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# THE STATUS OF SCIENCE COURSE OFFERINGS AND TEACHER PERCEPTIONS OF SCIENCE EDUCATION IN PUBLIC SCHOOL SYSTEMS OF FOUR SELECTED COUNTIES IN EAST TENNESSEE

A Thesis

Presented for the

Specialist in Education

Degree

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## ABSTRACT

The purpose of this study was to determine the status of science course offerings and the teacher perceptions of science education in the four selected counties of East Tennessee.

The review of the related literature showed that studies had been conducted in many states to determine the status of science course offerings, which led to certain improvements in the quality of science education. No recent information has been found on the current status of science programs and the preparation of science teachers in Tennessee. Neither could any studies be located on the perceptions of the teachers on science education in Tennessee; thus, there existed a need for an assessment.

A direct-mail questionnaire was the primary method used in this study. The questionnaire was administered to the current science teachers of grades 7 through 12 in all of the public schools of the four selected counties of East Tennessee. A total response of 38 was received out of a study population of 71 teachers, giving a 53.5 percent response to the study. Of the 38 schools in the study area, 26 schools responded for 68.4 percent.

Analysis of the data was made in terms of frequencies, percentages and totals. The data collected in this study were reported by the descriptive survey method, accompanied

by tables, charts and graphs. The following summary presents the principal findings of the study.

Since more males responded, the average science teacher of this study area is a male between the ages of 21-30 years with a BA/BS degree in Education with science certification and 4 to 6 years' teaching experience. The typical female teacher is between 51-60 years of age with 13 plus years' experience and the same degree and certification achievement levels as the male teachers.

The teachers of the study area are teaching primarily in the elementary and middle school range of grades 7 and 8. Most of the teachers surveyed taught in schools that are located in rural settings.

The science course most frequently offered is general science offered yearly with no ability or difficulty levels and no prerequisites for the science courses. The courses are offered as requirements rather than as electives.

The science programs offered by the schools are primarily of local origin based heavily on the textbook used in either a 6 or 9 weeks' segment. The NSF program material has made little impact on this region in the past, and the future plans of the region are based on the state textbook adoption plans.

The descriptive information was subdivided into four sections: teacher preparation, special programs,

instructional practices and credit. There appeared to be no special requirements for who taught advanced science courses, but most of the teachers felt the position should go to the best educated member of the staff. The special science programs such as an outdoor facility or nature trail were not widely used. At the time of the study, other special programs such as mainstreaming or IEP had made little impact in the study area. Finally, the teachers were in favor of no prerequisites for taking science courses. The instructional practices in science were generally found to be conservative in nature. The teachers favored an emphasis on values but not to the point of establishing a separate course, and the same was true of career education. They were in favor of more parental participation and felt this participation could broaden the scope of discussion of controversial topics. Teachers and their students did take advantage of science research by entering competitions. They did not feel that requiring research was the best way to achieve participation in science fairs, nor did they require research in order to receive an A grade. Teachers did not require formal research assignments in the advanced science classes. The teachers felt that the use of more practical material and nontechnical material would increase the appeal of science.

The information from the survey could be used by the universities and colleges in graduate level courses

at times and in places that are most convenient for teacher retraining. Courses should also be available at the undergraduate level concerning similar information to that in the graduate program in order to reach both populations of teachers. The course information should emphasize more practical and nontechnical material and should give experience in new techniques in the area of science education as the reporting teachers perceive a need for this information.

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# CHAPTER I

## INTRODUCTION

Currently there seems to be in the nation a genuine concern about what seems to be a decline in interest in science and student enrollment in science courses. The general concern (Bindle, 1978; Gardner, 1978) is reflected by a decrease in the number of science programs offered since the 1959 National Science Foundation (NSF) report as expressed by Atkinson (1977). With the decreased interest in science, there also is a concern about the source of our future supply of scientists. Additional concerns have focused on the question as to whether or not students of science are receiving adequate training in their field to be employable! There also is continuing apprehension over the availability of jobs for the trainees in science.

Atkinson (1977) in reviewing the NSF report of 1959 found a shortage of scientists to fill the labor market's demand, and of those trained, inadequate instruction due to curricula obsolescence and poorly prepared instructors led to student discouragement. The NSF in the late 1950's planned to increase the number of Ph.D.'s in the science field and to stimulate the development of scientific talent.

By 1971, the NSF report predicted an excess of scientists and engineers. Dodle and Scholock found the

quality and variety of those trained to be inadequate by stating (Cooper, 1973, p. 25), "Teacher education has not kept pace with today's schools, and the gap between the present requirements and existing programs continues to increase." There were also problems of inadequate understanding of science by nonscientists. The NSF report proposed to support science and other programs in education through research and development related to national need using no long-term funding and implementing programs through management objectives. In 1976, the NSF model for science (Atkinson, 1977) still predicted an excess of scientists and engineers. New emphasis was to be placed in the future on equity of opportunity for minorities. Efficiency was a new key word in education and was to be achieved through "Head-to-Head" competition, through equity in scientific targeting and finally, by increasing science libraries.

Atkinson (1977) has observed that in the 1980's, schools would be faced with a need to seek new sources of students, to change their offerings and to overcome the deficiencies of an aging faculty. The new individuals hired for teaching positions would be few, and there would be weak employment for Ph.D.'s. Atkinson also predicted that some schools would be closing or combining facilities and that there would be a shift to focus on declining enrollments and budgets. To economize, the new staff

members would be sought among the second best graduates in the Master's and Ph.D.'s levels for any new positions to be filled. There would be an increase in public demand for accountability for performance by the faculty.

## I. PURPOSE OF THE STUDY

The problem to be examined is to obtain up-to-date descriptive information regarding the science courses offered and the preparation and professional characteristics of science teachers in selected counties of a region of East Tennessee, as perceived by practicing science teachers.

Issues to be examined in this study include a descriptive analysis of the secondary school (grades 7 through 12) science programs and the competencies of the science teachers concerning selected aspects of the science curriculum in the four county study area of East Tennessee. Specific questions to be answered are:

(1) What are the perceptions of secondary science teachers of the four selected counties of East Tennessee regarding the qualifications and preparations of the science teaching staff?

(2) What are the perceptions of secondary science teachers in the region concerning the numbers, levels and variety of science course offerings in their schools?

(3) What are the perceptions of the secondary science teachers in the region regarding the enrollment trends in

the science courses including the NSF science programs?

(4) What are the perceptions of secondary science teachers regarding the appropriateness of subject matter content in the science courses?

(5) What are the perceptions of secondary science teachers regarding the characteristics of instructional practices in the science courses?

## II. THE IMPORTANCE OF THE STUDY

Several problems have been identified concerning the importance of the science teaching and science curricula and teacher preparation. One is the on-going effort to collect general data concerning secondary science curriculum and teacher perceptions of the curricula. Atkinson (1977) reported data that had indicated a decline since 1959 in the interest in science courses by students. Bindel reported (1978) a subsequent lessening of demand for additional science teachers. In recent years many schools have dropped the number of science offerings. Demands for science personnel have decreased and the personnel available seem to be less qualified now as compared to previous years (Atkinson, 1977). Since the 1959 NSF report, there has been a steady decline in interest in science as indicated by a leveling off trend as shown in the NSF report of 1976.

Beshoar (1975, p. 6) warned, "The U.S. may be facing a serious crisis as a result of a decline in knowledge of

scientific principles and facts among its students, and some of these students will be expected to provide the Nation with its science and technology in the next generation." In the studies of the level of science knowledge of students, he found scientific knowledge declining in American schools in virtually all types of socio-economic communities. The National Assessment of Educational Progress (NAEP) administered tests to 9, 13, and 17-year-olds in nine areas including science. The first testing occurred in 1969-70, and more than half of the questions were repeated in the 1972-73 tests on which Beshoar was reporting.

The results of the Beshoar study also may have significance in the area of professional training for secondary science teachers. For example, many of the writers who expressed doubts about the quality of the secondary science teacher identified the need to increase such topics as value considerations in teacher training and more competency based teacher education (Mackey, et al., 1977). The emphasis placed on value consideration may result in answering the question of how well prepared future science students would be to take part in decision making on social issues and how equipped they would be to formulate value systems of their own (UNESCO, 1977).

## III. DEFINITION OF TERMS

Biological Science Courses: Those courses whose content is concerned with the categories of botany, zoology, ecology, microbiology or a combination of these topics.

CUEBS: Commission on Undergraduate Education in the Biological Sciences. It has developed a list of skills necessary for the teaching of biological science.

East Tennessee Region: A rural region comprising the four selected counties of Loudon, Roane, Scott and Morgan in which the survey was conducted.

Junior High School: The school division following the elementary school that was used in the study area to include grades 7 to 9.

Middle School: The school division used in the study to indicate grades 6 to 8.

NSF: The National Science Foundation. One of the important governmental agencies whose major function has been to emphasize the advancement of science and science education (Atkinson, 1977) (see Appendix A).

NSTA: National Science Teacher Association. The foremost science teacher organization which is responsible for the publication of the Science Teacher and Science and Children, etc. The focus of special divisions of the organization is to serve the needs of the teachers from elementary, middle or junior high, high school and college.

Respondent: All persons answering the survey questionnaire in this study were current science teachers for grades 7 through 12.

Secondary School: The school division used in the study area to include grades 7 through 12.

Science Course: Any branch of study concerned with observation and classification of facts, especially when it relates to the physical world (Webster, 1959). Some examples used in this study included general science, earth science, life science, physical science, biology, chemistry, physics and advanced science (Appendix A).

## IV. ASSUMPTIONS

The basic assumptions of this study were:

(1) The responses of the study population to the questions of the instrument were accurate within the limits of the respondents' perceptions of the questions asked.

(2) The instrument used in this study yielded valid results of personal data and perceptions of the status of secondary science course offerings and of instructional characteristics.

(3) Secondary school science is accepted by the general population and the State Department of Education as a valuable component of the secondary school curriculum as evidenced by its widespread inclusion as an essential part of the school curriculum.

## V. LIMITATIONS

(1) The scope of the study was an appraisal of the perceptions of science courses and of teachers' roles in science courses of secondary schools in the four selected counties of East Tennessee.

(2) The respondent's perceptions of the science courses must be accepted as accurate for this area.

(3) The perceptions of the teachers might vary from school to school or area to area.

(4) The possibility existed that respondents often may answer in the manner they believe they "should" rather than their true opinions.

(5) The number of teachers who did not respond to the survey questionnaire, 46.5 percent, has a definite effect on the inferences and applicability of the finding to the entire population.

## VI. PROCEDURES

The investigation was conducted as a field study utilizing the perceptions of secondary science teachers in the four selected counties of East Tennessee. The four counties were representative of the rural counties of eastern Tennessee and Cumberland Plateau regions. They range in distance from 30 to 50 miles from Knox County. These counties are similar in the personal per capita

incomes of their populations (ranging from Morgan with $2,400 to Loudon with $3,900 for the year 1975). This compares with $4,895 average per capita income for the state of Tennessee.

The population sizes of the four counties fall into two groups. Scott and Morgan have about 15,000 population each and Roane and Loudon have 20,000 and 26,000 populations, respectively. The populations have remained relatively constant over the time period from 1960 to 1970 with the exception of Loudon county that has declined almost 5 percent for this time period.

The population consisted of secondary science teachers in a four-county region of East Tennessee where the questionnaires were sent to the principals. The principals were asked to distribute the questionnaires to all science teachers in grades 7 to 12 including both full-time and part-time science teachers.

Since no appropriate instrument appeared to be in existence, an instrument was developed following a review of the literature on science course offerings and instructional characteristics. The questions were submitted to 10 professionals comprising representatives from college, secondary and middle schools in the area of secondary science for their opinions on the appropriateness of the items included in the questionnaire. The instrument was then refined and printed.

The instrument also was read and approved by the committee on Human Subjects (Appendix B) and the three members of the writer's thesis committee before it was sent to the schools.

The principals in the four selected counties of East Tennessee distributed the questionnaires to his/her staff members. The completed forms were returned to The University of Tennessee's Bureau of Research and Development, Knoxville, where they were periodically gathered between the dates of April 7 and May 25.

Data from the instrument were coded and transferred to computer cards for analysis. Similarities and discrepancies in perceptions were noted and recommendations for bridging these discrepancies were suggested.

## VII. ORGANIZATION OF THE STUDY

Chapter I of the study contains an introductory statement, the statement of the problem, the questions to be answered, the importance of the study, assumptions, limitations, definition of terms, procedures and organization of the study.

Chapter II consists of a review of selected literature which the investigator felt was relevant to the study.

Chapter III provides a description of the theoretical implementation procedures of the study and description

of the instrument used. It includes a discussion of the subject, the instrument, the procedures for collection and analysis of the data.

Chapter IV presents an analysis of the data and a report of the finding and results.

Chapter V includes the summary of the data, the conclusions of the study, presentation of the findings and recommendations for the improvement in areas of general concern. Copies of the survey questionnaire and all the cover letters used in the study are found in Appendices C through F.

# CHAPTER II

## REVIEW OF RELATED LITERATURE

### I. INTRODUCTION

Currently there seems to be a nation-wide decline of interest in science and in student enrollment in science courses (Bindel, 1978; Gardner, 1978). In order to see if these trends also were true in East Tennessee, a research project was undertaken to examine the status of the science course offerings and the teacher perceptions of the competencies of the faculties in science training and instructional practices. Since teacher attitudes affect their actions and their influence over their students, teacher perceptions were used to determine the status of science course offerings, teacher practices, and the enrollment trends in science courses in four selected East Tennessee counties. The areas of teacher qualifications; science course offerings including NSF programs, enrollment and the appropriateness of the course content; and the characteristics of the instructional practices used by the teachers were examined in the selected literature reviewed in Chapter II.

Although the literature was examined, no references to either the perceptions of the status of science course offerings or the teacher perceptions of the qualifications

of the teaching staffs were found. This information again points to the importance of this study.

## II. HISTORICAL DEVELOPMENT OF SCIENCE PROGRAMS

The science curriculum with few exceptions has remained conservative in its offerings in the midst of scientific and technological revolution. It has been conservative because it was more suited to a farming rather than scientific-technological-industrialized society, and to a way of living that no longer existed (Hurd, 1969). An example was found in the biological science curriculum. T. H. Huxley wrote a high school textbook titled "Biology" in which he proposed to help students appreciate that "the study of living bodies really is one discipline, which is divided into zoology and botany simply as a manner of convenience" (Hurd, 1969, p. 79). Huxley introduced a phylogenetic model for the organization of biology courses in which he chose representative organisms to develop the concepts of diversity, complexity, structure and function and evolution. Directed observations, laboratory exercises and experiments were integrated into the textbook to form the major source of information. This was over 100 years ago! Between 1875 and 1960 in the United States dozens of curriculum committees, commissions, teacher associations and professional societies had sought to improve the Huxley curriculum model and to add new learning goals for the

teaching of biology (Hurd, 1976). The appropriateness of the Huxley "frog-fern" curriculum organization has been debated since the turn of the century (Hurd, 1969, p. 71). From time to time new movements and modest changes have been made but they were typically short lived. The biology taught to each generation of students has been quite similar to that taught to their parents.

In 1959 the National Science Foundation began the support of a curriculum project to update the subject matter, to explore new patterns of course organization and improve the quality of laboratory work. For the first time since Huxley, the curriculum committee went beyond a statement of rationale and goals and developed a variety of textbook, laboratory investigations, and supplemental teaching materials consistent with stated purposes (UNESCO, 1977).

During the 1960's the massive national curriculum effort of the NSF produced BSCS, PSSC, CHEMS and all of the other alphabet science courses, some of which seem now to be on the verge of becoming "ancient" history despite the millions of dollars spent in preparing the materials and re-training in-service teachers to use them. The revolution has brought an ever frantic search for relevance in education and science (Yager, 1975).

Education of the 1970's and the anti-science mood in our society have caused at least three significant

developments in science education: individualization, humanistic and futuristic trends. They have stimulated a search for meaning and relevance in the field of science education (Hurd, 1969).

The ordinary citizen and students in secondary schools have become disillusioned with science as a field of endeavor and as a major area of concern for schools. The anti-science attitude of the public was discernible on all sides. Philip Handler, President of the National Academies of Science, stated (Yager, 1976, p. 198):

> There is a growing belief among some of our young people that "Science is not relevant"--associating many national and international tragedies with the consequences of an advanced technology, unaware of the subtle relationship between science and technology, denying that science itself is amoral and that it is only the manner in which science is applied which may be moral or immoral, they reject science as irrelevant to their view of the better life. This rejection is evident in proportionally declining enrollments in the natural sciences and it is stated explicitly by articulate student leaders in every school, on every college campus, and at all levels.

The curriculum of the 1970's, it was hoped, would take advantage of the strengths and correct the weaknesses of the original projects. The emphasis was to be upon inquiry as a major process of science which was necessary if a student was to appreciate fully the meaning and usefulness of any knowledge. The new curricula stressed the nature of science and the scientific process. The new materials developed complemented the newer methods

of teaching which stress the intuitive, the questions and doubts, and the unifying threads of the non-authoritarian nature of the discipline. The "newer programs" (Atkinson, 1977) did not attempt to survey a field, rather they were concerned with fewer significant ideas which were pursued in depth and developed in the laboratory. These programs developed a wide variety of instructional materials to complement complete textbooks and laboratory guides. Although a total curriculum, except at the elementary level, had not been considered, complete courses and programs subsequently have been developed and tested. All of these programs represented significant strengths provided by the science curriculum efforts of the 1960's.

In 1972 the Calloway Gardens Conference recommended some improvements and solutions to the curriculum problems of the 1960's. They called for an instructional system that would provide interesting and useful materials for all students, an elaboration of specific competencies needed for the students to achieve scientific literacy, and choices for students beyond that necessary for minimal competency. Other ideas included an organization comprised of sequences much shorter than year long courses, a balance of basic and applied aspects of all sciences, units within the program that are independent of one another, variety of pathways for meeting objectives, and material for handling the different rates of learning among the learners.

Since the conference, the NSF has funded a major curriculum effort, Individualized Science Instructional System (ISIS), which used the conferences' recommendations as its guidelines (Yager, 1976).

The Human Science Program (HSP) represented another curriculum effort of the 1970's. It was for the middle school program, was multidisciplinary in approach, and was considered to meet the needs and interests of adolescents. The program did not attempt to update a field survey of science nor was it designed to increase the learning of content in a given area. Rather the program analyzed vital questions which resulted from discussion of the deficiencies apparent when considering the curriculum reforms of the 1960's (Yager, 1976).

The Outdoor Biology Instruction Strategies (OBIS) project was another curriculum effort for the intermediate school age child. This program enabled students to observe and to experiment with features of the out-of-doors which they would encounter most frequently in their daily living (Yager, 1976).

The new programs served as examples of model curriculum programs in science education with respect to curriculum, pedagogy and philosophy.

The science of the 1980's would need to take a new direction as Paul Hurd observed (1969, p. 102):

> We continue to make decisions assuming an historical continuity without regard to our recent cultural mutation and technological revolution accompanying it. Herein lies the source of many educational problems that seem so perplexing and confusing. If we present conditions, we end where we start, only the problems are new. The alternative is to develop a science curriculum not tied to the immediate past, but one relevant to the emerging society and the world that is yet to be. We may not know with certainty the specific conditions young people will face in the future; we do know they will differ from those of today.

According to Hurd (1969), education of today should be essentially a form of socialization and our curriculum was composed of stable beliefs. Each education problem would be treated as it arose and in isolation from the complexity of forces giving rise to the changing conditions that produced the problem in the first place. The weakness of this concept was that it would deal primarily with educational issues politically rather than through a policy and research program. Whatever solutions arose from this type of approach would have only short-range effect and the system assured its own obsolescence. The newer perspective would require a newness of purpose for science teaching. This would mean an orienting of science teaching toward the society that could be rather than the society that was as described by Hurd (1969). Alfred North Whitehead said, "The art of progress is to preserve order amid change and to preserve change amid order" (Sears, 1976, p. 28). This expressed the dilemma in science education today and represented one of the greatest challenges to

education as Yager saw it (1975). The science teacher was encouraged to create ways by which courses could lead to cultural change and societal development. The task was to become one of inventing the future and then planning for its attainment as Hurd expressed it (1969). He said that in the future of education the term "feed forward" will be more important in our thinking than "feed back" (1969, p. 105).

## Emphasis on Conceptual Schemes in Science Curriculum Development

The problem in developing science courses was to communicate an ever-expanding body of scientific knowledge in a way faithful to the discipline and useful to the student. The task was one of converting the ideas of science into units of instruction. One means of implementing this idea has been to select a small number of significant conceptual schemes. Concepts represent the simplest learning units with meaning in a scientific discipline many writers feel (Hurd, 1969). The next step was to arrange the concepts so that each concept built upon previous experiences and provided cues to the next order of conceptualization. The conceptual scheme has served to provide organization to the curriculum, minimize the disconnectedness of subject matter and provide a teaching module practical for pupil learning.

Concept learning also had the characteristics of a

decision-making process. The learner was presented with various facts or conditions and was required to: reduce the differences, find organizational properties of the information, and validate the conceptual organization which he gave to the data. Concept learning was to be a continuous process of making choices, guessing and testing rather than rote learning.

The task of restoring intellectual rigor to high school science courses was best done within the conceptual framework of the discipline itself as suggested by Hurd. How many and what kind of concepts would make up a good course? Certainly no more concepts should be introduced than can be taught to an acceptable level of understanding. Progress in learning science was to be measured in terms of understanding, not by the number of topics or chapters in a textbook covered (Hurd, 1969).

## Locally Developed Science Courses

The crises in science teaching reached a climax in the middle of the 1950's and curriculum reform was sought, something more drastic than the minor revisions characteristic of past efforts. A separate effort was that of the so-called "curriculum" studies. These were in fact not curriculum programs but were identified as course content improvement studies. Each separate program was oriented to a single major content field or related subjects:

physical science, chemistry, biology and earth science.

John I. Goodlad (1961, pp. 70-71) undertook an investigation of the gains in the new curricular studies and stated:

> In spite of some exemplary instances to the current curriculum reform, it is extentially a middle and upper middle-class movement. We still lack experience in developing new curriculum for disadvantaged communities, for schools that are relatively non-academic in atmosphere, and especially for the so-called "difficult thirty percent."

Many students of the processes of learning and of the nature of the learner have directed their efforts to correspond with their insights in developing the various fields of learning into a kindergarten through twelfth grade plan. Much evidence existed for the need to help the student in secondary school science to develop an interrelationship among the various fields or disciplines that tend to make science appear in separate school subjects. The basic unity in science would be hopefully affected by this interrelationship. An early effort was the creation of an interdisciplinary approach which would initiate a two-year integrated course in physics and chemistry, known as physical science. The effort was only moderately successful (Richardson, et al., 1968).

Another example was the unified science program, a four-year program for grades 9 through 12 developed at the University School of the College of Education in Ohio State University (Slesneck and Showalter, 1961).

The natural world should be seen, the authors felt, through the interconnection of things and events and through the phenomena of the natural world. The natural world was not the exclusive studies of either the specialists or the generalists. The program has been employed and has demonstrated its own merit in ways that present a more rational universe image than conventional programs in the familiar subject disciplines (Showalter, 1964).

A laboratory-centered course in general physical science, another idea in science, was designed to provide a more effective experience for high school juniors and seniors who do not elect chemistry and physics. A committee of science teachers planned and produced a set of materials including outlines of content, teaching suggestions, laboratory direction material, resource information sheets, teaching aids and newly designed equipment. Two features of the laboratory work included the direction of the laboratory work which encouraged the student to carry out actual experiments and then provided the student with the occasion to think on his own (Richardson, et al., 1968).

Team-teaching in science was used widely in the 1960's in the junior high school and included large group instruction for the classroom and small group instruction for the laboratory periods. Careful planning was considered as necessary to coordinate the various facets of the total program which included remedial groups and audio-tutorial

devices. The use of the audio-tutorial devices tended to eliminate the loss of identity and the avoidance of participation that students may develop in the large group (Selmes, 1974).

The most traditional aspect of teaching which was used commonly and used at every level of teaching consisted of planning the course around the scope and sequence of the selected textbooks that were used in the course. Many textbook publishers included a laboratory manual which was coordinated with the textbook and which focused on the traditional laboratory experiments with accompanying questions or the open-ended type of laboratory activity.

## NSF Sponsored Science Programs

The National Science Foundation (NSF), which had been asked by the Congress of the United States to make the decision as to who should restructure pre-college education in the sciences, chose the professional scientist as the most qualified person to improve the high school science courses.

The new science educator was not to be a generalist as were most educational theorists. He was conceived rather as a specialist and was to seek only to improve the high school course matching his research interests. This was one of the reasons the reform movement has been labeled a "discipline-centered approach" (Hurd, 1969, p. 85).

The NSF developed courses for five areas: biological

science, chemistry, earth science, physical sciences and physics. A brief description of the courses and the materials that were developed is included here and in Appendix A.

Selected Biological Science Courses. The Biological Science Curriculum Study (BSCS) contained several conceptual schemes describing modern biological thought and used these to pattern the content of the course. The schemes were developed into three biology courses for the same student population, with each of the three textbooks (Blue, Green and Yellow) containing different supporting concepts, but at the same time providing a common insight into the nature of biology.

In addition to material for the standard student, materials have been developed for gifted students. The BSCS second level course was written for the 10 percent of the high school students in the United States that were offered an advanced course.

The BSCS group has published an extensive list of equipment and supplies that were needed for all their programs including how to implement the program, teacher's guides, newsletter, innovations in equipment, and techniques for teaching laboratories.

Selected Chemistry Courses. The educational rationale and approach to chemistry culminated in the Chemical Bonding

Approach (CBA). The emphasis in the course was on structural chemistry and chemical dynamics. CBA had a laboratory manual, textbook, teacher's guide but did not have a film program.

A second program for chemistry was developed, the Chemical Educational Material Study (CHEMS program). The CHEMS program developed complementary textbooks, laboratory manual, teacher's guides, tests, films and a programmed sequence on the slide rule and exponential notations.

The two courses had points of similarity in that they emphasized the principles underlying chemical structure, combination and energy, the establishment of systematic relations between experiments and theory, the introduction of ideas tentatively and then the examination of them in light of experimental data. Additional similarities were that both courses had an internal logical structure in the textbook that discourages the practice of skipping around, the value of questioning and discussion to motivate and sustain interest, and the requirement of an inquiry environment in the classroom.

Selected Earth Science Courses. Earth Science Curriculum Project (ESCP) was an activity centered interdisciplinary program. The program format included topics on astronomy, geology, physical geography, meteorology, and oceanography. A teacher's guide, instruction materials,

reference series, laboratory kits, tests, films, and newsletters were made available to the schools.

Time, Space and Matter was based on the assumption that science teaching should focus on the inquiry process of science, offering the student not only an account of what has been discovered but also a systematic and logical method of thinking. The emphasis of the course was on the student actively investigating the aspects of the physical world. The TSM program consisted of student investigation booklets, a laboratory kit and record book, a teacher's guide, a reading series, tests and audio-visual aids (films, film loops and teacher's aids).

Selected Physical Science Courses. An alternative to the earth science course in the junior high school was development of a two-part course, Introductory Physical Science (IPS I and IPS II). The materials included a textbook with laboratory activities included in the reading material. The teacher's role was one of maintaining a climate of inquiry and acting as a guide to the reasoning process of the students.

Interaction of Matter and Energy (IME) was also a ninth grade course based on the inquiry system with the laboratory as the center of the course. The extensive laboratory required only minimum equipment of low cost. The materials included a textbook, teacher's guide and

tests. The tests emphasized the achievement of concepts and of inquiry skills.

Selected Physics Courses. The effort to improve the teaching of physics was the first venture in the science curriculum reform movement. The result of the effort to improve the course resulted in two major programs in the area of physics. The Physical Science Study Committee (PSSC) consisted of a textbook, laboratory guide, laboratory equipment, film program, teacher's guide and transparencies. There was a laboratory for each of the advanced topics.

Project Physics, originally known as Harvard Project Physics (HPP), had developers that were of the opinion that all students should have physics to understand modern society. To implement their program was a textbook, a student guide or handbook, supplementary units, readers on each of the units, a laboratory manual, audio-visual materials (film loops, sound films and transparencies) and a teacher's guide.

Engineering Concepts Curriculum Project (ECCP) emphasized laboratory experiments. The thrust was to involve the student in problem-solving activities. This program included a teacher's guide, and evaluation was to be based on the student's achievement of the objectives. This course had no previous counterpart in the curriculum.

It was in contrast to the content improvement rationale underlying the other science courses in the curriculum reform.

## III. CHARACTERISTICS OF TEACHER TRAINING PROGRAMS

The UNESCO publication, Learning to Be, makes the following statement (UNESCO, 1977, pp. 153-154):

> One of the essential tasks for educators at present is to change the mentalities and qualifications inherent in all professions; thus they should be the first to be ready to rethink and change the criteria and basic situation of the teaching profession, in which the jobs of educating and stimulating students is steadily superceding that of simply giving instruction. Present-day divisions between formal and informal, school and out-of-school, child and adult education are steadily fading. Furthermore, teachers trained today will still be exercising their profession after the year 2000. Their training should be designed with these two facts in mind.
>
> Conditions in which teachers are trained should be profoundly changed so that, essentially, they become educators rather than specialists in transmitting pre-established curricula, the principle of a first, accelerated training stage, followed by in-service training cycles, should be adopted.

Training programs developed in recent years tended to focus on the development of professional competencies rather than on mere training in the understanding of science competencies or academic pedagogy (UNESCO, 1977). Competency-based instruction had become a theme for the second half of the present decade (Stallings, 1977). Such instruction involved clearly specified learning objectives in

behavioral terms; specification of one or more means for determining the objectives; specifications of the methods of assessing achievement of the objectives; public sharing of the objectives, means of assessment, criteria and alternative activities; and assessment of the learning in terms of competency criteria. Competency-based programs usually implied mastery learning, and they placed on the learner the responsibility for meeting the criteria set down for the course (Cooper, 1973).

The National Science Teacher Association (NSTA) in 1971 suggested guidelines in the form of a self-inventory which stated that: a professional science teacher was well educated in science and liberal arts (Connally, 1972); possessed a functional philosophy of education and the technical skill of teaching (Hutchins, 1966; Norris, 1975; Dunn, et al., 1977); and continued to grow in knowledge and skill through his/her career (Lararowitz, et al., 1976). Other guidelines from the NSTA list insisted on a sound educational environment in which to work (Tamir, 1976; Ward, 1976) maintained a professional status; contributed to improving science teaching (Selmes, 1974); and took a vital interest in the quality of future science teachers (Stallings, 1977; Mackey, 1977; Tamppari, et al., 1975; Trowbridge, 1974).

The Commission on Undergraduate Education in the Biological Sciences (CUEBS) in 1969 developed a three-part

checklist (UNESCO, 1977). The CUEBS list consisted of skills relating to the philosophical basis of teaching biology such as developing an awareness of the interaction between biology and society or understanding of the ethical responsibility of biologists. Concerns were being reflected in the current literature (Carter, 1974) in the expanded use of bioethics as part of secondary high school programs (Barman, 1975; Barman and Rusch, 1978) and the use of bioethics as a course option in preparation for teaching as seen at The University of Tennessee, Knoxville.

The CUEBS list was concerned with personal competencies, such as strengthening self-confidence and skill in determining materials, equipment and supplies needed and in the procedures for ordering. CUEBS proposed the use of instructional media, classroom techniques, planning science facilities and evaluation techniques. Examples of this proposal showed that desirable characteristics of science teachers evolve, in part, in response to changing emphasis in the science curricula. Schools of the 70's stressed attainment of broad general educational objectives rather than those related only to the limited interest of the academic science specialist. The objectives emphasized intellectual skills associated with inquiry learning and stressed issues of individual, social and national relevance. The trends reflected the strong pressures on the curriculum makers to correlate courses more closely with

the needs of society. Teachers were responding to these needs by including emphasis on current topics in existing and newly developed courses (James, et al., 1974; Barman, 1975, 1978). Paul Sears (1976, p. 7) stated, "Good teaching, done with a sense of the cultural pattern of the community of which both teacher and pupil are a part, inevitably carries its own conviction."

In summary, the requirements of demands of the science teacher have changed from those needed for the organization and relaying of factual information about science to more broadly defined professional competencies with a stress on problem solving and inquiry learning (Seymour, 1974; Connelly, 1972; Starr, 1972; Jernigan, 1972; Cusimano, 1975; Marek and Renner, 1975; Lazarowitz, et al., 1976). The writer suggested that the teacher should be flexible in the face of social change since (s)he was expected to teach courses of direct relevance to the needs of the individual and of society. The trend in training, therefore, was towards competency-based programs of teacher education (Stalling, 1977).

## IV. CHARACTERISTICS OF INSTRUCTIONAL PRACTICES

Both pre-service and in-service programs of teacher education sought more emphasis on teaching competencies and on greater professional relevance. There has been a rapid changeover from traditional lecture and tutorial

methods to a wider range of training styles and strategies (UNESCO, 1977).

## Use of Objectives in Science Teaching

One of the new trends was the understanding of objectives generally expressed in behavioral terms. Thomas Cleaver (1975, p. 288) expressed his views in his "A Behaviorist Teacher's Creed" as:

> My descriptions of these new competencies should logically be behavioral, that is, descriptive of behavior that is observable and potentially measureable as to quantity or quality or both. Thinking, knowing, understanding, believing, awareness and the like are not themselves observable, but are all capable of expression in behavior that is observable. It is the latter that I will describe and attempt to measure as evidence of the former.

Mackey, et al. (1977) summarized seven categories of teacher behaviors and synthesized them into operational strategies statements. The categories dealt with efforts to increase teacher effectiveness by stating behaviors in a precise manner.

Koran Wilson (1973) identified four types of objectives and their usage: pre-objectives, prototype items, performance objectives and criteria-reference items. Each of these objectives could be useful in arriving at the desired type of learning for the student.

## Teaching and Learning Strategies

A trend in the CUEBS list was an appreciation of student differences which was leading to linking

instructional techniques to individuals and groups by matching resources and strategies with the needs of the individuals. Some examples are programmed instruction, audio-tutorials (Brown, 1975; Kahle, 1978; Hertzler, 1978) and multi-media training kits (Murray, 1976). Many of the types of learning strategies were included in the NSF programs for the various sciences, such as BSCS, PSSC, etc. These included laboratory material and manuals, audio-visual material and one topic reading.

Some of the newer science innovations combined the matching of resource materials with teacher strategies; one example was the development of the BIOS-I-Kits which contain such items as a guide to initial learning possibilities, pamphlets and articles, experimental and observational materials and bibliography cards as aids for further investigations (Murray, 1976). Some kits include audio-visual slides, graphics audio-tapes and how-to booklets. So far the kits have focused on a particular biological entity such as the prairie or a biological phenomenon such as competition that was central to current research in ecology or evolution.

Two technological advances, photography and television, have made it possible for schools to have access at a reasonable cost to the recording of various student activities on these media. Photographs could be a part of the multimedia approach (Moore, 1975). For student

projects, the use of video-tapes was reported by Sallee (1974).

Novak (1973) reported for the NSTA on the evolving patterns of greater use of technology for school science facilities and listed in increasing order of progression the following: 16 mm films; wall charts; maps; tackboards; overhead projectors; closed circuit TV computer assistance; dial access TV and audio-tapes; self-paced study materials; 8 mm loop film-filmstrip viewers; and finally instructional technology for student planned, individual and small group work. One example of the small group work was used by Cessna's class (1974) to make an ecology film.

Novak also noted that the study could not characterize a given facility or instructional technology as more or less effective without considering the kind of science program offered and the type of relationship that existed between student and staff member. The two must work together, he felt, in order to form an effective balance for student learning to occur.

The use of computers was found to be increasing in many areas of study, including the environment (Pasquine and Peelle, 1975), the study of genetics (Haggerty, 1975), and evolution (Mariner, 1973).

The CUEBS also reported the increased use of excursions or field trips for environmental and community analysis. Field studies were on the increase (Wurzelbacker, 1973)

especially in conjunction with environmental study (Frey, 1973; Jantzen, 1973; Nache, 1973; Davis and Grimm, 1973; Tushin, 1974; Wright, 1979). Even the addition of an outdoor facility to the school ground or nearby could be part of the science outdoor studies for students (Scarr, 1979). An unexpected bonus to the study of the outdoor environment could also be public involvement as reported by Berry (1974) and Davis, et al. (1973).

An additional change included the conventional block time scheduling which was conducive to the development of minicourses and other flexible ways of using time. Minicourses were used successfully in Colorado (Streubal, et al., 1974) and Ohio (Parkinson, 1976). Ohio also used flexible time scheduling in conjunction with their minicourses.

CUEBS also noted that advances were being made in the use of projects with genuine research emphasis. Research training was being extended for attitudinal development with special reference to the studies application to the problems (James, et al., 1973). Inquiry and problem solving were enlarged to include creativity and divergent thinking in research studies (Starr, 1972; Jernigan, 1972).

Additional ideas from CUEBS were extended to include the development of skills of curriculum construction;

learning to use resources (Karen, 1978); and educational technologies such as radio and TV. More development was found in the areas of media resource centers and service centers of the school district. Methods of evaluating in-service and pre-service programs of teacher education have been improved (Tollet and Achilles, 1972).

## V. PRACTICES AND TRENDS IN TEACHER RETRAINING PROGRAMS

In the past, most of the emphasis in retraining of teachers has related to the provisions of special courses for science teachers either as summer school or as week-end, evening or intensive minicourses. More recently the forms of in-service activity have diversified to include the following: within school programs, tours and visits (UNESCO, 1977), the use of teacher's centers and other devices. Courses remain, but the traditional lecture course has been replaced by even more relevant forms such as team teaching (Frey, 1973). Some examples were courses in the region either at the school or very nearby in the community; workshops for a specific purpose; conferences; exchanges of staff within and between local systems including intern programs; and comparative education tour study leave and individual study programs. Additional examples encompass consultancies, production and dissemination of training kits; displays and exhibitions; involvement in research and development; development of

new in-service institutes; training programs for in-service personnel; and research into retraining (UNESCO, 1977).

## VI. SUMMARY

Chapter II has presented a review of the literature related to the five aspects of science education surveyed for the four selected county study area of East Tennessee: a description of aspects of the historical background and growth of science course offerings; the role of NSF programs in science education; teacher preparation programs; instructional practices and teacher retraining.

Research indicated that until the NSF came into being, curriculum development programs have had very little impact on science for any period of time. With the development of new concepts and accompanying materials, the 60's saw the influence of the "alphabet" science courses. The 70's have brought about still newer courses, but as the 80's approach, the NSF programs were apparently beginning to fade.

Modern science courses are built around a framework of conceptual schemes on one hand and its investigative aspects (inquiry) on the other. These schemes were described in different ways by each of the curriculum groups sponsored by the NSF: however, it was important to note that in every project there was an effort to develop

a conceptual continuity and systematic relationship between all parts of the course.

One reason that the NSF programs have been fading could be the teacher training area which did not follow through with the new materials and course ideas. The NSF focused its efforts on institutes for in-service teacher retraining but not on pre-service teacher training.

The research showed that objectives of science teaching in schools have broadened so as to stress satisfaction of personal, social and national needs. Science teachers, therefore, were generally seen to require knowledge, understanding and skill both in their science and pedagogy in any program of teacher education.

Instructional practices have focused on the increased usage of technology, excursions or field trips for community study, scheduling changes in time usage, and more emphasis on research projects. In the search of the related literature, no material was found specifically on the science course offerings and teacher perceptions of instructional practices for either the East Tennessee study area or for the Southeastern United States.

The literature search revealed that there is concern about the issue of motivating teachers to recognize their responsibility to be involved in continuing education. The trend toward retraining of an entire staff through dynamic within-school programs could assist the teacher to be

active in his/her own self-education. Studies also point out that the motivation to accept continuous retraining must be encouraged by means that are appropriate and acceptable in each community.

# CHAPTER III

## METHODOLOGY AND PROCEDURES

### I. INTRODUCTION

A direct-mail questionnaire was the principle method utilized in this study. The questionnaire was mailed to all current secondary science teachers of grades 7 through 12 in the public school systems of the four selected East Tennessee counties located within 50 miles of Knox County: Morgan, Scott, Roane, Loudon and the two city systems, Lenoir and Harriman, within two of these counties. Analysis of the data was done in terms of frequencies, percentages and totals.

Chapter III described the methods and procedures used in this study. They were presented under the following sections: (1) Identification of the Population, (2) Development of the Instrument, (3) Questionnaire Response and (4) Analysis of the Data.

### II. IDENTIFICATION OF THE STUDY POPULATION

The study population was comprised of secondary science teachers of grades 7 through 12 in four selected counties of East Tennessee. The population composition was established using the following procedures:

1. The Director of the Tennessee Department of Education was contacted in an effort to obtain a list of current secondary science teachers in the four selected counties. Information was available only from the State Department of Education Preliminary Report which each teacher in the state is required to complete annually. The form included the subjects taught by each teacher. There were 38 in the four-county study area that contained grades 7 through 12 and approximately 71 teachers. The records for Lenoir City were not present at the time of examination, and from the size of the two schools involved, it was estimated that four teachers would be the approximate number for that system.

2. These four counties were found to have a total of 43 public schools. Since the study was concerned only with secondary science education in grades 7 through 12, schools having only grades kindergarten or first grades through the sixth grade, only vocational/technical or only special education schools were eliminated. This elimination resulted in the use of 38 schools for the study population.

## III. DEVELOPMENT OF THE INSTRUMENT

The principal instrument used to collect data was a direct-mail questionnaire. After a comprehensive search of the literature, information was obtained that resulted in a first draft. The writer's committee evaluated the

instrument which was composed by the researcher to meet the specific needs of this study (see Appendix F).

The final copy of the questionnaire was submitted to the Committee on Human Subjects for approval. The Committee suggested only one additional phrase--that return of the questionnaire would constitute informed consent on the part of the respondent. With this change, the questionnaire was ready for dissemination.

## IV. ADMINISTRATION OF THE QUESTIONNAIRE

The superintendents of the six systems involved in the study were contacted informing them of their selection for study and asking for their encouragement for participation in the study. All superintendents indicated a desire to participate, and requested a copy of the completed results.

On April 5, 1979, the completed questionnaire, along with a cover letter to the principal, a cover letter to the teacher and self-addressed and stamped envelope were sent to each of the 38 schools comprising the study population. Respondents were requested to respond by April 15, 1979 (see Appendices C, D, and F).

The cover letter to the principal requested that the questionnaire and cover letter(s) to all teachers who taught science in grades 7 through 12 be sent to the appropriate teachers. Twenty-six responses had been

received by April 15 yielding a 36.6 percent response. On May 1, the schools which had not responded were sent a second set of questionnaires and cover letters. A copy of the second follow-up cover letter to the teachers can be found in Appendix D. In addition, follow-up phone calls were made to school principals of the non-responding schools to encourage teacher participation. At this time it was learned that some of the schools did not desire to participate because of the length of the questionnaire and because they had already participated in multiple other studies.

## V. QUESTIONNAIRE RESPONSE

The original study population consisted of 38 schools with 26 schools responding for 68.4 percent. A total of 12 schools did not respond.

The study population was examined in terms of both the number of schools and the number of science teachers who responded. The calculations were done on the basis of the number of teacher respondents that participated in the study. Altogether a total of 38 teacher responses were received out of a study population of 71 teachers from the four-county area. This was a 53.5 percent response to the study (Table I).

## VI. TREATMENT OF DATA

The data collected were transferred to punch cards for computer analysis. A computer program was developed

TABLE I

SCHOOL AND TEACHER RESPONSES FROM THE FOUR COUNTY STUDY AREA OF EAST TENNESSEE (1979)

| Method of Contact | Question-naires Returned | % of Teachers | Schools Respond-ing | % of Schools |
|---|---|---|---|---|
| First Mailing | 26 | 36.6 | 15 | 39.5 |
| Second Mailing and Phone Call | 12 | 16.9 | 11 | 28.9 |
| Totals | 38 | 53.5 | 26 | 68.4 |

for use with Statistical Package for the Social Science (SPSS). Analysis of the data was made in terms of frequencies, percentages and totals. Due to the size of the response to the questionnaire, no further statistical analysis was deemed to be appropriate. The data collected in this study were most appropriately reported by a descriptive survey method, accompanied by tables, charts and graphs. A complete presentation of data is provided in Chapter IV.

## VII. SUMMARY

Chapter III has presented the methodology and procedures used in the study. It included sections on the identification of the study population, development of

the instrument, administration of the questionnaire, the questionnaire response and the treatment of the data.

# CHAPTER IV

# PRESENTATION AND ANALYSIS OF DATA

## I. INTRODUCTION

The purpose of this chapter was to present an analysis of the data gathered by the direct-mail questionnaire administered to a study population of 38 public schools in the four selected counties of East Tennessee. A response was received from 26 schools for 68.4 percent. A total of 71 teachers made up the study population. Of these teachers, 38 responded to the questionnaire. This is a 53.5 percent response. The analysis of data was based on the questionnaires returned by the secondary science teachers.

The presentation and analysis of the data were organized into seven major sections. Section I was an introduction, followed in Section II by the general background information of the school population. Section III presented the general background information of the teachers and also presented the educational training information of the secondary science teachers. Section IV presented the science course information with respect to what courses were offered, how frequently they are offered, what levels were offered, what was their curriculum status and what were the prerequisites for the courses offered. Section V detailed the program information and is subdivided into local programs,

NSF programs, enrollment and course content information. The final Section VI was the descriptive information on science instructional programs and the teachers' perception of these programs.

## II. BACKGROUND INFORMATION OF SCHOOL POPULATION

This portion of the questionnaire was designed to investigate selected characteristics of the school population (Table II). This section included school organization and location.

The school locations were in two regions--rural and small town. Rural schools constituted the larger category with 57.9 percent of the teachers from schools in this group. Not one of the locations was classified by the teachers as inner city or suburban.

The school organization was arranged mainly from groups ranging from kindergarten to eighth grade which constituted 23.7 percent of the population. The middle school organization (6-8 grades) was larger (18.4 percent) than junior high organization (5.3 percent). The high school organization of grades 9 to 12 was found more frequently (13.2 percent) than the organization of grades 10 to 12 (5.3 percent). The "other" organizations made up a substantial group (34.2 percent). The subcategories of the "other" classification are shown in Table II. When combined into the original statistics, the emphasis still favored the

TABLE II

SCHOOL LOCATION AND ORGANIZATION DATA FOR THE FOUR COUNTY STUDY AREA OF EAST TENNESSEE (1979)

| Question | Number Responding | Percent of Population |
|---|---|---|
| School Location | | |
| (1) inner city | | |
| (2) rural | 22 | 57.9 |
| (3) small town | 16 | 42.1 |
| (4) suburban | | |
| School Organization | | |
| (1) 0 - 8 | 9 | 23.7 |
| (2) 6 - 8 | 7 | 18.4 |
| (3) 7 - 9 | 2 | 5.3 |
| (4) 9 - 12 | 5 | 13.2 |
| (5) 10 - 12 | 2 | 5.3 |
| (6) other* | 13 | 34.2 |
| Other* | | |
| (1) K - 8 | 2 | 15.4 |
| (2) K - 12 | 4 | 30.8 |
| (3) 5 - 8 | 3 | 23.1 |
| (4) 7 - 12 | 4 | 30.8 |

teachers from the kindergarten to eighth grades with an increase from 23.7 to 28.9 percent. The middle school range, if enlarged to include grades 5 to 8, would increase to 23.7 percent. The two remaining categories are kindergarten to 12 (30.8 percent) and 7 to 12 (23.1 percent).

The average school size in the four counties was determined to be 400 pupils or less. The categories were equally divided between that of less than 200 and 200-399 students as shown in Table III. The science student enrollment of the teachers' responding to the questionnaire was a population of less than 200 students (39.3 percent).

The composition of the science staff of the school was examined in Table IV. The science staff of the schools, in the study area, that consisted of three or four full-time teachers was the most frequent size (26.7 percent). A membership of one and two for staff size was found 20.0 percent of the time. Only 6.7 percent of the respondents had a science staff of five members. Of the science staffs most were part time, teaching only one period a day (43.5 percent). Since most of the science teachers responding taught science in the seventh or eighth grades of an elementary or middle school (56.5 percent), these data were consistent. The figure 56.5 percent was a combination of the information from Table II on "School organization," including items 0-8, 6-8, and K-8 from the "Other" category.

TABLE III

SCHOOL AND SCIENCE ENROLLMENT DATA IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Student Enrollment | | |
| (1) less than 200 | 9 | 24.3 |
| (2) 200 - 399 | 9 | 24.3 |
| (3) 400 - 599 | 8 | 39.7 |
| (4) 600 - 799 | 6 | 13.5 |
| (5) 800 - 1000 | 2 | 5.4 |
| Science Enrollment | | |
| (1) less than 200 | 13 | 39.3 |
| (2) 200 - 399 | 8 | 24.2 |
| (3) 400 - 599 | 10 | 30.3 |
| (4) 600+ | 1 | 3.0 |

TABLE IV

SCIENCE STAFF COMPOSITION IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number Responding | Percent of Population |
|---|---|---|
| Number of Science Staff Members | | |
| (1) 1 | 7 | 18.9 |
| (2) 2 | 9 | 24.3 |
| (3) 3 | 7 | 18.9 |
| (4) 4 | 13 | 35.1 |
| (5) 5 | 1 | 2.7 |
| Number of Full-Time Staff | | |
| (1) 1 | 3 | 20.0 |
| (2) 2 | 3 | 20.0 |
| (3) 3 | 4 | 26.7 |
| (4) 4 | 4 | 26.7 |
| (5) 5 | 1 | 6.7 |
| Number of Part-Time Staff | | |
| (1) 1 | 10 | 45.5 |
| (2) 2 | 5 | 22.7 |
| (3) 3 | 4 | 18.2 |
| (4) 4 | 2 | 9.1 |
| (5) 5 | 1 | 4.5 |
| If Part-Time, Number of Science Periods Taught Per Day | | |
| (1) 1 | 5 | 21.7 |
| (2) 2 | 10 | 43.5 |
| (3) 3 | 1 | 4.3 |
| (4) 4 | 4 | 17.4 |
| (5) 5 | 3 | 13.0 |

## III. BACKGROUND INFORMATION OF TEACHERS

Table V contained the statistical data for the background characteristics of secondary science teachers. Of the respondents, 65.8 percent were males. There were 40.5 percent of the study population who are between 21 and 30 years of age. When asked about the degree held, most teachers indicated a BA/BS degree (63.2 percent). Almost one-third of the teachers hold a Master's degree (31.6 percent). Most of the teachers of this area hold education degrees with science certification (47.2 percent). The "other" category was made up of teachers with degrees ranging from math to guidance and one middle school teacher reported a degree in social studies.

The subject most frequently taught by the reporting teachers was general science, again pointing to the characteristic of the school's organization being mainly seventh and eighth grades. Most of the teachers characterized their course level as standard (51.4 percent) which would indicate a course designed to reach most of the students.

Table VI showed that most of the teachers have 13 or more years of teaching experience (37.8 percent). A second group (27.0 percent) had a four to six years' experience in teaching.

It was found that 15.8 percent of the graduate

TABLE V

TEACHER BACKGROUND DATA FOR THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Sex | | |
| (1) Male | 25 | 65.8 |
| (2) Female | 13 | 34.2 |
| Age | | |
| (1) 21 - 30 | 15 | 40.5 |
| (2) 31 - 40 | 7 | 18.9 |
| (3) 41 - 50 | 9 | 24.3 |
| (4) 52 - 60 | 5 | 13.5 |
| (5) 60+ | 1 | 2.7 |
| Degree | | |
| (1) None | 1 | 2.6 |
| (2) BS/BA | 24 | 63.2 |
| (3) MA/MS | 12 | 31.6 |
| (4) MA + 45 | -- | -- |
| (5) Ed.S. | 1 | 2.6 |
| Major | | |
| (1) Science with teaching cert. | 7 | 19.4 |
| (2) Education with science cert. | 17 | 47.2 |
| (3) Phys. educ. with science cert. | 2 | 5.6 |
| (4) Other | 10 | 27.8 |

TABLE VI

YEARS OF EXPERIENCE, SUBJECTS AND LEVELS TAUGHT BY SCIENCE STAFF IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Years taught | | |
| (1) 1 - 3 | 5 | 13.5 |
| (2) 4 - 6 | 10 | 27.0 |
| (3) 7 - 9 | 4 | 10.8 |
| (4) 10 - 12 | 4 | 10.8 |
| (5) 13+ | 14 | 37.8 |
| Science taught | | |
| (1) general science | 22 | 30.1 |
| (2) earth science | 16 | 21.9 |
| (3) physical science | 5 | 9.1 |
| (4) biology I | 13 | 23.4 |
| (5) biology II | 2 | 3.6 |
| (6) chemistry | 5 | 8.2 |
| (7) physics | 3 | 5.3 |
| (8) other | 7 | 12.6 |
| Levels taught | | |
| (1) advanced | 3 | 7.9 |
| (2) standard | 21 | 55.3 |
| (3) basic | 14 | 36.8 |

course work in a subject-area was taken between the years of 1973-75 (Table VII). By combining information from the table, the data showed that 42.2 percent of the graduate course work has been taken since 1973. The major reason for taking additional coursework was cited as a desire to update background information or to expand one's base of knowledge (60.7 percent). The subject-area course most frequently taken by teachers was in the area of physical sciences (23.5 percent).

Other ways of updating science knowledge were surveyed in Table VIII. Most of the teachers had never participated in an NSF institute (84.2 percent). The one "other" from this question identified the choice of participation in a workshop. The teachers tried to stay current by examining periodicals (29.4 percent), newsletters (18.8 percent) and new materials (16.5 percent). When combined, the data showed that taking additional work on a university campus or locally rated second for ways to stay current (24.7 percent). Of this 24.7 percent, 11.8 percent went to the university campus to take their courses.

The area of biological training ranked the highest for advanced degrees (30.6 percent). The biological course offerings at an advanced level in the schools were not found often as a course in Biology II was not offered 68.4 percent of the time. Of the schools that did have training requirements, the teachers reported the required level of

TABLE VII

TEACHERS' EFFORTS TO STAY CURRENT THROUGH ADDITIONAL COURSE WORK IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Last took subject-area science course | | |
| (1) Before 1970 | 3 | 7.8 |
| (2) 1970-1972 | 3 | 7.8 |
| (3) 1973-1975 | 6 | 15.8 |
| (4) 1976-1978 | 8 | 21.1 |
| (5) 1979 | 2 | 5.3 |
| Purpose | | |
| (1) certification | 5 | 3.6 |
| (2) update information | 27 | 60.7 |
| (3) renew certificate | 5 | 7.1 |
| (4) working on advanced degree | 9 | 17.9 |
| (5) other | 3 | 10.7 |
| Subject-area of course | | |
| (1) geology | 6 | 8.8 |
| (2) physical science | 10 | 23.5 |
| (3) physics | 3 | 8.8 |
| (4) ecology | 4 | 11.8 |
| (5) other | 11 | 31.9 |

TABLE VIII

TEACHER EFFORTS TO STAY CURRENT THROUGH VARIOUS MEANS IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| NSF Institute Attended | | |
| (1) never | 32 | 84.2 |
| (2) summer | 3 | 7.9 |
| (3) research | 1 | 2.6 |
| (4) other | 1 | 2.6 |
| Stay Current By | | |
| (1) additional course work, univ. | 11 | 12.9 |
| (2) additional course work, local | 10 | 11.8 |
| (3) periodicals | 25 | 29.4 |
| (4) new material | 14 | 16.5 |
| (5) newsletters | 16 | 18.8 |
| (6) traveling | 5 | 5.9 |
| (7) research | 1 | 1.2 |
| (8) other combinations of the above | 3 | 3.5 |

training for the teacher of Biology II was only a bachelor's degree (21.1 percent) as shown in Table IX.

## IV. SCIENCE COURSE INFORMATION

One of the major purposes of this study was to determine which science courses were offered and how they were offered. Table X summarized the data collected and examined the course offerings with relationship to four aspects: frequency of offering, levels offered, curriculum and prerequisites.

Since most of the school contained the seventh and eighth grades, it was not surprising to find that general science was offered by 78.9 percent of the study population. The second most frequently offered course was earth science, 71.1 percent; followed by biology, 57.9 percent; and physical science, 42.1 percent. All of these courses the teachers reported were offered on a yearly basis. Chemistry was offered 27.0 percent of the time on a yearly basis, 16.2 percent of the time on an alternate years basis, and 2.7 percent of the time as independent study. Physics was offered 24.3 percent of the time on a yearly basis and 16.2 percent of the time on an alternate year basis. Advanced science was offered as a minicourse 2.6 percent of the time and on independent study 2.6 percent of the time.

TABLE IX

BIOLOGY TRAINING OF TEACHERS VS. BIOLOGY BACKGROUND REQUIREMENTS IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Biology Training in Hours | | |
| (1) None | 8 | 22.2 |
| (2) 10 - 19 | 7 | 19.4 |
| (3) 20 - 29 | 6 | 16.7 |
| (4) 30 | 2 | 5.6 |
| (5) MA/MS | 11 | 30.6 |
| (6) Ph.D. | 2 | 5.6 |
| Biology II Teaching Background Required | | |
| (1) Biology II not offered | 26 | 68.4 |
| (2) No requirements | 1 | 22.6 |
| (3) BA/BS | 8 | 21.1 |
| (4) MA/MS | 1 | 2.6 |
| (5) Related science field | 1 | 2.6 |
| (6) Other | 1 | 2.6 |

TABLE X

SCIENCE COURSE OFFERINGS AVAILABLE IN THE FOUR COUNTY STUDY AREA (1979)

| Course | Frequency | | Level | | | Curriculum | | Prerequisite |
|---|---|---|---|---|---|---|---|---|
| Science | Yearly | None | Adv. | Stand. | Bas. | Req. | Elec. | None |
| General | 78.9 | 43.2 | | 23.7 | 23.7 | 63.2 | 15.8 | 89.5 |
| Life | 37.8 | 60.5 | | 13.2 | 18.4 | 26.8 | 2.6 | 89.5 |
| Earth | 71.1 | 28.9 | 2.6 | 39.5 | 32.2 | 57.9 | 13.2 | 81.6 |
| Physical | 42.1 | 57.9 | | 13.2 | 15.8 | 31.6 | 13.2 | 94.7 |
| Biology | 57.9 | 42.1 | | 28.9 | 10.5 | 16.2 | 45.9 | 94.7 |
| Chemistry | 27.0 | 55.3 | 5.3 | 28.9 | 5.3 | 2.6 | 42.1 | 63.2 |
| Physics | 24.3 | 57.9 | 7.9 | 23.7 | 7.9 | 5.4 | 37.8 | 67.6 |
| Advanced | 2.6 | 94.7 | | 2.6 | 2.6 | | 5.4 | 100.0 |
| Other | 40.0 | 25.0 | 25.0 | 25.0 | 25.0 | | 25.0 | 25.0 |

Most of the schools, the teachers stated, had not established ability or difficulty levels for their science courses. An exception seemed to be earth science which 28.9 percent of the time had no levels, 2.6 percent of the schools offered it at an advanced level, 39.5 percent offered it at the standard level, and 21.1 percent of the study population offered earth science at the basic level. Life science was offered more to basic level students than any other course (Table X).

Locally Developed Programs

In the section of the questionnaire dealing with locally developed programs, four questions were asked: (1) how or by whom were new science courses developed, (2) what was the course design, (3) how was the science enrollment status in the region and (4) how was the science course credit recognized by the state? Table XI showed how the teachers perceived local program development. Most of the courses were developed by the local system, 55.3 percent. The teacher was the only other major developer of courses, 29.8 percent.

The design of the course was felt to be important (Table XI). It was learned that the plan most frequently offered was a 6 week block with textbook orientation (36.8 percent). The second plan was as a semester course (28.9 percent). Thirdly, one year courses (23.7 percent)

TABLE XI

TEACHER PERCEPTIONS OF LOCAL PROGRAM DEVELOPMENT, COURSE DESIGN AND SCIENCE ENROLLMENT STATUS IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Developer | | |
| (1) Local system | 26 | 55.3 |
| (2) State adoption | 5 | 10.6 |
| (3) Teacher | 14 | 29.8 |
| (4) Student-teacher | 1 | 2.7 |
| (5) Other | 1 | 2.7 |
| Course Design | | |
| (1) 6 weeks, textbook | 14 | 36.8 |
| (2) 9 weeks, textbook | 2 | 5.2 |
| (3) Semester | 11 | 28.0 |
| (4) Minicourse | 2 | 5.3 |
| (5) One year | 9 | 23.7 |
| Science Enrollment | | |
| (1) Growing | 1 | 7.9 |
| (2) Declining | 3 | 2.6 |
| (3) Constant | 32 | 84.2 |
| (4) Other | 1 | 2.6 |

were offered. Two very small categories were 9 week textbook orientation (5.2 percent) and as minicourses (5.3 percent). Modular orientation either as a 6 or 9 week plan was not found nor were any courses offered with audiotutorial formats.

The teachers perceived the science enrollment as remaining fairly constant (84.2 percent) in contrast to the national trends, as reported earlier in the review of related literature, which showed a decline. A small number of teachers reported that their area was growing (7.9 percent).

The final question of this section pertained to the teacher's perception of the State of Tennessee's credit recognized for the courses offered (see Table XII). One year's credit was by far the most used plan (84.2 percent). Minicourse credit was reported by 5.2 percent of the teachers. The minicredit design was for an accumulation of several different credits, each of which was equal to less than one year's credit for any one subject. The State Department of Education recognized the accumulation of one such minicourse credit as acceptable for graduation requirement. None of the schools offered credit for two or more years in one subject the teachers reported.

NSF Programs

The majority of schools (82.5 percent) offered no NSF programs. Earth science is offered by 5.0 percent of

TABLE XII

TEACHER PERCEPTIONS OF CREDIT RECOGNITION IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| State Credit Recognition | | |
| (1) One year | 32 | 84.2 |
| (2) Minicourse | 2 | 5.2 |
| (3) Extra years as applied science credit | 1 | 2.6 |
| (4) Other | 3 | 7.9 |

the schools and 2.5 percent of the schools offered physics courses (Table XIII).

In the study population 73.8 percent did not use NSF material. Only 11.9 percent used one or more of the NSF textbooks while 7.1 percent of the teachers used some supplemental material, such as the BSCS newsletter. No schools were employing a total program: laboratory manuals, laboratory equipment packages, and audio-visual materials (Table XIII).

The future plans to use NSF programs in East Tennessee seemed equally unsure. The study population reported that 83.3 percent were not sure of any future plans to use NSF material. Only 2.8 percent have used NSF material but plan to drop it. Those teachers who were using NSF material now and planned to continue made up 11.1 percent of the respondents. The rest, 2.8 percent, indicated that their plans were contingent on the state adoption plans (Table XIII).

When asked if the teachers had ever examined or were using the newer NSF materials, the overwhelming response (86.8 percent) was no. When asked if they were using related but not NSF material, the teachers reported only ISIS, Individual Science Instructional System, with 10.5 percent acceptance (Table XIII).

TABLE XIII

TEACHER PERCEPTIONS OF NSF PROGRAMS IMPACT ON THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| 5. NSF Programs Offered | | |
| (1) None | 33 | 82.5 |
| (2) Earth science | 4 | 10.0 |
| (3) Physical science | 2 | 5.0 |
| (4) Other | 1 | 2.5 |
| 6. NSF Materials Used | | |
| (1) None | 31 | 73.8 |
| (2) Text material | 5 | 11.9 |
| (3) Lab manual | 1 | 2.4 |
| (4) Audio-visual material | 2 | 4.8 |
| (5) Supplementary material | 3 | 7.1 |
| 7. NSF Future Plans | | |
| (1) None | 30 | 83.3 |
| (2) Used but dropping | 1 | 2.8 |
| (3) Using and continuing | 4 | 11.1 |
| (4) Depends on state adoption | 1 | 2.8 |
| 8. Newer NSF Material Usage | | |
| (1) None | 36 | 87.8 |
| (2) Outdoor Biology | 2 | 4.9 |
| (3) Me and My Environment | 2 | 4.9 |
| (4) Intermediate Science (ISCS) | 1 | 2.4 |
| 9. Related NSF Material Usage | | |
| (1) None | 33 | 86.8 |
| (2) IIS | 4 | 10.5 |
| (3) Other | 1 | 2.6 |

Enrollment in Science Programs

As seen in Table II, page 48, the school enrollment in the rural and small town areas ranged most frequently around 400 to 600 students. The most frequent number reported by the teachers to be enrolled in the science programs was found to be less than 200 students (39.3 percent). The teacher's perceptions of the status of their school's science enrollment trends could be found in Table III, page 50. Most of the teachers (84.2 percent) perceive their science course enrollment as fairly constant in contrast to the national science enrollment trends that have shown decline.

## V. SCIENCE COURSE CONTENT

This section examined the emphasis placed on science by the teacher and the school. The teachers were asked about their emphasis on research in science in their school. The schools, the teachers reported, in 61.0 percent of the cases offered no research. Where research emphasis in science was offered, 24.4 percent of the schools entered the Science Fairs with their projects. Another 2.4 percent of the study population submitted research papers to the Junior Science Symposium or Westinghouse Talent Search. Another 7.3 percent have a combination of these selections (Table XIV).

As an indication of the schools' support of the science programs, the teachers were asked to evaluate

TABLE XIV

TEACHER PERCEPTIONS OF SCHOOL EMPHASIS ON SCIENTIFIC RESEARCH IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Research Emphasis | | |
| (1) None | 25 | 61.0 |
| (2) Enter science fairs | 10 | 24.4 |
| (3) Attend Jr. Sc. Sym. | 1 | 2.4 |
| (4) Submit papers | 2 | 4.8 |
| (5) Other | 3 | 7.3 |
| Administrative Support | | |
| (1) None | 15 | 30.0 |
| (2) Project room | 2 | 4.0 |
| (3) Time/room | 14 | 28.0 |
| (4) Trips | 6 | 12.0 |
| (5) Outdoor facility | 3 | 6.0 |
| (6) Small classes | 9 | 18.0 |
| (7) Other | 1 | 2.0 |
| Talented Science Student | | |
| (1) No | 34 | 89.5 |
| (2) Advanced biology | 2 | 5.3 |
| (3) College credit courses | 1 | 2.6 |
| (4) Other | 1 | 2.6 |

their programs in terms of the science equipment and released time for the teachers. From the study population 30.0 percent of the schools reported that there was none. Only 4.0 percent had a project room for science students. If students engaged in research, the teacher had to provide the time and the room for the student's projects in 28.0 percent of the cases. The administration did allow small classes for 18.0 percent of the teacher's reporting. Another 6.0 percent of the schools were reported by the teachers to have an outdoor facility on the grounds or nearby the school (Table XIV).

Special science courses for the talented student were available in biology in 5.3 percent of the study population (Table XIV). College credit is available in 2.6 percent of the cases. In 89.5 percent of the population, no special courses were available. This was understandable since most of the reported school's organization in the study population consisted of no higher than grade 9.

To determine the impact of controversial topics on the school's program, teachers were asked what flexibility existed for controversial discussions. The topics for discussion were left to the teacher's discretion in 73.7 percent of the cases. The school principal was the determining factor in 13.2 percent. There was no flexibility for discussion in 10.5 percent, and the supervisor

determined the flexibility 2.6 percent of the time (Table XV).

The most frequently discussed controversial topic was how the universe began (23.9 percent), and this was closely followed by the topic of animal and plant reproduction (20.2 percent). All of the topics and their rank could be seen in Table XV. Associated with the idea of controversial topics was the subject of value clarification. Most teachers (70.3 percent) included value clarification in their discussions, but they felt that there were limits as to what could be discussed (see Table XVI).

## VI. DESCRIPTIVE INFORMATION OF TEACHER PERCEPTION ON SCIENCE PROGRAMS AND PRACTICES

This section was concerned with descriptive information: science instructional practices and programs. Teacher perceptions of the preparation of science teachers, science programs for the special student, eligibility for science courses, instructional practices and science credit were all examined by the study population.

### Teacher Preparation

Items one through six dealt with teacher perceptions of the preparation of the science teacher (Table XVII). The question of who should teach the advanced courses was

TABLE XV

TEACHER PERCEPTIONS OF DISCUSSION OF CONTROVERSIAL TOPICS AND THEIR RANKING FOR THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Controversial Topics | | |
| (1) None | 4 | 10.5 |
| (2) Principal/superintendent | 5 | 13.2 |
| (3) Supervisor | 1 | 2.6 |
| (4) Teacher | 28 | 73.7 |
| Most Discussed Topics | | |
| (1) Abortion | 16 | 11.9 |
| (2) Contraception | 12 | 9.0 |
| (3) Reproduction | 28 | 20.9 |
| (4) Futuristics | 4 | 3.0 |
| (5) Ethics | 9 | 6.7 |
| (6) Universe beginnings | 32 | 23.9 |
| (7) Life on other planets | 14 | 10.4 |
| (8) Evolution | 19 | 14.2 |

TABLE XVI

TEACHER PERCEPTIONS OF VALUE CLARIFICATION AND THEIR INCLUSION IN THE SCIENCE PROGRAM IN THE FOUR COUNTY STUDY AREA (1979)

| Question | Number | Percent |
|---|---|---|
| Value Clarification | | |
| (1) No | 6 | 16.2 |
| (2) Yes with limits | 26 | 70.3 |
| (3) Yes no limits | 5 | 13.5 |
| How Included | | |
| (1) Whenever | 33 | 94.3 |
| (2) Biology | 1 | 2.9 |
| (3) Other | 1 | 2.9 |

TABLE XVII

TEACHER PERCEPTIONS OF DESCRIPTIVE INFORMATION ON TEACHER PREPARATION FOR THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | SA | A | U | D | SD | DK |
|---|---|---|---|---|---|---|
| 1. | 5.6 | 22.2 | 25.0 | 27.8 | 19.4 | |
| 2. | 36.1 | 30.6 | 11.1 | 11.1 | 11.1 | |
| 3. | 44.4 | 25.0 | 19.4 | 8.3 | 2.8 | |
| 4. | 8.3 | 41.7 | 38.9 | 11.1 | | |
| 5. | 50.0 | 41.7 | 5.6 | 2.8 | | |
| 6. | 16.7 | 27.8 | 28.9 | 16.7 | | |

Q. No. = question number; A = agree; D = disagree; SA = strongly agree; U = undecided; SD = strongly disagree; DK = don't know.

the subject of questions one and two. When asked if the senior member of the science staff should teach this course, the teachers chose the category of disagree 27.8 percent. Of those disagreeing, males disagreed more strongly (39.1 percent) than females (7.7 percent). The females leaned toward the undecided choice, 38.5 percent (Table XVIII). The teachers from the 21-30 age group chose the strongly disagree category (14.3 percent); whereas, the 41-50 age group was equally split between those who chose the disagree and those who chose the undecided category (Table XVIII).

In the second item, the teachers were asked if advanced courses should be taught by the best educated member of the science staff. The teachers chose the categories agree (30.6 percent) or strongly agree (36.1 percent). The females agreed more strongly in both categories than the males--38.5 percent in both the strongly agree and agree (Table XVIII). When examined with respect to age, the 21-30 age group of teachers agreed and strongly agreed 26.7 percent of the time.

There was agreement (44.4 percent) that politics definitely played a role in selecting who taught the advanced courses; and as shown in Tables XVII-XX, regardless of age, sex or residence, all of the teachers felt the same.

In item four, the information suggested that teachers should have backgrounds containing preparation

TABLE XVIII

TEACHER PERCEPTIONS OF TEACHER PREPARATION BY AGE FOR THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No.* | T. % | Age Range | No. | % | Response |
|---|---|---|---|---|---|---|
| 1. | 10 | 28.6 | 21 - 30 | 5 | 14.3 | SD |
| | | | 41 - 50 | 3 | 8.6 | |
| | 8 | 22.9 | 21 - 30 | 3 | 8.6 | U |
| | | | 41 - 50 | 3 | 8.6 | |
| 2. | 12 | 34.3 | 21 - 30 | 4 | 26.7 | SA |
| | 11 | 31.4 | 21 - 30 | 4 | 26.7 | A |
| 3. | 15 | 42.9 | 21 - 30 | 7 | 20.0 | SA |
| 4. | 15 | 42.9 | 21 - 30 | 8 | 22.9 | U |
| | | | 21 - 30 | 5 | 14.3 | A |
| 5. | 17 | 48.6 | 21 - 30 | 8 | 22.9 | SA |
| | 15 | 42.9 | 41 - 50 | 6 | 17.1 | A |
| 6. | 14 | 40.0 | 21 - 30 | 7 | 20.0 | U |

*T. No. = total number.

TABLE XIX

TEACHER PERCEPTIONS OF TEACHER PREPARATION BY SEX FOR THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | % Males | % Females | Response |
|---|---|---|---|---|---|
| 1. | 10 | 27.8 | 39.1 | 7.7 | D |
| | 9 | 25.0 | 17.4 | 38.5 | U |
| 2. | 13 | 36.1 | 34.8 | 38.5 | SA |
| | 11 | 30.6 | 26.1 | 38.5 | A |
| 3. | 16 | 44.4 | 43.5 | 46.2 | SA |
| 4. | 15 | 41.7 | 39.1 | 46.2 | A |
| | 14 | 38.9 | 43.5 | 30.8 | U |
| 5. | 18 | 50.0 | 47.8 | 53.8 | SA |
| | 15 | 41.7 | 39.1 | 46.2 | A |
| 6. | 14 | 38.9 | 43.5 | 30.8 | U |

TABLE XX

TEACHER PERCEPTIONS OF TEACHER PREPARATION BY LOCALE FOR THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | Locale | No. | % | Response |
|---|---|---|---|---|---|---|
| 1. | 10 | 27.8 | Rural | 8 | 22.2 | D |
| 2. | 13 | 36.1 | | 8 | 22.2 | SA |
| | 11 | 30.6 | | 7 | 19.4 | A |
| 3. | 16 | 44.4 | Both | 8 | 22.2 | SA |
| 4. | 14 | 38.9 | Rural | 11 | 30.6 | U |
| | 15 | 41.7 | Small Town | 8 | 22.2 | A |
| 5. | 18 | 50.0 | Both | 9 | 25.0 | SA |
| 6. | 14 | 38.9 | Rural | 11 | 30.6 | U |

in ethics or bioethics. The teachers agreed (41.7 percent) on this question. The teachers who agreed were closely followed by a group who were undecided at 38.9 percent. Males tended to lean toward the undecided choice (43.5 percent) while females chose agree more often (46.2 percent). The youngest group of teachers favored the undecided position (22.9 percent) and also showed the choice of agree (14.3 percent).

Information reported by teachers suggested teacher preparation should emphasize practical information, such as laboratory planning, equipment, safety procedures, etc. Teachers chose the strongly agree 50.0 percent and the agree 41.7 percent of the time. The females favored the strongly agree category (53.8 percent) more often than they chose agree (46.2 percent). The teachers in the 21-30 age group selected the category of strongly agree (22.9 percent).

Item six pertained to teacher's attitudes toward the use of competency tests being given prior to hiring. Teachers were undecided on this practice (28.9 percent). Males showed that they matched the undecided 43.5 percent to the females' match of 30.8 percent. The age group 21-30 showed an agreement of 50.0 percent on this question (Table XIX).

Special Programs

In items 7 through 12, the topics dealt with areas of special programs or facilities available to the students

and the student's eligibility for science programs (Table XXI). In question 7 the teachers were asked about the necessity of an outdoor facility or field experiences for their students. The reporting teachers agreed that they perceived outdoor activities as a need, 61.1 percent. Females agreed slightly more (61.5 percent) to males (60.9 percent). The youngest age group expressed their recognition of this need and chose agree (22.9 percent).

In item 8 the availability of resource or special education teachers for aiding the teacher in planning programs for the handicapped student was approached. The opinions are unclear with as many agreeing as disagreeing (38.2 percent). The males tended to choose disagree slightly more (38.1 percent to 33.3 peccent) than the females who were equally split 38.5 percent in each category (Table XXII). When examined with respect to age groups, more teachers of the 31-40 age group chose disagree. The teachers disagreed 18.2 percent of the 39.4 percent in the disagree category. In the agree portion, the 41-50 age group matched 15.2 percent of the time.

In item 9 the teachers were asked if they perceived "mainstreaming" as successful and wanted to see it continued. Table XXI showed most teachers were undecided (48.6 percent), and a few (2.9 percent) were unfamiliar with the idea. This trend was found in both the male and female agreement with the undecided category. Males showed

TABLE XXI

TEACHER PERCEPTIONS OF DESCRIPTIVE INFORMATION ABOUT SPECIAL PROGRAMS IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | SA | A | U | D | SD | DK |
|---|---|---|---|---|---|---|
| 7. | 33.3 | 61.1 | 5.6 | | | |
| 8. | 8.8 | 35.3 | 11.8 | 38.2 | 5.9 | |
| 9. | 8.6 | 8.6 | 48.6 | 25.7 | 5.7 | 2.9 |
| 10. | 8.8 | 44.1 | 23.5 | 11.8 | 2.9 | 8.8 |
| 11. | 16.9 | 38.9 | 28.3 | 25.0 | 11.1 | |
| 12. | 13.9 | 30.6 | 19.4 | 27.8 | 8.3 | |

TABLE XXII

TEACHER PERCEPTIONS OF SPECIAL PROGRAMS BY SEX IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | % Males | % Females | Response |
|---|---|---|---|---|---|
| 7. | 22 | 61.1 | 60.9 | 61.5 | A |
| 8. | 13 | 38.2 | 38.1 | 38.5 | D |
| | 12 | 35.2 | 33.3 | 38.5 | A |
| 9. | 17 | 48.6 | 50.0 | 46.2 | U |
| | 1 | 2.9 | 0.0 | 100.0 | D |
| 10. | 15 | 44.1 | 42.9 | 35.2 | A |
| 11. | 14 | 38.9 | 43.5 | 40.8 | A |
| 12. | 11 | 30.6 | 39.1 | 15.4 | A |
| | 10 | 27.8 | 30.4 | 23.1 | D |

50.0 percent undecided and females 46.2 percent. The youngest age group showed the greatest agreement (23.5 percent with undecided). The teacher group that was most unfamiliar with the idea was the 51-60 age bracket (Table XXIII). In examining the locale of the school's influence on their discussion, it was found that there was highest agreement with agree group, 37.1 percent, which only slightly exceeded those who disagreed, 27.8 percent.

In item 10 the teachers were asked specifically if the Individual Education Program (IEP) increased the teacher's workload. Also they were asked if IEP were beneficial to the student. Forty-four percent agreed with this statement. Again males and females were about the same. The 21-30 age group and the 31-40 age group made up two-thirds of the agreement category. The rural teachers chose the agree category more frequently than small town teachers (Table XXIV).

In questions 11 and 12, the subject dealt with was the idea of eligibility for science course offerings. The teachers were asked if science courses should be open to all students regardless of ability. The study population agreed with this idea, 38.9 percent. Both males (43.5 percent) and females (40.8 percent) chose agree for this category. Both the 21-30 age group and rural teachers showed highest agreement in the agree category (Tables XXII-XXIII).

TABLE XXIII

TEACHER PERCEPTIONS OF SPECIAL PROGRAMS BY AGE IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. & | Age Range | No. | % | Response |
|---|---|---|---|---|---|---|
| 7. | 22 | 61.9 | 21 - 30 | 8 | 22.9 | A |
| 8. | 13 | 39.4 | 31 - 40 | 6 | 18.2 | D |
| | 12 | 36.4 | 41 - 50 | 5 | 15.2 | A |
| 9. | 17 | 50.0 | 21 - 30 | 8 | 23.5 | U |
| 10. | 15 | 45.5 | 21 - 30 | 6 | 18.2 | A |
| | | | 31 - 40 | 5 | 15.2 | |
| 11. | 14 | 40.0 | 21 - 30 | 5 | 14.3 | A |
| 12. | 11 | 31.4 | 21 - 30 | 5 | 14.3 | A |
| | 10 | 28.6 | 21 - 30 | 4 | 11.4 | D |
| | | | 41 - 50 | 3 | 8.6 | D |

TABLE XXIV

TEACHER PERCEPTIONS OF SPECIAL PROGRAMS BY LOCALE IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | Locale | No. | % | Response |
|---|---|---|---|---|---|---|
| 7. | 22 | 61.1 | Rural | 14 | 38.9 | A |
| 8. | 13 | 38.2 | | 8 | 23.5 | D |
| | 12 | 35.3 | | 8 | 12.5 | A |
| 9. | 17 | 48.6 | | 13 | 37.1 | A |
| | | | Small Town | 4 | 11.4 | U |
| 10. | 15 | 44.1 | Rural | 10 | 29.4 | A |
| 11. | 14 | 38.9 | | 9 | 25.0 | A |
| 12. | 11 | 30.6 | | 6 | 16.7 | A |
| | | | Small Town | 5 | 13.9 | |
| | 10 | 27.8 | Rural | 7 | 19.4 | D |

In question 12 the idea of eligibility was narrowed still further by asking if only students who have completed established prerequisites should be allowed to take science course offerings. Those who agreed (30.6 percent) only slightly exceeded those who disagreed (27.8 percent). Females tended to disagree more, 23.1 percent to 15.4 percent who agreed. The age group showing the highest agreement was the 21-30 group (14.3 percent) and also showed the greatest percent in the disagree category (11.4 percent). Teachers in the rural areas were fairly evenly split, 16.7 percent agree to 19.4 percent disagree. The sma-1 town teachers chose the strongly agree category (35.7 percent) over (21.4 percent) the disagree or undecided categories (Table XXIV).

## Instructional Practices in Science Teaching

In questions 13 through 28, the idea of teachers' perception of instructional practices were examined in Tables XXV-XXVIII. Several aspects of instructional practices were examined: value clarification, controversial topics, research emphasis, career education and more practical science course material.

Value clarification in science teaching. In question 13 the teacher was asked if the students needed to practice value identification. The agreement with this question was 62.9 percent. Sixty percent of the males agreed with this

TABLE XXV

TEACHER PERCEPTIONS OF DESCRIPTIVE INFORMATION IN INSTRUCTIONAL PRACTICES FOR THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | SA | A | U | D | SD | DK |
|---|---|---|---|---|---|---|
| 13. | 19.4 | 62.9 | 16.7 | | | |
| 14. | 2.8 | 30.6 | 50.0 | 13.9 | | 2.8 |
| 15. | 5.6 | 2.8 | 33.3 | 44.4 | 13.0 | |
| 16. | 11.1 | 52.6 | 22.2 | 13.9 | | |
| 17. | 8.2 | 41.7 | 22.2 | 22.2 | 5.6 | |
| 18. | 20.6 | 72.5 | 2.0 | 2.9 | | |
| 19. | 12.1 | 39.4 | 27.3 | 21.2 | | |
| 20. | 2.9 | 48.6 | 25.7 | 22.9 | | |
| 21. | 25.7 | 51.4 | 20.0 | 2.9 | | |
| 22. | 11.4 | 74.3 | 2.9 | 11.4 | | |
| 23. | 11.4 | 45.7 | 22.9 | 17.1 | 2.9 | |
| 24. | 2.9 | 22.9 | 42.9 | 28.6 | 2.9 | |
| 25. | 18.2 | 45.5 | 24.2 | 9.2 | 3.0 | |
| 26. | 22.9 | 48.6 | 22.9 | 2.9 | 2.9 | |
| 27. | 11.4 | 48.6 | 28.6 | 11.4 | | |
| 28. | 9.1 | 51.5 | 9.1 | 30.3 | | |

TABLE XXVI

TEACHER PERCEPTIONS OF INSTRUCTIONAL PRACTICES BY SEX IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | % Male | % Female | Response |
|---|---|---|---|---|---|
| 13. | 23 | 62.9 | 60.9 | 69.2 | A |
| 14. | 18 | 50.0 | 56.5 | 28.5 | U |
| | 11 | 30.6 | 30.4 | 30.8 | A |
| 15. | 16 | 44.4 | 43.5 | 46.2 | D |
| 16. | 19 | 52.8 | 56.5 | 46.2 | A |
| 17. | 15 | 41.7 | 47.7 | 30.8 | A |
| | 8 | 22.2 | 26.1 | 15.4 | D |
| 18. | 15 | 41.7 | 47.7 | 30.8 | A |
| 19. | 13 | 39.4 | 42.9 | 33.3 | A |
| 20. | 17 | 38.6 | 50.0 | 46.2 | A |
| 21. | 18 | 51.4 | 59.1 | 38.5 | A |
| 22. | 26 | 74.3 | 81.8 | 61.5 | A |
| 23. | 16 | 45.7 | 45.5 | 46.2 | A |
| 24. | 15 | 42.9 | 40.9 | 46.2 | U |
| 25. | 15 | 45.5 | 42.9 | 50.0 | A |
| 26. | 17 | 48.6 | 59.1 | 30.0 | A |
| 27. | 17 | 48.6 | 50.0 | 46.2 | A |
| 28. | 17 | 51.5 | 45.5 | 63.6 | A |

TABLE XXVII

TEACHER PERCEPTIONS OF INSTRUCTIONAL PRACTICES BY AGE IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | Age Range | No. | % | Response |
|---|---|---|---|---|---|---|
| 13. | 23 | 65.7 | 21 - 30 | 10 | 28.6 | A |
| 14. | 18 | 51.4 | 21 - 30 | 7 | 20.0 | U |
| | 11 | 31.4 | 21 - 30 | 6 | 17.1 | A |
| 15. | 16 | 45.7 | | 8 | 22.9 | D |
| 16. | 19 | 54.3 | | 9 | 25.7 | A |
| 17. | 15 | 42.9 | | 5 | 14.3 | A |
| | | | 41 - 50 | 5 | 14.3 | |
| 18. | 14 | 42.9 | 21 - 30 | 5 | 14.3 | A |
| 19. | 13 | 40.6 | | 6 | 18.8 | |
| 20. | 17 | 50.0 | | 7 | 20.6 | |
| 21. | 18 | 52.9 | | 7 | 20.6 | |
| 22. | 26 | 76.5 | | 11 | 32.4 | |
| 23. | 16 | 47.1 | | 6 | 17.6 | |
| 24. | 15 | 44.1 | | 7 | 20.6 | U |
| 25. | 15 | 46.9 | 31 - 40 | 4 | 12.5 | A |
| | | | 51 - 60 | 4 | 12.5 | |
| 26. | 17 | 50.0 | 21 - 30 | 7 | 20.6 | |
| 27. | 17 | 50.0 | | 8 | 23.5 | |
| 28. | 17 | 51.5 | | 6 | 18.2 | |

TABLE XXVIII

TEACHER PERCEPTIONS OF INSTRUCTIONAL PRACTICES BY LOCALE IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | Locale | No. | % | Response |
|---|---|---|---|---|---|---|
| 13. | 23 | 63.9 | Rural | 16 | 44.4 | A |
| 14. | 18 | 50.0 | | 11 | 30.6 | U |
| 15. | 16 | 44.4 | | 10 | 27.8 | D |
| | 12 | 33.3 | Small Town | 6 | 16.7 | U |
| 16. | 19 | 52.8 | Rural | 10 | 27.8 | A |
| | | | Small Town | 9 | 25.0 | |
| 17. | 15 | 41.7 | Rural | 9 | 25.0 | A |
| 18. | 15 | 41.7 | | 10 | 25.0 | |
| 19. | 13 | 39.4 | | 10 | 30.3 | |
| 20. | 17 | 48.6 | | 11 | 31.4 | A |
| 21. | 18 | 51.4 | | 13 | 37.1 | A |
| 22. | 26 | 74.3 | | 19 | 54.3 | |
| 23. | 16 | 45.7 | | 10 | 38.6 | |
| 24. | 15 | 42.9 | | 11 | 31.4 | U |
| 25. | 15 | 45.5 | | 8 | 24.2 | A |
| | | | Small Town | 7 | 21.2 | |
| 26. | 17 | 48.6 | | 13 | 37.1 | |
| 27. | 17 | 48.6 | | 13 | 37.1 | |
| 28. | 17 | 51.5 | | 13 | 39.4 | |

choice as compared to approximately 69 percent of the females (Table XXVI). Again the 21-30 age group was in highest agreement, 28.6 percent, for the choice of agree. The rural teachers agreed more (44.4 percent) than did the small town teachers (19.5 percent).

When asked if bioethics should be a part of the science curriculum, 50 percent of the teachers were undecided. Thirty percent said they were in favor of a bioethics course. Males and females differed greatly on their level of agreement on the choice undecided--56.5 to 28.5 percent, respectively. In Table XXVII the 21-30 age classification matched most closely in both the areas of undecided (31.4 percent) and the area of agree (51.4 percent).

In item 15 an alternative point of view was stated, the idea that value identification was not the function of the science curriculum. The teachers disagreed with this position, 44.4 percent. Females disagreed slightly more (46.2 percent to 43.5 percent) than males. The youngest age group of teachers disagreed 50.0 percent of the time on this question. The teachers in the rural area felt more strongly about this question, 22.9 percent disagreed. The small town teachers were split between undecided and disagree, both with 42.9 percent (Table XXVIII).

Controversial topics. An attempt was made to evaluate the national trend as to what might increase the appeal of science. Teachers were asked if more discussion of controversial topics would appeal to students. Teachers agreed 52.6 percent of the time. All of the males, females and the 21-30 age group showed high agreement with this question. Small town teachers felt strongly about this idea, too, making up 25.0 of the agree category.

Teachers were asked their feelings about having a parent advisory board to assist the science program to expand into controversial areas. The response was 41.7 percent agreeing while 22.2 were either undecided or disagreed. Males agreed more--47.7 percent--than females--30.8 percent. Both the 21-30 and 41-50 age groups showed 33.3 percent agreement. The youngest group showed the highest percent undecided, 37.5 percent, as well as the highest disagreement, 50.0 percent. Both rural and small town teachers did not agree, 25.0 to 16.7 percent, respectively.

Scientific research. In items 19 and 20 the teachers' perception of the importance of scientific research was examined (Table XXV). When asked if science inquiry is emphasized by requiring students to enter research competitions, 39.4 percent of the teachers agreed that they did require entering competitions. How research should be

offered within the program or as a separate module of study is the subject of question 20. The teachers thought research should be a part of a science course rather than as a module unto itself in 48.6 percent of the respondents.

Items 21 and 22 are related to whether a varied science format should be used in Biology II or advanced or in all science courses regardless of the level. The teachers felt strongly that the varied format should be used in all sciences (74.3 percent) rather than just in the advanced courses (51.4 percent) as asked in item 21.

Career education. Items 23 and 24 inquired as to the place of career education and the use of this topic by the teacher. The teachers said that they did have career education (45.7 percent), but in 42.9 percent of the cases the teachers were unsure as to whether it should be a separate course rather than a part of the science class. The locale (Table XXVIII) did not matter; both groups of teachers felt the same about their usage of career education. However, small town teachers were more undecided about the idea of having career education as a separate course. Females out-rated males in both their agreement (46.2 to 45.5 percent) and their uncertainty (46.2 to 40.9 percent).

More practical science courses. In items 25 through 28, all the teachers were asked if the emphasis of making science more practical was perceived by the teacher as a need (Table XXV, page 82). When asked if a nontechnical course was offered for students beyond the ninth grade, the teachers said it was offered in their schools (45.5 percent). Then teachers were asked if they thought a more practical approach would increase the appeal and enrollment in science courses; and again they agreed, 48.6 percent. They agreed (48.6 percent) when asked if the use of nontechnical material would appeal to their students. Finally, teachers were asked if they included field trips in their science courses, and 51.5 percent said they did. Males seemed to show greater agreement with the idea of practicality (59.1 percent) and the use of nontechnical material (50.0 percent) while females tended to include more usage of field trips (63.6 percent). The locale of the teacher made more of a difference substantially with small town teachers; 37.1 percent tended to use field trips more than did the teacher of rural areas. Two age groups, 31-40 and 51-60, were in greater agreement with the idea of practicality in science courses than were any others.

## Credit

In item 29 (Tables XXIX-XXXII), the teachers were asked if they perceived a need for the expansion of state credit to allow additional years of science to be taken in

TABLE XXIX

TEACHER PERCEPTIONS OF DESCRIPTIVE INFORMATION ON CREDIT FOR THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | SA | A | U | D | SD | DK |
|---|---|---|---|---|---|---|
| 29. | 2.9 | 48.6 | 42.9 | 5.7 | | |
| 30. | 2.9 | 48.6 | 31.4 | 17.1 | | |
| 31. | 5.7 | 54.3 | 31.4 | 8.6 | | |
| 32. | 5.7 | 22.9 | 28.6 | 40.0 | | |
| 33. | 5.9 | 11.8 | 23.5 | 55.9 | 2.9 | |

TABLE XXX

TEACHER PERCEPTIONS OF CREDIT BY SEX IN THE FOUR COUNTY STUDY AREA (1979)

| Q. No. | T. No. | T. % | % Males | % Females | Response |
|---|---|---|---|---|---|
| 29. | 17 | 48.6 | 50.0 | 46.2 | A |
| | 15 | 42.9 | 50.0 | 30.8 | U |
| 30. | 17 | 48.6 | 54.5 | 38.5 | A |
| 31. | 19 | 54.3 | 54.5 | 53.8 | A |
| 32. | 14 | 40.0 | 45.5 | 30.8 | D |
| 33. | 19 | 55.9 | 63.6 | 41.7 | D |

TABLE XXXI

TEACHER PERCEPTIONS OF CREDIT BY AGE IN THE FOUR COUNTY STUDY AREA (1979)

| Q No. | T No. | T % | Age | No. | % Resp. |
|---|---|---|---|---|---|
| 29. | 17 | 50.0 | 21-30 | 7 | 20.6 A |
| 30. | 17 | 50.0 | 21-30 | 9 | 26.5 A |
| 31. | 29 | 55.9 | 21-30 | 8 | 12.5 A |
| 32. | 13 | 38.2 | 21-30 | 6 | 17.6 D |
| | | | 31-40 | 5 | 14.7 D |
| 33. | 19 | 57.6 | 21-30 | 7 | 21.2 D |

TABLE XXXII

TEACHER PERCEPTIONS OF CREDIT BY LOCALE IN THE FOUR COUNTY STUDY AREA (1979)

| Q No. | T No. | T % | Rural | No. | % Resp. |
|---|---|---|---|---|---|
| 29. | 17 | 48.6 | Rural | 10 | 28.6 A |
| | 15 | 42.9 | | 12 | 34.3 U |
| 30. | 17 | 48.6 | | 11 | 31.4 A |
| 31. | 19 | 54.3 | | 12 | 37.1 A |
| 32. | 14 | 40.0 | | 8 | 22.9 D |
| 33. | 19 | 55.9 | | 13 | 38.2 D |

one area such as chemistry. The teachers were split between agree (48.6 percent) and undecided (42.9 percent).

In items 30 and 31, teachers were asked about the state's existing plan of "out-of-school" credit for the areas of science. Teachers felt (48.6 percent) that students should be given credit for participation in science activities, and 54.3 percent felt that this credit would encourage participation in science fairs or other related science projects. Males felt most strongly (54.5 percent) about students receiving credit through an "out-of-school" program for science participation (Table XXX). Rural area teachers favored both ideas, 31.4 to 37.1 percent, more than small town teachers (Table XXXII).

In items 32 and 33, teachers were asked about the requiring of research to obtain student participation in science fairs and for advanced science students. Both ideas were rejected by the respondents, particularly the males, as can be seen in Table XXX.

## VII. SUMMARY

The study was organized into the following seven sections: Introduction which identified the study population; Background Information of School Population which showed the schools to be medium sized and located in a rural setting; Background Information of Teachers which showed the preponderance of teachers responding to be males

with a BA/BS degree in education; Science Course Information which showed that the science offered to be those of a middle school variety; Program Information which showed an emphasis on course development and design that is conservative in nature; and Descriptive Information which identifies teacher perception in the areas of teacher preparation, special programs, instructional practices and credit. Related narratives to present the data and its analysis were used when describing the tables of material containing the pertinent data. A complete summary of the findings is presented in Chapter V.

# CHAPTER V

# SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

## I. SUMMARY

Although on the national level science interest and enrollment seemed to be declining as indicated by the literature search, this study was undertaken to determine if those national trends were found in the four selected counties of East Tennessee. In addition to national trends, the review of related literature showed that studies had been conducted to determine the status of science education, which led to improvement in the quality of science education. No study has been found on the perceptions of the status of teachers currently teaching secondary science nor of the teacher perceptions of the qualifications of the teaching staff and their practices for the East Tennessee region; thus, there existed a need for an assessment.

The purpose of this study was to identify the status of the secondary school science program and to analyze the perceptions of the staff concerning selected aspects of the science curriculum in four counties of East Tennessee.

The questions to be answered as stated in Chapter I were:

(1) What are the perceptions of the secondary science teachers regarding the qualifications and preparation of the science teaching staff?

(2) What are the teachers' perceptions of the numbers, levels and variety of science course offering in their school?

(3) What are the perceptions of the enrollment trends in science courses including the NSF science program?

(4) What are the perceptions of the teachers of the appropriateness of the content in the science courses?

(5) What are the perceptions of the science teachers regarding the characteristics of instructional practices in the science courses?

A direct-mail questionnaire was the primary methodology utilized in this study. The questionnaire was distributed to all current science teachers of grades 7 through 12 in the public school of the four counties of East Tennessee. A total study population of 38 schools was utilized. In the 38 schools there were approximately 71 teachers and 38 of these responded to the questionnaire, giving a 53.5 percent response to the study.

Analysis of the data was made in terms of frequencies, percents, and totals. The data collected were most appropriately reported by the descriptive survey method accompanied by tables, charts and graphs. A complete presentation of the findings is found in Chapter IV.

Based upon data gathered in this study, the findings indicated that:

(1) The most typical science teacher of this region was male between the ages of 21-30 years with four to six years' teaching experience; for females the average age was the 51-60 age group of teachers with 13 plus years' experience.

(2) The education level most frequently found for the teachers of the study area was a BA/BS degree in education with a science certification.

(3) Although the questionnaires were sent to all science teachers in grades 7-12, most of the responding teachers were from grades 7, 8, and/or 9.

(4) The teachers of the study area taught in schools that were located in either a rural or small town setting.

(5) The most typical school size of the study area was reported by the teachers to be of 400 students or less. The teachers also reported that regardless of the school size they felt that the science enrollment within the schools was remaining fairly constant.

(6) The science course most frequently offered in the study area was general science which was offered yearly. The science courses offered are mainly required courses with no ability or difficulty levels and no prerequisites.

(7) The science programs offered by the schools were

developed locally and were based heavily on the textbook. The textbook emphasis was found consistently whether the course was taught in either 6 or 9 week segments.

(8) The NSF program material has had little direct impact on this region in the past, and the future plans for the usage of NSF material in the study area would be based on state textbook adoption plans. Although the school may not adopt a specific NSF program by title, the NSF material is now a part of many newer text books.

(9) The teachers reported that there were no requirements beyond a BA/BS degree for the teacher of the advanced science courses of their school. Most of the teachers felt the teaching position for the advanced courses should go to the best educated member of the staff. Teachers reported that since politics played such a large role in the selection of who taught the courses that the best educated staff member was not always chosen for the position.

(10) Special programs such as mainstreaming or IEP had made little impact in the study area.

(11) The teachers were in favor of varied formats, more practical science programs and no prerequisites for all students in the science program. The teachers felt that more practical and less technical material would increase the appeal of the science courses.

(12) The teachers favored an emphasis on values in the science courses but not to the point of establishing

a separate course. They felt that same was true of career education.

(13) The teachers also were in favor of more parental participation in the form of an advisory board. The participation, they felt, could widen the scope of controversial topics and possibly this broadening of the scope of the topics for discussion would appeal to students.

(14) The teachers indicated that they did take advantage of science research by entering competitions. The teachers reported difficulty in having adequate facilities for the students to do their research. This difficulty may have resulted in the teachers feeling that requiring research was not the best way to achieve participation in science fairs, nor did they require research in order to get an A grade or in the advanced classes.

## II. CONCLUSIONS

Analysis of the data collected during the process of the study provided sufficient evidence to answer the five questions on pp. 3-4 under the Purpose of the Study:

(1) There was evidence that there was not very effective matching of training background of the teacher's preparation to the science position as there were many individuals with advanced backgrounds in the biological sciences but only a few schools offered either advanced science or Biology II. The incompatibility of teachers'

training in regard to the subjects they teach could influence the students by decreasing his/her interest in science since the teacher could be less effective in a subject for which (s)he was poorly prepared. This idea was found in the national trends to have influenced student's lack of interest in science.

(2) There was not a large variety of science courses offered due to the large number of respondents from schools with small enrollment numbers. Also most of the teachers of science in the study area were teaching grades 7 through 9 using a middle school emphasis on curriculum rather than an organization similar to high school where selection of courses is possible.

(3) The enrollment in the science courses was found to remain fairly constant in the study area in contrast to the national science enrollment trends that showed a decline. The population of the area has also held constant over the period from 1960-1970.

(4) The NSF programs have had little direct impact in this area. Most of the study area's programs are locally developed or developed by the teachers within the system. There was evidence of the rural nature of the population in that some schools had developed agricultural science courses for the students.

(5) The conservative nature of the responses indicated that there was not much experimentation with new ideas

in the region. The subjects, presentation, usage of text oriented material, failure to accept new ideas such as new courses, new practices, etc., indicated that the content had changed very little and would probably remain so in the study region. The same teaching practices and materials were used even though large numbers of the teachers indicated participation in training programs through the university and expressed an interest in keeping current through reading related materials and periodicals.

## III. IMPLICATIONS AND RECOMMENDATIONS

The following implications and recommendations are offered on the basis of the findings of this study:

(1) There should be improved efforts to match teaching backgrounds to the teaching position.

(2) Improvement in advancement practices should be established within the schools or at least improvement in internal communications in the school as to why one person was advanced over another which might help the teacher's perception of the justification for the advancement. The standardization of advancement practices could serve as incentives to teachers for improving educational backgrounds.

(3) If the NSF programs desired to continue to have their courses used in local school systems, more effort would have to be made to bring the course information into

the college or university realm. This effort would seem to be the best way to reach the teachers of this region.

(4) Since these in-service teachers are native to this area, more effort should be made to bring updating courses to them through summer and evening course work to acquaint them with the way new materials and techniques on a practical and more nontechnical approach could be achieved or what materials were already available commercially. If the information could not be made available through the university courses, then it could be made available through such local operations as teacher workshops or teacher centers. This familiarity with the material might inspire the teachers to request the state to adopt more of the less technical and more practically oriented materials.

(5) There was also an indication of a need for more practical and less difficult material and methods to be included in the pre-service teacher programs since some new teachers are being employed in the study area. The teachers felt that the use of this material might increase science enrollment. The younger teachers seemed to be more open to the use of new practices and materials, hence, there would be the need for the materials to be included in pre-service programs.

(6) Additional research should be conducted in areas which included large metropolitan communities to determine if the stability in science course enrollment was

characteristic to Tennessee as a whole or only to the study area. Also further examination of teacher perceptions of teaching practices would be necessary to determine the influence of the problems identified in the study.

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# APPENDICES

# APPENDIX A

## SPECIAL SCIENCE PROGRAMS

BSCS: Biological Science Curriculum Study stresses science as inquiry and the historical background of biological concept.

BSCS: Biological Science: Interaction of Experiments and Ideas. A second level course in biology which is almost entirely a program on the investigative phase of biology.

BSCS: BSCS has three versions or textbooks: Y--yellow is a classical approach, G--green is an exological-evolutionary approach, B--blue is a physiological-biochemical approach.

CBA: Chemical Bond Approach Project has one central scheme around which it is organized--the study of chemical bonds.

CHEMS Program: Chemical Education Materials Study describes its conceptual schemes in terms of behavioral observations that the student is expected to achieve.

ESCP: Earth Science Curriculum Project is an activity centered course for ninth graders.

HSP: Human Science Program for the middle school (grades 6 to 8) which is multidisciplinary in approach.

IME: Interaction of Matter and Energy is a ninth grade course based on the inquiry system and is a laboratory

IIS: Ideas and Investigations in Science by Wong Dolmatz is a series for junior and senior high school science including Life Science, Physical Science, Biology, Chemistry and Physics.

IPS: Introductory Physical Science was developed as an alternative to earth science for the ninth grade.

ISCS: Intermediate Science Curriculum Study is a series of topic studies. There are three levels concerned with physical, chemical, and biological sciences.

ISIS: Individualized Science Instruction System is an integrated science course for the ninth grade.

OBIS: Outdoor Biology Instruction Strategies is directed to the intermediate school age child.

PSSC: Physical Science Study Committee is a high school physics course emphasizing the logical unity of physics by stressing the inseparable qualities of time, space and matter.

TSM: Time, Space and Matter is a secondary school physical science course developed at Princeton University.

APPENDIX B

APPLICATION FOR REVIEW OF RESEARCH

FORM B -- THE UNIVERSITY OF TENNESSEE, KNOXVILLE

CRP#_____
Date Received_____

Application for Review of Research Involving Human Subjects
(In accordance with general institutional assurance dated July 15, 1975, as amended November 25, 1975)

I. Identification of Project: Specialist in Education Thesis

Date: February 20, 1979

Project Director: Sue Stockman Arnhart
(Dr. A. Paul Wishart, Committee Chairman)

Title of Project: The status of science course offerings and teacher perceptions of science education in the public school systems of four selected counties in East Tennessee

Supporting Agency: None

Department: Curriculum and Instruction

Estimated Starting Date and Completion Date: March 1979 to April 1979

Grand Submission Deadline: None

II. Objectives of Project:

The general objective of this study is to find how science teachers feel about elective science education in public secondary schools. The data provided from the study will answer the specific questions:

(1) How do secondary science teachers perceive the qualifications of the science teaching staff?
(2) How do secondary science teachers perceive the numbers, levels and variety of science course offerings?
(3) How do the secondary science teachers perceive the enrollment trends in the elective science courses including the NSF science programs?

(4) How do secondary science teachers perceive the appropriateness of content in the elective science courses?
(5) How do secondary science teachers perceive the characteristics of instructional practices in the elective science courses?

III. Description of Subjects:

The subjects for this study will consist of a sample from secondary science teachers. This sample will consist of all science teachers in schools whose grade levels are organized to include grades 7 through 12 in the following East Tennessee Counties: Roane, Scott, Morgan, and Loudon. There are approximately 200 individuals in this sample. All members of this sample are above 18 years of age.

IV. Methods of Procedure:

Data will be gathered for this study through the use of a questionnaire. This questionnaire will be administered to approximately 200 science teachers. The questionnaire will consist of five parts.

Part I will ask for general background information, school organization, age, sex, educational background, subjects taught, levels taught, college major and subject matter up-dating by the teacher. Part II will consist of science program offerings as to the frequency, level, curriculum position and prerequisites. Part III will deal with locally developed programs, NSF programs and enrollment trends. Part IV will ask for specific information concerning course content in the areas of research and value identification. Part V will ask the teacher to indicate the degree of agreement and disagreement with a list of attitudes and concerns toward elective science education in secondary schools.

V. Protection Measures:

Only the investigator will have knowledge of the results of the individual questionnaires and subjects will not be identified in the thesis. No questionnaire will require teacher's name.

VI. Method of Obtaining "Informed Consent" from Subjects:

Response from the subjects in the study will be strictly voluntary. A cover letter will be attached

to each questionnaire outlining the purpose of the questionnaire and the way the results of the questionnaire will be used. The cover letter will indicate that the project director is requesting a voluntary response. The questionnaire will not subject the respondents to any kind of emotional or physical stress. A completed and returned questionnaire will indicate that the subject desired voluntarily to participate in the study and be considered informed consent by the respondent.

VII. Responsibility of Project Director:

By compliance with the policies established by The University Committee on Research Participation, the Project Director subscribes to the broad principles stated in "The Declaration of Helsinki" and standards of professional ethics in all research, development and related activities involving human subjects under the auspices of The University of Tennessee, Knoxville.

a. When appropriate, Form DHEW 596 will be completed and returned to the Office of the Vice Chancellor for Graduate Studies and Research, 404 Andy Holt Tower.
b. Approval will be obtained from The University Committee prior to instituting any change in project protocol.
c. Development of any unexpected risks will be reported to The University Committee.
d. Signed consent statements (completed questionnaires) will be kept for the duration of the project and for at least three years thereafter.
e. A status report (Form D)* will be submitted at 12-month intervals, or as requested, attesting to the current status of the project.

Signature:

Project Director_____

Date_____

*Available in the Office of the Vice Chancellor for Graduate Studies and Research, 404 Andy Holt Tower.

## APPENDIX C

### COVER LETTER FOR QUESTIONNAIRE TO PRINCIPAL

Dear Principal:

I am working on my Specialist in Education thesis in Curriculum and Instruction, Science Education Area, at The University of Tennessee, Knoxville. My thesis deals with the status of science education in grades 7 through 12 in four East Tennessee counties. This is part of a continuous research effort in science and environmental education under the direction of Dr. A. Paul Wishart.

The enclosed coded questionnaire is being used to gather the needed information. I will appreciate your distributing the enclosed questionnaire to the appropriate science teacher(s). Please give full-time science teachers questionnaires first and part-time science teachers the remaining ones. When completed, the questionnaire may be mailed to The University of Tennessee, Knoxville, and the postage will be paid.

As this information is essential to the thesis research and to the long-range investigation of science and environmental education, I would greatly appreciate your cooperation. I will be glad to send a summary of the study findings to you or any of your staff if they will indicate their interest on the questionnaire.

Yours sincerely,

(Signed by:)

Sue S. Arnhart
Biology Teacher
Farragut High School

(Signed by:)

A. Paul Wishart
Professor of Science Education
The University of Tennessee,
Knoxville

Enclosure

## APPENDIX D

## COVER LETTER FOR QUESTIONNAIRE TO TEACHERS

Dear Fellow Teacher:

I am working on my Specialist in Education thesis in Curriculum and Instruction, Science Education Area, at The University of Tennessee, Knoxville. My thesis deals with the status of science education in grades 7 through 12 in four East Tennessee counties. This is part of continuous research in science and environmental education under the direction of Dr. A. Paul Wishart.

The enclosed coded questionnaire is being used to gather the needed information. Would you please take time out of your busy day to complete the questionnaire and return it to me? Simply fold and staple the questionnaire closed. The postage will be paid by me. A completed and returned questionnaire will be considered your informed consent to participate in the research.

No respondent's name will be identified in the results of this study. As this information is essential to the thesis research and to the long-range investigation of science and environmental education, I would greatly appreciate your cooperation. Since I am operating within a prescribed time framework, your attention to this request before April 15th will be appreciated.

Thank you in advance for your cooperation. If you would like to have a resume of the completed study, please indicate in the appropriate space on the questionnaire.

Yours sincerely,

(Signed by:)

Sue S. Arnhart
Biology Teacher
Farragut High School

(Signed by:)

A. Paul Wishart
Professor of Science Education
The University of Tennessee, Knoxville

Enclosure

## APPENDIX E

## COVER LETTER II

Dear Sir:

I am working on my Specialist in Education thesis in Curriculum and Instruction, Science Education Area, at The University of Tennessee, Knoxville. My thesis deals with the status of science education in grades 7 through 12 in four East Tennessee counties: Roane, Morgan, Scott, and Loudon (also Lenoir City). This is part of continuous research in science and environmental education under the direction of Dr. A. Paul Wishart.

A coded questionnaire is being used to gather the needed information. No respondent's name will be identified in the results of this study. A completed and returned questionnaire will be considered informed consent to participate in the research.

I hope to have gathered all the needed information by May 10th. If you would like to have a resumé of the completed study, I would be happy to furnish one to you. Please send your request to me at the following address:

Sue S. Arnhart
501 Rockingham Dr.
Knoxville, Tn. 37919

Thank you for your cooperation in this matter.

Sincerely,

(Signed by:)

Sue S. Arnhart
Biology Teacher
Farragut High School

(Signed by:)

A. Paul Wishart
Professor of Science Education
The University of Tennessee,
Knoxville

# APPENDIX F

## QUESTIONNAIRE

I. SCIENCE TEACHER -BACKGROUND DATA: Place an "X" in the box corresponding to your answer(s). You may check more than one answer if they apply. (The numbers to the right of the answer selections are for the computer)

1. My sex is:
[](1) Male
[](2) Female (1-1)

2. My age is:
[](1) 21-30
[](2) 31-40
[](3) 41-50
[](4) 51-60
[](5) 60+ (2)

3. I have taught for:
[](1) 1-3 years
[](2) 4-6
[](3) 7-9
[](4) 10-12
[](5) 13+ (3)

4. School location:
[](1) inner city
[](2) rural
[](3) small town
[](4) suburban (4)

5. School organization:
[](1) 0-8 grades
[](2) 6-8
[](3) 7-9
[](4) 9-12
[](5) 10-12
[](6) other_____ (5)

6. Highest academic degree:
[](1) no degree
[](2) BA/BS
[](3) MA/MS
[](4) MA/MS + 45
[](5) EdS
[](6) EdD/PhD (6)

7. Science taught:
[](1) general science
[](2) earth science
[](3) physical science
[](4) biology I
[](5) biology II
[](6) chemistry
[](7) physics
[](8) other_____ (7-9)

8. The level(s) taught:
[](1) advanced
[](2) standard
[](3) basic
[](4) remedial
[](5) other _____ (10-12)

9. College Major Field: (13)
[](1) Science with teaching cert.
[](2) Education with science cert.
[](3) P.E. with science cert.
[](4) Health with science cert.
[](5) other_____

10. How many members are on the science staff?[][] #full time?[][] #part time #part time? [][] (14-17)

11. If a part time teacher of science, how many science period(s) do you teach?[] (18)

12. When did you last take a subject-area science course(s) for graduate credit? (use the last two digits of the year as your answer) [][] (19-20)

13. The purpose of taking an additional course(s) was to: (21)
[](1) become certified in science
[](2) update my information or expand my base of knowledge
[](3) to renew my teaching certificate
[](4) working on an advanced degree
[](5) other_____

14. When I last took a science-area course(s), it was in the area(s) of: (check more than one if appropriate)
[](1) geology
[](2) physical science
[](3) physics
[](4) chemistry
[](5) ecology
[](6) botany (22-24)
[](7) zoology
[](8) microbiology
[](9) other_____

15. How much training have you had in the biological sciences?
[](1) none
[](2) 3-9 hrs.
[](3) 10-19
[](4) 20-29
[](5) 30+ hrs. (25)
[](6) MA/MS
[](7) PhD
[](8) other_____

16. Have you ever participated in a National Science Foundation Institute?
[ ](1) no
[ ](2) summer
[ ](3) research
[ ](4) course development
[ ](5) graduate level (26)
[ ](6) other_____

17. The three major ways that I have tried to stay current in my field are:
[ ](1) taking additional courses on a college or university campus (27-29)
[ ](2) taking additional courses for college credit but offered locally
[ ](3) reading current periodicals (ex., American Biology Teacher, Sc. Amer.)
[ ](4) examing new teaching materials (ex., IIS, ISIS, ISCS)
[ ](5) looking at newsletters from publishers (ex., BSCS, Carolina Biological)
[ ](6) traveling and gathering information (conferences, slide or lecture)
[ ](7) by actively participating in research in my field
[ ](8) other _____

18. What level of teacher background is expected or required by the school administration to teach the advanced science course(s) such as biology II?
[ ](1) not offered at our school
[ ](2) no requirements (30)
[ ](3) BA/BS in science or science education
[ ](4) MA/MS
[ ](5) related science field degree (health or PE with science cert.)
[ ](6) anyone available regardless of certification
[ ](7) other _____

II. SCIENCE COURSE INFORMATION: Place your answer in the space under each column. More than one answer may be appropriate. IMPORTANT: Data cannot be used unless all questions are answered (numbers under questions and in parenthesis are for the computer).

| | How are they offered? | | | |
|---|---|---|---|---|
| 1. Which courses are offered in your school? (Please answer for each course) | 2.Frequency:<br>(1) never<br>(2) yearly<br>(3)alternate years<br>(4) independent study<br>(5)minicourse<br>(6)6-9 weeks<br>(7) other___ | 3. Levels:<br>(1) none<br>(2)advanced<br>(3)standard<br>(4) basic<br>(5)remedial<br>(6) other__ | 4.Curriculum:<br>(1) required<br>(2) elective<br>(3) terminal<br>(4) don't know<br>(5) other____ | 5.Prerequisits:<br>(1) none<br>(2) grade pt.ave.<br>(3) learning disability<br>(4) teacher recommendation<br>(5) other course requirements<br>(6) other_____ |
| sample: biology | 2 | 3,4 | 2 | 1 |
| (1) general science (31-38) | | | | |
| (2) life science (39-46) | | | | |
| (3) earth science (47-55) | | | | |
| (4) physical science (56-63) | | | | |
| (5) biology (64-71) | | | | |
| (6) advanced topics (72-2/3) | | | | |
| (7) chemistry (4-11) | | | | |
| (8) physics (12-17) | | | | |
| (9) other(s) (18-25) | | | | |

III. PROGRAM INFORMATION: Locally Developed Science Programs, National Science Foundation(NSF) Programs and Enrollment. Place an "X" in the box(es) of your answer(s).

A. LOCALLY DEVELOPED PROGRAMS:

1. How or by whom are new sicence courses developed? (26-27)
[](1) adoption by the local system
[](2) state adoption necessary
[](3) teacher(s) may develop new course(s)
[](4) student and teacher develop individualized course
[](5) other_____

2. What is the course design for the science offerings? (28-29)
[](1) 6 weeks with textbook orientation
[](2) 6 weeks modular orientation (one topic studied in depth)
[](3) 9 weeks textbook orientation
[](4) 9 weeks modular orientation (one topic studied in depth)
[](5) semester course
[](6) minicourse (2-4 weeks)
[](7) audio-tutorial
[](8) other_____

3. The state credit recognized for science courses is: (30-32)
[](1) one year blocks only
[](2) less than one year recognized as "minicredit", not science credit
[](3) two years in one area (ex., biology, physics, etc.)
[](4) greater than two years in one subject area allowed
[](5) extra years in one area must be counted as applied science credit
[](6) other_____

B. NSF PROGRAMS:

5. Does your school teach any of the NSF programs? (33-35)
[](1) no
[](2) biology BSCS - Green[] Blue[] Yellow[] Advanced or Second Year[]
[](3) chemistry - CHSM Study [] CBA[]
[](4) earth science - ESCP[] TSM[]
[](5) physical science - IPS[] IME[]
[](6) physics - Project Physics[] ECCP[]
[](7) junior high - Patterns and Processes[]

6. What materials from the NSF Programs do you use? (36-38)
[](1) none
[](2) text material only
[](3) laboratory manual
[](4) laboratory equipment packages
[](5) audio-visual material
[](6) supplementary material such as BSCS newsletter
[](7) complete program

7. What are your schools future plans for NSF Programs? (39)
[](1) not sure
[](2) have used but plan to drop
[](3) are now using and plan to continue
[](4) have inspected material and recommend adoption
[](5) depends on state textbook adoption
[](6) other_____

8. Have you examined or are you using some of the newer NSF material?
[](1) no
[](2) Individualized Science Instruction System (ISIS)
[](3) Human Science Program (HSP) (40-41)
[](4) Outdoor Biology Instruction Strategies
[](5) Me and My Environment
[](6) Intermediate Science Curriculum Study (ISCS) levels: 1[] 2[] 3[]

9. Are you using related but not NSF Programs?
[](1) no (42-43)
[](2) Ideas and Investigations in Science : Physical Science[] Life Science[] Biology[] Chemistry[]
[](3) Programmed course packet: Original[] Commerical[]
[](4) audio-tutorial programs: Original[] Commerical[]
[](5) other_____

C. ENROLLMENT:

[][][][] 10. What is the student enrollment of your school? (44-47)

[][][][] 11. What is the approximate number of students enrolled in your science programs? (48-51)

12. What is the status of science student enrollment in your school?
[](1) a growing student population
[](2) a declining student population (52)
[](3) remains fairly constant
[](4) other _____

IV. COURSE CONTENT: Place an "X" in the boxes provided (the numbers in parenthesis are for the computer).

1. How much emphasis is placed on research by your school?
[](1) none
[](2) enter the Science Fairs or conduct our own (53-54)
[](3) attend the Junior Science Symposium
[](4) submit research papers to the Junior Science Symposium, Westinghouse Talent Search, etc.
[](5) other_____

2. How much administrative support in terms of equipment and release time do your science teachers receive?
[](1) none (55-56)
[](2) research area or project room for independent research by students
[](3) teacher must make time and/or room for research projects of students
[](4) trips are available for marine, desert or other research
[](5) outdoor facilities are on the grounds or nearby (can walk to them)
[](6) small classes are possible
[](7) other_____

3. Are there special science courses available for the talented science student(s)?
[](1) no (57)
[](2) advanced courses in biology
[](3) advanced course in chemistry
[](4) advanced course that is multidisciplinary
[](5) college credit available through local university or college offered high school students
[](6) other_____

4. What flexibility or options exist for discussion or study of controversial topics in your science course?
[](1) none (58)
[](2) parent permission only
[](3) forbidden by law (local or state)
[](4) at discretion of principal/superintendent
[](5) at discretion of supervisor
[](6) at discretion of teacher
[](7) other_____

5. Which four topics for discussion are most often included in your science course(s)?
[](1) abortion
[](2) euphanasia
[](3) contraception
[](4) reproduction, plant/an.
[](5) futuristics
[](6) values or ethics
[](7) how the universe began (59-62)
[](8) life on other planets
[](9) evolution/adaptation
[](10) current issues
[](11) Other_____

6. Is value clarification included in the topic discussion?
[](1) no
[](2) yes with limitations (63)
[](3) yes without limitations
[](4) it is a course in itself
[](5) other_____

7. How are these controversial topics most often included in the course?
[](1) whenever appropriate or when they come up
[](2) only in the advanced topics course or biology II

7. How are these controversial topics most often included in the course?
[ ](1) whenever appropriate or when they come up
[ ](2) only in the advanced topics course or biology II (64)
[ ](3) only in segregated courses with one sex permitted
[ ](4) only with parent permission
[ ](5) only in the biological sciences
[ ](6) other_____

V. DESCRIPTIVE INFORMATION: SCIENCE INSTRUCTIONAL PROGRAMS. As you read each of the following statements, decide how strongly you agree or disagree with the statement. Select the number corresponding to your answer and place it in the column to the right. Space has been provided for any additional comments you would wish to include. PLEASE answer all questions.

| ITEMS FOR RESPONSE (use the number only) | 1.strongly agree<br>2.agree<br>3.undecided<br>4.disagree<br>5.strongly disagree | COMMENTS |
|---|---|---|
| 1. The teaching of advanced courses should be staffed by the senior member of the faculty if (s)he wants it. (65-66) | | |
| 2. The teaching of advanced courses should be taught by the best educated member of the science staff. (67-68) | | |
| 3. Politics does not play a part in the selection of who teaches the course. (69-70) | | |
| 4. Teacher training should include a background in etics or bioethics. (71-72) | | |
| 5. Teacher training should include more practical science information such as laboratory planning, equipment, safety procedures, etc. (73-74) | | |
| 6. There should be a teacher competency test prior to hiring. (75-76) | | |
| 7.Teachers need outdoor facilities as well as indoor ones (ex., mature trainl, field experiences, etc.) to teach science. (3/1-2) | | |

| | | |
|---|---|---|
| 8. Resource or Special Education teachers are available to aid with planning for students in my science classes. (3-4) | | |
| 9. "Mainstreaming" of special students has been sucessful and should be continued. (5-6) | | |
| 10. Individual Education Program has increased my work load but is beneficial to special students. (7-8) | | |
| 11. Science course offerings should be open to all students regardless of ability. (9-10) | | |
| 12. Science Course offerings should be open only to those students who have completed established prerequisits for the course. (11-12) | | |
| 13. Students need to practice identifying values and value systems on current topics of interest in order to build a value system of their own. (13-14) | | |
| 14. A course offering in bioethics should be a part of the science curriculum. (15-16) | | |
| 15. Identifying values is not the function of secondary education. (17-18) | | |
| 16. More opportunity to discuss controversial topics would increase interest in science courses. (19-20) | | |
| 17. Having a parent advisory board would assist the science program in expanding into controversial areas. (21-22) | | |

| | | |
|---|---|---|
| 18. Some experience with research is of value to a student entering the science fields. (23-24) | | |
| 19. I emphasize science inquiry by requiring students to do research and enter science competitions such as science fairs. (25-26) | | |
| 20. Scientific research should be offered only as an integrated part of science rather than as a module or unit by itself. (27-28) | | |
| 21. A varied format that includes discussion, audio-visual materials, lecture, literature review and guest speakers is necessary for advanced topics or biology II. (29-30) | | |
| 22. I use a varied format for teaching all science courses regardless of level. (31-32) | | |
| 23. Career education is a functional part of each science course I teach. (33-34) | | |
| 24. Career education should be a course in itself not a part of the regular course. (35-36) | | |
| 25. A practical science course that emphasizes much "hands-on" experience should be open to noncollege and/or vocational students beyond the ninth grade. (37-38) | | |

| | | |
|---|---|---|
| 26. A more practical approach to science would increase student interest and enrollment in science courses. (39-40) | | |
| 27. The use of nontechnical material would increase the appeal of science to my students. (41-42) | | |
| 28. Museums, planetariums and other area field trips are a functional part of the science courses I teach. (43-44) | | |
| 29. State credit should be expanded to include the possibility of obtaining more credit(s) in the area of science (ex., 2 or 3 yrs. in one area such as chemistry). (45-46) | | |
| 30. Students should receive credit for participation in science activities through a "Quest" or "out-ofSchool" credit program (Carnegie unit credit). (47-48) | | |
| 31. An "Out-of-School" credit for science participation would encourage students to participate in science fairs and science related projects. (49-50) | | |
| 32. Requiring that all students submit science research projects is the best way to increase participation in science fairs and symposiums. (51-52) | | |
| 33. I require only those students working for the grade of A or only in advanced classes to complete research. (53-54) | | |

[]I would like a summary of the results of this study.

# VITA

Sue Stockman Arnhart, daughter of Melton and Amy Stockman, was born in Knoxville, Tennessee, on April 3, 1940. She attended Sequoyah Hills Elementary School, Tyson Junior High School, West High School and was graduated from Brenau Academy in Gainesville, Georgia. Most of her college study was at The University of Tennessee, Knoxville but some courses were taken from Emory University. In 1960 she received the B.S. in elementary education from The University of Tennessee, Knoxville.

For two years following graduation, she taught fifth grade at Briar Vista Elementary School in Atlanta, Georgia. During the early childhood of her two children, she remained at home as a full-time mother. However, when the younger child entered kindergarten, she began work on an advanced degree. In 1972 she completed a M.S. in Zoology at The University of Tennessee, Knoxville. After finishing the work on the advanced degree, she continued an additional quarter's work to change her certification to secondary science education. From 1972 to the present time she has been employed by Knox County Schools to teach biology at Farragut High School in Knoxville. The Specialist of Education was conferred in December 1979 from The University of Tennessee, Knoxville.

She is married to Thomas William Arnhart of Knoxville, Tennessee, and they have two children--Amy Diane and Karen Denise.