A SURVEY OF FIRST-GRADE SCIENCE IN THE THIRD CLASS CITIES OF KANSAS

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS

I. INTRODUCTION

The elementary school years are crucial in the life of a boy or girl. In this formative period children's experiences profoundly affect their physical, social, mental, and emotional growth. Today's schools are challenged to provide meaningful experiences that will help these children realize their full potentialities. Science is one of the aspects of elementary education through which schools seek to meet the needs of children.

With the increase in enrollment at all levels of the public schools and the tremendous increase in knowledge, educators have become increasingly aware of the necessity to (1) improve the qualifications of teachers of science, (2) teach the new contemporary science as one of the basic subjects in the elementary school, and (3) provide materials necessary for a good science program. One of the principal reasons for this awareness was Russia's bid for technical leadership by launching the first satellite into orbit, and the rapidly increasing technology of our times.

A decade or more ago science in the elementary school could be looked upon as an incidental part of the curriculum;

if and when there was time, science could be taught. Very little was done to provide in-service teacher training and institutions of higher learning were slow in providing courses in general science education. Many of the elementary schools were forced to teach science with very little equipment and supplementary aids. However, with the awakening of the population to the importance of scientific knowledge, financial assistance and pressure from all sides demanded improvement in science programs from kindergarten through high school.

"But why should every individual understand the fundamental nature and significance of science--why not just relax and enjoy the fruits of technology?"[1] M. F. Vessel suggests the following reasons:

1. Scientific advances and discoveries move inexorably forward at an ever faster pace. In varying degrees they affect everyone in the home or on the job. Science can assist the individual in making adjustments to the new conditions.

2. Occupations in the future will require more and more scientific skills and knowledge.

3. Science education can provide the individual with experience and thought processes which will enable him to search out and evaluate the evidence presented, or trust the administrative decisions of our leaders when a new scientific or technological enterprise is inaugurated.

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[1]M. F. Vessel, Elementary School Science Teaching (Washington, D.C.: The Center for Applied Research in Education, Inc., 1963), p. 4.

4. Science continuously seeks physical and logical explanations for the behavior of objects in nature, and it can dispel many of man's suspicions and fears.

5. One should have some understanding of how the scientist operates.

6. Science education can develop one's rational thought processes.

7. The laws of science have no boundaries, natural or international, and they form a basis for universal understanding.

8. Science education also offers the individual an introduction to the broad spectrum of biological and physical phenomena and some of their aesthetic features.[2]

Vernon E. Anderson says that no longer may science be taught to the talented and surveys to those of lesser abilities. All must be taught a general education which leads to an understanding of the social implications of science. Science contributes greatly to the understanding and solution of social issues.[3] This form of reasoning has made educators aware of a need for well-defined objectives for the science program.

Paul D. Hurd says the objectives of teaching science are the same from elementary through high school, and lists these in the following categories:

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[2]*Ibid.*, pp. 4-6.

[3]Vernon E. Anderson, "Science Education for Changing Times," *Rethinking Science Education*, Fifty-Ninth Yearbook of the National Society for the Study of Education, Part I (Chicago: University of Chicago Press, 1960), p. 28.

1. Understanding science (knowledge, enterprise, concepts, vocabulary, principles).

2. Problem-solving (incentive, intuition, imagination, fertility of ideas, creativeness).

3. Social aspects of science (relation of basic research to applied research, and the interplay of technological innovations and human affairs).

4. Appreciation (of science as a discipline and as a vocational pursuit).

5. Attitudes (open-mindedness, knowledge, confidence, curiosity, creativity).

6. Careers (identify and motivate those who develop special interests).

7. Abilities (reading, using tools and techniques, inferring, evaluating, expressing, social action, relationships, ideas).[4]

Most authorities in the field of elementary education are in general agreement concerning the purposes of science in the elementary school. However, they are not in agreement on the methods to be used to implement these purposes. With the increase in scientific materials and new approaches to teaching science, many studies should be initiated to compare these materials and approaches in the classroom.

Many authorities also agree that success of any venture in a classroom is dependent upon the teacher. For many years the teaching of science in the elementary school has

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[4]Paul DeHart Hurd, "Science Education for Changing Times," Rethinking Science Education, Fifty-Ninth Yearbook of the National Society for the Study of Education, Part I (Chicago: University of Chicago Press, 1960), pp. 33-37.

been entrusted to teachers with little or no background in science. As a result, very little science has been taught, especially at the lower levels. However, in recent years great emphasis has been placed on upgrading the program from kindergarten through high school.

As a result of recent emphasis on upgrading science programs in elementary schools, a great amount of concern has been generated relative to the extent of implementation of contemporary science programs in the elementary schools. Implementation would necessitate a change from a traditional and frequently used incidental approach, to one encompassing a contemporary or modern approach to teaching science.

II. THE PROBLEM

Statement of the Problem

The purpose of this study was to determine the present status of science programs in first-grade classrooms of elementary schools in third-class cities of Kansas. It was hoped that from this study the extent of implementation of the new contemporary science programs in first-grade classrooms could be determined.

The investigator was concerned with the science programs of third-class cities because:

a. Has spent most of her life in third-class cities.

b. Her children were educated in third-class city schools.

c. Has recognized and been concerned about some of the shortcomings in first-grade science programs for several years.

d. Teaches first-grade in public school (not a third-class city).

e. Through association with other first-grade teachers, became aware of negative attitudes toward first-grade science.

The Research Hypothesis

The hypothesis tested in this study was: There is no significant difference in the per cent of teachers using a contemporary approach and the per cent of teachers using a traditional approach in teaching first-grade science in third-class cities of Kansas.

In order to test the research hypothesis, data were collected which could provide answers to the following specific questions:

1. What is the level of preparation of teachers (college hours) and how recent was college training for teaching of first-grade science?

2. How much class time was allotted to first-grade science?

3. What patterns of organization and presentation of first-grade science are used?

4. What procedures for science curriculum development in first-grade classrooms are used?

5. What methods of evaluating pupil achievement in first-grade science are most common?

6. Do teachers feel that they have sufficient equipment and materials to make first-grade science programs functional?

Importance of the Study

Many studies and group endeavors have been undertaken in recent years in an effort to improve the teaching of science in elementary schools. Studies have stressed a need for development of critical thinking, concept formation and problem solving, clearly defined objectives, improvement of instruction, improvement in quality and quantity of equipment, and last but not least, improved teacher training. Many studies have stressed a need for greater pupil participation and investigation, in preference to a teacher-dominated method.

Because of his direct relation to the learning situation the key to the success of any method is the teacher. "The teacher is a specialist in the education of children and not necessarily a specialist in science."[5] Vessel points out the inadequacy of science background in elementary teachers as shown by numerous studies. Teachers themselves list their lack of training as one of their principal difficulties.[6]

The result of teacher inadequacies has often been a tendency to make science instruction dependent upon an incidental approach. Craig points out that:

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[5]Gerald S. Craig and others, Learning with Science: Science Today and Tomorrow (Boston: Ginn and Company, 1957), p. v.

[6]Vessel, op. cit., p. 70.

> Science is no incident in the lives of children. In fact, it is and probably will continue to be one of the most dominating and decisive factors in their lives. Schools developing science on an incidental basis will not provide boys and girls with the education they need for the great decisions they must make for themselves, their country, and the world. Science with its profound and challenging ideas has a great contribution to make to the formation of concepts and important ideas. This instruction must not be incidental.[7]

Some teachers feel that they are forced to use the incidental approach to science because of a lack of equipment. Vessel feels that much of this difficulty is a result of their college training. Too many teachers feel that without expensive equipment they cannot conduct a science experiment. He suggests that available science kits may be purchased, but much of the equipment needed in an elementary science program can be constructed.[8]

It appears to be evident that the new science program in first grade has many strengths and weaknesses, and it is the desire of the writer that this study may to some degree point out these strengths and weaknesses which may lead to further research in this area.

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[7]Craig and others, op. cit., pp. xv-xvi.

[8]Vessel, op. cit., pp. 64-68.

III. DEFINITIONS OF TERMS USED

These definitions are presented to insure accurate interpretation and understanding of the terms to be used in this study:

Contemporary approach. Contemporary approach refers to a method of teaching science which places emphasis on pupil participation and minimum teacher direction. Materials from all three major science areas are provided which provide for open-ended rather than teacher or textbook directed investigation. Scientific literacy, concept development from basic science generalizations, and process acquisition are stressed. Operationally it is a classroom where there is independent study, small group activities, discussion groups, and students are testing ideas and accepting or rejecting them on the basis of their own observations. This approach emphasizes the "doing" aspect of science. It also provides for many opportunities "to use the science exercises as motivation for reading, oral and written communication, mathematics, art, and social studies."[9]

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[9]Commission on Science Education, Science--A Process Approach; Commentary For Teachers (Third Experimental Edition; American Association for the Advancement of Science, 1968), p. 13.

Traditional approach. Traditional approach is a method of teaching science which places emphasis on teacher lectures, use of school adopted textbook and unit tests, teacher directed demonstrations and student discussion of teacher selected concepts. This approach has the teacher as the center of activity rather than the students. It emphasizes the "seeing and telling" aspects of science.

Audiovisual aid. Audiovisual aid is any device by which the learning process may be encouraged or carried on through the sense of hearing, and/or the sense of sight.[10]

Basic subject. The basic subject is one of those subjects (e.g. English, science, math, history) which are essential to the common learnings that form the base upon which is built the good citizen in a democratic society.[11]

Curriculum. Curriculum is a group of courses and planned experiences which a student has under the guidance of the school.[12]

[10] Carter V. Good (ed.), Dictionary of Education (New York: McGraw-Hill Company, Inc., 1959), p. 22.

[11] Ibid., p. 534.

[12] Ibid., p. 149.

Source materials. Source materials are publications, audiovisual supplies, and equipment used to extend and enrich the educational experiences of the learners.[13]

Supplementary texts. Supplementary texts are any books used in addition to the basic text for a course or subject.[14]

IV. LIMITATIONS OF THE STUDY

The limitations of this study were as follows:

1. The population of the study was confined to the first-grade classes of one hundred thirty of the third-class cities of Kansas.
2. The study may have been affected by variables prevalent in many surveys, such as a feeling of inadequacy in supplying information required, excessive demand on the respondent's time, reluctance to reveal their true status, and inaccuracy of construction of the questionnaire.

The population involved in this study was composed of first-grade teachers in the elementary schools of one hundred thirty third-class cities of Kansas. These cities were selected at random and questionnaires sent to the principles of these schools for distribution to first-grade teachers.

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[13] Ibid., p. 332.

[14] Ibid., p. 541.

VI. METHOD OF PROCEDURE

The basic procedure used to gather data for this study was the closed-form questionnaire (see Appendix) which required the respondent to respond to items appropriate to his situation. The questionnaires were sent to principals of elementary schools in one hundred thirty of the third-class cities of Kansas for distribution to first-grade teachers. The results of the questionnaire were then analyzed to arrive at appropriate answers to questions presented earlier in the statement of the problem.

CHAPTER II

REVIEW OF LITERATURE

I. INTRODUCTION

Since the advent of the twentieth century, educators have become increasingly aware of the importance of science to development of the whole personality. Man has come to realize the social implications of science and it therefore behooves him to train his children in the ways of science. Through science, man is better able to understand the world in which he lives and adjust to the demands of a technological age.

Emphasis has been placed upon revitalizing and up-grading science programs with an extension downward through kindergarten. Much money and effort are being expended to improve programs, yet among us are many who still cling to the old ways. Charles A. McMurray aptly described the situation sixty years ago when he said, "We talk about science teaching, realism, sense training, experimental work, investigation, field work, etc. and still we hug our books as tightly as before."[1]

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[1]Charles A. McMurray, Special Method in Elementary Science for the Common School (New York: The Macmillan Company, 1904), p. 3.

Too widely separated from objects and realities of experiences which surround the child, school education has always leaned toward the bookish side. "Adults can be so blind to the ideals and dreams of children! How many times adults enter and trample down the alters of the inner shrines of children."[2]

As a program of modern science progresses, more funds are being provided for research, equipment, teacher-training programs, in-service training and public relations. The result has been a continual improvement in qualifications of many elementary teachers in the field of science.

In reviewing literature pertinent to this study, attention was given to the works of researchers and science education specialists in areas related to the growth of science and improvement of instruction in public schools. Some of the more interesting and relevant areas of literature are (a) development of science education, (b) classroom teacher, (c) teacher-training programs, (d) curriculum development, (e) evaluation of achievement, and (f) facilities and materials.

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[2]Gerald S. Craig, Science for the Elementary School Teacher (Waltham, Massachusetts: Blaisdell Publishing Company, 1966), p. 19.

II. DEVELOPMENT OF SCIENCE EDUCATION

Perhaps no discipline in formal education has had a more controversial history than that of science in our public schools. For at least three hundred years this controversy has raged, beginning in our colleges and universities and sifting downward to the secondary and elementary schools.

According to Robert K. Merton, much emphasis on the teaching of science in the latter part of the seventeenth century came from the Puritans of England. Among the most prominent of the Puritan movement was Samuel Hartlib who formed the connecting link between the Puritans in England and the Pietists on the Continent who were led by Francke.

In England and on the Continent, both Puritans and Pietists were persecuted by the more conservative elements of the Protestant and Catholic churches. However, by the eighteenth century changes had resulted in a so-called "holy alliance between science and religion."[3]

C. C. Gillispie says that science flourished in France during the seventeenth and eighteenth centuries. The French scientific community was the most brilliant in the world and was the most highly institutionalized. However,

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[3] Robert K. Merton, "Puritanism, Pietism, and Science," <u>The Sociology of Science</u> (New York: The Free Press, 1962), pp. 47-48.

with the rise of the Jacobin Dictatorship during the latter part of the eighteenth century, science stood across the cosmic ideals of the Republic. The Academy of Science became the primary target of the Jacobins. The Convention did however, establish twelve chairs of biology which made possible the great age of comparative anatomy and the tradition of experimental biology in the nineteenth century.[4]

The association of protestantism and science spread to the New World under the leadership of the Younger John Winthrop who had spent some time in London with Hartlib and John Amos Comenius, the Bohemian reformer. Some years later, Increase Mather, the president of Harvard College, established a philosophical society at Boston. It was from this meager beginning that science was established in the curriculums of other universities, eventually threading its way into the secondary and elementary schools of the New World.[5]

Herbert A. Smith traces modern elementary school science through its development of more than one hundred years:

> Elementary science was greatly influenced by the didactic literature brought into this country and by

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[4]C. C. Gillispie, "Science in the French Revolution," <u>The Sociology of Science</u> (New York: The Free Press, 1962), pp. 89-91.

[5]Merton, <u>loc</u>. <u>cit</u>.

the 'Pestalozzian object teaching' movement, which reached the United States in the late 1850's.

Through the National Education Association which was organized in 1857, interest was engendered to the task of adapting some of this literature for use in the school classroom. It was also through the National Education Association, that the 'Oswego Method' of object teaching was given nearly universal acclaim. This brought about an interest in revision of content and the method of study in the elementary schools.

The depression of 1873 spurred demands for a critical examination of our school system, with the elementary school in particular, receiving the greatest amount of criticism. The taxpayers were demanding a re-evaluation of the elementary school structure. Most of the educational journals joined the movement, with all demanding the teaching of more science in the elementary school.

Near the end of the nineteenth century, the National Education Association sponsored a study at the secondary school level. As a result of this study, emphasis was placed on laboratory and other direct experiences and on the need for special training for science teachers. It was only after this study, that material for pupil use and teacher planning appeared in any appreciable amount.

At the turn of the century, many men rose to prominence through a movement called 'nature study,' which replaced 'object teaching.' But, by the middle of the 1920's it was apparent that nature study was no longer satisfactory for a modern science program. It considered the child in terms of his limitations rather than his capabilities. Nature study had also been developed by science specialists who lacked the understanding and perception of experienced teachers of children.

In 1927 a thesis was written at Columbia University by Gerald S. Craig, which has been one of the landmarks of elementary science, and is basic to much of the later writings in the field. Craig turned his back on nature study and took note of the great chaos of educational goals which were receiving much lip service. He emphasized the utilitarian aspect of science and the effective dimensions of attitudes, appreciations and interests.

Three other major steps in revision of elementary science to everyday life, were taken by the National Society for the Study of Education, from 1932 to 1960. Each of these culminated in the publication of an integrated science plan to meet the needs of the elementary school science program at the time of publication. The publications, in order, were: Thirty-First Yearbook, published in 1932; Forty-Sixth Yearbook, published in 1947; and the Fifty-Ninth Yearbook, published in 1960.

The Fifty-Ninth Yearbook recognizes the dependence of society upon science and goes further than preceding reports of the Society in stressing that characteristic of science which is known as 'process' or 'inquiry.'[7]

III. THE CLASSROOM TEACHER

Since science has become a definite part of the school program, a teacher is compelled to be as well trained in science as in any other subject. A teacher must realize that to teach science requires some knowledge of the subject. If he has the proper qualifications and likes children, a quality program will be developed.

Numerous studies have been made which point out the inadequacies of science background in elementary teachers. In many of these studies, teachers themselves have pointed out the lack of science training as one of their difficulties.

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[7]Herbert A. Smith, "Historical Background of Elementary Science," Readings in Science Education for the Elementary School (New York: The Macmillan Company, 1967), pp. 33-40.

A survey by John Sterning in 1960, recorded reports from fifty-two elementary school systems in thirty-six states which had operating elementary science programs. To the question of what are the most persistent problems in elementary science teaching, the answers were (a) teacher insecurity in science, (b) poor preparation, (c) rapid turnover, and (d) the need for continuous in-service education just to keep from sliding back.[8]

A study by Jacqueline V. Buck and George Mallinson, reveals that most elementary teachers do not possess an adequate knowledge of science to enable them to teach it effectively. While most teachers have a good background in high school science, it appears that they need further training at the college level to refresh and supplement their science knowledge.[9]

In June 1958, an inquiry concerning the status of science supervision at the county level was mailed to all state departments of education. From forty-five replies received, it was found that elementary teachers, in the

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[8]John Sternig, "The Elementary Grades in the Nation's Schools," The Nations Schools, Vol. 65, No. 2 (1960), p. 98.

[9]Jacqueline V. Buck and George Mallinson, "Some Implications of Recent Research in the Teaching of Science at the Elementary-School Level," Science Education, XXXVIII (February, 1954), pp. 81-101.

main, lack sufficient training in science and tend to shy away from science.[10]

In another study into the reluctance of the elementary science teacher to teach science, Edward Victor found this reluctance to be due to several problems confronting the elementary teacher. He states these problems as:

1. Lack of familiarity with the subject and materials (inadequate science background).
2. The feeling that one has to be an expert to teach science in the elementary school.
3. Lack of familiarity with objectives of science education in the elementary school.
4. The feeling that science teaching is a man's job.
5. The feeling of loss of classroom prestige due to difficulty in answering questions about or teaching various phases of science.[11]

To overcome this reluctance and to allay the fears of the elementary science teacher, Glenn O. Blough and Julius Schwartz present the following points as worthy of consideration:

1. Almost all girls and boys like science.
2. They do not expect you to know all the answers to their questions.

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[10] Donald Stotler, "The Supervision of the Science Program," Rethinking Science Education, Fifty-Ninth Yearbook of the National Society for the Study of Education, Part I (Chicago: University of Chicago Press, 1960), pp. 218-219.

[11] Edward Victor, "Why are our Elementary School Teachers Reluctant to Teach Science?", Science Education, XLVI (March, 1962), pp. 185-192.

3. Science in the elementary school is based on concepts that are essentially easy to understand.

4. You can learn with the children.

5. It is no harder to teach science than it is to teach social studies or any other subject.

6. Science experiences and learning often combine naturally with the general learning going on in your room.

7. The first time over the ground is the hardest; a little practice in teaching science will bolster your confidence.

8. There is more help available to you in teaching science than you may realize.[12]

Although many elementary teachers feel inadequate and have a negative attitude toward science in elementary school, not all of these teachers will return to college to upgrade their competency in this area. However, outside pressures and constant effort by colleges and universities to improve general-education science programs has resulted in an increase in the number of teachers returning to these institutions for further training in science.

IV. TEACHER TRAINING

Although inadequacies have been known to exist for many decades, little had been done to alleviate the problems confronting elementary science teachers until the 1930's.

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[12]Glenn O. Blough and Julius Schwartz, _Elementary School Science and How to Teach It_ (third edition; New York: Holt, Rinehart and Winston, 1964), pp. 4-5.

Liberal education, the purpose of which was to correct some of these inadequacies, became specialized education as young people used college education to improve their social and economic status. This was followed by a period in which much experimentation took place with various general-education science courses. New courses tended to take the form of integrated principles courses, based on concepts, processes, and procedures running through one or more science fields, to strengthen the preparation of teachers in the basic sciences.[13]

Studies were made by curriculum committees and education specialists to recommend requirements to strengthen the preparation of teachers in elementary science. Some of these have generally recommended that a prospective teacher for the elementary school take at least two years of science during the undergraduate college years.[14]

A state advisory committee in California suggests the following minimum requirements for training elementary teachers in science:

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[13] W. C. Van Deventer, "Science for General Education in the Colleges," Rethinking Science Education, Fifty-Ninth Yearbook of the National Society for the Study of Education, Part I (Chicago: University of Chicago Press, 1960), pp. 97-98.

[14] William B. Ragan, Modern Elementary Curriculum (New York: Holt, Rinehart and Winston, 1966), p. 375.

1. One year basic course in biological sciences with laboratory period.

2. One year course in physical sciences with laboratory period.

3. A combination methods and materials course.[15]

John S. Richardson proposes the following approaches to the preparation of elementary teachers with competence in science: (a) determine how to use the content of science to promote the optimum growth of the child, (b) panel or round-table discussions in which students practical teaching problems can be analyzed, (c) study the teaching of science in surroundings recommended for use in elementary schools, (d) laboratory experiences should be activities suitable for children, (e) student demonstrations and experiences should be shared, (f) proposed undertakings and their evaluation should be in practical terms, (g) experience should be gained in construction, improvisation and use of commonplace resources, and (h) direct investigation in the laboratory and field.[16]

Other approaches suggested by the AAAS Committee report for improving present College courses are:

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[15] M. F. Vessel, Elementary School Science Teaching (Washington, D.C.: The Center for Applied Research in Education, Inc., 1963), p. 92.

[16] John S. Richardson, "The Education of the Science Teacher," Rethinking Science Education, Fifty-Ninth Yearbook of the National Society for the Study of Education, Part I (Chicago: University of Chicago Press, 1960), pp. 260-261.

a. College science courses should be designed to give a fuller and wider spectrum of science. The courses would probably include materials drawn from several science departments and should teach the logical and operational assumptions on which science is built.

b. Professional education experiences for prospective elementary teachers should include opportunity to observe the work of well qualified teachers who like science and who like children. Prospective teachers should also be provided opportunities to gain experience in formulating questions that are meaningful to children, in developing methods for using quantitative approaches, in using audio-visual and laboratory materials, and in adapting to science instruction materials found in the surroundings of children.

c. All prospective elementary teachers should have an area of concentration. For some, this area should be in science. The teachers who had concentrated in science could then become special science teachers or could assist other teachers less acquainted with science.[17]

Time and space do not permit the inclusion of the many programs of general-education science courses in institutions of higher learning. The general trend however, is to shift from the systematic development of a discipline to an approach which is more psychological in nature and based on an understanding of student needs. As in the spiral science program in elementary schools, the trend in colleges is toward selection of areas of study that form a sequential picture. Another trend is for a comprehensive examination

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[17]"Science Teaching in Elementary and Junior High Schools," Report of a Study by the American Association for the Advancement of Science, Science, Vol. 133, No. 3469 (1961), p. 2022.

for entering freshmen to determine their needs for a general-education science course.[18]

In spite of the tremendous advances made by colleges and universities in the field of general-education science courses, Richard E. Haney believes that the real hope for the future of elementary school science lies with the natural science major. He says:

> The potentialities of science instruction in the elementary school, very likely, will not be realized until persons with natural science majors are prepared as elementary school teachers, and are then employed in positions in which their abilities can be used.[19]

Progress has also been made by colleges and universities in providing graduate level, general-education science courses for teachers already in the field. Further impetus has also been given to this program by the National Defense Education Act and other federal programs. Other in-service activities are workshops, educational radio and television science programs, conferences and conventions, visitations, curriculum committees, and science consultants and supervisors.

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[18] Van Deventer, op. cit., pp. 101-102.

[19] Richard E. Haney, The Changing Curriculum: Science (Washington, D.C.: Association for Supervision and Curriculum Development, NEA, 1966), p. 34.

V. CURRICULUM DEVELOPMENT

With the advent of the twentieth century, educators became increasingly aware of the importance of science in the elementary school. Some emphasis was placed upon revitalizing the science program, but it was not until the past decade that the movement has gained much momentum.

> Since 1957, a massive curriculum reform movement motivated at least in part by the desire to use the schools as instruments for national survival, has centered attention on the content and procedures of the elementary school science program.[20]

Numerous studies have been made during the last quarter of a century relative to the science curriculum in elementary schools. In all of these studies, researchers are in agreement that, first of all, one needs a set of objectives.

Fletcher G. Watson, reflecting upon the complex problem of curricular design, believes these objectives must be specific, clear, and stated operationally:

1. The several individuals working on a curriculum need to agree on their targets so they can work together effectively.

2. Explicit objectives in terms of pupil behavior must be used to appraise the effectiveness of materials.

3. School administrators and parents should be provided with explicit statements of the purposes of the instruction proposed for their children.

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[20]Ragan, op. cit., p. 366.

4. Teachers need to know what is expected, or otherwise they may unintentionally distort the intent of the instruction as initially planned.[21]

After agreement has been reached on objectives, the next major problem confronting planners is the content of an elementary science program. Several studies have indicated that science courses in elementary schools were spotty in organization and emphasized topics from the biological sciences. "At present, in an age when the physical sciences have advanced tremendously, the greatest emphasis is still on the biological sciences."[22]

As stated by Jacqueline V. Mallinson, the reasons for this are (a) the residual affect of the nature-study approach to elementary science and (b) elementary teachers receive at least some training in biological sciences in their pre-service training but little in the physical sciences.[23]

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[21]Fletcher G. Watson, "Curriculum Design in Science," Readings in Science Education for the Elementary School (New York: The Macmillan Company, 1967), p. 65.

[22]Louis I. Kusian, "Elementary Science in Connecticut, 1850-1900," A paper presented at the Thirty-Second Annual meeting of the National Association for Research in Science Teaching, Atlantic City, New Jersey, February 18-21, 1959.

[23]Jacqueline V. Mallinson, "The Current Status of Science Education in the Elementary Schools," School Science and Mathematics, LXI (April, 1961), pp. 252-270.

Most science educators are in agreement that a complete elementary curriculum should be selected from all three general areas of science. These general areas are (a) earth and the rest of the universe (earth sciences), (b) living things (life sciences), and (c) matter and energy (physical sciences).

The third major problem confronting the curriculum planner is a method or techniques of presentation. Craig states that, "Content in itself is not a complete solution of achieving the objectives of the science program. Techniques and content cannot be divorced in a discussion of teaching science."[24]

Numerous attempts have been made to determine the best technique for teaching elementary science. Two of these were described by Vessel as being quite conclusive. One was a comparison by Regan Carpenter of the "problem-solving approach" and the textbook discussion technique, in which he reported that greater gains were made by those who had been exposed to the problem-solving approach and that personal preference of the students was for this method of teaching rather than of reading and discussion. The other study was done by Lawrence Hubbel, in which he compared three types of presentation, (a) the textbook method,

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[24]Craig, op. cit., p. 103.

(b) the audio-visual method using filmstrips and (c) the pupil-activity approach. He found the group which used the pupil-activity approach achieved highest and those using the textbook method achieved lowest of the three.[25]

From a brief survey made by the investigator of ten of the contemporary science programs in use in some of the first-grade classrooms in Kansas, it was found that not one of these had a student textbook, as such. Most of the reading materials prepared for the programs are for the teacher only. Students are expected to become scientifically literate as they progress in the programs. No longer is, "you can't teach children science until they are able to read" a valid excuse for not teaching science in kindergarten and first grade.

A study was conducted by David W. Russell for the purpose of determining the basic methods of teaching elementary science and the relative value of each. From a review of over 500 references he determined four basic teaching methods: (a) the incidental method, (b) definitely planned units, (c) subject-core units and (d) science concept units. According to comments of fifty-one well-known science educators, a majority favored the science concept method.[26]

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[25]Vessel, op. cit., p. 78.

[26]David W. Russell, "Here's an Answer to the

Studies also show that many organized elementary science programs are designed around a spiral approach to science subject matter. This plan offers a continuous sequential program of science that is relatively free of gaps and overlap.

> One such spiral pattern recycles the basic units of science at three levels in the elementary curriculum. The three levels are kindergarten-grade2; grades3-4; and grades 5-6. Each of the 'basics' are dealt with once at each of these three levels. The exact approach to the units differs at each of these levels on the basis of maturity of the children involved.[27]

Other studies among elementary teachers have been made concerning the value of sensory aids in teaching elementary science. One such study made by Buck and Mallison, resulted in conclusions that (a) it is difficult to make any generalizations with respect to the comparative values of sensory aids, (b) sensory aids increase a student's factual knowledge, and (c) they are of help to an elementary teacher who may lack subject-matter background in the field of science.[28]

Perhaps Herbert Spencer had a solution to presenting science, as shown by the following statement:

Question, How Shall Science be Taught in the Elementary Grades," Science Education, XXXIII (January, 1959), pp. 38-42.

[27] Suggested Study Guide for Elementary Science (Grand Rapids Public Schools, Grand Rapids, Michigan, 1958), p. 25.

[28] Buck and Mallinson, op. cit., pp. 81-101.

> To tell a child this, and to show the other is not to teach it how to observe, but to make it a mere recipient of another's observations--a proceeding which weakens rather than strengthens its powers of self-instruction, which deprives it of the pleasure resulting from successful activity, which presents this all-attractive knowledge under the aspect of formal tuition, and which thus generates that indifference and even disgust with which these object lessons are sometimes regarded. On the other hand, to pursue the true course is simply to guide the intellect to its appropriate food, and to habituate the mind from the beginning to that practice of self-help which it must ultimately follow. Children should be led to make their own investigations and to draw their own inferences. They should be told as little as possible, and induced to discover as much as possible.[29]

Another item of importance in curriculum design is the time to be devoted to elementary science.

> There is definite agreement that science should be a regular part of the daily program, and have adequate time within the program. Both interest and learning are lost if science is scheduled only once or twice a week. Opinions vary, however, as to how much time should be allotted to science, daily or weekly. The general feeling is that more time should be devoted to science in grades 4-6 than in K-3. Some schools require that a definite amount of time be devoted daily to science. One recommended time allotment is 20-30 minutes per day for K-3 and 30-40 minutes per day for grades 4-6. Some schools set aside three days a week for science, with an average of 40-60 minutes per day. Other schools merely stipulate a definite amount of time per week, usually 120-180 minutes, and let the teacher allocate the time as needed throughout the week. Still other schools require that science be taught, but leave the time allotment to the discretion of the individual teacher.[30]

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[29]George Ricks, OBJECT LESSONS And How To Give Them, Second Series (Boston: D. C. Heath and Company, Publishers, 1893), p. XIII.

[30]Edward Victor, Science for the Elementary School (New York: The Macmillan Company, 1965), p. 40.

Studies have not shown that any one method of teaching elementary science is superior to another method. However, much research has been undertaken in an effort to find the "one" best teaching technique. Findings seem to indicate any accepted method for teaching elementary science is effective if it is properly selected and used.

VI. EVALUATION OF ACHIEVEMENT

With the extension and enrichment of elementary school programs, a need has been recognized for evaluation procedures that will measure more than a child's memorization of facts and development of mechanical skills. Unless teachers learn how to evaluate pupil progress in understanding, in seeing relationships, and in making practical applications of facts and skills learned to better solve the problems of living, these important aspects of the education of a child will continue to be neglected.

> Evaluation should be thought of as an integral part of teaching, rather than as something set aside to do at a special time, such as a test at the end of a period of instruction. As a teacher works, she can study the children to determine the effect of the learning upon them. This study of the children guides the teacher moment by moment, as she proceeds with the instruction.[31]

In evaluating achievement a variety of procedures are used, namely, (a) nontesting procedures such as watching

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[31]Craig, op. cit., pp. 867-868.

pupils perform in class, (b) paintings, models, songs and dramatic responses, (c) tape recordings of discussion periods in science, (d) pencil and paper tests, (e) practical examinations (handling equipment or materials), and (f) situational examinations (problem situations).

According to Fletcher G. Watson, there is a scarcity of research on science teaching in relation to pupil behavior. Most of the research involving pupil behavior has utilized pupil gain on achievement tests as the sole or primary description of changed pupil behavior. Such tests have been concerned mainly with recall and recognition behaviors and the whole realm of affective behavior has been neglected. Even if such achievement tests are valid for their narrow purpose, there is small basis for asserting that they have any relevance to the more general objectives claimed for instruction in science.[32]

Now that science has taken on a more definite form in elementary schools, there is a decided need for improved evaluation. Many kinds of techniques are necessary for measuring students' progress in learning basic science information, concepts, scientific literacy, and development

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[32] N. L. Gage (ed.), "Research on Teaching Science," Handbook of Research on Teaching (Chicago: Rand McNally and Company, 1963), p. 1031.

of desirable behavior. A better picture is obtained from using many devices rather than one form or instrument.[33]

VII. FACILITIES AND MATERIALS

All educators and science education experts are in agreement that elementary science should be an integral part of an elementary school program. Therefore, school facilities and materials should provide a proper setting for an elementary science program.

John G. Navarra and Joseph Zafforoni are of the opinion that adequate facilities and materials are vital to the success of the science program. Equipment is inexpensive and easily obtained, but the acquisition and use of such materials requires careful planning or else it will be used only in purposeless demonstrations. They also feel that a lack of information and understanding as to how these facilities and materials may be obtained, is one of the greatest deterrents to the development of a successful program.[34]

A classroom should be both functional and flexible to provide for many activities going on in an elementary school. Most authorities recommend that the ideal classroom should

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[33]Victor, op. cit., pp. 234-238.

[34]John G. Navarra and Joseph Zafforoni, Science Today for the Elementary-School Teacher (Evanston, Illinois: Row, Peterson and Company, 1960), pp. 5-6.

contain (a) sufficient space, (b) movable tables and movable desks, (c) ample bulletin board and peg board space, (d) running water and a sink, (e) sufficient electrical outlets, (f) ample window space, (g) adequate storage space both inside and outside the classroom, (h) adequate counter space, and (i) curtains for darkening the room.

To provide an ideal classroom would require a considerable outlay of capital which many school districts cannot afford. Also, many of our schools were erected prior to emphasis on elementary science and thus do not contain some of the items recommended. However, many education specialists feel that an imaginative and industrious elementary teacher can provide many interesting and worthwhile activities in inadequate surroundings.

Peter C. Gega stated it well when he said no one in an elementary school needs a shiny laboratory to have interesting and worthwhile activities take place. A teacher's work is greatly facilitated by a few conveniences or special arrangements which are easily provided. An electrical outlet is desirable; however, some other form of heat can be provided. It is possible to get by easily without a sink by using a bucket and a pan. A few tools are indispensable, such as a hammer, saw, pliers, screwdriver, nails, and a few lumber scraps. Some of these items may be borrowed occasionally.[35]

The desired results of teaching science in the elementary school are also dependent upon the variety and quality of materials available for a classroom. Amounts available vary from system to system and in some instances teachers are expected to produce desired results with only a textbook and very little equipment. In others, materials go unclaimed because teachers are not aware of them nor adequately trained in their uses.

However, as shown by the following comments of education authorities, it would appear that our fears relative to expense and need for complex equipment are unfounded. Ruby H. Warner says expensive equipment is not necessary for science. Some may be obtained locally at very little expense. Other equipment can be easily and cheaply made with help from older students and the school custodian.[36]

Vessel is of the opinion that it may be disadvantageous to have elaborate equipment in an elementary classroom, because students may become more concerned with equipment than principles being demonstrated. Equipment may be too

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[35]Peter C. Gega, Science in Elementary Education (New York: John Wiley & Sons, Inc., 1966), pp. 82-83.

[36]Ruby H. Warner, The Child and His Elementary School World (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1957), p. 270.

difficult for students to operate and there would be little opportunity or incentive to devise or modify equipment for use in the program.[37]

Gega says that most of the elementary materials used in an elementary science program are simple and readily accessible. These items are found around the home, in local stores, and in other convenient places.[38]

Another source for an elementary science program may be found in the surrounding environment. It provides an unlimited source of materials and opportunity for study and experimentation.

Other sources of great significance are the many programs of contemporary science which have resulted from cooperative efforts of numerous committees, made up of public school teachers, college and university specialists, and other education specialists. Kits and instructional materials may be purchased which provide nearly all materials necessary for a modern approach to science.

Also of importance to an elementary science program is selection of printed materials. Numerous kinds of printed materials are necessary and are available to an elementary science teacher. Victor says teachers must avail

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[37]Vessel, op. cit., p. 64.

[38]Gega, op. cit., p. 67.

themselves of professional publications that will help them develop or reorganize their program. There is a wide variety of source books from which may be taken much information for improving a science program. There are also bulletins and pamphlets that are specially printed to help both teachers and students.[39]

From comments of these science education specialists, it would appear that it is not an absolute necessity to have "ideal" facilities and materials to provide an excellent science program in an elementary school.

VIII. SUMMARY

Since the beginning of the twentieth century man has realized science is very important in preparing one for life in a technological age. Time, money and effort are being expended to upgrade science programs in our public schools and colleges, yet many of us connected with these institutions are dragging our feet.

Our citizenry as a whole, has become quite conscious of a need for science and have brought pressures to bear, to provide funds necessary for providing programs to upgrade science in our public schools and colleges. These pressures and an awareness of need have resulted in tremendous

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[39]Victor, *op. cit.*, p. 223.

advances in pre-service and in-service programs for training our teachers in the public schools.

Instruction in science, which had its beginning in Europe during the seventeenth century, was introduced into the New World by the younger John Winthrop. It spread from a philosophical society established by Cotton Mather, President of Harvard, to other colleges and universities and gradually sifted downward into secondary and elementary schools.

Science was taught by a method known as "object teaching" during the latter half of the nineteenth century. At the turn of the twentieth century, it was replaced by a movement known as "nature study." This movement was considered inadequate by the middle of the 1920's and was replaced by a program which placed emphasis upon the utilitarian aspects of science and the effective dimensions of attitudes, appreciation, and interests. This new emphasis on science was brought about by concern for the social aspects of science, in an era of advanced technology.

Since 1957, there has been a massive movement in curriculum reform. Numerous studies have been made relative to the science curriculum in elementary schools. More emphasis has been placed on stated objectives which serve as a guideline for new programs, teaching science from three general areas, and methods of presentation.

Numerous approaches to teaching elementary science are in evidence, such as (a) incidental, (b) developmental, (c) integrated, and (d) eclectic approaches. Studies have not shown that any one method of teaching elementary science is superior to another method. Findings seem to indicate that any accepted method for teaching elementary science is effective if it is properly selected and used.

Since science has become an integral part of elementary school programs, teachers should be adequately prepared to teach it. However, studies have shown elementary teachers to be inadequate in science background.

The results of these studies has been a concerted effort to improve the background of science teachers, by providing training through various avenues of endeavor. Colleges and universities are reorganizing and upgrading science-education programs and science institutes have been established through the National Defense Education Act. However, these programs cannot accommodate all teachers, thus, many in-service programs have been established, namely, workshops, radio and television science programs, conferences and conventions, visitations, curriculum committees, and science consultants and supervisors.

With the extension and enrichment of elementary school programs, there is a definite need for improvement in our methods of evaluating student achievement. Evaluation of achievement is changing from a test which measures mere memorization of facts to one which involves numerous procedures which will measure a child's over-all growth.

School facilities and materials necessary for an elementary science program should be determined by the content of the curriculum and the objectives to be served. A classroom should be both functional and flexible and contain at least a minimum of furniture and items felt necessary for the program. Materials and equipment should be provided which are both simple and inexpensive. Printed materials and aids should be plentiful and definitely on the educational level of students using them.

CHAPTER III

METHODOLOGY OF THE STUDY

I. INTRODUCTION

The purpose of this study was to determine the present status of science programs in first-grade classrooms of elementary schools in third-class cities of Kansas in an attempt to ascertain the extent of implementation of contemporary science programs.

II. POPULATION AND SAMPLING PROCEDURE

The population of the study included the first-grade teachers in 410 third-class cities in Kansas. A list of third-class cities was obtained from a Directory of Kansas Public Officials - 1968, and a number was assigned to each city. Corresponding numbers were placed in a container and 130 (approximately one third) of the numbers were drawn at random. Cities with numbers corresponding to the numbers drawn were involved in the investigation. The investigator arbitrarily selected 130 schools out of a possible 410 in order that the sample might be representative of the population and to avoid excessive expense and time in completing the study.

The procedure used to gather data was the closed-form questionnaire which required the teacher to respond to items appropriate to his situation. A copy of the questionnaire may be found in the Appendix.

The names and addresses of principals of the elementary schools located in the selected cities were obtained from the Kansas Educational Directory. One hundred eighty questionnaires were mailed to principals for distribution to first-grade teachers. Thirty follow-up letters were also sent. The sample of this study included one hundred fifty (84%) of the teachers responding to the questionnaire, which represented one hundred twelve (86%) of the schools contacted.

III. THE INSTRUMENTATION

All areas considered important to the investigation were included in the questionnaire. Specific answers were sought to questions concerning (a) teacher preparation (college hours) and recency of training, (b) time devoted to science, (c) pattern of organization and presentation, (d) curriculum, (e) student achievement (evaluation), and (f) facilities and materials.

Percentage and frequency were used to give meaning to responses received on the questionnaires. Percentages were rounded off to whole figures and computed on the basis of total number answering each item. The reason for this procedure was that not all items were answered by each respondent.

Teacher Preparation (College Hours) and Recency of Training

The number of college hours in science, areas of science preparation, and recency of training are factors likely to affect the type of science being taught. Respondents were asked to respond to the above noted factors and the following minimum criteria were decided upon to determine if first-grade teachers in third-class cities were adequately prepared to teach contemporary science:

a. Twenty hours of college science.[1]

b. College credit in all three major areas (life, physical, and earth).[2]

c. At least one course taken since 1958.[3]

d. At least one course in science methods taken.[4]

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[1]Maxine Dunfee, Elementary School Science: A Guide To Current Research (Washington, D.C.: Association for Supervision and Curriculum Development, NEA, 1967), p. 54.

[2]The Oklahoma Curriculum Improvement Commission, The Improvement of Science Instruction in Oklahoma Grades K - 6 (Oklahoma City: Oklahoma State Department of Education, 1968), p. 22.

[3]M. F. Vessel, Elementary School Science Teaching (Washington, D.C.: The Center for Applied Research in Education, Inc., 1963), p. 92.

[4]Ibid.

Time Devoted to Science

Respondents were asked to note length of science period, number of periods in science per week, and per cent of class time devoted to science each week. Length of the period is of utmost importance; if it is too short very little can be accomplished, whereas if it is too long, first-graders tend to lose interest. Length of period and number of periods determine amount of time devoted to science each week.

Criteria decided upon to determine if sufficient time is being devoted to first-grade science are:

a. Length of science period should be 20 to 30 minutes.[5]

b. Time devoted to science each week should be from 100 to 150 minutes.[6]

c. Number of science periods per week should be five.[7]

d. There should be a regularly scheduled science program for both semesters.*

Patterns of Organization and Presentation

First-grade teachers were asked to respond to:

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[5]Edward Victor, Science for the Elementary School (New York: The Macmillan Company, 1965), p. 40.

[6]Ibid. [7]Ibid.

*Based on recommendations of Curriculum Department of Unified School District 259, Wichita, Kansas.

a. Method of approach: developmental, incidental, integrated, and eclectic.

b. General areas taught: earth and the rest of the universe (earth science), living things (life science), and matter and energy (physical science).

c. Procedures commonly used in teaching science: "telling and seeing" which included reading, reciting and writing, radio and television, and field trips; "doing" which included audio-visual aids, demonstrations, experimentation, projects, and problem solving activities.

Criteria for determining if the teachers were teaching contemporary science were:

a. Using a developmental or a combination of a developmental and integrated approach.[8]

b. Teaching from all three major science areas.[9]

c. Using the "doing" procedures of presentation.[10]

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[8]Gerald S. Craig, Science for the Elementary School Teacher (new edition; Boston: Ginn and Company, 1958), p. 144.

[9]Commission on Science Education, Science--A Process Approach--Commentary For Teachers (Third Experimental Edition; American Association For The Advancement of Science, 1968), pp. 4-5.

[10]George Ricks, OBJECT LESSONS And How To Give Them (Boston: D. C. Heath and Company, Publishers, 1893), p. xiii.

The teachers were also asked to check one of the new science curriculum programs if they were teaching it in the first-grade science classroom. If a teacher was not teaching one of the new programs listed, but was teaching one not on the questionnaire, he was asked to write in the name of the program.

<u>Science Curriculum Development</u>

First-grade teachers were asked to respond to the following questions by answering "yes" or "no"?

a. Does your school have an active science curriculum committee?

b. Does your school provide you with a science curriculum guide?

c. Do you organize your science program to meet your own objectives?

d. Do you have latitude to determine your own curriculum?

Some assumptions in this area are:

a. If there is an active science curriculum committee in a school, there is a continuous reorganization of the science program.

b. If science is being taught and there is no curriculum guide available, the course is either an incidental or textbook-oriented program.

c. Teachers who organize their science program to meet their own objectives are not teaching contemporary science.

d. Teachers who have latitude to determine their own curriculums are not teaching contemporary science for the following reasons:

1. Lack of leadership and support by administrators.
2. Inadequacy in science preparation and curriculum development.
3. Insufficient time.
4. No science specialists available in most small schools.
5. Lack of materials.

Criteria decided upon for attempting to determine if contemporary procedures are being used in curriculum development are:[11]

a. The school has an active curriculum committee.

b. A curriculum guide is provided.

c. Teacher does not organize curriculum to meet his own objectives.

d. Teacher does not have latitude to determine his own curriculum in science.

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[11]Oklahoma Curriculum Improvement Commission, op. cit., pp. 15-19.

Student Achievement (Evaluation)

Teachers were asked to check each of the following procedures they used in evaluating student achievement:

a. Anecdotal records and observation.

b. Tape recordings.

c. Painting, models, songs, etc.

d. Pencil and paper tests.

e. Practical examinations (handling equipment or materials).

f. Situational examinations (problem situations).

Criteria for determining if a teacher is using a traditional or contemporary approach in evaluation are:[12, 13]

a. It shall be deemed a traditional approach if observation, practical examinations, and situational examinations are not included in methods of evaluation.

b. It shall be deemed a contemporary approach if not less than three procedures are used and include observation, practical examinations, and situational examinations.

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[12]Gerald S. Craig, Science for the Elementary School Teacher (Waltham, Massachusetts: Blaisdell Publishing Company, 1966), pp. 867-870.

[13]Dunfee, op. cit., pp. 40-44.

<u>Science Facilities and Equipment</u>

First-grade teachers were asked to answer "yes" or "no" to the question: "Do you have sufficient equipment to make your science program functional?" They were also asked to check the facilities available, from the list considered necessary for an "ideal situation."

Some assumptions in this area are:

a. Since contemporary science is functional, there must be enough equipment provided to make the science program functional.

b. A functional program of science may be in operation without all of the facilities deemed necessary for an "ideal" classroom.

c. If a teacher feels that he does not have sufficient equipment to make a science program functional, then he will not be teaching a program which could be considered contemporary in approach.

d. By analyzing available facilities checked on the questionnaires, it will be possible to determine whether or not the first-grade classrooms are adequate for contemporary science.

e. In order for a classroom to be adequate, there must be movable tables and movable desks.

IV. DATA ANALYSES

Analyses of data were made in two procedural operations, one concerned with tabulating answers to the specific items included in the questionnaire and the other concerned with testing the research hypothesis.

For purposes of interpretation, teachers' responses to specific questions were tabulated in terms of per cent and frequency of occurrence. The percentages were computed on the basis of total number of teachers answering each specific item and rounded to whole figures.

At the conclusion of the analysis of data compiled from teachers' responses to items included in the questionnaire, it was possible, on the basis of the criteria established, to separate the total number of first-grade teachers into two groups, one using a contemporary approach and one using a traditional approach in teaching first-grade science.

The statistic used to test the research hypothesis of no difference was then applied to the two groups. The analysis made use of the nonparametric chi-square test for a one sample case. The .05 level of significance was selected as a level that must be obtained before the two groups of teachers would be considered significantly different. This statistic was deemed appropriate since it may be used to test whether a significant difference exists between an observed number of objects or responses falling in each category and an expected number based on the null hypothesis.[14]

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[14] Sidney Siegel, Nonparametric Statistics For The Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), p. 43.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

I. INTRODUCTION

The purpose of this study was to ascertain the present status of science in first-grade classrooms of elementary schools of third-class cities of Kansas. It was hoped that from this study, the extent of implementation of new contemporary science programs in first-grade classrooms could be determined. Areas considered vital to this purpose, which were included in the questionnaire were (a) teacher preparation and recency of training, (b) time devoted to science, (c) patterns of organization and presentation, (d) science curriculum development procedures, (e) student achievement (evaluation), and (f) facilities and equipment.

II. ANALYSIS OF QUESTIONNAIRE RESULTS

Teacher Preparation (College Hours) and Recency of Training

In an attempt to determine the qualifications of first-grade teachers, each was asked to list the number of college hours of science earned in various areas. From one hundred thirty-two responses received, number of college hours earned ranged from three to twenty-five. Table I, below, shows the distribution of total hours of science earned by teachers responding.

TABLE I

TOTAL HOURS OF COLLEGE CREDIT IN SCIENCE, FOR FIRST GRADE TEACHERS

Hours credit in science	Number of teachers
3	1
4	2
5	4
6	9
7	2
8	8
9	10
10	13
11	10
12	5
13	14
14	8
15	16
16	4
17	4
18	4
19	4
20	8
21	2
22	2
23	1
25	1
	N = 132

Table II, page 55, presents distribution of college hours in the various sciences for first-grade teachers. Subjects are listed in descending order, on the basis of total number of hours as indicated on the questionnaire.

TABLE II

DISTRIBUTION OF HOURS OF COLLEGE CREDIT IN SCIENCE,
FOR FIRST GRADE TEACHERS

	College hours earned													
Subject	1	2	3	4	5	6	7	8	9	10	15	16	18	Total hours
Biology	0	2	33	6	25	6	1	7	1	0	0	1	0	382
General Science	1	5	31	4	8	4	0	1	0	0	0	0	0	201
Science Methods	0	4	45	1	4	1	0	0	0	0	0	0	0	173
Other Sciences	1	3	10	3	6	0	1	4	1	0	0	0	1	157
Chemistry	1	0	3	3	6	1	0	2	0	5	2	0	0	141
Botany	1	1	5	3	12	1	0	1	0	0	0	0	0	104
Geology	2	1	18	2	7	0	0	0	0	0	0	0	0	101
Earth Science	1	2	21	4	1	0	0	0	0	1	0	0	0	99
Zoology	0	0	10	1	7	0	0	1	0	0	0	0	0	77
Physics	1	3	7	3	4	0	0	0	0	0	0	0	0	60
Physical Science	0	1	0	1	10	1	0	0	0	0	0	0	0	57
Astronomy	1	8	9	1	0	0	0	0	0	0	0	0	0	45

The distribution shows a preponderance of hours in life sciences. Numerals in columns opposite course names indicate number of teachers falling within each interval of hours earned.

In reply to the question concerning year of last science course taken, it was found that ninety-nine teachers (75 per cent) have taken a science course since 1958, whereas thirty-three teachers (25 per cent) have not. Among those who have not taken a science course within the past ten years, dates of last science course ranged from years 1924 to 1958.

In response to the item concerning workshops attended, it was found that nineteen teachers (16 per cent) had attended workshops, whereas ninety-nine teachers (84 per cent) had not attended one. The span of years in which workshops had been attended by the nineteen teachers was from 1951 to 1968. One teacher had attended workshops in 1962 and 1968, one had attended workshops in 1964, 1965, 1966, and three had attended two workshops in 1967.

Concerning number of science institutes attended, it was found that five teachers (4 per cent) had attended one, whereas one hundred thirteen teachers (96 per cent) had not. Of the five who had attended a science institute, dates of attendance ranged from 1960 to 1968.

In reply to the question, "Has your background adequately prepared you to teach science?" the results were (a) sixty-four (48 per cent) answered "yes", whereas sixty-eight (52 per cent) answered "no." Average number of college hours of science for those answering "yes" was thirteen, whereas for those answering "no," the average was twelve hours.

In many cases there seemed to be little, if any, relationship between responses and number of college hours in science earned. Several teachers with less than ten hours felt they were qualified, whereas several with eighteen or more hours felt they were not qualified. From among those who answered "yes" to the question concerning background, many added the comment, "for first grade."

Table III, page 58, shows results of tabulation in relation to minimum criteria for determining adequacy of first-grade teachers in science preparation. Fourteen teachers (11 per cent) have twenty or more hours of college credit in science, whereas one hundred eighteen (89 per cent) have less than twenty hours. It was also found that only nineteen teachers (14 per cent) have college credit in all three general areas, whereas one hundred thirteen teachers (86 per cent) do not. Ninety-nine teachers (75 per cent) have earned credit in science since 1958, whereas thirty-three teachers (25 per cent) have not. Fifty

TABLE III

MINIMUM CRITERIA FOR TEACHER PREPARATION IN SCIENCE

Minimum criteria	Number qualifying	Per cent qualifying	Number not qualifying	Per cent not qualifying
Twenty hours college credit in science	14	11	118	89
College credit in general areas	19	14	113	86
College credit since 1958	99	75	33	25
Methods course	50	38	82	62
N = 132				

teachers (38 per cent) have taken a science methods course since 1958, whereas eighty-two teachers (62 per cent) have not.

In a breakdown of the four areas, it was found that (a) fifty-one (40 per cent) qualified in only one area, (b) thirty-five (26 per cent) qualified in two areas, (c) twenty-three (17 per cent) qualified in three areas, and (d) eight (6 per cent) qualified in all four areas. Thirteen (10 per cent) failed to meet minimum criteria for qualification in any of the four areas. This means that one hundred twenty-four teachers (94 per cent) do not meet minimum criteria for teacher preparation, whereas eight teachers (6 per cent) do.

Time Devoted to Science

Of one hundred fifty returns received, one hundred thirty-two teachers (88 per cent) have a regularly scheduled science period. Fifteen teachers (10 per cent) do not have a regularly scheduled science program. Three teachers (2 per cent) do not teach science in first grade. Among the teachers having a regularly scheduled science period, twelve (9 per cent) teach science during the second semester only.

Table IV, page 60, presents distribution of class schedules according to length, for the one hundred twenty teachers who teach a regularly scheduled science class both semesters. The length of class periods varied from ten minutes to fifty-five minutes. To accommodate this varience, the table was divided into five intervals of five minutes each. Distribution of number of class periods per week, per interval was as follows: fifteen classrooms--one period, thirty-six--two periods, thirty-four--three periods, fourteen--four periods, and twenty-one--five periods. Average number of science periods per classroom, per week, was three. Distribution of number of classrooms in each time interval was as follows: thirty-one--ten to fifteen minutes, forty-seven--twenty to twenty-five minutes, twenty-nine--thirty to thirty-five minutes, eleven--forty to forty-five minutes, and two--fifty to fifty-five minutes. The average class period length was twenty-six minutes.

TABLE IV

TABULATION OF CLASS SCHEDULES
(Full year course)

Periods per week	Length of periods in minutes 10-15	20-25	30-35	40-45	50-55	Totals
1	2	3	3	6	1	15
2	9	11	13	2	1	36
3	6	19	7	2	0	34
4	6	5	2	1	0	14
5	8	9	4	0	0	21
Totals	31	47	29	11	2	120

Of those who do not have a regularly scheduled program, or do not offer science in first grade, some felt that reading, writing, and arithmetic were more important than science. Some commented they did not have enough time during the day to include science, whereas others were of the opinion that science should be taught after a student is able to read.

Table V, page 62, presents results of a tabulation of per cent of weekly class time devoted to first-grade science, by those teaching it both semesters. Row (1) represents intervals of per cent, row (2) represents number of classrooms which fall within each interval, and row (3) represents per cent of classrooms within each interval. Time devoted to first-grade science ranged from five hundredths of one per cent to eleven and one tenth per cent. Average class time devoted to science was four per cent.

Table VI, page 63, presents results of a tabulation of class schedules according to length, for those teaching first-grade science during the second semester only. Length of class periods varied from fifteen to forty-five minutes. To accommodate this variance, the table was divided into four intervals of five minutes each. Distribution of number of class periods per week, per interval, was as follows: one classroom--one period, four classrooms--three periods, and seven classrooms--five periods. Average number of science periods per classroom per week was four. Distribution of classrooms in each time interval was as follows: three-classrooms--ten to fifteen minutes, two classrooms--twenty to twenty-five minutes, four classrooms--thirty to thirty-five minutes, and three classrooms--forty to forty-five minutes. Average length of class periods was twenty-eight minutes, and average per cent of weekly class time devoted to science was five.

TABLE V

PER CENT OF WEEKLY CLASS TIME DEVOTED TO SCIENCE

Per cent of classtime	Number of classrooms	Per cent
0-.9	1	1
1	4	3
2	20	17
3	47	39
4	15	13
5	11	9
6	8	7
7	5	4
8	6	5
9	2	2
10	0	0
11	1	1
	N = 120	

Table VII, page 64, presents results of tabulation of criteria for determining adequacy of time devoted to science. Seventy-five teachers (51 per cent) fall within the 20 to 30 minute period recommended for first-grade science, whereas seventy-two teachers (49 per cent) are either below or above the recommended time. Twenty-one teachers (14 per cent) devote from 100 to 150 minutes per week to first-grade science, whereas one hundred twenty-six teachers (86 per cent) devote more or less time than that recommended. Twenty-six teachers (18 per cent) have a science period five days per week, whereas one hundred twenty-one teachers (82 per cent) have less than five periods per week. One hundred twenty teachers (82 per cent) teach science both semesters, whereas twenty-seven teachers (18 per cent) do not.

TABLE VI

TABULATION OF CLASS SCHEDULES
(Second semester only)

Periods per week	Length of periods in minutes 10-15	20-25	30-35	40-45	Totals
1	0	0	0	1	1
2	0	0	0	0	0
3	0	0	3	1	4
4	0	0	0	0	0
5	3	2	1	1	7
Totals	3	2	4	3	12

It was concluded that one hundred thirty-nine teachers (93 per cent) do not meet all four criteria for time devoted to science, whereas eleven teachers (7 per

TABLE VII

TABULATION OF CRITERIA, FOR TIME DEVOTED TO SCIENCE

Criteria	Number qualifying	Per cent qualifying	Number not qualifying	Per cent not qualifying
Length of class period (20-30 min.)	75	51	72	49
Weekly time devoted to science (100-150)	21	14	126	86
Five science periods per week	26	18	121	82
Science taught both semesters	120	82	27	18

N = 147

cent) do. In a breakdown of the four areas it was found that (a) forty-five teachers (30 per cent) qualify in only one area, (b) seventy teachers (47 per cent) qualify in two areas, (c) three teachers (2 per cent) qualify in three areas, and (d) eleven teachers (7 per cent) qualify in all four areas. Twenty-one teachers (14 per cent) failed to meet any of the criteria requirements for qualification.

Patterns of Organization and Presentation

Table VIII, page 66, presents responses to the question concerning approaches used in presenting a science program, with results as follows: (a) twenty-one teachers (16 per cent) use a developmental approach, (b) eighteen teachers (14 per cent) use an incidental approach, (c) five teachers (4 per cent) use an integrated approach, (d) sixty-two teachers (46 per cent) use an eclectic approach, (e) sixteen teachers (12 per cent) use both developmental and incidental approaches, and (f) eleven teachers (8 per cent) use both incidental and integrated approaches.

Table IX, page 67, presents responses to general areas taught in first-grade science, with results as follows: (a) one teacher (1 per cent) taught only earth and the rest of the universe, (b) twenty-eight teachers (20 per cent) taught only living things, (c) two teachers (1 per cent) taught only matter and energy, (d) fifty-three teachers (37 per cent) taught earth and universe, and living things,

(e) three teachers (2 per cent) taught living things, and matter and energy, and fifty-six teachers (39 per cent) taught from all three general areas.

TABLE VIII

APPROACHES USED IN PRESENTING SCIENCE PROGRAM

Approach	Number of teachers	Per cent
Developmental	21	16
Incidental	18	14
Integrated	5	4
Eclectic	62	46
Developmental and incidental	16	12
Incidental and integrated	11	8
Totals	N = 133	100

A third area of vital importance in elementary science programs is procedures commonly used in teaching science. Table X, page 67, lists procedures recommended, number of teachers, and per cent using each procedure. Of one hundred forty teachers responding, there was considerable variation in number of procedures used, ranging from only audio-visual in one classroom to all procedures used in eight classrooms. A very large number of teachers incorporated a mixture of traditional and contemporary procedures in presenting first-grade science.

TABLE IX

AREAS TAUGHT IN FIRST GRADE SCIENCE

Areas taught	Number of teachers	Per cent
Earth and universe	1	1
Living things	28	20
Matter and energy	2	1
Earth and universe; living things	53	37
Living things; matter and energy	3	2
All three general areas	56	39
Totals	N = 143	100

TABLE X

PROCEDURES COMMONLY USED IN TEACHING SCIENCE

Procedures	Number of teachers	Per cent
Reading, reciting and writing	126	90
Radio and television	18	13
Field trips	84	60
Audio-visual aids	113	81
Projects	72	51
Demonstrations	111	79
Experimentation	112	80
Problem solving activities	46	33
	N = 140	Per cent

Emphasis in contemporary science as evidenced by the many programs developed in recent years, is upon use of a teacher's manual and very little, if any, reading material for students. No textbook is provided for the student, however, supplementary materials providing related information of interest are recommended in all new programs.

To determine extent of textbook usage in first-grade science, the teachers were asked to check whether they used a single or multi-text approach to teaching science. Results show that fifty-seven teachers (39 per cent) use a single-text approach, sixty-six teachers (45 per cent) use a multi-text approach, twenty-one teachers (14 per cent) use a teacher's manual, and three teachers (2 per cent) use no textbook.

Of the three who do not use a science textbook, one teaches science on an incidental basis because of outside emphasis on other areas. One teacher used only "current situations," and one taught no science "outside the Weekly Reader."

Since contemporary science emphasizes the "doing" aspects of science, laboratory experiences are of utmost importance in first-grade science. Teachers were asked to answer "yes" or "no" to the question, "Do you have a science laboratory period?" Results show that thirty-nine teachers (29 per cent) do have a science laboratory period, whereas ninety-five teachers (71 per cent) do not. Of those having a science laboratory period, twenty-nine (74 per cent) have a regularly scheduled laboratory period, whereas ten (26 per cent) have an "occasional" laboratory period.

Length and number of science periods per week did not appear to be a determining factor in regard to a science laboratory period. Among those having a laboratory period, twenty teachers (51 per cent) devoted from ten to sixty minutes per week to science in first grade, whereas nineteen teachers (49 per cent) devoted from seventy-two to one hundred fifty minutes per week to science.

Results also show that among those not having a laboratory period, seventy-seven teachers (81 per cent) commonly use demonstrations and experimentation in teaching first-grade science. This would perhaps lead one to believe that most demonstrations and experiments are performed by these teachers.

Additional information obtained from the study of patterns of organization and presentation shows that one hundred eleven teachers (84 per cent) either teach first-grade science using an incidental approach or a combination of incidental approach with either developmental or integrated approaches. It also shows that fifty-six teachers (39 per cent) meet the requirement of teaching from all three general areas, whereas eighty-seven teachers (61 per cent) do not. In the area of procedures used in presenting first-grade science, results show that twenty-one teachers (15 per cent) use only the "doing" methods, whereas one hundred nineteen teachers (85 per cent) use a combination of "doing" and "telling and seeing."

In summation of patterns of organization and presentation, it was found that twenty-one teachers (15 per cent) met all requirements in approaches used, areas taught, and procedures of presentation, whereas one hundred twenty-two (85 per cent) did not meet all requirements.

Science Curriculum Development

Patterns of organization and presentation are dependent upon the extent of planning done in a school system. Planning or lack of planning, as the case may be, is determined by the leadership and organization provided in a school. If there is positive leadership and well planned organization of a school curriculum, one may expect an adequate science program which meets proposed objectives of contemporary science.

In an attempt to determine adequacy of planning in first-grade science, teachers were asked to respond to several areas of curriculum procedure which are pertinent to contemporary science. Of one hundred thirty-eight responding: (a) ten teachers (7 per cent) stated they do have an active science curriculum committee, whereas one hundred twenty-eight teachers (93 per cent) do not, (b) fifty teachers (36 per cent) have a curriculum guide available, whereas eighty-eight teachers do not, (c) one hundred twenty-two teachers (88 per cent) have their own objectives for the science program, whereas sixteen teachers (12 per cent) do not, (d) one hundred seventeen teachers (84 per cent) have latitude to determine their own science curriculum, whereas twenty-one (16 per cent) do not.

During the past decade there has been a tremendous amount of energy expended to produce elementary science programs which would better prepare students for life in a technological age. Many programs have been developed and some of these have been adopted by a few of the elementary schools of Kansas.

Ten of these programs were listed and first-grade teachers were asked to check the correct program in use in their respective schools. Of one hundred twenty-six teachers responding, it was found that one hundred five teachers (83 per cent) do not use one of these programs, whereas twenty-one teachers (17 per cent) have adopted one of the new programs. Following is a list of new programs with number of classrooms participating in each:

_5_ American Association for the Advancement of Science
_1_ Minnesota Mathematics and Science Teaching Project
_5_ Elementary Science Study
_0_ Oakleaf Individualized Elementary School Science
_3_ Reorganized Science Curriculum, K-12

1 Conceptually Oriented Program for Elementary Science
2 Elementary Curriculum Materials Project
1 Elementary Science Project
0 Elementary School Science Project
3 Science Curriculum Improvement Study
0 Other program

In a breakdown of the four areas of curriculum development, it was found that (a) sixty teachers (44 per cent) did not qualify in any area, (b) forty-eight teachers (35 per cent) qualified in one area, (c) twenty teachers (14 per cent) qualified in two areas, and (d) ten teachers (7 per cent) qualified in all four areas. This means that ten teachers (7 per cent) meet all criterion in curriculum development, whereas one hundred twenty-eight teachers (93 per cent) do not.

Student Achievement (Evaluation)

Another area of great significance in elementary science is evaluation of student achievement. Teachers were asked to check each of six recommended procedures which they use in evaluating achievement of their students. Table XI, page 73, presents procedures, with number and per cent of teachers using each one. Results were as follows: (a) thirty-three teachers (28 per cent) use anecdotal records and observation, (b) eleven teachers (9 per cent) use tape recordings, (c) sixty-three teachers (53 per cent) use paintings, models, songs, etc., (d) forty-five teachers (38 per cent) use pencil and paper tests, (e) eighty-one teachers (68 per cent) use practical examinations (handling equipment or materials), and (f) fifty-six teachers (47 per cent) use situational examinations (problem situations).

TABLE XI

PROCEDURES USED IN EVALUATION OF STUDENT ACHIEVEMENT

Procedure	Number of teachers	Per cent
Anecdotal records and observation	33	28
Tape recordings	11	9
Paintings, models, songs, etc.	63	53
Pencil and paper tests	45	38
Practical examinations	81	68
Situational examinations	56	47
N = 119		

There was considerable variation in procedures used by teachers responding. Number of procedures used ranged from one used by several teachers, to all six procedures used by one teacher. Table XII, page 74, shows the distribution of procedures used and number of teachers using each group, with results as follows: (a) thirty-three teachers (28 per cent) used only one evaluative procedure, (b) thirty-eight (32 per cent) used various combinations of two, (c) twenty-seven (23 per cent) used combinations of three, (d) sixteen (13 per cent) used combinations of four,

(e) four teachers (3 per cent) used combinations of five, and (f) one teacher (1 per cent) used all six of the procedures.

TABLE XII

DISTRIBUTION OF PROCEDURES OF STUDENT EVALUATION USED IN FIRST GRADE SCIENCE

(1)	1	3	4	5	6
(2)	5	4	3	17	4
(1)	1,4	1,5	1,6	2,3	2,5
(2)	4	3	3	2	1
(1)	3,4	3,5	3,6	4,5	4,6
(2)	3	3	5	5	1
(1)	5,6	1,2,6	1,3,5	1,3,6	1,4,5
(2)	8	1	4	1	2
(1)	1,5,6	2,3,4	2,5,6	3,4,5	3,4,6
(2)	4	2	1	3	1
(1)	3,5,6	4,5,6	1,2,3,4	1,3,4,5	1,3,4,6
(2)	7	1	1	1	2
(1)	1,3,5,6	2,3,4,5	2,3,4,6	3,4,5,6	1,2,3,4,5
(2)	4	1	1	6	1
(1)		1,3,4,5,6	2,3,4,5,6	1,2,3,4,5,6	
(2)		1	2	1	
			N = 119		

Key: (1) procedures used by teachers
1 anecdotal records and observation
2 tape recordings
3 paintings, models, songs, etc.
4 pencil and paper tests
5 practical examinations
6 situational examinations

(2) number of teachers using procedures

Additional data obtained shows that ninety-seven teachers (82 per cent) used procedures in evaluating student achievement which did not include all three of the required procedures listed in the criteria. Twenty-two teachers (18 per cent) used at least three or more procedures which included all three of the required procedures. This means that only twenty-two teachers (18 per cent) would qualify as using a contemporary approach to evaluation of student achievement, whereas ninety-seven teachers (82 per cent) would not qualify.

Science Facilities and Equipment

Another area of significant importance to a good science program is adequacy of facilities and materials. A classroom should be both functional and flexible, and contain at least a minimum of furniture, equipment, and materials on the educational level of students using them.

Teachers were asked to respond to several items considered important by most science education specialists, and responses were as follows: (a) fifty-five teachers (40 per cent) stated that they did have a science equipment center, whereas eighty-four teachers (60 per cent) stated they had no center in the building, (b) fifty teachers (36 per cent) stated that their school furnished all science equipment used in science, whereas eighty-nine teachers (64 per cent) stated that their school did not furnish all equipment, and (c) one hundred six teachers (81 per cent) make some of their equipment, whereas twenty-five teachers (19 per cent) do not.

The responses concerning classroom facilities available were as follows: ninety-one classrooms (65 per cent) have a sink and running water; one hundred fifteen (82 per cent) have sufficient electrical facilities; ninety-seven (69 per cent) have shades for darkening a classroom; eighty-two (58 per cent) have sufficient counter space; one hundred twenty-three (88 per cent) have sufficient bulletin, chart, and peg board space; one hundred thirty-seven (98 per cent) have movable tables and chairs.

Of one hundred forty responses to this area, it was found that eleven classrooms (8 per cent) have available only two of the recommended facilities, twenty-seven (19 per cent) have three, twenty-three (16 per cent) have four, thirty-two (23 per cent) have five, and forty-seven (34 per cent) have all six of the facilities.

Of one hundred thirty-nine responses received concerning science equipment available, seventy-five teachers (54 per cent) stated that they had sufficient equipment to make their science program functional, whereas sixty-four teachers (46 per cent) stated that they did not have enough equipment to make their science program functional. This would lead one to infer that sixty-four teachers (46 per cent) do not have enough equipment to meet requirements of a contemporary science program.

III. SUMMARY OF ANALYSIS

As indicated in Table XIII, page 78, eight teachers met minimum criteria for teacher preparation and recency of training, eleven in time devoted to science, twenty-one in patterns of organization and presentation, nineteen in science curriculum development, twenty-two in student achievement (evaluation), and seventy-five in facilities and materials.

Further analysis and tabulation of teacher responses indicated that seven teachers (5 per cent) meet minimum criteria in all six areas. The investigator concluded that of the one hundred fifty teachers involved in this study, seven (5 per cent) were using a contemporary approach, and one hundred forty-three (95 per cent) were using a traditional approach to teaching first-grade science.

The hypothesis tested in this study was: There is no significant difference in per cent of teachers using a contemporary approach and per cent of teachers using a traditional approach in teaching first-grade science in third-class cities of Kansas.

The statistical data presented in Table XIV, page 79, represents the focus of this study. The chi-square value

TABLE XIII

SUMMARY OF ANALYSIS OF FIRST-GRADE SCIENCE SURVEY

Area	N	Teachers meeting criteria		Teachers not meeting criteria	
		Number	Per cent	Number	Per cent
Teacher preparation/ recency of training	132	8	6	124	94
Time devoted to science	150	11	7	139	93
Patterns of organization and presentation	143	21	15	122	85
Science curriculum development	138	10	7	128	93
Student achievement (evaluation)	119	22	18	97	82
Adequacy of facilities and equipment	139	73	54	64	46

obtained in an analysis of the two groups of teachers was greater than that required to reject the null hypothesis at the .05 level of significance. Further, the actual probability would allow rejection of the null hypothesis at less than the .001 level of significance.[1]

TABLE XIV

CHI-SQUARE ANALYSIS OF PER CENT OF TEACHERS USING A CONTEMPORARY APPROACH AND PER CENT OF TEACHERS USING A TRADITIONAL APPROACH IN TEACHING FIRST-GRADE SCIENCE

Factor	Cell classification		X^2	Probability
	Contemporary	Traditional		
Observed approach	5%	95%		
Expected approach	50%	50%	81	p .001

The statistical computation was completed as follows:

1. $X^2 = \frac{(O - E)^2}{E}$ Degrees of freedom = k - 1

2.

		C	T
Observed	=	5%	95%
Expected	=	50%	50%
(O - E)			

3. $(O - E)^2$ = 2025 2025

[1] Sidney Siegel, Nonparametric Statistics For The Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), p. 249.

4. $(O-E)^2/E = 40.5 + 40.5$

5. $X^2 = 81$

There was a significant difference in per cent of teachers using a contemporary approach and per cent of teachers using a traditional approach to teaching first-grade science in third-class cities of Kansas. Observation of cell classifications indicates a difference in favor of teachers using a traditional approach.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

The elementary school years are crucial in the life of a boy or girl. In this formative period, children's experiences profoundly affect their physical, social, mental and emotional growth. Today's schools are challenged to provide meaningful experiences that will help these children realize their full potentialities. Elementary science is one of the aspects of elementary education through which schools seek to meet the needs of children.

Instruction in science, which had its beginning in Europe during the seventeenth century, has had a most controversial history. Since its introduction into the New World by the younger John Winthrop, there has been a difference of opinion regarding the science curriculum, its presentation and purpose. This difference of opinion which has been responsible for much of our progress in the area of science education, is still very much in evidence today.

During the latter half of the nineteenth century, "object teaching" was the predominant method of teaching science in American public schools, although there were many who felt it to be inadequate. With the turn of the century, it was replaced by a movement known as "nature study." By the 1920's, this program was also considered inadequate and was replaced by a program which placed emphasis upon the utilitarian aspects of science. This was followed by a period in which, with the exception of a few science education specialists, most of the population became quite complacent regarding science education in America. People were awakened from this complacency with the firing of Sputnik I by the Russians in 1957. Since this eventful occurrence there has been a massive movement in science curriculum reform. Emphasis has been placed upon objectives which require teaching of concepts with its expected scientific literacy, rather than a mere memorization of facts.

Tremendous effort has been expended on local, state, and national levels, to bring about a new science program which will meet the needs of a technological age. Programs have been formulated by many groups, organizations, and educational institutions, which have resulted in complete revision of science objectives, content, and methods of presentation.

Emphasis has been placed on a program which will meet present-day needs, extending upwards from kindergarten through high school. As a result of this emphasis, the purpose of this study arose, namely, to ascertain the present status of science in first-grade classrooms of elementary schools of third-class cities of Kansas. It was hoped that from this study, the extent of implementation of contemporary science programs in first-grade classrooms of third-class cities of Kansas could be determined.

To obtain information, questionnaires were mailed to principals in one hundred thirty elementary schools for distribution to one hundred eighty first-grade teachers. Specific answers were sought to questions concerning teacher preparation (college hours) and recency of training, time devoted to science, patterns of organization and presentation, science curriculum development, student achievement (evaluation), and facilities and materials.

II. CONCLUSIONS

Data analyzed in this study indicate that implementation of contemporary science in first-grade classrooms of third-class cities of Kansas has moved slowly. Only seven (5 per cent) of one hundred fifty classrooms have a contemporary science program; however, certain areas in the analysis indicate that many teachers have adopted various procedures and techniques which are part of contemporary science programs.

In the area of teacher preparation, variance was found in number of hours of college credit earned in science, with the number of hours ranging from three to twenty-five. Many teachers also lacked preparation in all three general areas of science, however, indications are that an increasing number are returning to college for additional training. Seventy-five per cent of teachers surveyed have earned credit in science in the past ten years. However, at present, ninety-four per cent fail to meet minimum criteria for teacher preparation in elementary science.

There was a difference in amount of time devoted to first-grade science in third-class cities of Kansas. A number of teachers offered a regularly scheduled science program, but there was considerable variation in length and number of periods per week. Length of class periods varied from ten to fifty-five minutes and number of periods varied from one to five per week. Average number of science periods per week was three and average length of class periods was twenty-six minutes. This indicates that on the average, only seventy-eight minutes (4 per cent) of weekly time was devoted to science in first grade. Of the teachers surveyed, ninety-four per cent do not meet all four criteria for time devoted to science.

There was variety in patterns of organization and presentation of first-grade science in third-class cities of Kansas. Considerable variance in approaches were used, with sixteen per cent of the teachers using a developmental approach, and eighty-four per cent using an approach which included incidental science. Thirty-nine per cent taught from all three general science areas, whereas sixty-one per cent taught from only one or two areas. Considerable variation in procedures of presentation existed, varying from only audio-visual in one classroom to all procedures used in eight classrooms. Fifteen per cent of the teachers used only the "doing" methods, whereas eighty-five per cent used a combination of "doing" and "telling and seeing."

A difference in procedures of science curriculum development was found in first-grade classrooms of third-class cities of Kansas. Very little had been done to establish active science curriculum committees for updating elementary science programs. Approximately thirty-five per cent of the teachers were provided a science curriculum guide, whereas the remaining sixty-five per cent taught without one. Approximately ninety per cent were allowed to determine their own objectives for first-grade science, and eighty-five per cent were allowed to determine their own science curriculum.

From results obtained, the assumption was made that not enough is being done to bring about an updating of science curriculums in first-grade classrooms. Too little leadership and organization are provided, and teachers are allowed to operate without adequate supervision and help from the administration.

A variety of methods of evaluating pupil achievement in first-grade science in third-class cities were used. However, the trend seemed to be toward use of evaluative procedures which measured more than a mere memorization of facts. Sixty-five per cent used from one to five of the procedures considered as contemporary evaluation. However, at present, only eighteen per cent are using a contemporary approach to student evaluation.

There was no difference in number of teachers who felt they did have, and those who felt they did not have, sufficient equipment to make first-grade science programs functional. From responses received, it was found that a slight majority of teachers felt that they did have sufficient equipment for first-grade science. It was also found that a large per cent of classrooms had adequate facilities for a functional first-grade science program.

Other information deemed pertinent to the study is as follows: (a) a large majority of the teachers still used a textbook as a guide in first-grade science; (b) only thirty per cent had a laboratory period, and of these, one third had only an "occasional" one; (c) only forty per cent of the schools had a science equipment center, whereas sixty per cent required teachers to store all equipment in the classroom; (d) thirty-six per cent of schools provided all science equipment used in science programs; (e) eighty-one per cent of the teachers made part of the equipment used in first-grade science.

The trend is moving very slowly toward development of contemporary science programs in first-grade classrooms of third-class cities of Kansas. With the exception of science areas taught, and science equipment and facilities available, ninety-five per cent of first-grade teachers surveyed fall far short of criteria established for contemporary science in first-grade classrooms of third-class cities of Kansas.

A significant difference was found to exist between the per cent of teachers using a contemporary approach and per cent using a traditional approach to teaching first-grade science.

III. RECOMMENDATIONS

As a result of this study, the following recommendations have been made:

1. A more intense public relations program should be provided at local, state, and national levels to provide information concerning the importance of contemporary science to everyday living.

2. More leadership should be provided from the state level to assess needs, facilities, and procedures for developing contemporary elementary science in public schools.
3. There should be an intensive program of "selling" by college and state education officials, to convince public school administrators of a need for contemporary science, K - 12.
4. Administrators must find some means of relating their needs to college officials to help in planning adequate general-education science programs for pre-service elementary teachers.
5. Greater effort should be made by local, state, and national organizations toward providing more in-service opportunities in elementary science for elementary teachers. These programs should involve actual classroom situations and should place emphasis on teaching science by a contemporary method.
6. Administrators should provide more leadership in science curriculum development.
7. Specialists in elementary science education should be provided by state and colleges, to assist in planning elementary science programs.

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APPENDIX

Marjorie E. Schreiner
R. R. #2, Box 182
Douglass, Kansas 67039

January 16, 1969

Dear Principal:

As a final step toward the completion of my work toward the Master Teacher degree at Kansas State Teachers College, I am gathering data for my research paper. The title of my paper is, "A Survey of First Grade Science in the Third Class Cities of Kansas."

I would appreciate it very much if you would give the enclosed questionnaires and stamped, self-addressed envelopes to your first-grade teachers.

Your cooperation in this endeavor will be greatly appreciated.

Yours truly,

Marjorie E. Schreiner (Mrs.)

Marjorie E. Schreiner
R. R. #2, Box 182
Douglass, Kansas 67039

January 16, 1969

Dear First Grade Teacher:

As a final step toward the completion of my work toward the Master Teacher degree at Kansas State Teachers College, I am gathering data for my research paper. The title of my paper is, "A Survey of First Grade Science in the Third Class Cities of Kansas."

I would appreciate it if you would take a few minutes of your time and fill out the attached questionnaire, and mail it to me in the stamped, self-addressed envelope accompanying this letter.

Your cooperation in this endeavor will be greatly appreciated.

Yours truly,

Marjorie E. Schreiner (Mrs.)

A SURVEY OF FIRST GRADE SCIENCE IN THE ELEMENTARY SCHOOLS OF THE THIRD CLASS CITIES OF KANSAS

Teacher Preparation

List below the number of hours credit you have in each of the following:

Astronomy	_____	Earth Science	_____	Zoology	_____
Biology	_____	General Science	_____	Science Methods	_____
Botany	_____	Geology	_____	Other Sciences	_____
Chemistry	_____	Physics	_____		

Date of last science course taken________________.
Number of science workshops attended___, year or years______.
Number of science institutes attended___, year or years_____.
Has your background adequately prepared you to teach science?
Yes____ No____

Time Devoted to Science

The length of the science period is____________minutes.
The number of periods in science each week is: 0_____, 1_____, 2_____, 3_____, 4_____, 5_____.
What per cent of your class time each week is devoted to science? _____per cent

Patterns of Organization and Presentation

Fill in appropriate response.

_____Developmental approach (basic science generalizations thought essential to a child's development in education).

_____Incidental approach (objects of science interest brought in by students, or as a result of happenings in the world outside the classroom).

_____Integrated approach (other subject fields allied with science).

_____Eclectic approach (utilization of the above methods).

What general areas are taught in your science program? Check appropriate responses.

_____Earth and the rest of the universe (earth science).

_____Living things (life science).

_____Matter and energy (physical science).

Procedures commonly used in teaching science. Check all items applying to your program.

_____Reading, reciting and writing
_____Radio and television
_____Field trips
_____Audio-visual aids
_____Demonstrations
_____Experimentation
_____Projects
_____Problem solving activities

Do you use the single or multi-text approach to teaching science?
Single_____ Multi-text_____
Do you have a science laboratory period? Yes_____ No_____

Science Curriculum Procedures

Does your school have an active science curriculum committee?
Yes_____ No_____
Does your school provide a science curriculum guide?
Yes_____ No_____
Do you have your own objectives for the science program?
Yes_____ No_____
Do you have latitude to determine your own science curriculum?
Yes_____ No_____

Do you use one of these science curriculum programs? Check correct response.

_____a. American Association for the Advancement of Science (AAAS).
_____b. Minnesota Mathematics and Science Teaching Project (MINNEMAST).
_____c. Elementary Science Study (ESS).
_____d. Oakleaf Individualized Elementary School Science.
_____e. Reorganized Science Curriculum, K-12.
_____f. Conceptually Oriented Program for Elementary Science (COPES).
_____g. Elementary Curriculum Materials Project.
_____h. Elementary Science Project.
_____i. Elementary School Science Project (ESSP-USU).
_____j. Science Curriculum Improvement Study.
_____k. None of these.
_____l. Other_____________________________

<u>Student</u> <u>Achievement</u> (<u>Evaluation</u>)

Check methods used to evaluate progress of your students.

_____Anecdotal records and observation.
_____Tape recordings.
_____Paintings, models, songs, etc.
_____Pencil and paper tests.

_____Practical examinations (handling equipment or materials).
_____Situational examinations (problem situations).

Science Equipment

Do you have sufficient equipment to make your science program functional? Yes_____ No_____
Does your school have a science equipment center in your building? Yes_____ No_____
Does your school furnish all science equipment used in your classroom? Yes_____ No_____
Do you make any of the equipment used in your science program? Yes_____ No_____

Classroom Facilities

Check facilities you have available in your classroom.
_____Running water and sink.
_____Sufficient lighting and outlets.
_____Shades for darkening room.
_____Counter space.
_____Bulletin, chart, and peg boards.
_____Movable tables and movable desks.

Would you be interested in receiving a summary report from this survey? Yes_____ No_____

Sample of Follow-up Letter

Marjorie E. Schreiner
R. R. #2, Box 182
Douglass, Kansas 67039

February 11, 1969

First-Grade Teacher
Public Schools
City, State

Dear Colleague:

Recently you received a questionnaire concerning science in the first-grade classroom. I realize you have a busy schedule and perhaps put it aside for later consideration.

Enclosed is another questionnaire. I would appreciate it very much if you would complete it and return it to me in the self-addressed, stamped envelope within the next few days.

Your cooperation in this endeavor will be greatly appreciated.

Yours truly,

Marjorie E. Schreiner (Mrs.)