

A STUDY OF BSCS IN THE STATE OF KANSAS 1968-1969

by *1264*

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A MASTER'S REPORT

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MASTER OF SCIENCE

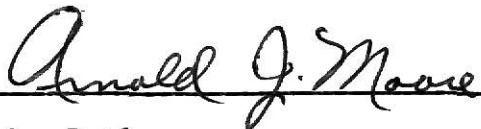
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## CHAPTER I

### INTRODUCTION AND STATEMENT OF PROBLEM

Science teaching has undergone many changes in the past ten years. The emphasis on science since the Russians launched Sputnik has made teachers and scientists aware that the teaching of science could be improved. Many teams of writers in the different fields of science met to produce completely new programs using the laboratory approach and emphasizing student inquiry as the method of teaching. These programs require the student to find his own answers by investigation in laboratory. One of these programs, the Biological Science Curriculum Study, or BSCS, has been used extensively in the United States. This program sought to meet a wide range of abilities and needs of students.<sup>1</sup> There are three text versions, a slow learner's course, a second year course, laboratory blocks, and numerous instructional materials such as films to provide added individuality in teaching and learning. The selection of themes for BSCS is based upon the idea that scientific knowledge is expanding too fast for all to be included in one course, and as a consequence broad concepts and themes should be emphasized since they will not become outdated. A student's knowledge may soon become obsolete if he lacks the concepts

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<sup>1</sup>Alexander Calandra, "The New Science Curriculums," School Management VII (November, 1964), 78.

and skills necessary to think in and about science.<sup>2</sup> Dr. Bentley Glass summarizes the intent of BSCS by saying:

If we are successful, 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, old error eliminated and an ever closer approximation of truth attained.<sup>3</sup>

BSCS is a secondary school biology program whose general emphasis is on scientific inquiry by the students through laboratory investigations which are set up to help the learner discover the principals under investigation. The students learn the function of the scientist in society and learn concepts by doing experiments as the scientist does, not just by hearing about them. Student and teacher work together to discover, and discussion is the means of communication in the classroom. Learning can be individualized by using the supplementary materials published by BSCS or by choosing one of the four versions written by BSCS.

The Blue Version emphasizes theories of the gene, cell and evolution, the Green Version emphasizes ecology, and the Yellow Version the development of the organism. The Special Materials are

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<sup>2</sup>W. C. Van Deventer, "BSCS Materials in the Preparation of Teachers of Biology," School Science and Mathematics, LXIV (November, 1964), 683-693.

<sup>3</sup>Bentley Glass, New York Times, (July 16, 1964) as quoted in "Guidelines for Development of Programs in Science Instruction, Report of a Study...etc." National Academy of Science--National Research Council, Publication 1093 (May, 1963), p. 79.

made primarily for the slower learners in biology and has challenging, but workable experiments which emphasize the broad concepts of biology. Supplementary materials include technique films which assist teachers in mastering certain laboratory techniques, short single topic films which show experiments and reinforce concepts, examinations for the various texts and units, research problems for advanced students, and a teacher's handbook. The laboratory blocks, which are extended research projects of about 6 weeks, can be used to make an entire course in biology.

#### The Problem.

The purposes of this study were to (1) determine if there is a difference in attitude toward BSCS by those teaching BSCS compared to those not teaching it in Kansas; (2) determine some factors that are hindering BSCS adoption in Kansas; (3) learn what ways BSCS is being implemented and what materials are used in Kansas; (4) discover some criticisms that teachers have of BSCS in Kansas; (5) determine differing characteristics for BSCS and non-BSCS teachers in Kansas.

#### Importance of the Study.

The publishers and writers of BSCS cannot do all of the necessary research and encourages individuals and institutions to help in evaluation. Some areas suggested by BSCS for study are the total impact of the program, the BSCS materials being used and other materials being used to supplement them, the extent BSCS courses are

actually implemented in the schools, the teacher's interpretation of his role in BSCS and its effect on BSCS in the classroom, ways students are experiencing difficulties, and the help that BSCS materials have given teachers who are not actually using BSCS with their classes.<sup>4</sup> This study was undertaken to provide additional information for evaluation of BSCS.

### Definition of Terms.

BSCS. This stands for the Biological Science Curriculum Study which has developed a series of instructional materials including three different versions, materials for slow learners, and supplementary materials based on inquiry through laboratory investigations by the students.

BSCS Blue Version. Molecules to Man, the title of the Blue Version, has a unifying thread composed of the theories of the gene, cell and evolution. It has attempted to provide and emphasize a physiological dimension to these areas.

BSCS Green Version. The book is titled High School Biology and has as a unifying theme the ecological aspect emphasizing the world biome.

BSCS Yellow Version. This version is titled An Inquiry Into Life. Reproduction, evolution, and development receive the major emphasis in this version.

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<sup>4</sup>Hulda Grobman, "Needed Research in High School Biology," American Biology Teacher, XXVII (November, 1965), 705-707.

BSCS Special Materials. Patterns and Processes is designed especially for students who have trouble in regular biology courses. There is much emphasis on laboratory and examples which are relevant to the students.

BSCS Teacher. Any teacher reporting to use of the BSCS versions or laboratory blocks to make biology courses. It is expected that their method of teaching will be based on BSCS philosophy rather than traditional.

Non-BSCS Teachers. Any teacher using a biology program other than BSCS.

Single Topic Films. These are silent four minute films which show an experiment or its results to develop and reinforce a concept.

BSCS Technique Films. They assist teachers in mastering certain laboratory techniques.

Pamphlet Series. Each pamphlet covers a specific area in biology and develops one or more of the nine themes. They provide background knowledge and indicate kinds of thinking done in biology.

BSCS Examinations. These are put out by BSCS and are designed to test concepts and principles and understanding of science.

Research Problems in Biology. This consists of four volumes which suggest research problems that are aimed at students capable of carrying on lengthy investigations.

Biology Teacher's Handbook. This contains information on topics such as chemistry, statistics, and testing materials to help teachers in preparing to teach BSCS.

## CHAPTER II

### REVIEW OF THE LITERATURE

Much of the literature concerning BSCS tends to be qualitative and as a consequence only that which has been useful in developing this project is reported here.

#### Philosophy of BSCS.

BSCS is different from traditional biology and has been intended to differ in the following ways. BSCS shows that science is an ongoing, self-revising process, not just isolated facts. The process of science and science as a method of inquiry are emphasized via laboratory exercises designed so that the student learns through self-discovery and first hand experiences. The scope of the subject matter is at the cellular, molecular and ecological levels rather than at the organ and tissue level.<sup>5</sup>

Furthermore, there are nine themes BSCS believes to be basic to presenting modern biology in a logical and unified manner. The nine themes are listed below:

- (1) Science as inquiry.
- (2) The intellectual history of biological concepts.
- (3) The change of living things through time--evolution.

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<sup>5</sup>Lorenzo Lisonbee and Bill J. Fullerton, "The Comparative Effect of BSCS and Traditional Biology on Student Achievement," School Science and Mathematics, LXIV (October, 1964), 594-598.



- (4) The diversity of type and unity pattern in living things.
- (5) The genetic continuity of life.
- (6) The complementarity of organisms and environment.
- (7) The biological roots of behavior.
- (8) The complementarity of structure and function.
- (9) Regulation and homeostasis--the preservation of life in the face of change.

The first two themes give the logical structure, and the last seven give the content stressed in BSCS.<sup>6</sup>

#### Teachers' Attitudes and BSCS.

In a study by Rozolis, teachers and administrators were asked in an interview why they had chosen the BSCS program rather than a different one. They all agreed that the BSCS versions were the best so far developed for use in high school biology. The advantages and disadvantages of BSCS given by these teachers and administrators is given in Table I.<sup>7</sup>

In another study by Rozolis, thirty-three high school biology teachers were asked to give their opinions of the different versions

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<sup>6</sup>The Teacher and BSCS Special Materials, BSCS Special Publication 4, p. 3.

<sup>7</sup>James T. Rozolis, "An Evaluation of The Biological Science Curriculum Study Program from the Professional Viewpoint and Implications for the University," BioScience, XVII (July, 1967), 452-459.

of BSCS and traditional biology. Data from this study are given in Table II.<sup>8</sup>

It appears that teacher's attitudes determine to some extent the version of BSCS used. Something seen as an advantage to one teacher may be a disadvantage to another, and this is why BSCS has three main versions.

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<sup>8</sup>James T. Rozolis, "A Comparison of Traditional High School Biology Courses and the Biological Sciences Curriculum Study Program of Courses," BioScience, XVII (May, 1967), 315-324.

TABLE I  
ADVANTAGE AND DISADVANTAGES OF BSCS GIVEN BY TEACHERS AND  
ADMINISTRATORS IN A STUDY BY ROZOLIS

Advantages Given

1. Laboratory investigations
2. The text is based on understanding of concepts
3. The emphasis on themes rather than details
4. Inductive and analytical approach
5. New ideas reflect the current scientific thinking
6. Financial support attracted the best professional people
7. Laboratory is applicable to real life
8. More challenging to the teacher
9. Avoids repetition of materials in lower science courses
10. Increases student awareness of biological world
11. Prepares students better for standardized tests
12. Emphasis on function rather than structure
13. Allows a choice of texts
14. Meets student needs best

Disadvantages Given

1. Teachers need special training to teach BSCS
2. Laboratory facilities and materials not adequate
3. Laboratory preparation is time consuming for the teacher
4. Classes are too crowded to carry out successful lab
5. Teachers may use BSCS because it is popular and still stress memorization and identification
6. Too much material is presented
7. The level is too advanced
8. Required to know too much math, chemistry, physics and lab techniques
9. Student may think he knows more than he actually does
10. Because of emphasis on current literature the versions will become outdated soon
11. Students are at a disadvantage for the college entrance exams
12. There is a threat of national curriculum control and rigidity of thought

TABLE II  
ADVANTAGES AND DISADVANTAGES OF EACH VERSION OF BSCS AND TRADITIONAL  
BIOLOGY AS GIVEN BY BSCS TEACHERS IN A STUDY BY ROZOLIS

#### TRADITIONAL BIOLOGY

##### Advantages

1. Reading level of the books is equal to that of the average student

##### Disadvantages

1. Emphasis upon the text material
2. Lack of emphasis on laboratory
3. Compartmentalized structure
4. It is dull

#### BLUE VERSION

##### Advantages

1. Theoretical and molecular approach is the best one year background
2. Reading level is demanding
3. Comes close to achieving the role of the scientist
4. Most logical in organization and development
5. Written for above average students
6. Treats evolution honestly
7. No limitations of other two versions

##### Disadvantages

1. Too difficult for even college preparatory students
2. Reading beyond the students' grade level
3. Too theoretical in its approach
4. Too much mathematics and chemistry
5. Students did not have enough previous background
6. Too narrow in approach
7. Too little emphasis on traditional subjects
8. Too much evolution taught as fact rather than theory

TABLE II (continued)

## GREEN VERSION

## Advantages

1. Can be taught to all ability students
2. Laboratory
3. Greater area of traditional biology encompassed
4. Good photographs and pictures of wildlife
5. Appropriate for rural environment

## Disadvantages

1. Unsatisfactory for use with college preparatory students
2. Excessive amount of chemistry
3. Too brief treatment of genetics
4. Appropriate for rural rather than urban environments
5. Ease of evaluating knowledge in a traditional manner
6. More time and materials required for laboratory

## YELLOW VERSION

## Advantages

1. Conventional design
2. Lower reading level
3. More traditional laboratory materials

## Disadvantages

1. Too much chemistry
2. Unworkable labs
3. Overemphasis on bacteria
4. Too much material in text
5. Lack of teacher interest in this version
6. Danger of teachers slipping back into old ways of teaching

Other research has shown that there is little difference in the achievement of the students using different versions as long as the teacher is free to choose the version he teaches.<sup>9</sup>

Blankenship obtained data from fifty-five Oklahoma teachers who had institute training in BSCS. He found teachers ranking favorably toward BSCS had high scores on the measure of capacity for independent thought and action and had taught high school biology fewer years. Some reasons given for not now teaching BSCS biology by those with favorable and unfavorable attitudes were ; the text and laboratory materials are not available; laboratory space is not available; equipment and supplies are not available; the school administration does not favor the program; I am not teaching biology now; there is a lack of funds.

Reasons given by those with unfavorable attitudes were; inadequate personal preparation and training; an excessive amount of work for the teacher, and fellow biology teachers do not like the program.<sup>10</sup> Some of these reasons were incorporated into the study to help determine some reasons for unfavorable attitudes of teachers.

A study of the status of BSCS was done in Ohio by Wimberly and Buell in 1966. There were forty-seven teachers using BSCS in

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<sup>9</sup>Hulda Grobman, "Some Comments of the Evaluation Program Findings and Their Implications," BSCS Newsletter, XIX 25-29.

<sup>10</sup>Jacob W. Blankenship, "Biology Teachers and Their Attitudes Concerning BSCS," Journal of Research in Science Teaching, III (1965), 54-60.

Ohio who had received institute training in the study. The teachers had an average of thirty-two semester hours beyond the Bachelor's degree, and fourteen of these were in institute training. They also had an average of ten years of experience. Most said the administration was cooperative, and the resistance encountered was credited to poor ground work laid before adoption, fear of increased cost, materials thought to be too difficult by the administration, and resistance by improperly informed and trained teachers. Over three-fourths felt there was a definite need of a BSCS oriented program in their district. Most said the initial cost of BSCS was more, but the annual upkeep was less costly. There was more teacher effort in laboratory reported by 97 per cent, and about 57 per cent felt class scheduling in its present form was outdated for BSCS.<sup>11</sup> This study is influenced by the fact that these were some of the first teachers to try BSCS and were trained in its philosophy. Teachers who do not have proper training or desire to teach BSCS may well have varied responses.

A recent study by Pringle gives some facts of the status of BSCS in Kansas. He sent a questionnaire to all of the teachers in Kansas teaching high school with 71 per cent responding. Of these there were 148 BSCS teachers and 294 non-BSCS teachers. There were 33 per cent of the BSCS teachers who said the physical facilities for BSCS were poor at their school; 41 per cent said biology was a required

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<sup>11</sup>Robert C. Wimberly and Robert R. Buell, "BSCS Biology in Ohio Schools 1966," *School Science and Mathematics*, LXII (November, 1967), 703-707.

subject, and 70 per cent said they had ability grouping. BSCS teachers had an average of 7.6 years of teaching experience, and non-BSCS teachers had an average of 8.5 years. Master's degrees had been earned by 54 per cent of the BSCS teachers and by only 25 per cent of the non-BSCS teachers. The BSCS teachers also had more graduate and undergraduate hours in biology, but no difference in chemistry hours was noted. Most of the BSCS teachers had also had special training in BSCS. A lack of funds was listed as the major obstacle by the non-BSCS teachers for incorporating BSCS into their school system. Of the teachers who taught other biology courses, 65 per cent said BSCS was superior, and 7 per cent said it was inferior. Those saying it was inferior had not been exposed to it as a philosophy through a specific course. Most teachers said their students could handle the materials with only moderate difficulty. They also said they had encountered major difficulties of adequate physical facilities, shortage of materials, student disinterest, too difficult for "C" students, lack of teacher training, and classes that are too large.<sup>12</sup>

It is the purpose of the present study to go beyond the literature cited above and to determine some specific attitudes Kansas teachers might have about the biology course they are teaching, to assess any negative attitudes toward BSCS, to determine factors

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<sup>12</sup>James W. Pringle, "The Status of BSCS in the State of Kansas, 1967-1968," (unpublished Master's research problem, Kansas State Teachers College, Emporia, Kansas, 1968), pp. 4-28.



hindering BSCS adoption, to discover any differing characteristics for BSCS and non-BSCS teachers, and to determine if there is a difference in attitude toward BSCS by those teaching it as compared to those not teaching BSCS.

## CHAPTER III

### PROCEDURE

The biology teachers in Kansas were identified through information provided by the State Department of Public Instruction in Topeka, Kansas. This information facilitated identification of the BSCS teachers in Kansas.

The questionnaire was developed by sending a tentative form to twenty-five teachers and asking them to answer the questions and make comments. Revisions were then made to clarify the questions and responses. Copies of the questionnaire and letter sent are found in Appendices A and B.

The final questionnaire was sent to 190 BSCS teachers and 93 non-BSCS teachers. The questionnaire contained three parts. Part I was for BSCS teachers only, Part II for non-BSCS teachers only, and Part III for all teachers. Copies of the questionnaire and letters sent are found in Appendices C, D, and E.

All items in the questionnaire were evaluated descriptively and use was made of computer programming in the analysis where feasible. Correlation coefficients and computer programming produced a correlation matrix for selected items in identifying factors which influence attitudes toward BSCS. Three correlation matrices were obtained. The first was for the full sample; a second was for BSCS teachers only, and a third was for non-BSCS teachers.

## CHAPTER IV

### RESULTS

Two hundred forty-six teachers, or 87 per cent of the sample, returned the questionnaires, with 146 of these being BSCS teachers, and 88 non-BSCS. Twelve of the teachers could not be classified from the information they gave in the questionnaire. A further analysis by version revealed 85 using the Green, 31 Blue, 21 Yellow Version, and 9 Special Materials.

Table III reports data for BSCS teachers. It was found that the majority of BSCS teachers had some type of formal training for teaching BSCS, and were planning to continue to use the BSCS materials. There were 62 per cent who had taught BSCS over 3 years. There were few teachers who stated a change in science enrollment since BSCS, but more reported decreases than reported increases.

In Table IV data are presented showing that about 45 per cent had chosen the version they taught themselves, and most did not teach a second year course or have ability grouping.

Table V and Table VI shows that the major strengths and weaknesses of each version were varied. In Table VII BSCS teachers reported that they felt the role of the teacher in BSCS to be mainly guiding, stimulating or motivating, and that student difficulties were mainly concerned with students being able and willing to read, work, and think on their own.

TABLE III

THE RESPONSES OF TEACHERS OF EACH BSCS VERSION TO QUESTIONS ABOUT THEIR TRAINING, EXPERIENCE, AND THE USE OF BSCS.

	NUMBER OF TEACHERS			SPECIAL
	GREEN	BLUE	YELLOW	MATERIALS
How many years have you taught BSCS?				
1	19	10	3	2
2	16	4	6	3
3	11	5	9	2
over 3	34	30	20	1
Will you use BSCS next year?				
Yes	72	30	20	6
No	7	1	1	2
What formal training have you had for BSCS?				
NSF	29	12	8	3
In-service	33	12	7	1
Workshop	6	4	-	-
Other	4	4	3	1
None	21	10	8	3
What proportion of your classes in biology are BSCS?				
All BSCS	59	26	17	6
Mostly BSCS	19	5	5	-
More of other biology programs than BSCS	2	-	2	-
Has there been a change in science enrollment since BSCS?				
Yes	15	4	1	1
Increase				
Biology	1	-	-	-
Chemistry	1	-	-	-
Physics	-	-	-	-
Other	1	1	-	-
Decrease				
Biology	2	2	-	-
Chemistry	-	-	1	1
Physics	-	-	1	1
Other	1	2	-	-

TABLE IV

TEACHERS REPORTING CHOOSING THE BSCS VERSION, TEACHING A SECOND YEAR COURSE, AND HAVING ABILITY GROUPING

	NUMBER OF TEACHERS			SPECIAL
	GREEN	BLUE	YELLOW	MATERIALS
Did you choose the BSCS version yourself?				
Yes	36	13	9	3
No	44	19	12	2
Why did you choose it?				
Laboratory	2	1	-	-
Subject matter emphasized	9	4	4	-
Inquiry	2	-	1	-
Students needs and level	8	2	-	2
Qualified to teach it	8	2	-	-
Recommended by Emporia State	2	-	-	-
Liked it best	4	3	-	-
Brainwashed	1	-	-	-
Experiment to see if good	-	-	-	2
More general	-	-	1	-
Closer to traditional	-	-	1	-
Accurate information	-	-	1	-
Are you teaching a second year course?				
Yes	15	9	3	1
No	62	23	18	7
Do you have ability grouping in your classes?				
Yes, use the same materials	11	6	2	1
Yes, use different materials	19	6	2	4
No, do not have grouping	49	21	16	2

TABLE V

THE MAJOR STRENGTH OF BSCS VERSIONS AS LISTED BY TEACHERS USING THEM

NO. OF TEACHERS RESPONDING

	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
Laboratory	18	4	7	1
Ecology	23	-	-	-
Evolution	2	1	-	-
Develops reasoning and concepts	6	-	-	-
Fit for rural area	6	-	-	-
Inquiry approach	3	-	-	-
Good introduction to biology	4	-	-	-
Relevant	4	-	-	-
Involvement of students	4	-	-	-
Plant study	1	-	-	-
Opportunities to branch out	1	-	-	-
Concern of society	1	-	-	-
View of nature	1	-	-	-
Cell structure	-	-	1	-
Genetics	-	1	1	-
Cell Function	-	-	3	-
Biochemical approach	-	-	2	-
Prepares students for college	-	1	2	-
Student participation	-	-	1	1
Balance	-	-	1	-
Nearest to traditional biology	-	-	1	-
Covers broad areas	-	-	1	-
Attractiveness of illustration	-	-	2	-
Chemistry of life	-	5	-	-
Improves thinking	-	3	-	-
Sequence and continuity	-	4	-	-
Approach	-	1	-	-
Medically oriented	-	1	-	-
Chronological order	-	1	-	-
Evidence for Conclusions	-	1	-	-
Reading level	-	-	-	1
Students can do work	-	-	-	1
Lots of activities and little reading	-	-	-	1
Made for slow	-	-	-	1

TABLE VI

MAJOR WEAKNESS OF BSCS VERSION AS LISTED BY THOSE TEACHING THEM

NO. OF TEACHERS RESPONDING

	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
Too general	5	-	2	-
Too narrow	12	-	-	-
Taxonomy	2	-	-	-
Biogenetics	2	-	-	-
Too much ecology	8	-	-	-
Too easy for best student	3	-	-	-
It doesn't prepare students for college	2	-	-	-
Lab exercises, equipment, and time	11	4	-	-
The manual	2	-	-	-
Text and lab arrangement	2	-	-	-
Understanding text and its concepts	5	-	-	-
Too little lecture	1	-	-	-
Too little factual material	1	-	-	-
Dullness	1	1	-	-
Too hard	-	1	4	-
Chemistry approach	-	5	-	-
Not enough information given	-	1	-	-
Not enough lab	-	1	-	-
Too complex	-	1	-	-
Some areas lack too much information	-	3	4	-
Too much genetics	-	1	-	-
Evolution is treated as fact	-	1	-	-
Too time consuming for teacher	-	1	1	-
Too much chemistry	-	-	5	-
Not relevant to students	-	-	1	-
Some labs are too sophisticated	-	-	1	1
Teacher preparation	-	-	-	1
Not enough variations of lab	-	-	-	1
Vocabulary	-	-	-	1

TABLE VII

THE TEACHERS ROLE IN BSCS AND STUDENT DIFFICULTIES AS REPORTED BY THE QUESTIONNAIRE

	GREEN	BLUE	YELLOW
What is the teacher's role in BSCS?			
Guiding	27	11	10
Stimulating and motivating	4	7	12
Inquiry	-	-	4
Summarizing and directing	11	6	6
Same as other biology courses	5	0	1
Bringing in outside information	20	8	-
Leading	7	-	-
Managing	2	4	-
Lecturing	-	1	-
Individualizing the approach	-	1	-
In what ways are students experiencing difficulties in BSCS?			
Too easy	1	4	-
Too hard	-	-	3
Vagueness of material	2	-	3
Low student interest and initiative	2	-	3
Students can't work alone	27	2	1
Text and concepts	5	10	-
Reading and understanding	-	11	-
Time	-	6	2
Transfer learning	-	-	1
Terminology	-	-	1
Details	-	-	1
Library resources	-	-	1
Can't cover enough material	-	1	1
Lab techniques	5	-	-
Facilities and materials	7	-	-
Frustrating	1	-	-
Poor for college prep	1	-	-
Math	-	1	-
Chemistry	-	2	-
Dull	-	2	-
Getting the spirit of science	-	1	-



As it is shown by Table VIII the supplementary BSCS materials were widely used, especially the Biology Teacher's Handbook. Better laboratory exercises and putting the laboratory manual in the text were considered most often as improvements in the 1968 revised versions.

Data on non-BSCS teachers show that few had teaching experience in BSCS, but 65 per cent had examined the BSCS materials. About one-half were planning to adopt BSCS. The majority reported that BSCS had some influence on their teaching. The data are reported in Table IX.

In Table X the reasons are given by non-BSCS teachers for not adopting BSCS. Lack of funds was stated by 36 per cent, and lack of space was stated by 45 per cent. There were 70 of the 88 teachers, or 80 per cent, who said that BSCS was too hard.

In Table XI data show that non-BSCS teachers had more experience, with 62 per cent teaching over five years, but only 50 per cent BSCS teachers had this much experience. Those using the Special Materials had the fewest and Blue Version teachers had the most semester hours of biology college credit, but non-BSCS teachers averaged fewer hours than BSCS teachers. About 47 per cent of non-BSCS teachers and 54 per cent of BSCS teachers were teaching in schools over 500.

Table XII reports the per cent of slow learner's and college bound students taught, and the average class size in biology. There were slightly more non-BSCS teachers reporting a smaller class size than BSCS teachers.

TABLE VIII

THE RESPONSES OF BSCS TEACHERS OF EACH VERSION TO THE FOLLOWING QUESTIONS CONCERNING BSCS MATERIALS

	NO. OF TEACHERS			SPECIAL
	GREEN	BLUE	YELLOW	MATERIALS
Have you examined the 1968 revised versions?				
Yes	52	25	14	2
What improvements have been made?				
Color photos	3	1	3	-
Labs in the text	16	3	1	-
More details and information	-	-	1	-
Easier to read	-	-	1	-
Better labs	9	-	-	-
Organization and relationships	4	4	1	-
Less chemistry	2	1	-	-
Teaching schedules	-	1	-	-
Graphs	-	-	1	-
Better explanations	-	-	-	1
No improvement	2	1	-	-
What BSCS materials do you use?				
Laboratory blocks	18	17	6	1
BSCS examinations	46	22	10	4
Single Topic Films	56	21	11	3
Research Problems in biology	28	13	8	1
BSCS Technique Films	24	10	5	2
Biology Teacher's Handbook	66	30	21	6
Are you using BSCS complete as written or modified?				
Complete	35	11	11	3
Modified	38	19	14	3

TABLE IX

THE RESPONSES OF NON-BSCS TEACHERS TO THE FOLLOWING QUESTIONS CONCERNING THEIR EXPERIENCE WITH BSCS

The Number of Teachers Responding

Have you ever taught BSCS?	
Yes	15
Are you planning to adopt BSCS?	
Yes	41
No	47
Would you like to adopt BSCS?	
Yes	29
No	14
Have you thoroughly examined the BSCS materials?	
Yes	57
No	31
How has BSCS influenced your biology teaching?	
In no way	38
Have more lab	20
Have more discussion	21
Students do more work on their own	20
In other ways	6

TABLE X

## REASONS GIVEN FOR NOT ADOPTING BSCS BY NON-BSCS TEACHERS

REASON	NUMBER RESPONDING
Too hard	70
Too easy	3
I don't agree with the philosophy	16
Lack of funds	32
Lack of lab space	40
Omits important facts and information	12
Doesn't prepare students for college	6
Other	30
Answers given under Other	
Administration not interested or against it	3
Science supervisor doesn't like it	2
School board won't approve it	2
It doesn't cover all areas of biology	1
The scheduling is too rigid for the teacher	2
Lack of equipment	1
We don't have grouping	1
Other teacher's don't like it	2
Current texts are still in good condition	4
Lab preparation and grading	1
Teachers and training	2
Too small a school here	1
Time	1
Lack of information about it	1
Not practical for average student	2
Slow student needs	1
Student turnover	2

TABLE XI

RESPONSES OF TEACHERS TO THE FOLLOWING QUESTIONS CONCERNING THEIR EXPERIENCE, COLLEGE CREDIT, SIZE OF SCHOOL, AND GRADE LEVEL AT WHICH BIOLOGY IS TAUGHT

	NO. OF TEACHERS RESPONDING				SPECIAL MATERIALS
	NON-BSCS	GREEN	BLUE	YELLOW	
How many years have you taught biology?					
1	4	7	2	1	-
2	12	12	2	-	1
3-5	25	23	6	9	3
6-10	33	19	1	6	2
over 10	26	24	13	7	1
What is your average school enrollment?					
Under 50	1	-	-	-	-
50-100	10	2	3	2	-
101-250	19	4	3	3	-
251-500	10	16	2	3	-
501-1000	24	17	5	7	2
1001-2000	18	16	2	5	2
over 2000	4	16	7	-	3
At what grade is beginning biology taught?					
9	17	15	4	2	1
10	73	56	21	11	7
11	40	32	11	6	3
12	34	27	10	6	3
What is the average semester hours of biology credit you have obtained in college?	46	57	63	59	28

TABLE XII

THE RESPONSES GIVEN BY TEACHERS RETURNING THE QUESTIONNAIRE FOR THE FOLLOWING QUESTIONS CONCERNING CLASS SIZE AND THE TYPE OF STUDENTS ENROLLED

	NON-BSCS	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
How many of your students in your classes are slow learners?					
Less than 10%	21	47	15	9	-
10-25%	24	24	3	8	1
25-50%	5	17	1	2	-
51-75%	2	1	1	1	2
over 75%	1	-	-	-	4
What percent of your students in your classes are college bound?					
Less than 10%	2	-	-	1	3
10-25%	14	5	3	4	2
26-50%	19	38	7	9	1
51-75%	17	44	3	5	1
over 75%	3	11	9	1	-
What is the average class size you have in biology?					
Less than 10	6	4	3	2	1
10-20	9	3	1	1	-
21-25	21	35	6	1	3
26-30	17	42	12	4	3
31-35	4	1	-	2	1
over 35	-	-	-	1	-

Table XIII reports data for BSCS and non-BSCS teachers concerning the science programs in their schools. About one-half of the teachers did not know what science program was used in the elementary schools in their school system. It was also found that few students had inquiry approaches in science prior to biology, and the majority of teachers reported biology to be required.

The amount of time spent in various class activities is reported in Table XIV. Non-BSCS teachers spent more time in lecture and less in lecture and laboratory directed by the manual than BSCS teachers. Special Materials teachers allowed more class time for reading the text and for teacher directed laboratory, but less time for manual directed laboratory than did the other BSCS teachers.

Teachers were asked to evaluate the statements in Part III of the questionnaire, items 1-30 as being more true of BSCS, more true of other biology courses, equally true of both or irrelevant. Results are reported in Table XV. BSCS teachers shared similar opinions with non-BSCS on some items, but differed on others. There was also much disagreement on some of the items among BSCS teachers of different versions.

More Blue Version teachers had negative attitudes toward BSCS. The following are some statements the Blue Version teachers as a group felt more true of BSCS; there was too much math and chemistry, evolution was not treated in a proper perspective; parents did not like BSCS; students did not learn to understand the function

of science in a modern society; it was not orderly and sequential; it was not the best one-year background for students; students did not learn to discover and correct their own errors; it did not fulfill local needs, and problem solving did not become a thinking process in BSCS. Special Materials teachers also felt the parents did not like BSCS.

More Blue and Yellow Version teachers felt the administration did not like BSCS; the text covered too much material; skills and knowledge gained in other courses would be more useful in solving school and daily problems, and fellow biology teachers did not like BSCS. More Yellow and Special Materials teachers felt BSCS to be for college preparatory students, and Special Materials teachers did not feel BSCS was relevant to students.

The majority of Green Version teachers were more positive than the other BSCS teachers. A majority felt the following true of BSCS; evolution was treated in a proper perspective, most teachers did not have adequate training to teach BSCS; students learned the function of science in a modern society; it was the best one-year background for students; skills and knowledge gained would be useful in problem solving; it was relevant to students, and problem solving became a thinking process, not just an exercise.

The majority of non-BSCS teachers also felt most teachers did not have adequate preparation and training to teach BSCS. They also felt students in BSCS learned to discover and correct their own errors; problem solving became a thinking process, and BSCS is a new way of teaching traditional biology.



TABLE XIII

THE RESPONSES OF TEACHERS TO THE FOLLOWING QUESTIONS CONCERNING THE SCIENCE PROGRAM IN THEIR SCHOOL

	NON-BSCS	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
What other inquiry approaches are offered to students?					
IPS	10	12	9	3	2
ESCP	14	15	12	3	1
BSCS	17	72	26	8	5
CHEMS	17	39	18	5	4
PSSC	16	31	12	2	3
CBA	-	4	-	1	-
HPP	-	1	1	-	1
OTHER	16	3	4	1	2
What inquiry approaches are offered to students prior to biology?					
IPS	5	8	7	3	1
ESCP	11	10	9	3	1
OTHER	7	7	2	2	-
Do students take advanced courses in science and what do they take?					
Chemistry	62	69	28	9	6
Physics	32	58	29	9	6
Advanced Biology	16	37	19	4	5
Other	16	14	2	2	1
Is Biology required or highly recommended in your school?					
Required	50	22	10	2	1
Highly recommended	32	31	10	4	2
Neither	1	6	2	6	5
Contrast the type of student in BSCS as compared to other biology courses					
Average	1	17	2	10	-
Above average	1	12	3	3	-
Slow	1	1	-	1	1
What science programs are offered in the elementary school?					
AAAS	2	2	-	2	1
SCIS	4	2	-	1	-
SINGER	12	17	1	2	-
SILVER-BURDETT	9	8	1	2	-
Other	20	19	8	9	2

TABLE XIV

THE AMOUNT OF TIME SPENT IN VARIOUS CLASS ACTIVITIES AS REPORTED BY  
TEACHERS IN PERCENTAGES WHICH ARE AVERAGE FOR THE GROUP

	NON-BSCS	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
Laboratory-teacher directed	13	14	14	16	20
laboratory-manual directed	11	18	18	19	11
laboratory individualized by the student	5	4	6	6	3
lecture	29	21	18	22	17
Discussion	23	20	26	22	20
Reading the text	7	8	6	4	18
Independent reading	3	3	4	5	3
Viewing films	5	7	5	4	7
Other	2	2	2	2	1

TABLE XV

## EVALUATION OF STATEMENTS BY NON-BSCS TEACHERS

	A	B	C
A More true of other courses			
B Equally true of both			
C More true of BSCS			
1. The reading level of the book is too high	4	33	23
2. The biology lab facilities are adequate for the course	25	14	21
3. The administration does not like the course	5	46	9
4. Most students have little trouble in understanding the concepts of the course	23	24	13
5. The teacher must spend too much time preparing for class	1	25	34
6. There is too much math and chemistry in the course	3	31	26
7. Evolution is treated in a proper perspective	7	32	21
8. Most teachers' preparation and training is adequate to enable them to teach the course	42	10	8
9. Students learn to compete with themselves rather than others in the class	3	21	36
10. Class scheduling does not leave enough time for lab	10	21	29
11. Too much living material is called for that is hard to obtain	1	28	31
12. Parents do not like the program	3	54	3
13. Biology is mainly for the college preparatory student	7	37	16
14. The book covers too much material	10	39	11

TABLE XV (continued)

	A	B	C
15. The students learns to understand the function of science in a modern society	7	14	39
16. Equipment is hard to get	3	31	26
17. The presentation of the course material is orderly and sequential	16	26	18
18. It is the best one year background for students	21	21	18
19. Students learn to discover and correct their own errors	3	14	43
20. Local funds will not support the cost of the course	3	30	27
21. Students interest is high	6	38	16
22. There is too much theory involved in the course	14	35	11
23. Skills and knowledge gained will be useful to students in solving both school and daily problems.	9	25	26
24. It is a new way of teaching traditional biology	5	15	40
25. Fellow biology teachers do not like the course	8	43	9
26. The course does not fulfill our local needs	8	38	14
27. Problems solving becomes a thinking process, not just an exercise	3	9	48
28. Students find throught the course that science is most always correct	6	43	11
29. The course has relevance to students because they can identify with the ideas presented	5	29	26
30. The historical aspect of biology presented is helpful to the students in understanding biology	12	28	19

TABLE XV (continued)

EVALUATION OF STATEMENTS BY BSCS TEACHERS TEACHING DIFFERENT VERSIONS			NO. OF TEACHERS RESPONDING									SPECIAL MATERIALS		
			GREEN			BLUE			YELLOW			A	B	C
			A	B	C	A	B	C	A	B	C			
B.	A	More true of other biology courses	12	39	17	17	-	9	7	3	4	3	2	3
	B	Equally true of BSCS and other biology courses	18	14	36	11	7	8	3	3	8	4	-	4
	C	More true of BSCS	20	44	4	-	10	16	-	2	12	1	-	8
1.	The reading level of the book is too high.		17	28	23	8	7	11	3	3	8	2	4	2
2.	The biology lab facilities are adequate for the course		8	28	32	12	2	12	6	-	8	1	1	6
3.	The administration does not like the course		10	46	12	7	2	17	9	3	2	-	3	5
4.	Most students have little trouble in understanding the concepts of the course		3	14	51	19	3	4	7	2	5	5	-	3
5.	The teachers must spend too much time preparing for class													
6.	There is too much math and chemistry in the course													
7.	Evolution is treated in a proper perspective													

TABLE XV (Continued)

B.	GREEN			BLUE			YELLOW			SPECIAL MATERIALS		
	A	B	C	A	B	C	A	B	C	A	B	C
8. Most teachers' preparation and training is adequate to enable them to teach the course	39	15	14	5	8	13	2	7	5	2	4	2
9. Students learn to compete with themselves rather than others in the class	4	30	34	11	2	19	1	2	9	-	-	8
10. Class scheduling does not leave enough time for lab	10	56	2	15	2	9	5	1	8	2	-	6
11. Too much living material is called for that is hard to obtain	5	37	26	7	5	14	8	1	5	3	1	4
12. Parents do not like the program	10	56	2	1	3	23	6	-	8	-	-	8
13. Biology is mainly for the college preparatory student	13	45	10	10	6	10	-	3	11	2	-	6
14. The book covers too much material	13	43	12	9	2	15	3	1	10	2	1	5
15. The students learn to understand the function of science in a modern society	5	11	51	20	1	5	4	2	8	5	0	2
16. Equipment is hard to get	7	46	15	7	2	15	4	3	8	0	-	8
17. The presentation of the course material is orderly and sequential	11	24	33	20	1	5	6	3	4	3	0	4
18. It is the best one year background for students	11	9	48	23	2	1	2	4	8	6	-	2
19. Students learn to discover and correct their own errors	4	23	41	17	1	8	7	1	5	6	-	2

TABLE XV (continued)

	GREEN			BLUE			YELLOW			SPECIAL MATERIALS		
	A	B	C	A	B	C	A	B	C	A	B	C
20. Local funds will not support the cost of the course	5	54	9	6	2	18	2	1	11	-	0	8
21. Student interest is high	5	27	36	18	2	6	3	1	10	2	0	7
22. There is too much theory involved in the course	17	38	13	12	3	11	3	4	7	1	5	3
23. Skills and knowledge gained will be useful to students in solving both school and daily problems	3	19	46	14	1	11	8	1	5	8	-	0
24. It is a new way of teaching traditional biology	12	24	32	10	9	7	6	2	6	4	-	4
25. Fellow biology teachers do not like the course	18	43	7	1	11	14	4	-	10	2	0	5
26. The course does not fulfill our local needs	26	35	7	5	6	15	7	3	4	-	3	4
27. Problem solving becomes a thinking process, not just an exercise.	1	12	55	27	-	1	12	-	2	7	-	1
28. Students find through the course that science is most always correct	14	40	14	6	7	13	2	2	10	1	-	7
29. The course has relevance to students because they can identify with the ideas presented	5	17	46	12	1	13	-	2	12	8	-	-
30. The historical aspect of biology presented is helpful to students in understanding biology	6	33	29	16	2	8	5	3	6	2	1	5

### Correlation.

There were 179 questionnaires used in the correlation. The others returned did not answer all the questions to be used in the computer program, and, therefore, could not be used. Correlations obtained which were significant for the group are discussed below.

Non-BSCS teachers who were planning to adopt BSCS had some expectations for BSCS which were higher than those realized by teachers already using the BSCS approach. Results are reported in Table XVI and are significant at the 0.05 level. Teachers planning to adopt BSCS more often felt student interest was high in BSCS and evolution was treated in a proper perspective than did experienced BSCS teachers.

Correlations significant at the 0.05 level are also given in Table XVI for teachers of each BSCS version. Positive correlations mean that they felt the statement more true of BSCS, and negative correlations mean they felt the statement more true of other biology courses. Blue and Yellow Version teachers agreed the most frequently in their evaluation, and Green Version teachers often opposed them in evaluation. Positive correlations were produced for Blue Version teachers with the following; the reading level of the book was too high, there was too much theory in the course, and biology was mainly for the college preparatory student. Positive correlations were found for Yellow Version teachers with; there was too much math and chemistry in the course; fellow biology teachers did not like BSCS, and the course did not fulfill local needs. Green Version teachers had positive



correlations with students learned to learned to compete with themselves rather than others in BSCS, and the course was relevant to students.

Yellow Version teachers had negative correlations with BSCS on the following; the course was relevant to students, and student interest was high. Green Version teachers had negative correlations with the reading level of the book was too high, there was too much math and chemistry, biology was mainly for the college preparatory students, and the course did not fulfill our local needs.

Table XVII reports correlations of BSCS teachers with items which are significant at the 0.01 level. Teaching BSCS correlates positively and significantly with enrollment of the school and the teacher's hours in biology.

TABLE XVI

EVALUATION OF QUESTIONS FOR NON BSCS TEACHERS PLANNING TO ADOPT BSCS AND THOSE ALREADY TEACHING BSCS USING CORRELATION COEFFICIENTS AS COMPARISON

Correlations are significant at the 0.05 level which are at least 0.26 for non-BSCS and 0.17 for BSCS.

Positive correlation indicate the statement is felt to be more true of BSCS. Negative correlations indicate the statement is felt to be more true of other biology courses.

A.

	PLANNING TO ADOPT	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
Evolution is treated in a proper perspective	+0.3092	+0.0169	+0.0508	-0.0227	+0.0073
Equipment is hard to get	-0.2686	-0.0859	+0.0186	+0.1298	+0.0073
Local funds will not support the cost of the course	-0.2844	+0.0464	+0.390	-0.0424	+0.0251
Student interest is high	+0.4100	-0.0512	+0.0965	+0.2176	-0.0580
There is too much theory involved in the course	-0.4217	-0.1430	+0.2662	+0.0154	-0.1640

TABLE XVI (continued)

B.	GREEN	BLUE	YELLOW	SPECIAL MATERIALS
The reading level of the books is too high	-0.2257	+0.222	+0.1563	+0.0224
There is too much math and chemistry in the course	-0.2752	+0.1303	+0.3734	-0.1873
Students learn to compete with them- selves rather than others in the class	+0.2266	+0.0619	-0.1416	-0.0135
Biology is mainly for the college prepara- tory student	-0.3131	+0.2559	+0.1919	+0.0106
It is the best one year background for students	+0.0490	+0.0706	-0.2281	+0.0678
Fellow biology teach- ers do not like the course	-0.0545	-0.1108	+0.2197	-0.0036
The course does not fulfill our local needs	-0.2488	+0.0814	+0.2587	+0.1031
The course has relevance to students because they can identify with the ideas presented	+0.2618	+0.1718	-0.2556	+0.1533

TABLE XVII

CORRELATION COEFFICIENTS OBTAINED FOR BSCS TEACHERS WITH QUESTIONS BELOW

Correlations of 0.20 are significant at the 0.01 level

	BSCS TEACHERS
School enrollment	+0.2262
College semester hours of biology credit	+0.2318
the administration does not like the course	-0.2730
Evolution is treated in a proper perspective	+0.3444
Presentation of materials of the course is orderly and sequential	+0.2409
It is best one year background for students	+0.3282
Local funds will not support the cost	-0.3323
student interest is high	+0.2003
Skills and knowledge gained will be useful to student insolving both school and daily problems	+0.2350
It is a new way of teaching traditional biology	-0.2085

Positive correlation indicate the statement is felt to be more true of BSCS and negative correlations indicate they felt the statement to be more true of other biology approaches

## CHAPTER V

### CONCLUSIONS AND IMPLICATIONS

There were five stated purposes of this study. They were to (1) determine if there is a difference in attitude toward BSCS by those teaching BSCS compared to those not teaching BSCS in Kansas; (2) determine some factors that are hindering BSCS adoption in Kansas; (3) learn what ways BSCS is being implemented and what materials are being used in Kansas; (4) determine some criticisms that teachers have of BSCS in Kansas; (5) determine differing characteristics for BSCS and non-BSCS teachers in Kansas.

Some difference in attitude about BSCS was noted for BSCS and non-BSCS teachers. A larger percentage (40) of non-BSCS teachers thought the reading level of BSCS was too high, and students might have trouble in understanding some of the concepts of BSCS. Many BSCS (50 per cent) and non-BSCS (57 per cent) teachers thought the teacher spent too much time in preparation for class in BSCS. There were 87 per cent non-BSCS and 73 per cent BSCS teachers who felt teachers were more prepared to teach traditional courses than BSCS. A large percentage of BSCS (51) thought student interest to be high in BSCS, but only a small percent (27) of non-BSCS teachers felt this. There were 66 per cent of non-BSCS and 53 per cent of BSCS teachers who said BSCS encouraged development of skills and knowledge to be used in solving problems.

More non-BSCS teachers (66 per cent) thought BSCS was a new way of teaching traditional biology, but many (42 per cent) BSCS teachers also said this. BSCS is supposed to be a completely new approach emphasizing inquiry and is definitely not intended to be traditional. There were only 18 per cent of the non-BSCS teachers who said they did not agree with the BSCS philosophy, however, many of these teachers may not fully understand what the BSCS philosophy implies.

Non-BSCS teachers planning to adopt BSCS had positive correlations significant at the 0.05 level. A correlation of 0.3092 was found for evolution is treated in a proper perspective in BSCS, and 0.4100 for student interest is high in BSCS. These are higher than correlations obtained for experienced BSCS teachers.

As a general rule non-BSCS teachers were often more diverse in their evaluation which was probably due to their greater heterogeneity in courses taught. The Green Version teachers appeared to be the most satisfied with the BSCS approach. Blue and Yellow Version teachers felt that BSCS was often not the most desirable for achieving certain outcomes. Special materials teachers were often negative of BSCS too. Over one-half of the BSCS teachers were using the Green Version which weighted the sample of BSCS teachers heavily in favor of the Green Version teachers. The fact that there are more Green Version Teachers in itself may indicate a general attitude toward the BSCS program and the different versions in the state of Kansas.

Some factors hindering adoption of BSCS are closely linked to the financial situation of the school. Lack of funds by 35% and laboratory facilities by 45% of those teachers reporting were stated as being important in preventing adoption. Many non-BSCS teachers (80 per cent) felt the BSCS program was too hard. This could be due to the difference of approach and the emphasis on areas such as chemistry, or from a reported higher reading level of the BSCS texts. Obtaining approval of the school board or the supervisor was also stated as a main hinderance. Since there were only 18 per cent of the non-BSCS teachers who said they did not agree with the philosophy, this may give an indication that there are other influences operating to prevent BSCS adoption.

BSCS is reported to be implemented in nearly the same way it was written according to teachers reporting in this study. About one-half of the BSCS teachers had made modifications including mostly addition or deletion of material. A few special materials teachers reported that the book was too hard, and they were using other texts. One Blue Version teacher was using it with a chemistry course to make a combined two hour course. Some teachers reporting the use of BSCS completely as it was written have probably made some modifications nearer to traditional courses, but did not state this. This can be supported by the fact that a high percentage of the class time was reported by BSCS teachers to be devoted to lecture, and about the same amount of time was devoted to laboratory work as the non-BSCS teachers. The

supplementary materials for BSCS were widely used by BSCS teachers. The Biology Teachers' Handbook and the Single Topic Films were the most frequently reported supplements used.

Criticisms of BSCS were largely concerned with the content and laboratory exercises. The text was often reported being too hard to read and gain concepts, and the reading level itself was also reported high by some teachers. Lack of student background and consequent problems developing from this in the course were mentioned by many BSCS teachers. Students apparently had trouble in thinking and working on their own.

One differentiating factor for BSCS teachers and non-BSCS teachers was the size of school in which they taught. BSCS teachers in general taught in larger schools and non-BSCS teachers were more often teaching in smaller schools. There were many exceptions, however. BSCS teachers as a group reported having more college bound students in their classes than non-BSCS teachers. They also had smaller classes, but this is likely a function of the smaller school size for non-BSCS teachers. Non-BSCS teachers reported spending a larger percentage of class time in lecture than BSCS teachers. They also allotted less time to manual directed laboratory, but spent about the same amount of time in teacher directed laboratory as BSCS teachers. BSCS teachers had slightly less teaching experience and more hours in biology.



### Implications.

It appears from this study that BSCS has been widely used in the state of Kansas, and the Green Version has been most often used. Those teaching the Green Version seem to be the most satisfied with BSCS. Although, most BSCS teachers had some type of formal training for BSCS, it appears doubtful that they all use the BSCS approach completely without slipping back into the old style of traditional biology. Since teachers and students are accustomed to this traditional style, it is easier to teach this way. By the time students reach high school it may be nearly too late to start an inquiry approach because of the difficulty of reconditioning them into learning on their own in the classroom. Perhaps more inquiry type, or thinking courses should be implemented at an earlier level if courses such as BSCS will be in use in the high schools.

More Green Version teachers felt that teachers were generally not adequately trained to teach BSCS without further preparation. Since the Green Version teachers also seemed the most satisfied with BSCS, the other teachers in BSCS may be having problems because they don't use a totally different approach in teaching. It could also be that BSCS teachers using the Green Version find it better to use with all ability students.

It appears that small schools have more difficulty in affording the cost of BSCS and providing the facilities in which it can be

adequately taught. Teachers with more hours were in larger schools and larger schools more often taught BSCS. Perhaps having more hours in biology would enable a teacher to be better qualified to teach BSCS.

It would be interesting and of merit to study further the teachers questioned in this study to determine how they are actually using BSCS, why they have some of the attitudes they do, the community attitude toward education and its influence on BSCS, and how their students react to the BSCS approach. By delving deeper into the use of BSCS in Kansas, we could discover many of the problems and ways BSCS and biology might be improved.

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## BIBLIOGRAPHY

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## APPENDIX A

February 17, 1969

Dear Teacher:

The attached questionnaire about the Biological Sciences Curriculum Study is part of a state wide study being carried on cooperatively by Mr. Jan Holman, Science Consultant, at the State Department of Public Instruction and Kansas State University College of Education. This questionnaire is a pilot study to help in setting up the acutal research. The purpose of the study is to determine the attitude toward BSCS, how BSCS has affected teachers even though they are not teaching it, and why some teachers have negative attitudes about BSCS. The results will be useful in guiding the development of science in Kansas and in educating teachers and future teachers.

We are particularly desirous of obtaining your responses because of your experience in teaching BSCS. Please fill out the questionnaire and make comments on the questions as you see fit. We would like you to give us an over-all impression of the questionnaire and ways in which you feel it might be improved.

Your prompt return of the questionnaire will be appreciated because we cannot carry out the study until all the questionnaires have been returned and the results analyzed. Please complete it and return it in the stamped self-addressed envelop by February 24, 1969. Thank you for your cooperation.

Sincerely,

Jackie Splitter

## APPENDIX B

## QUESTIONNAIRE

1. How many years have you taught biology? ☐ a. 1  
☐ b. 2  
☐ c. 3-5  
☐ d. 6-10  
☐ e. over 10
2. How many years have you taught BSCS? ☐ a. 1  
☐ b. 2  
☐ c. 3  
☐ d. more than 3
3. What is your school enrollment? ☐ a. under 50  
☐ b. 50-100  
☐ c. 101-250  
☐ d. 251-500  
☐ e. 501-1000  
☐ f. 1001-2000  
☐ g. over 2000
4. How many semester hours of college credit do you have in biology?
5. What year did you last gain college credit hours?
6. What training for BSCS have you had? ☐ a. NSF  
☐ b. In-service training  
☐ c. Workshop  
☐ d. Other-specify
7. What grade level do you teach? ☐ a. 9  
☐ b. 10  
☐ c. 11  
☐ d. 12
8. What version do you use? ☐ a. Green  
☐ b. Yellow  
☐ c. Blue
9. Why did you choose this version?
10. If you are teaching a second year course are you using the BSCS techniques even though you are not using the prepared second year course?



11. Do you have ability grouping in your classes? If you do, does each class use the same version or do they use other materials?
12. What per cent of the students in your BSCS classes are college bound? ☐ a. less than 10  
☐ b. 10-25  
☐ c. 26-50  
☐ d. 51-75  
☐ e. Over 75
13. What per cent of your BSCS students are slow learners?  
☐ a. less than 10  
☐ b. 10-25  
☐ c. 26-50  
☐ d. over 50
14. How many students do you have in your BSCS classes? (Total)  
☐ a. 20  
☐ b. 21-60  
☐ c. 61-100  
☐ d. 101-150  
☐ e. over 150
15. How many BSCS classes do you have? How many biology classes total?
16. What is the major strength of your version?
17. What is the major weakness of your version?
18. What do you feel is the teacher's role in teaching BSCS?
19. In what ways are students experiencing difficulties in BSCS?
20. If you have examined the revised versions, how do you feel they have been improved?
21. Are you using BSCS complete as it has been written or have you modified it?
22. Is biology either required or highly recommended as a subject to students?

23. Check the supplementary materials that you use.
- ☐ a. Laboratory blocks
  - ☐ b. BSCS examinations
  - ☐ c. Single Topic Films
  - ☐ d. BSCS Technique Films
  - ☐ e. BSCS Pamphlet Series
  - ☐ f. Research Problems  
in Biology
  - ☐ g. Biology Teacher's  
Handbook by Schwab
24. At what grade level is the beginning biology course taught?
25. Have students had ESCP or some other "inquiry approach" course prior to biology?
26. Does your school offer CHEMS or CBA?
27. Is there a significant change in enrollment since BSCS in any of the sciences? If so, what science and when did it occur?
28. What percentage of your students take chemistry?  
What percentage of your students take physics?  
What percentage of your students take advanced biology?
29. Would you list the approximate percentage of time you would estimate the class spends in the following activities?
- ☐ a. Laboratory-independent study
  - ☐ b. Lecture
  - ☐ c. Viewing films
  - ☐ d. Laboratory-teacher or lab manual directed
  - ☐ e. Reading text
  - ☐ f. Reading-independent
  - ☐ g. Other (specify if possible)

Answer the following questions using the following scoring system; +, if you think the statement is true of BSCS more than other biology materials; -, if you think it is more true of other biology materials than BSCS; and 0, if you feel they are both equal or that the statement is irrelevant to both.

- ☐ 1. The reading level of the book is too high.
- ☐ 2. The biology lab facilities are adequate for the course.
- ☐ 3. The administration does not like the course.
- ☐ 4. Most students have little trouble in understanding the concepts of the course.
- ☐ 5. The teacher must spend too much time preparing for class.
- ☐ 6. There is too much math and chemistry in the course.
- ☐ 7. Evolution is treated in a proper perspective.
- ☐ 8. Most teachers' preparation and training is adequate to enable them to teach the course.
- ☐ 9. Students learn to compete with themselves rather than others in the class.
- ☐ 10. Class scheduling does not leave enough time for lab.
- ☐ 11. Too much living material is called for that is hard to obtain.
- ☐ 12. Parents do not like the program.
- ☐ 13. Biology is mainly for the college preparatory student.
- ☐ 14. The book covers too much material.
- ☐ 15. The student learns to understand the function of science in a modern society.
- ☐ 16. Equipment is hard to get.
- ☐ 17. The presentation of the course materials is orderly and sequential.
- ☐ 18. It is the best one year background for students.
- ☐ 19. Students interest is high.
- ☐ 20. Students learn to discover and correct their own errors.
- ☐ 21. Local funds will not support the cost of the course.
- ☐ 22. There is too much theory involved in the course.
- ☐ 23. Skills and knowledge gained will be useful to students in solving both school and daily problems.
- ☐ 24. It is a new way of teaching traditional biology.
- ☐ 25. Fellow biology teachers do not like the course.
- ☐ 26. The course does not fulfill our local needs.
- ☐ 27. Problem solving becomes a thinking process, not just an exercise.
- ☐ 28. Students find through the course that science is most always correct.
- ☐ 29. The course has relevance to students because they can identify with the ideas presented.
- ☐ 30. The historical aspect of biology presented is helpful to the student in understanding biology.

## APPENDIX C

## PART I--FOR BSCS TEACHERS ONLY

1. How many years have you taught BSCS? a. 1\_\_\_\_ b. 2\_\_\_\_ c. 3\_\_\_\_  
d. over 3\_\_\_\_
2. Will you use BSCS next year? a. yes\_\_\_\_ b. no\_\_\_\_
3. What formal training for BSCS have you had? a. NSF\_\_\_\_  
b. In-service\_\_\_\_ c. Workshop\_\_\_\_ d. Other\_\_\_\_ e. None\_\_\_\_
4. What version do you use? a. Green\_\_\_\_ b. Blue\_\_\_\_ c. Yellow\_\_\_\_  
d. Slow Learner's\_\_\_\_
5. Did you choose this version yourself? Why did you choose it?
6. Are you teaching a second year course? If so, do you use BSCS techniques even though you are not using the prepared second year course?
7. Do you have ability grouping in your classes? If so, does each class use the same version or do they use different materials?
8. How many BSCS classes do you teach? How many biology classes do you teach?
9. What is the major strength of your version?
10. What is the major weakness of your version?
11. What do you feel the teacher's role is in teaching BSCS?
12. In what ways are students experiencing difficulties in BSCS?
13. Have you examined the 1968 revised versions? How have they been improved?
14. Is there a significant change in enrollment in any of the sciences since BSCS? If so, in what science and when did it occur?
15. Are you using BSCS complete as it is written, or have you modified it? How have you modified it?

16. Check the supplementary materials that you use.

- ☐ a. Laboratory blocks
- ☐ b. BSCS examinations
- ☐ c. Single topic films
- ☐ d. BSCS technique films
- ☐ e. Research Problems in Biology
- ☐ f. Biology Teacher's Handbook

PART II--FOR NON BSCS TEACHERS ONLY

1. Have you ever taught BSCS? a. yes ☐ b. no ☐
2. Have you thoroughly examined the BSCS materials? a. yes ☐  
b. no ☐
3. Are you planning to adopt BSCS? a. yes ☐ b. no ☐  
Would you like to adopt it?
4. What influence has BSCS had on your teaching? a. none ☐  
b. more lab ☐ c. students work more on own ☐ d. more  
discussion ☐ e. other (specify) ☐
5. Are there some specific reasons for not adopting the program?  
Check, if so. a. too hard ☐ b. too easy ☐ c. I don't agree  
with the philosophy ☐ d. lack of funds ☐ e. lack of lab  
space ☐ f. omits important facts and information ☐ g. doesn't  
prepare students for college ☐ h. other (specify) ☐

PART III--FOR BOTH BSCS AND NON-BSCS TEACHERS

1. How many years have you taught biology?  
a. 1 ☐ b. 2 ☐ c. 3-5 ☐ d. 6-10 ☐ e. over 10 ☐
2. What is your school enrollment? a. under 50 ☐ b. 50-100 ☐  
c. 101-250 ☐ d. 251-500 ☐ e. 501-1000 ☐ f. 1001-2000 ☐  
g. over 2000 ☐
3. How many semester hours of college credit do you have in biology?
4. What year did you last gain college credit hours in biology?

5. What grade levels do you teach? a. 9\_\_\_\_ b. 10\_\_\_\_ c. 11\_\_\_\_  
d. 12\_\_\_\_
6. What per cent of the students in your classes are college bound?  
a. less than 10\_\_\_\_ b. 10-25\_\_\_\_ c. 26-50\_\_\_\_ d. 51-75\_\_\_\_  
e. over 75\_\_\_\_
7. What per cent of the students in your classes are classified as  
slow learners? a. less than 10\_\_\_\_ b. 10-25\_\_\_\_ c. 26-50\_\_\_\_  
d. 50-75\_\_\_\_ e. over 75\_\_\_\_
8. What is the average class size in biology? a. less than 10\_\_\_\_  
b. 10-20\_\_\_\_ c. 20-25\_\_\_\_ d. 26-30\_\_\_\_ e. 31-35\_\_\_\_ f. over 35\_\_\_\_
9. At what grade level is beginning biology taught? a. 9\_\_\_\_ b. 10\_\_\_\_  
c. 11\_\_\_\_ d. 12\_\_\_\_
10. Which of the following are offered to the students? a. IPS\_\_\_\_  
b. ESCP\_\_\_\_ c. BSCS\_\_\_\_ d. CHEMS\_\_\_\_ e. CBA\_\_\_\_ f. PSSC\_\_\_\_  
g. HPP\_\_\_\_ h. Other\_\_\_\_
11. Prior to biology have students had a. IPS\_\_\_\_ b. ESCP\_\_\_\_  
c. another inquiry approach\_\_\_\_
12. What per cent of the biology students take other advanced science  
courses? Do they take a. Chemistry\_\_\_\_ b. Physics\_\_\_\_ c. Advance  
Biology\_\_\_\_ d. Other\_\_\_\_?
13. Is biology a. required\_\_\_\_ b. highly recommended\_\_\_\_ c. neither\_\_?
14. Which science programs are offered in the elementary school?  
a. AAAS\_\_\_\_ b. SCIS\_\_\_\_ c. Singer\_\_\_\_ d. Silver-Burdett\_\_\_\_  
e. Other\_\_\_\_
15. Is there a contrast in students enrolling in BSCS and other biology  
courses in your school? If so, check BSCS student type.  
a. average\_\_\_\_ b. above average\_\_\_\_ c. slow\_\_\_\_
16. Estimate the approximate percentage of time devoted to each of  
the following.
 

____ a. Laboratory-teacher directed	____ f. reading the text
____ b. Laboratory-manual directed	____ g. Independent reading
____ c. Laboratory-individualized by the student	____ h. Viewing films
____ d. Lecture	____ i. Other
____ e. Discussion	

Answer the following questions using the following scoring system; +, if you think the statement is true of BSCS more than other biology materials; -, if you think it is more true of other biology materials than BSCS; and 0, if you feel they are both equal or that the statement is irrelevant to both.

- ☐ 1. The reading level of the book is too high.
- ☐ 2. The biology lab facilities are adequate for the course.
- ☐ 3. The administration does not like the course.
- ☐ 4. Most students have little trouble in understanding the concepts of the course.
- ☐ 5. The teacher must spend too much time preparing for class.
- ☐ 6. There is too much math and chemistry in the course.
- ☐ 7. Evolution is treated in a proper perspective
- ☐ 8. Most teachers' preparation and training is adequate to enable them to teach the course.
- ☐ 9. Students learn to compete with themselves rather than others in the class.
- ☐ 10. Class scheduling does not leave enough time for lab.
- ☐ 11. Too much living material is called for that is hard to obtain.
- ☐ 12. Parents do not like the program.
- ☐ 13. Biology is mainly for the college preparatory student.
- ☐ 14. The book covers too much material.
- ☐ 15. The student learns to understand the function of science in a modern society.
- ☐ 16. Equipment is hard to get.
- ☐ 17. The presentation of the course materials is orderly and sequential.
- ☐ 18. It is the best one year background for students.
- ☐ 19. Students learn to discover and correct their own errors.
- ☐ 20. Local funds will not support the cost of the course.
- ☐ 21. Students interest is high.
- ☐ 22. There is too much theory involved in the course.
- ☐ 23. Skills and knowledge gained will be useful to students in solving both school and daily problems.
- ☐ 24. It is a new way of teaching traditional biology.
- ☐ 25. Fellow biology teachers do not like the course.
- ☐ 26. The course does not fulfill our local needs.
- ☐ 27. Problem solving becomes a thinking process, not just an exercise.
- ☐ 28. Students find through the course that science is most always correct.
- ☐ 29. The course has relevance to students because they can identify with the ideas presented.
- ☐ 30. The historical aspect of biology presented is helpful to the student in understanding biology.



## APPENDIX D

March 11, 1969

Dear Teacher:

This enclosed questionnaire is part of a state wide study of the Biological Sciences Curriculum Study being carried out cooperatively by Mr. Jan Holman, Science Consultant, at the State Department of Public Instruction and Dr. Arnold Moore, Professor, College of Education at Kansas State University. The purpose of the study is to determine teachers' attitudes toward BSCS, how BSCS has affected teachers whether or not they are using it, and reasons for positive or negative attitudes toward BSCS. The results will be useful in guiding the development of science teaching in Kansas and in educating teachers and future teachers.

The questionnaire is in three parts. The first part is for BSCS teachers only, the second for non-BSCS teachers, and the third for both BSCS and non-BSCS teachers. Feel free to answer the questions as you feel they should be answered and add comments if you feel that they are necessary or helpful.

Your prompt return of the questionnaire will be appreciated because we need all questionnaires returned before the results can be analyzed successfully. Please complete it and return it in the stamped self-addressed envelope by March 17, 1969. Thank you for your cooperation and help in making the study a success.

Sincerely,

Jackie Splitter  
Kansas State University  
Graduate Student

## APPENDIX E

March 18, 1969

Dear Teacher:

The enclosed questionnaire is part of a state wide study of the Biological Sciences Curriculum Study being carried out cooperatively by Mr. Jan Holman, Science Consultant, at the State Department of Public Instruction and Dr. Arnold J. Moore, Professor, College of Education at Kansas State University. The purpose of the study is to determine teachers' attitudes toward BSCS, how BSCS has affected teachers whether or not they are using it, and reasons for positive or negative attitudes toward BSCS. The results will be useful in guiding the development of science teaching in Kansas and in educating teachers and future teachers.

The questionnaire is in three parts. The first part is for BSCS teachers only, the second for non-BSCS teachers, and the third for both BSCS and non-BSCS teachers. Feel free to answer the questions as you feel they should be answered and add comments if you feel that they are necessary or helpful.

Your prompt return of the questionnaire will be appreciated because we need all questionnaires returned before the results can be analyzed successfully. Please complete it and return it in the stamped self-addressed envelope by March 24, 1969. Thank you for your cooperation and help in making the study a success.

Sincerely,

Jackie Splitter  
Kansas State University  
Graduate Student

A STUDY OF BSCS IN THE STATE OF KANSAS 1968-1969

by

JACKIE LEE SPLITTER

B. A., Kansas State University, 1968

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AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1969

## ABSTRACT

A study of BSCS in the state of Kansas was done to achieve the following five objectives; (1) to determine if there is a difference in attitude toward BSCS by those teaching BSCS compared to those not teaching it in Kansas; (2) to determine some factors that are hindering BSCS adoption in Kansas; (3) to learn what ways BSCS is being implemented and what materials are used; (4) to discover some criticisms that teachers have of BSCS in Kansas; (5) to determine some factors which differ for BSCS and non-BSCS teachers.

A questionnaire was sent to 190 BSCS teachers and 93 non-BSCS teachers to obtain information and 87 per cent were returned. All items on the questionnaire were evaluated descriptively and some were correlated.

Non-BSCS teachers were diverse in their responses, but many felt BSCS was too hard. Many were favorable and those planning to adopt BSCS expected high student interest in BSCS. Green Version teachers favored BSCS more than other BSCS teachers. Over one-half of the BSCS teachers were teaching the Green Version and weighted the responses for the BSCS teachers as a group. Blue, Yellow and Slow Learner's Version teachers found BSCS less satisfactory than did the Green Version teachers.

Major hindering factors to adoption of BSCS were lack of funds and facilities, and many felt BSCS was too hard. Few said they did not adopt BSCS because they did not agree with the philosophy.

BSCS was reported implemented in nearly the same way that it was written by about one-half of the BSCS teachers. Few had made revisions, but some Slow Learner's Version teachers were using other books in place of the BSCS text.

Criticisms of BSCS were concerned mainly with the text and laboratory exercises being hard, vague, or impossible to do. The students were having problems in thinking, reading, and working on their own.

BSCS teachers taught in larger schools, had more college hours in biology, and reported having more college bound students. Non-BSCS teachers spent more time in lecture, and less time in manual directed laboratory than BSCS teachers.