science Fdn.		80.0			33.3		
	c. Other training		--			22.3		
11.	Time familiar with BSCS--(years)	3.7		1-7	2.6		0-7	Participants have been acquainted with BSCS for longer time than non-participants.
12.a	No. Biology classes taught	2.9		1-5	3.1		0-5	
b	No. students/class	27.9		16-32	24.8		0-35	
c	Total no. Biology students/BSCS classes	822 students, 16-150 per teacher						
+ 15A and 26B	Version of BSCS used or referred to:							
	Blue		20,0			27.8		
	Green		10.0			16.7		
	Yellow		70.0			23.3		The Yellow version is most used by participants, and the Blue version is most referred to by the non-participants.
	None		--			14.4		
	Unfamiliar		--			17.8		

*Questionnaire questions

TABLE I (Cont.)

COMPARISON OF FORM A AND B

No.*	Factors	Form A (Participants) Mean	Per Cent	Range	Form B (Non-Participants) Mean	Per Cent	Range	Comments
ATTITUDES								
16A and 24B	Version of BSCS liked best:							
	Blue		18.2			25.0		
	Green		18.2			25.0		
	Yellow		63.6			22.0		The Yellow version is preferred.
	None		--			1.0		
	Unfamiliar		--			27.0		
17A and 25B	Version of BSCS liked least:							
	Blue		40.0			16.7		The Blue version is least liked.
	Green		20.0			13.3		
	Yellow		20.0			15.6		
	No preference		10.0			--		
	All are good		10.0			1.1		
	Unfamiliar		--			48.9		
	Undecided		--			4.4		
18A and 27B	Should the three versions be revised, rewritten, or integrated							Indications are that the majority of the participants are
	Yes		30.0			10.0		satisfied with present
	No		60.0			26.7		3 volumes and 3
	Question unimportant		10.0			--		versions of BSCS
	Unfamiliar		--			63.3		materials. The majority of non-participants were too unfamiliar to offer comment.

*Questionnaire questions

TABLE I (Cont.)

COMPARISON OF FORM A AND B

No.* VALUES	Factors	Form A (Participants) Mean	Per Cent	Range	Form B (Non-Participants) Mean	Per Cent	Range	Comments
23A and 19B	Is Government wasting money supporting BSCS							
	Yes		--			2.2		Majority of respondents favored government support to BSCS
	No		100.0			73.3		
	Undecided		--			18.9		
	Unfamiliar		--			5.6		
25A and 22B	Value of BSCS to Biology teacher:							One hundred per cent of the participants and 40% of non-participants were in the moderate to marked category on value of BSCS.
	None		--			11.1		
	Slight		--			15.6		
	Moderate		10.0			24.4		
	Marked--great		90.0			15.6		
	Undecided		--			4.4		
	Unfamiliar		--			28.9		
21A and 16B	Is current biology curriculum mtg. student needs by offering:	Yes	No		Yes	No		
	College preparation	90.0	10.0		69.0	31.0		Majority of teachers felt their current biology curriculum is meeting needs of students.
	Terminal education	70.0	30.0		69.0	31.0		
	Knowledge of Human Body	100.0	--		64.0	36.0		
	No answer	--	--		14.7			
24A and 18B	Is current biology curriculum satisfactory in terms of these teacher needs:	Yes	No		Yes	No		Majority of participants are satisfied; majority of non-participants are dissatisfied with their current biology
	Teaching materials	70.0	30.0		22.2	77.8		
	Presentation	80.0	20.0		40.0	60.0		
	Cultivating scientific thinkers	80.0	20.0		32.2	67.8		
	Professional stimulation	80.0	20.0		25.5	74.5		
	Unanswered	--	--		32.2			

*Questionnaire questions

II. ANALYSIS OF DATA PERTAINING TO TEACHERS PARTICIPATING IN BSCS TEACHING

Analysis of Form A. Form A is the survey questionnaire completed by those teachers using or participating in the BSCS program. There are twenty-eight questions involved in this form, the analyses of which will be presented in the sequence of the original questionnaire with the exception of items included in Table I. Since there were only 10 respondents from nine high schools participating in BSCS, the replies were convenient to analyze. These teachers are 10 per cent of the total number of teachers in the sample of this study, as previously indicated.

Question Eleven

From what source did you learn about BSCS? When did you first develop a desire to become more familiar with the BSCS program?

Dr. A. Grobman, Director of BSCS informed 10 per cent of the teachers; 30 per cent found out from institute courses; 30 per cent were informed at the University of New Mexico; 30 per cent were advised by administrators and one of the writers. These teachers were familiar with the program for a mean of 3.7 years with a range from 1 to 7 years.

Question Thirteen

How long have you used or participated in the BSCS project?

Sixty per cent of the teachers have used this program for only 1 year; 10 per cent have participated for two years; 20 per cent of the teachers have used it for three years and

only 10 per cent have used BSCS for four years.

Question Fourteen

How does the student achievement in the BSCS program compare with the traditional or your program of previous years?

a.	Lower	0%
b.	Higher	50%
c.	No change	30%
d.	No way of knowing now	20%

In the opinion of these teachers BSCS did no harm to the student achievement. Five of the teachers thought student achievement was higher.

Question Sixteen

Which version of BSCS do you like best? Why?

a.	Blue	18.2%
b.	Green	18.2%
c.	Yellow	63.6%

The following reasons were given to support the above choices:

"Yellow is a happy medium, better fits needs of students, not too hard, not too easy, like the approach, like the labs, good in today's major area Biochemistry or chemistry of the cell."

"Yellow. Better adapted for our area-- evolution approach considered more important in present day biology."

"Yellow. Not familiar with others, in the sense of using them."

"Blue. This is the one I was taught, the chemistry is deep, but I like it. When the students apply themselves, they do all right." (sp.)

Question Seventeen

Which version do you like least? Why?

a.	Blue	40%
b.	Green	20%
c.	Yellow	20%
d.	No preference	10%
e.	All versions are good	10%

"Blue. Too hard; reading level too high; do not like the molecule approach; a little heavy on chemistry."

"Blue. Chemical approach."

"Green. Probably green would be less adaptable in our environment."

"Yellow. No reason other than personal opinion."

Question Eighteen

Do you think the three versions should be revised, rewritten or combined into two volumes which could then be used as a high school biology text?

a.	Yes	30%
b.	No	70%

"No. Why ruin three good books; you have too much material now and 70% is common to all three versions."

"No. Teachers can combine and use from all using one basic better than an editor can combine into one."

"Yes. I think all three could be combined into one textbook taking the best from each."

Question Nineteen

What suggestions can you offer to improve BSCS, or to integrate the current three versions for use as a class text?

It was found that 50 per cent of the participating BSCS teachers have no suggestions nor opinions concerning this aspect. Here are a few suggestions by the other teachers:

"None; use the three texts; let the individual teachers make the choice."

"Train teachers! 'As the teacher, so is the school--of course.' May sound 'trite'--but it is true."

"At present, I am highly satisfied with the results I am getting."

Question Twenty

Do you believe the BSCS program has stimulated your interests and aspirations as a biology

a.	Not at all	0%
b.	Slightly	0%
c.	Moderately	20%
d.	Markedly	80%

"Moderately! It requires more study because it is very up-to-date much of the material, I did not have during my B. S. in Education days."

"Markedly! New materials, new approach, more interest from students, better fits today's needs."

"Markedly! Have had 30 college hours in 5 years to bring 1935 work up-to-date. Have been center leader for yellow version experiment."

Question Twenty-two

Are there any basic differences between your traditional or previous curriculum and BSCS? Please explain your interpretation of the term "basic difference".

a.	Yes	90%
b.	No	0%
c.	Undecided	10%

These teachers indicated their meaning related to item a. as follows:

"Sex education, body functions presented much more realistically."

"A basic difference is a change from memorizing details and skimming too much material to better sampling of important materials and testing principles rather than details."

"Traditional curriculum stresses memorization of parts and names; the BSCS places emphasis on understanding and principles."

"Key = more lab., more techniques are acquired by students. Students do more observing and actual simple research instead of compiling notebooks."

Question Twenty-five

All in all, what value is the BSCS program to you as a biology teacher? Please give your interpretation of the term "value" as you applied it.

a.	None	0%
b.	Slight	0%
c.	Moderate	10%
d.	Marked or great	90%

It is clear that most teachers believe the BSCS program has marked or great value. These are some of their opinions concerning value:

"New--Different presentation--Better for students."

"Importance to general development of student and increased morale of teacher."

"The value to me is a tool for teaching principles which I consider most important."

"I think it stimulates more thinking by both students and me."

Question Twenty-six

How does BSCS help you on the job?

These are some typical responses reflecting the attitudes of the teachers in the state of New Mexico:

"Experiments are done, not for definite expected results, but for accurate observation and presentation of data."

"By including up-to-date materials that would have to be brought in."

"Keeps me supplied with latest developments in the field."

"Since it is some of the latest materials, it keeps me active keeping up present day ideas in biology."

Question Twenty-seven

Why did you or your Biology Department decide to use the BSCS program? Please explain.

These are representative of the quotations of the teachers:

"New program! Set up a center, with one teacher in each high school. Tried the new program to see--."

"As Department Head, I introduced it. Two teachers used it. Six will use it in 1965."

"We were with the experiment in 1961-62 and 1962-63, and decided it better met our needs."

"Best method of presenting subject matter."

"We haven't decided."

There were no indications that outside pressure caused these teachers to use the BSCS program. The teachers thought the program was worth at least a trial. Some schools are still using the BSCS materials only on an experimental basis to evaluate it relative to the needs of their society, more specifically the socio-economic needs, student needs and teacher needs.

Question Twenty-eight

What is your general opinion of the Biological Science Curriculum Study? Please explain.

A definitely positive opinion of the BSCS is reflected by the following teacher statements:

> "It is a fine organization, and should continue working on various areas. The slow learner is one area now being considered. Over all I believe they have done a good job."

> "Good--Up-to-date material--a method of teaching for future study and knowledge in biology that will double in the next 10 years."

> "It is not the only acceptable program, or the only one, but it is a decided improvement over traditional courses offered."

> "I think the BSCS stimulates interest in students. It makes them aware of the processes of science. For those who do not attend college this appreciation would never come about. Also they would not have any knowledge of basic biological principles otherwise. For college bound students the background and understanding is, of course, even more important."

> "Most important change in the teaching of biology in my lifetime."

The questions and responses listed above and elsewhere are an effort to synthesize answers sought in this study. An attempt was also made to answer the following question concerning two basic principal objectives of the Biological Sciences Curriculum Study.

Are the original objectives of BSCS being accomplished by the average students involved in this program?

These two objectives are: (1) to help the student to understand various processes in biological research; (2) to

develop within the student an understanding and appreciation of the scientific enterprise (Table II).

The teachers were asked to evaluate fourteen more specific objectives pertaining to the two general objectives by comparing their average pupils in the BSCS program during the 1963-1964 school year, with average pupils in the previous program or traditional programs from past or present experiences. The students were rated on their degree of improvement in these fourteen sub-objectives. The results were as follows for the two basic principal objectives:

IMPROVEMENT	TEACHERS' EVALUATION OF STUDENT ACHIEVEMENT
None	00.0%
Slight	15.5%
Some	15.5%
Notable	37.0%
Great	32.0%

The fourteen sub-objectives used to obtain this student achievement rating are listed in Form A of the Appendix on page 93. The statistics obtained indicate that the objectives are actually being accomplished by the students and teachers to a marked extent (Table II). The data indicates that these participating teachers of biology have a positive opinion toward the Biological Sciences Curriculum Study.

TABLE II STUDENT ACHIEVEMENT

Form A (Continued)

The two basic principal objectives of the Biological Science Curriculum Study are:

1. To help the student to understand various processes in biological research.
2. To develop within the student an understanding and appreciation of the scientific enterprise.

The following statements should help to evaluate these two objectives stated by the BSCS. Please compare your average pupils in the BSCS program this year, with average pupils in the previous program or traditional program from past or present experience, by checking (✓) your opinion in the appropriate column to the right.

The average student in the BSCS compared to the average pupil in traditional biology:	*IMPROVEMENT* NO	SLIGHT	SOME	NOTABLE	GREAT	
	00%	16%	16%	40%	28%	Obj.#1
1. defines a problem in researchable terms.		10%	40%	40%	10%	
2. recognizes a reasonable hypothesis which can be tested by experiment or observation, concerning a problem.		20%	20%	40%	20%	
3. recognizes the importance of appropriate controls in an experimental design.		20%	10%	30%	40%	
4. distinguishes among different kinds of data. Data, as used here and elsewhere in these objectives, includes observations as well as other kinds of data.		10%	00%	70%	20%	
5. recognizes the importance of accuracy in obtaining data.		20%	10%	30%	40%	
6. selects a suitable procedure for the analysis of data.		20%	20%	40%	20%	
7. realizes that being a scientist involves much study and routine work.		10%	10%	30%	50%	
8. realizes that both teamwork and individual work are important in research.		10%	00%	40%	50%	
9. recognizes that his participation in a scientific investigation contributes to his learning.		20%	10%	40%	30%	
10. recognizes that scientists do not base judgments on authority.		10%	30%	30%	30%	
11. recognizes the value of creative thinking and ingenuity in science.		00%	30%	30%	40%	
12. recognizes that scientists share ideas with others.		10%	20%	20%	50%	
13. realizes the value of a broad background in areas other than the sciences.		40%	00%	30%	30%	
14. sees the unity and relationships among the sciences (botany, zoology, chemistry, physics, mathematics, etc.).		10%	10%	30%	50%	
		15%	15%	34%	36%	Obj.#2
	TOTAL	15.5%	15.5%	37%	32%	= 100%

I (do) (do not) desire a copy of the summary of the findings of this opinion survey.

NAME: _____

ADDRESS: _____

SCHOOL: _____

LOCATION: _____

THANK YOU FOR COMPLETING THIS SURVEY QUESTIONNAIRE!

III. ANALYSIS OF DATA PERTAINING TO NON-PARTICIPATING TEACHERS IN BSCS PROGRAMS

Analysis of Form B. Form B is the survey questionnaire completed by those teachers not using the BSCS and are teachers referred to as non-participants. There are ninety (90) respondents from seventy-nine (79) public high schools included in this sample. These teachers represent the non-participants in the BSCS program and are 90 percent of the total number of respondents. There are twenty-eight questions on this form also. However, the answers discussed in Table I of this chapter will not be recapitulated.

Question Seven

Please indicate your additional school responsibilities.

a.	Chairman of the Biology Department	18.2%
b.	Others subjects taught	31.8%
c.	Other than academic (clubs, etc.)	27.3%
d.	Other duties (athletics)	19.9%
e.	None	2.8%

These figures indicate that only 21 per cent of the teachers can devote all of their time to the field of biology, without additional school responsibilities. This is below the national average of 25 per cent and 12.3 per cent below the participants or BSCS teachers in this study.

Question Eleven

From what source did you learn about BSCS? How long have you known about the work of the American Institute of Biological Science on the Biological Sciences Curriculum Study project?

The teachers indicated that they were informed by pamphlets, educational literature, education meetings, college

seminars, National Science Foundation, the school principal, American Institute of Biological Science Bulletins, Albuquerque Public Schools, fellow teachers, BSCS Bulletins, summer institutes, New Mexico Educational Association meetings student teaching, conventions, Biology Teachers Association Journal, college professors and their high school department chairman. There appeared to be no pressure applied by any group to force adoption of BSCS upon the non-participating teachers.

Question Thirteen

What biology curriculum program are you participating in other than BSCS? Please list your text or texts being used.

The majority of the teachers described their biology curriculum as being "None" or "Traditional" however, a few others used the following terminology: "My own development," "Modern Biology," "General Biology," "Advanced Biology," "My personal program," "Only classroom work," "Standard college prep. course," "Own Curriculum," "Team teaching with Moon, Mann and Otto," "Conventional," "E.B.F. (Encyclopedia Britannica Films)," "Regular text book curriculum" and "Based on the text."

This aforementioned description of the current biology program indicated a definite lack of standardization in the high schools of this state. However, a lack of quality is not implied.

The following text books are being used by 83 of the non-participating teachers:

Titles According to Popularity	Per Cent Respondents
1. Modern Biology: Moon, Mann and Otto. Henry Holt & Co., N. Y., 1956	49.4%
2. Elements of Biology: Dodge, 1959. Allyn & Bacon	15.7%
3. Exploring Biology: the science of living things; Ella Thea Smith, 5th ed. Harcourt, Brace & Co., 1959.	15.7%
4. New Dynamic Biology: Baker, et al. Rand McNally Co., 1959.	8.4%
5. Biology: Kroeber, Wolf and Weaver D. C. Heath & Co., 1957.	4.8%
6. Biology For You: Vance & Miller J. B. Lippincott, 1958.	1.2%
7. Biology and Human Progress: L. Eisman & C. Tanzer; 2nd ed., 1958. Prentice-Hall, Inc.	1.2%
8. Textbook of Anatomy & Physiology: Kimber, et al. 13th ed. (accelerated) MacMillan Co., 1955.	1.2%
9. Your Biology: Ella Thea Smith & Lorenzo Lisonbee; Harcourt, Brace & Co., 1958.	1.2%
10. Living Things: Fitzpatrick, et al. Henry Holt & Co., 1958.	1.2%
11. Biology: A Basic Science; Heiss, et al. D. Van Nostrand, 1958.	1.2%
*12. Biology: C. Villee, 4th ed. Saunders, 1962.	1.2%
*13. Adv. with Plants and Animals: Heath & Co.	1.2%
*14. Today's Biology: Fried & Co.	1.2%
*15. Biology and Daily Life: Ginn & Co.	3.6%

The last four (*) books are not listed in "State Adopted Textbooks," State of New Mexico, Department of Education, Free Textbook Division.

Question Fourteen

Although you are not presently participating in, or using BSCS, do you think you will?

a.	Never	2.2%
b.	Undecided	20.0%
c.	Maybe in the future (2-3 yrs.)	50.0%
d.	Next year	26.7%
e.	No answer	1.1%

These figures seem reasonable and would approximate a normal curve. The prognosis that BSCS will be used more extensively in the future is indicated by these percentages.

Question Fifteen

Do you believe the BSCS program has stimulated your interests and aspirations as a biology teacher? Please explain.

a.	Not at all	6.6% Teachers
b.	Slightly	16.8%
c.	Moderately	34.4%
d.	Markedly or great	27.8%
e.	Unfamiliar	2.2%
f.	Unanswered	12.2%

The following statements of the respondents support the percentages listed above.

(a) "I have not investigated this study in more detail as yet. Perhaps it is OK, but as yet I have not been stimulated by what it has to offer."

(b) "I am not completely sold on the idea. Perhaps more information is essential."

(c) "I need to become more familiar with the BSCS program. I feel that it adds greatly to teaching biology and that it is worth while."

(d) "Have been interested in Biological Education for many years. It's not the curriculum, but the teacher that makes a good biology program."

(d) "It seems to meet the needs of our present day better than any other. We must present science as concepts rather than facts."

(d) "I have been using quite a bit of the laboratory work of BSCS with my students."

(d) "Its laboratory block approach resembled and supported what we were already doing in Biology II. The text books contain basic material contained in Moon, Mann and Otto, plus supplementary material which we either were already adding or would have if adequate reading background had been available to students."

(d) "I am interested in the approach of inquiry and concepts."

(d) "Biology can be experienced by the student rather than being the textbook subject of traditional biology sources."

Question Sixteen

Is your current biology curriculum meeting the needs of your students by:

No	Yes		
31%	69%	a.	Offering college preparation
31%	69%	b.	Offering a good background for terminal education.
36%	64%	c.	Providing an understanding of the Human Body, to satisfy the biological inquiry of young adults.

It appears that further improvement in their current curriculum is necessary in Items a., b., and c., and that this group is less content than the group of teachers using BSCS to help meet the needs of the students. It should be added that 14.7% of the teachers did not answer this question. It is not possible to assume an answer for them, however, if it were assumed that all 14.7% would have answered "yes," the cumulative results would be less than the results on Form A.

Question Seventeen

Is there any difference between your present curriculum and BSCS? Please explain your interpretation of the term "basic difference."

a.	Yes	51	56.6%
b.	No	2	2.3%
c.	Undecided	24	26.7%
d.	Unfamiliar	13	14.4%

The statements below support the above data:

Y

(a) "BSCS forces students to think on their own and lets them use what they learn."

E

(a) "We do not have three separate programs as does BSCS. We do not have as complete a lab program as BSCS.

S

(a) "Our program does not have the laboratory time that is spent in BSCS."

(a) "The BSCS lab work (blue) is more complex and advanced than mine."

(a) "The curriculum I now teach is out of date and is based solely upon what is in the book, the student does not think for himself."

(a) "BSCS is lab oriented; mine is not. BSCS stresses inquiry; mine is traditional."

NO (b) "Cellular and ecological approaches are pretty much the same as BSCS."

UNDECIDED (c) "Fairly similar, considering different text. We approach BSCS through supplementation. As applied here it probably means scientific method versus scientific facts; doing versus pure book learning; problems versus answers."

(c) "Basic curriculum is probably the same."

(c) "Our program is adequate."

These figures and statements indicate that 51 teachers think the BSCS is better than their biology curriculum. Twenty-four teachers seem to be content with their curriculum and believe it is as good as BSCS and adequate.

Question Eighteen

Is your current biology curriculum satisfactory to you in terms of teacher needs by:

No Answer	No	Yes		
32%	46%	22%	a.	Supplying better teaching materials.
32%	28%	40%	b.	Helping you to give students a better presentation of biology.
32%	36%	32%	c.	Helping to cultivate young scientific thinkers.
32%	42%	26%	d.	Stimulating you professionally.

There seems to be evidence of the current biology curriculum failing to satisfy the teachers' needs listed above. It must be pointed out however, that twenty nine

or 32 percent of these non-participating teachers did not answer this question. It can not be assumed whether their answers would have been "yes", "no" or otherwise. If it were assumed that all 32 per cent of the answers were "yes", the total cumulative results would still indicate less teacher satisfaction than the same question in Part II of this Chapter, answered by the teachers participating in BSCS. Since assumptions can not be made and the sample of this study is limited only to 100 biology teachers, the analysis must be limited only to their responses.

The analysis given in this study is based entirely upon the opinions and attitudes of teachers answering the questions on the survey. No attempt has been made to assume any answers, opinions or attitudes not given by the respondents.

Based on the answers to this question some of the non-participants are not being supplied better teaching materials and are not being stimulated professionally by their present biology curriculum.

Question Twenty

As a non-participant, what is your general opinion of the BSCS project? Please explain.

The majority or 62.3 per cent of the teachers reflected a positive general opinion toward BSCS; 33.3 per cent showed a lack of familiarity with the program, and 4.4 per cent were negative to the project. The negative non-participants gave

the following reasons: (1) funding difficulty; (2) material too specialized for the heterogeneous group of this school system; (3) lack of teachers qualified to teach BSCS; and (4) too difficult for our average high school students. The following quotations will support the above generalizations:

(1) "I believe it would be very effective to those schools who could adopt it. This school needs more funds for better texts and materials, therefore unlikely to be adopted here. I would like to see it here."

"It is not revolutionary, however, it is a good effort to up-date our instruction. I believe the program will be excellent for larger systems but will suffer in the smaller schools where money for laboratories and facilities is lacking."

(2) "I think the BSCS material can be used successfully with better than average students."

"Splendid work but it is only a facet of constant study needed; there is no cure-all for teaching heterogeneous groups."

"Teacher loads in smaller schools very nearly obviate the possibility of a teacher being able to present adequately the BSCS program."

(3) "I think it is very worthwhile and would like to use it if I had the time and the training. I feel I should have a summer institute in it before using the material."

"Let it stabilize and cool off and <u>get teachers trained</u>."

(4) "Too advanced. Students should learn basic principles first."

"Not applicable on the high school level, too complex for students (alright for reference for myself), an excellent book or books for freshmen college students."

"I would like to try it with the upper 50% of my students, but not with the lower 50%."

"I feel the BSCS project is very good for biological study, but needs some modification for the students such as I teach because they need more terminal teaching."

Question Twenty-one

Why did you or your Biology Department decide not to use BSCS?

All of the responses can be classified into seven types of answers reflecting the opinions of the teachers:

(1) Unfamiliar with BSCS; never considered it. 41.1%

(2) Lack of Finance; inadequate time and laboratories, lack of prepared teachers. 20.0%

(3) We have not decided for or against BSCS, as yet. 15.6%

(4) Preparation to use it is in progress. 7.8%

(5) Negative to BSCS: 7.8%
"Not sufficiently convinced BSCS is perfect."

"Why should we, if we have something better, and more applicable."

(6) Some teachers in the Biology Department are using BSCS. 4.4%

(7) I do not know! 3.3%

Here, again, it is found that very few teachers have a negative attitude toward the BSCS program. However, the high percentage of this unfamiliarity fails to confirm a positive opinion toward this project. The most outstanding factor is the very high percentage of teachers who are unfamiliar with current curriculum developments. Forty-one per cent (41.1%) of the teachers reflect unfamiliarity with the Biological Sciences Curriculum Study.

Question Twenty-two

All in all, what value is the BSCS program to you as a biology teacher? Please give your interpretation of the term value as you applied it.

a.	None	10	11.1%
b.	Slight	14	15.6%
c.	Moderate	22	24.4%
d.	Marked or great	14	15.6%
e.	Undecided	4	4.4%
f.	Unfamiliar	26	28.9%

The following statements show their interpretation of value as they used it:

(a) "I know little about BSCS."

"My own program is as good."

(b) "I use some of the material to supplement the regular course."

"It has made me aware of a fine program."

(c) "Source of ideas for improvement of my own program."

"Even if text is not adopted, it is excellent reference material."

(d) "Better, more detailed preparation in cultivating scientific thinking."

"I think it stimulates a teacher as well as his students."

(e) "I do not know until I see the full scale program."

The respondents to Items (a) and (f) indicate unfamiliarity and ignorance or complete lack of opinion concerning the program. Again, 40% of the teachers are unfamiliar with the materials of the BSCS or did not answer. therefore, an

interpretation of value in the positive or negative sense cannot be assessed. The remaining majority or 55.6% of the teachers state the values in a positive sense.

Question Twenty-three

Are you familiar with the BSCS texts?

a.	Yes	55	61.1%	
b.	No	29	32.2%	
c.	Slightly	2	2.2%	38.9%
d.	No answer	4	4.5%	

These statistics, with a slight variation, further support the aforementioned questions and give a better view of the following questions.

Question Twenty-four

Which version of BSCS do you like best? Why?

25%	a.	Blue	"Biological Science: Molecules to Man"
25%	b.	Green	"High School Biology"
22%	c.	Yellow	"Biological Science: An Inquiry into Life"
1%	d.	None	
27%	e.	Unfamiliar	

There seems to be but slight difference in preference of the version used. The reasons given indicate a lack of familiarity which necessitates that valid opinions be based upon more knowledge. The following are typical statements:

(a) "More vital and dynamic in its approach."

(a) "I have only been fortunate enough to read the blue version."

(b) "Basic approach; Language more understandable."

"I find ecology interesting--personal preference."

(c) "I am most familiar with it."

"I only have read one version."

(d) "None. Don't care for any of them."

(e) "I do not know."

Question Twenty-five

Which version do you like least? Why?

a.	Blue	15	16.7%
b.	Green	12	13.3%
c.	Yellow	14	15.6%
d.	All	1	1.1%
e.	Unfamiliar	44	48.9%
f.	Undecided	4	4.4%

Again, there seems to be but slight difference between the percentages for teachers who indicated the version least preferred. About one-half of the teachers werenot able to make a choice because they lack familiarity with the three texts. The following quotations support the above preferences:

(a) "Overemphasis on biochemistry."

"Because of the background of chemistry it pre-supposes."

(b) "Limited flora and fauna in semi-desert region."

"Green doesn't impress me a great deal."

(c) "Not as good as the blue."

"It has a tendency to select the students."

(d) "I do not have enough information on BSCS to make an objective statement."

"Each is good; The use depends upon the group."

Question Twenty-six

Which of these BSCS versions do you refer to on the job?

a.	Blue	25	27.8%	
b.	Green	15	16.7%	
c.	Yellow	21	23.3%	
d.	None	13	14.4%	32.2%
e.	Unfamiliar = No Answer	16	17.8%	

The Blue version "Biological Science: Molecules to Man" is most popular as a reference book used by the teachers. The Yellow version is next in popularity and the Green version is least referred to on the job. Again, there is the same percentage (32.2%) of teachers unfamiliar with the versions as was found in the replies to Question Twenty-three. The trend of the statistics indicates that one third of the Biology teachers in New Mexico are not familiar with current curriculum development in Biology.

Question Twenty-seven

Do you think the three versions should be revised or integrated for use as a class text? Explain.

After analyzing many statements, three categories became clear and the following percentages were apparent: 10% of the teachers said "Yes;" 26.7% replied "No," and the majority or 63.3% were so unfamiliar with the program that they were either unable to answer the question or felt not qualified to answer. These are a few quotations supporting these findings:

(Yes) "I think more consideration should be given to the 'time factor'."

"It certainly needs revision or be discarded."

"A version is needed for the lower 50% of the students."

(No) "No. I think each teacher should be free to make their choice depending on their background and interests."

"I like the three different approaches."

"No; there are only 180 days in a school year."

"No. They should be adopted as is for the present. later editions within the next few years will be improved even more."

"No, I think the three versions will meet the needs of different classes better than one integrated one."

"No; differences of opinion are healthy--we do not all agree."

"No. I think as separate books, a teacher can pick the one which fits the situation best."

Question Twenty-eight

Please give your suggestions for improvement of BSCS.

Only 18.9% of the teachers were willing to give suggestions: 11.1% are satisfied and have no further recommendations for improvement; 2.2% were not sure or undecided; and, 67.8% were unfamiliar or not qualified to answer.

These are some suggestions from some of the teachers participating in this study:

1. "More participation by more teachers using the materials in the revision of the present programs."

2. "Find a way of providing all the lab equipment needed. Work for smaller biology classes. Eliminate certain lab studies that tend to be heavy for slower and disinterested students because these lab studies protract relatively unimportant readings for too long a time."

3. "More practical labs; learn basic biology first."

4. "Get rid of the idea that the approach is entirely new and novel--teachers have been doing this kind of teaching long before BSCS."

5. "Anything for the improvement of presenting facts, principles and attitudes is worthwhile, BSCS is therefore worthwhile. Without teaching BSCS, I hesitate to offer suggestions for improvement. More comprehension material for first year students would be one suggestion."

6. "Simplify material and vocabulary; it would be fine for second year selected biology students."

7. "Somehow make it available to more schools."

8. "Evolve practical presentation for terminal students who need to use more materials they will know through experience."

9. "Add a glossary."

10. "Give it time to catch on. Rome was not built in a year. People change slowly."

11. "Teacher preparation should be offered either at the universities, or as weekly workshops. Some class periods should be extended for laboratory periods."

12. "Less students per class."

13. "Re-due it for students without a science background like some Indians."

14. "Some of the materials required do not fit the budget of some school systems."

15. "Development of version less difficult to read."

16. "None, except that you need a book for the non-academic student."

17. "I have none at this time, except I feel there should be a better program for acquainting teachers with BSCS."

In essence, these teachers seem to be asking three basic things. The uninformed or unfamiliar teachers are asking for (1) help and leadership in becoming prepared and informed about BSCS. The better informed teachers are asking for (2) materials less difficult to read and more suitable for their students who are not necessarily college bound, and for (3) a way to solve the problem of finance involved in the transition to BSCS.

CHAPTER V

CONCLUSIONS

The conclusions are based on the results of the survey questionnaires indicating the opinions and attitudes of 100 biology teachers in New Mexico. The conclusions are based on the responses of these 100 teachers only. The conclusions are not broad generalizations concerning opinions and attitudes of all biology teachers in New Mexico toward BSCS. The 100 teachers include 10 biology teachers who used the Biological Sciences Curriculum Study and 90 biology teachers who did not participate in the BSCS program.

This study was undertaken in order (1) to survey the opinions of biology teachers in the state of New Mexico toward the BSCS program; (2) to discover the answers sought about the BSCS program in this state; (3) to evaluate the program, so far as meeting teacher and student needs; (4) to see if the original objectives of BSCS are being accomplished by the average students involved in this program; and (5) to test the eight hypotheses concerning teachers, students, BSCS, schools and the state of New Mexico.

CONCLUSIONS

On the basis of the findings of this study the following conclusions seem to be warranted:

1. In high schools using the BSCS program the following

characteristics seem to exist; (1) usually the participant was only one of six to eight biology staff members; (2) the population of the school community was over 10,000 people; (3) there was a high percentage of college bound students: and (4) the teachers were better qualified in their discipline and general educational background.

2. BSCS has been used for only one year by six of the ten participating teachers.

3. BSCS, on the basis of responses of the 10 participating teachers, seems to have stimulated their interests to a marked degree. These same teachers believe BSCS has improved students' processes in biological research and understanding of the scientific enterprise.

4. Most of the participating teachers have a positive attitude toward the Biological Sciences Curriculum Study program, according to their responses. The Yellow Version was most used by the participants however, the Blue Version was most referred to by the non-participants.

5. Advantages. The ten participating biology teachers liked the BSCS program because in their opinion (1) it offers up-to-date information; (2) it prepared an enormous amount of teaching materials to aid them in getting the information and concepts over to the students; (3) the emphasis has changed from memorizing details to understanding and testing principles; and (4) students do more observing and actual simple

research instead of compiling notebooks. All three versions have 70 per cent of common subject material with 30 per cent devoted to the special interest of the teachers and students in areas of ecology, evolution or biochemistry. This variation allows for the individual's special interests without sacraficing essential basic biological concepts.

6. Disadvantages. The majority of the non-participating biology teachers disliked the BSCS program because in their opinion (1) the materials were too specialized for the heterogenous group of the school system; (2) it was difficult for the average high school students; and (3) many schools in New Mexico did not have money for the equipment and facilities recommended by the BSCS program.

7. The participating teachers felt that the objectives of BSCS were being accomplished by their average students.

Concerning the original hypotheses (subject to the limitations of the small number of participating teachers (10) and non-participating teachers (90) in the BSCS):

Hypothesis 1. The biology teacher's knowledge about the BSCS is proportional to his scientific background and professional qualifications. This was indicated by teachers' college or university preparation, association in professional organizations, mamberships, participation in workshops or National Science Foundation Institutes, and their amount of teaching experience. The best qualified teachers seemed to be the most

informed and most active in accepting and using BSCS or rejecting it and giving a good reason for doing so. The 10 participants had more university training than the 90 non-participating biology teachers.

Hypothesis 2. The participation in BSCS of the schools is directly proportional to the population of the school community. Based on the data of this survey no trend or proportional relation can be established relating schools participating in BSCS to the population of the school community. This hypothesis can not be accepted or rejected.

Hypothesis 3. Many teachers are in favor of using the BSCS but think they do not have adequate facilities, equipment and student ability available. At least 20 per cent of the non-participating teachers gave this reason for not using the BSCS in their biology departments, therefore this statement is true for some of the teachers qualifying the word "many".

Hypothesis 4. Many teachers do not qualify to give the students the BSCS program because of lack of training and inadequate familiarity with the program, as indicated by the quotations of teachers and the statistics concerning National Science Foundation Institute participation.

Hypothesis 5. The respondents indicated that many schools have decided not to use the BSCS because of the additional finance involved.

Hypothesis 6. Many teachers feel that BSCS in its three present versions are above the ability of their high

school students. Non-participating teachers asked for more simplicity to meet the needs of the terminal education of students, and the reading ability of their average student, not an imaginative "average" student..

Hypothesis 7. Many teachers are resistant to change and are satisfied with their present program and methods. "Many" can not be accepted without qualifications. Although there are implications that a minority of teachers are satisfied with their present programs because they are not convinced that BSCS is any better, or can better satisfy the teacher and student needs, they are not resistent to change. It appears that they would change to something better if given the opportunity or possibly better informed by their school administrators.

Hypothesis 8. Most teachers in New Mexico are not informed about BSCS and therefore are not using the program, or have no opinion or attitude concerning this program. One qualification to this is "most biology teachers or most teachers of biology".

It is concluded that biology teachers using the BSCS in New Mexico have a positive attitude toward the Biological Sciences Curriculum Study however, due to the high percentage of uninformed teachers in the non-participating group a similar conclusion can not be drawn.

BIBLIOGRAPHY

BIBLIOGRAPHY

American Institute of Biological Sciences - Biological Sciences Curriculum Study. BSCS Newsletter No. 17. Boulder: University of Colorado, March, 1963. 32 pp.

_____. BSCS Newsletter No. 21. Boulder: University of Colorado, April, 1964. 40 pp.

Baker, J. J. W. "BSCS Biology Bandwagon," Science Teacher, 30:73-74, October, 1963.

Brett, William J. "BSCS Biology," Teachers College Journal, 33:116-118 ff., March, 1962.

Cubberley, Ellwood P. The History of Education. New York: Houghton Mifflin Company, 1920. 849 pp.

Dixon, Wilfrid, and Frank J. Massey, Jr. Introduction to Statistical Analysis. New York: McGraw-Hill Book Company, Inc., 1957. 488 pp.

Duggan, Stephen. A Student's Textbook in the History of Education. New York: Appleton-Century-Crofts, 1948. 512 pp.

Frankel, E. "BSCS--Where New Horizons Begin," Science Teacher, 29: 47 ff., May, 1962.

Fraser, Dorothy M. Current Curriculum Studies in Academic Subjects. Washington, D.C.: National Education Association, 1962. 102 pp.

Glass, Bentley. "Renascent Biology: A Report on the AIBS-Biological Sciences Curriculum Study," School Review, 70:16-43, September, 1962.

Grobman, Arnold. "National Curricula," American Biology Teacher, 24:484 ff., November, 1962.

Grobman, Hulda. "Study in Educational Improvements," Clearing House, 36:163-165, November, 1961.

Hurd, Paul DeHart. Biological Education in American Secondary Schools 1890-1960. AIBS-BSCS Bulletin No. 1. Baltimore: Waverly Press, Inc., 1961. 263 pp.

Ivo, Sister Mary. "Catholic High School and the BSCS Program," American Biology Teacher, 24:361-363, May, 1962.

Johnson, R. H., and R. Shutes. "Biology and Team Teaching," American Biology Teacher, 24:247-255, April, 1962.

Jordon, Pascual. Science and the Course of History. New Haven: Yale University Press, 1955. 139 pp.

Klinckmann, Evelyn. "New Curriculum Patterns for Biology Teachers," Yearbook of The American Association of Colleges for Teacher Education (AACTE), 1962. Pp. 94-103.

Klinge, P. "Resources for Improving Instruction in Biology," School Life, 45:12-14, October, 1962.

Knight, Edgar W. A Documentary History of Education in the South before 1860. Chapel Hill: University of North Carolina Press, 1953. 368 pp.

Koelsche, C. L. "Facilities and Equipment Available for Teaching Science in Public High Schools," Science Education, 45:365-372, October, 1961.

Lee, Addison. "Biology--Laboratory Instruction Innovation," Science Teacher, 28:46-47 ff., October, 1961.

_____. "Experimental Approach in Teaching Biology: An Introduction to the BSCS Laboratory Block Program," American Biology Teacher, 23:409-411, November, 1961.

Lisonbee, L. "Teaching Science to the Disadvantaged Pupil," Science Teacher, 30:18-21, October, 1963.

London Times Educational Supplement. "BSCS Biology Course--Blue, Green and Yellow Version," 2502:922, May 3, 1963.

McCormick, Patrick J. History of Education: A Survey of Development of Educational Theory and Practice in Ancient, Medieval, and Modern Times. Washington, D.C.: The Catholic Educational Press, 1946. 649 pp.

Monroe, Paul. A Text-Book in the History of Education. New York: The MacMillan Company, 1910. 772 pp.

"New Science Curriculum: Biology," School Management, 7:63, January, 1963.

Noble, Stuart G. A History of American Education. New York: Rinhart and Company, 1954. 552 pp.

Novak, A. "Scientific Inquiry in the Laboratory," American Biology Teacher, 25:342-346, May, 1962.

_____, and N. Abraham. "Excellence in Biology Facilities," Science Teacher, 29:14-15 ff., March, 1962.

Scott, William A., and Michael Wertheimer. Introduction to Psychological Research. New York: John Wiley and Sons, Inc., 1962. 445 pp.

Van Deventer, W. C. "BSCS Biology," School Science and Mathematics, 63:89-94, February, 1963.

Viall, W. P. "Secondary Science and Mathematics Teachers Surveyed," Journal of Teacher Education, 13:475-476, December, 1962.

Weaver, R. L. "BSCS--Plus," American Biology Teacher, 25:404, October, 1963.

APPENDIX

THE UNIVERSITY OF NEW MEXICO | ALBUQUERQUE

889-1964
TH ANNIVERSARY

DEPARTMENT OF SECONDARY EDUCATION
COLLEGE OF EDUCATION

Dear

A survey of the opinions of Biology teachers in New Mexico toward the Biological Science Curriculum Study is being conducted. The information sought in the attached questionnaire will be analyzed in a thesis study at the College of Education, University of New Mexico.

Will you please have your teachers of Biology complete either the attached questionnaire Form A or B, as appropriate, and return it in the enclosed self-addressed envelope as soon as possible. This information is urgently needed on or before

It is expected that a summary of the results of this survey will be mailed to you.

Please understand that this study is in no way concerned with promoting the BSCS nor, is it trying to influence teachers' opinions. However, it is highly important to ascertain teachers' attitudes at this time in the absence of more empirical data.

Your cooperation will be sincerely appreciated.

Yours truly,

Frizelle L. Aguilar, Grad. Student
Secondary Education Department
University of New Mexico

FLA:hlr
Encl.
end:

Endorsement

This study has the endorsement of Dr. Bonner M. Crawford, Professor of Secondary Education and Instructor of Materials and Methods in teaching for Science and Mathematics teachers at the University of New Mexico.

Your completion of the appropriate questionnaire is requested.

Bonner M. Crawford
Bonner M. Crawford
Professor of Education
University of New Mexico

FORM A

S U R V E Y
QUESTIONNAIRE

If you are a teacher of Biology and using the Biological Science Curriculum Study, please complete this Form A. If you are not using BSCS, please complete Form B. After selecting the appropriate form, either mark the letter which reflects your answer, complete the blank, or explain where indicated.

1. How many students are enrolled in biology courses of all teachers in your school at the present time? _____
   How many of these students are in your classes? _____
2. What is your total high school enrollment for 1963-1964? _____
3. Compared to the entire state of New Mexico, what is the socio-economic status of your students in their out-of-school environment?
   a. Lower class b. Middle class c. Upper class
4. What percentage of your total student population usually will enter college? _____
5. What is the approximate population of your community? _____
6. How many years have you taught biology? _____
7. Please indicate your additional school responsibilities.
   a. Chairman of the Biology Department.
   b. Other subjects taught: _____
   c. Other than academic (clubs, etc): _____
   d. Other duties (athletics): _____
8. Please list your membership in professional, technical or scientific organizations or societies. _____
   _____
9. Which category best describes your teaching preparation?
   a. Bachelor's degree with major in biology.
   b. Bachelor's degree with minor in biology.
   c. Bachelor's degree with neither major or minor in biology.
   d. Master's degree with major in biology.
   e. Master's degree with minor in biology.
   f. Master's degree with neither major or minor in biology.
   g. None of the above are applicable.
10. Please indicate special training not included in the above which may have been in workshops, the military service, under some government agency grant (A.E.C.) or educational organization (N.S.F., or N.A.S.A., ect.) _____
    _____
    _____
11. From what source did you learn about BSCS? _____
    When did you first develop a desire to become more familiar with the BSCS program? _____
12. How many classes of BSCS biology are you teaching? _____
    How many students are in each class? _____
13. How long have you used or participated in the BSCS project?
    a. 1 year b. 2 years c. 3 years d. 4 years
14. How does the student achievement in the BSCS program compare with the traditional program of previous years?
    a. Lower b. Higher c. No change
15. What version of BSCS materials are you using?
    a. Blue - "Biological Science: Molecules to Man"
    b. Green - "High School Biology"
    c. Yellow - "Biological Science: An Inquiry Into Life"
16. Which version of BSCS do you like best? Why?
    a. Blue b. Green c. Yellow _____
    _____
    _____

Form A (Continued)

17. Which version do you like least? Why?
a. Blue b. Green c. Yellow

18. Do you think the three versions should be revised, rewritten or combined into two volumes which could then be used as a high school biology text? a. Yes b. No
Why? _____

19. What suggestions can you offer to improve BSCS, or to integrate tl current three versions for use as a class text? _____

20. Do you believe the BSCS program has stimulated your interests and aspirations as a biology teacher? Please explain.
a. Not at all b. Slightly c. Moderately d. Markedly

21. Is your current biology curriculum meeting the needs of your students by:
a. Offering college preparation.
b. Offering a good background for terminal education.
c. Providing an understanding of the HUMAN BODY, to satisfy the biological inquiry of young adults.

22. Are there any basic differences between your traditional or previous curriculum and BSCS? a. Yes b. No c. Undecided
Please explain your interpretation of the term "basic difference".

23. Do you think the government is wasting money by supporting BSCS?
a. Yes b. No c. Undecided

24. Is your current biology curriculum satisfactory to you in terms of teacher needs by:
a. Supplying better teaching materials.
b. Helping you to give students a better presentation of biology
c. Helping you to cultivate young scientific thinkers.
d. Stimulating you professionally.

25. All in all, what value is the BSCS program to you as a biology teacher? a. None b. Slight c. Moderate d. Marked or great
Please give your interpretation of the term "value" as you applied it.

26. How does BSCS help you on the job?_____

27. Why did you or your Biology Department decide to use the BSCS program? Please explain._____

28. What is your general opinion of the Biological Science Curriculum Study? Please explain._____

Form A (Continued)

The two basic principal objectives of the Biological Science Curriculum Study are:

1. To help the student to understand various processes in biological research.
2. To develop within the student an understanding and appreciation of the scientific enterprise.

The following statements should help to evaluate these two objectives stated by the BSCS. Please compare your average pupils in the BSCS program this year, with average pupils in the previous program or traditional program from past or present experience, by checking (✓) your opinion in the appropriate column to the right.

The average student in the BSCS compared to the average pupil in traditional biology:	*IMPROVEMENT* NO	SLIGHT	SOME	NOTABLE	GREAT
1. defines a problem in researchable terms.					
2. recognizes a reasonable hypothesis which can be tested by experiment or observation, concerning a problem.					
3. recognizes the importance of appropriate controls in an experimental design.					
4. distinguishes among different kinds of data. Data, as used here and elsewhere in these objectives, includes observations as well as other kinds of data.					
5. recognizes the importance of accuracy in obtaining data.					
6. selects a suitable procedure for the analysis of data.					
7. realizes that being a scientist involves much study and routine work.					
8. realizes that both teamwork and individual work are important in research.					
9. recognizes that his participation in a scientific investigation contributes to his learning.					
10. recognizes that scientists do not base judgments on authority.					
11. recognizes the value of creative thinking and ingenuity in science.					
12. recognizes that scientists share ideas with others.					
13. realizes the value of a broad background in areas other than the sciences.					
14. sees the unity and relationships among the sciences (botany, zoology, chemistry, physics, mathematics, etc.).					

I (do) (do not) desire a copy of the summary of the findings of this opinion survey.

NAME: _____

ADDRESS: _____

SCHOOL: _____

LOCATION: _____

THANK YOU FOR COMPLETING THIS SURVEY QUESTIONNAIRE!

FORM B

S U R V E Y
QUESTIONNAIRE

If you are a teacher of Biology and not using the Biological Science Curriculum Study program, please complete this Form B, by marking the letter which reflects your answer, completing the blank or explaining where indicated.

1. How many students are enrolled in biology courses of all teachers in your school at the present time? _____
   How many of these students are in your classes? _____
2. What is your total high school enrollment for 1963-1964? _____
3. Compared to the entire state of New Mexico, what is the socio-economic status of your students in their out-of-school environment?
   a. Lower class b. Middle class c. Upper class
4. What percentage of your total student population usually will enter college? _____
5. What is the approximate population of your community? _____
6. How many years have you taught biology? _____
7. Please indicate your additional school responsibilities.
   a. Chairman of the Biology Department.
   b. Other subjects taught: _____
   c. Other than academic (clubs, etc.): _____
   d. Other duties (athletics): _____
8. Please list your membership in professional, technical or scientific organizations or societies. _____
   _____
9. Which category best describes your teaching preparation?
   a. Bachelor's degree with major in biology.
   b. Bachelor's degree with minor in biology.
   c. Bachelor's degree with neither major or minor in biology.
   d. Master's degree with major in biology.
   e. Master's degree with minor in biology.
   f. Master's degree with neither major or minor in biology.
   g. None of the above are applicable.
10. Please indicate special training not included in the above which may have been in workshops, the military service, under some government agency grant (A.E.C.) or educational organization (N.S.F.,or N.A.S.A., etc.) _____
    _____
    _____
11. From what source did you learn about BSCS? _____
    How long have you known about the work of the American Institute of Biological Science on the Biological Science Curriculum Study project?
    _____
12. How many classes of biology are you teaching? _____
    How many students are in each class? _____
13. What biology curriculum program are you participating in other than BSCS? _____
    Please list your text or texts being used. _____
    _____
14. Although you are not presently participating in, or using BSCS, do you think you will?
    a. Never; b. Undecided; c. Maybe in the future(2-3yrs); d. Next yr
15. Do you believe the BSCS program has stimulated your interests and aspirations as a biology teacher? Please explain.
    a. Not at all; b. Slightly; c. Moderately; d. Markedly or greatly
    _____
    _____

NEW MEXICO SCHOOLS

R OF PUBLIC AND NONPUBLIC:

LEVEL	PUBLIC	NONPUBLIC
ELEMENTARY	492	102
JUNIOR HIGH	84	4
SENIOR HIGH	107	28
SPECIAL	8	

***

INDEPENDENT ADMINISTRATIVE UNITS	86
COUNTY ADMINISTRATIVE UNITS	3
TOTAL	89

ISTRATION:

NEW MEXICO HAS 89 SCHOOL ADMINISTRATIVE UNITS, 86 OF WHICH ARE INDEPENDENT OR MUNICIPAL SYSTEMS. EMAINING THREE ARE COUNTY UNITS WHICH COMPRISE 17 COUNTY SCHOOL DISTRICTS. IN THE PAST 20 YEARS EXICO HAS REDUCED THE NUMBER OF SCHOOL DISTRICTS FROM 769 TO 106.

THE STATE HAS 107 HIGH SCHOOLS ACCREDITED BY THE STATE DEPARTMENT OF EDUCATION. THERE ARE 84 C JUNIOR HIGH SCHOOLS AND 492 ELEMENTARY SCHOOLS. NEW MEXICO HAS 28 NONPUBLIC HIGH SCHOOLS, 4 BLIC JUNIOR HIGH SCHOOLS AND 102 NONPUBLIC ELEMENTARY SCHOOLS WITH A TOTAL ENROLLMENT OF 25,329 NTS DURING THE FIRST MONTH OF 1963-64.

NNEL:

APPROXIMATELY 11,150 PEOPLE IN NEW MEXICO ARE ENGAGED IN WORK DIRECTLY RELATED TO PUBLIC EDUCA- THIS FIGURE INCLUDES CLASSROOM TEACHERS, PRINCIPALS, SUPERVISORS, AND ADMINISTRATORS. MORE ONE-HALF OF THE SECONDARY TEACHERS AND ONE-FOURTH OF THE ELEMENTARY TEACHERS HOLD ADVANCED DEGREES. VERAGE ANNUAL SALARY FOR ELEMENTARY CLASSROOM TEACHERS IN NEW MEXICO IS $5971 AND $5965 FOR SECOND- LASSROOM TEACHERS.

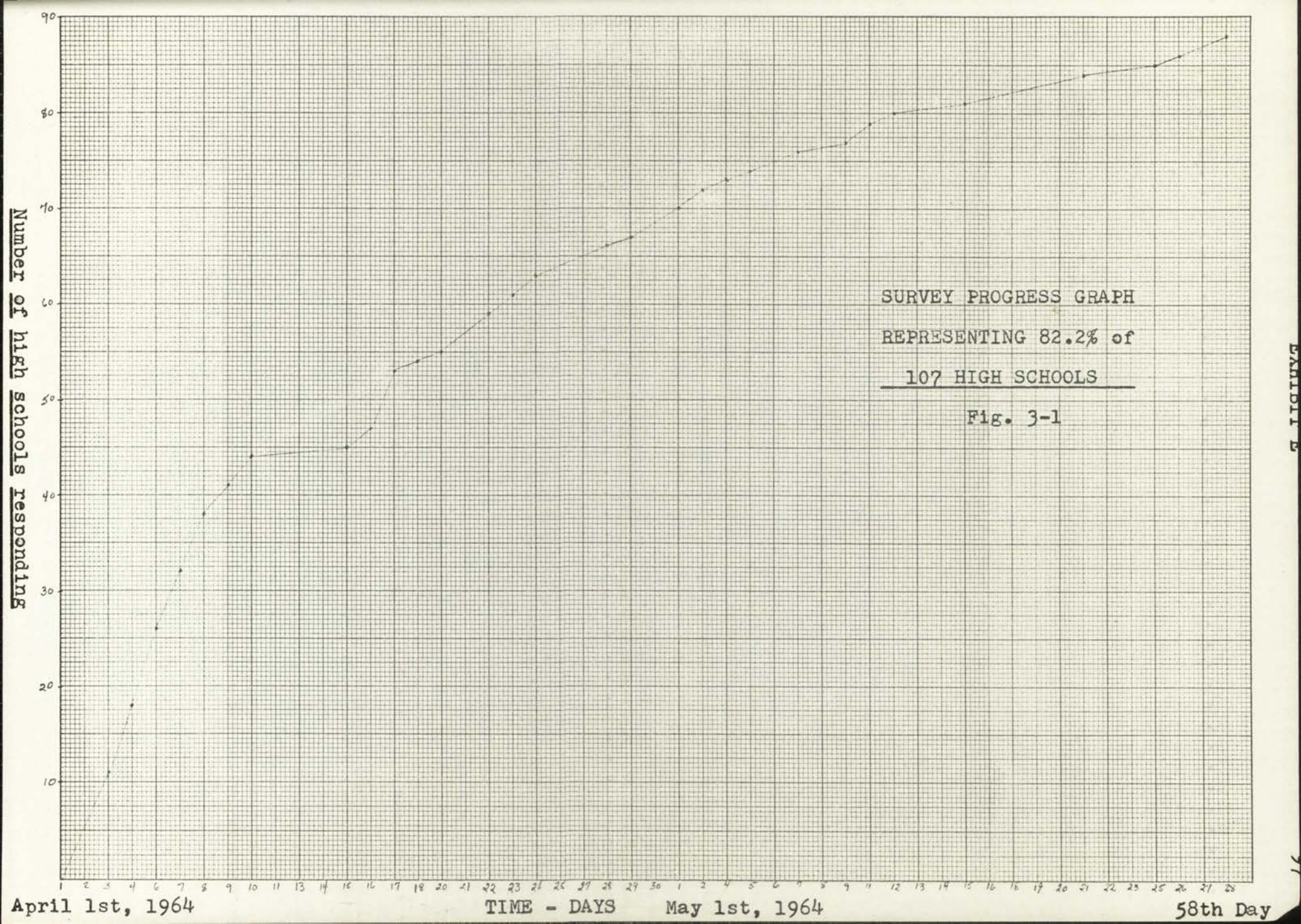
PORTATION:

NEW MEXICO, THE FIFTH LARGEST STATE IN THE NATION, MUST MAINTAIN A SUBSTANTIAL PUPIL TRANSPORTA- SYSTEM. IN SCHOOL YEAR 1962-63, MORE THAN 82,000 CHILDREN WERE TRANSPORTED DAILY TO AND FROM L ON SOME 1,355 BUSES. THESE BUSES TRAVELED A TOTAL ANNUAL MILEAGE OF NEARLY 12 MILLION MILES AVERAGE COST OF $66.14 A YEAR PER PUPIL. TOTAL ANNUAL COST OF SCHOOL TRANSPORTATION IN 1962-63 5,435,385.

L LUNCH:

THE SCHOOL LUNCH PROGRAM IN NEW MEXICO DURING 1962-63 INCREASED ALMOST 12 PER CENT OVER THE PRE- G YEAR. A TOTAL OF 522 SCHOOLS PARTICIPATED; OVER 16 MILLION LUNCHES WERE SERVED TO CHILDREN THE PROGRAM; MORE THAN 2 MILLION OF WHICH WERE FREE TO THE CHILDREN WHO WERE SERVED THEM. IN PECIAL MILK PROGRAM, 527 SCHOOLS PARTICIPATED, AND MORE THAN 14 MILLION HALF-PINTS OF MILK WERE D TO CHILDREN. THIS MILK IS IN ADDITION TO MILK USED IN SCHOOL LUNCHES.

DEPARTMENT OF EDUCATION
ION OF STATISTICS
ARY 1964


Number of high schools responding
90
80
70
60
50
40
30
20
10
SURVEY PROGRESS GRAPH
REPRESENTING 82.2% of
107 HIGH SCHOOLS
Fig. 3-1
April 1st, 1964
TIME - DAYS
May 1st, 1964
58th Day

SURVEY PROGRESS GRAPH

RATE OF RECEIPT OF

100 QUESTIONNARES

Fig. 3-2

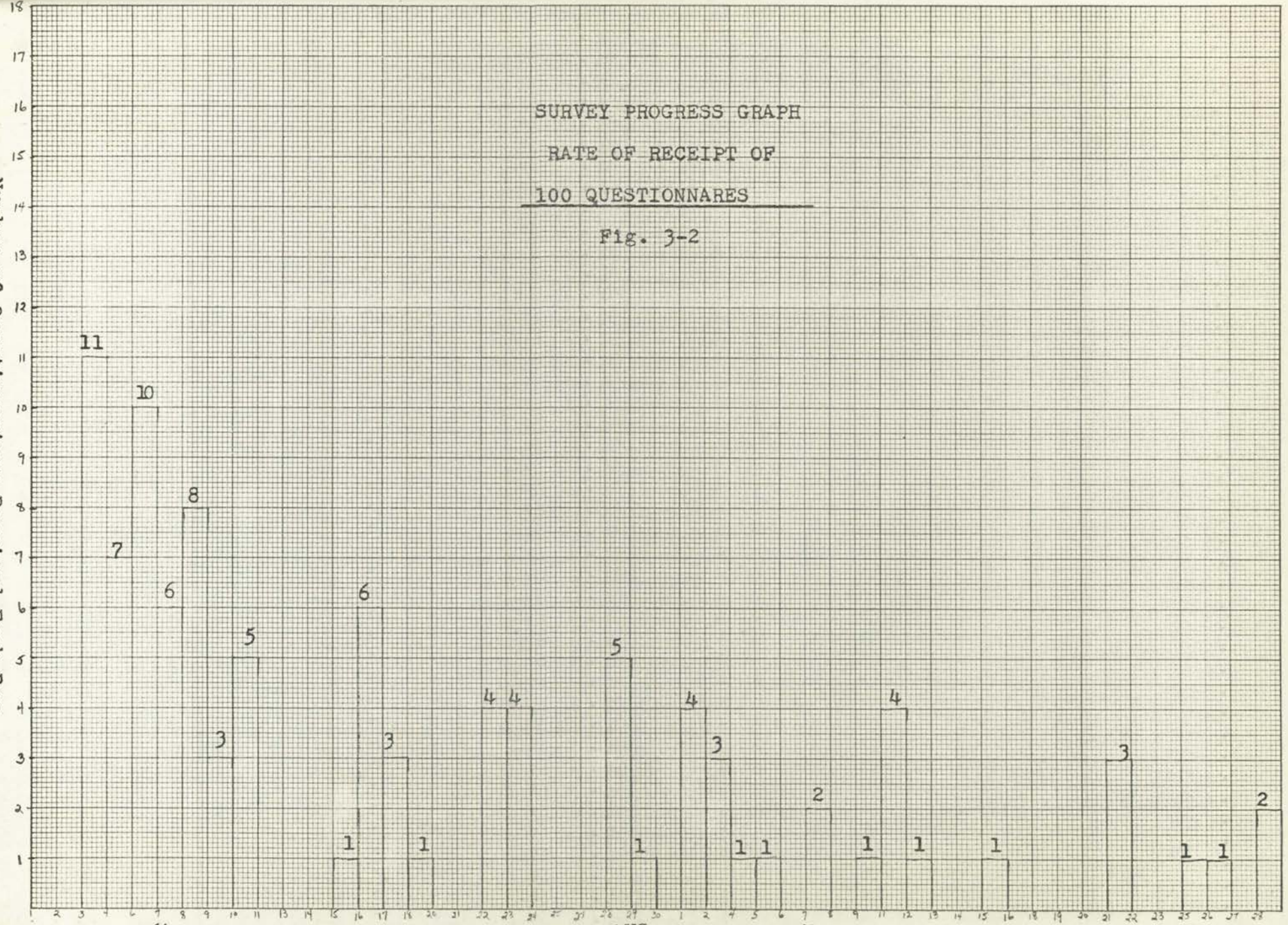


EXHIBIT G

BSCS AREA MEETING

The New Mexico Area Consultant for BSCS Marshall S. Floyd conducted an Area Meeting on March 20, 1965 at Highland High School, Albuquerque, New Mexico. Seventy-six biology teachers, administrators and educators were present. Fifteen of these people were teachers using the BSCS materials.

Dewitt Ivey of Sandia High School asked which versions were being used and the following results were obtained:

(1964-65)		(Statistics of this survey) (1963-64)	
Blue Version	5 Teachers		2 Teachers
Yellow "	4 "		7 Teachers
Green "	6 "		1 Teachers
Total # teachers	15		10 Teachers

These figures can not be compared because of the nature of the sample. However, there is an increase in the number of participating teachers within the two year period.

This meeting was not very informative for the person on the BSCS mailing list who has perused the BSCS literature. Imogene Russell, Dewitt Ivy, Harry Bishop and John House reviewed the outline of the Blue, Green, Yellow Versions and Special Materials, respectively. There was no new information or statistics regarding teachers and their opinions toward the BSCS. The meeting was informative for the uninformed. However, it appeared that only the informed were interested enough to be present.

NOTICE

It must be observed and remembered that this study is in no way concerned with promoting the Biological Sciences Curriculum Study. This is the first such study to be done in the nation, to survey the attitudes of biology teachers in the state of New Mexico or any other state, toward the Biological Sciences Curriculum Study.