A STUDY OF THE EFFECT OF THE OKLAHOMA STATE UNIVERSITY TRAVELING SCIENCE TEACHER PROGRAM ON THE ATTITUDES OF HIGH SCHOOL STUDENTS TOWARD SCIENCE AND SCIENTISTS

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CHAPTER I

INTRODUCTION TO THE STUDY

The Traveling Science Teacher Program is one of many efforts which has been sponsored by the National Science Foundation to improve the quality of science education in the United States. For the 1959-60 school year, over $1,600,000 was allocated by the National Science Foundation for the subsidization of this program through four Traveling Science Teacher Centers in the United States.

The sponsoring institutions were the University of Oregon, Michigan State University, Oklahoma State University, and the Oak Ridge Institute of Nuclear Studies. Each sponsoring institution, at the request of the National Science Foundation, submitted a detailed proposal which outlined the type of program desired. Although details varied from institution to institution, the underlying principles of each of the four Traveling Science Teacher Programs reflected the stated request of the National Science Foundation that:

1. Outstanding science teachers be selected.
2. These teachers be vigorously up-dated in modern scientific theory and practice.
3. Each teacher be supplied with science demonstration apparatus.
4. These teachers present lecture-demonstrations in science in applying schools and communities within the area assigned to their sponsoring institution.

The Oklahoma State University Traveling Science Teacher Program

In February of 1959, a grant of money was made by the National Science Foundation to Oklahoma State University with which to initiate and operate a Traveling Science Teacher Program along the general lines prescribed by Oklahoma State University in an earlier proposal. The stated objective of the program was to improve science education through stimulating the interests of teachers, students, and lay citizens in problems of science education and how they could be solved. Over 500,000 school children plus several thousand teachers and other adults were included in the audiences of the Oklahoma State University Traveling Science Teachers during the 1959-60 school year.

Selection of Traveling Teachers

Approximately 20,000 brochures describing the Traveling Science Teacher Program were sent by Oklahoma State University to each high school principal, superintendent, and science teacher in the eight states within the designated area of operations. (See Appendix A.) Included in this area were Colorado, New Mexico, Kansas, Oklahoma, Texas, Missouri, Arkansas, and Louisiana. When the program was continued for 1960-61, two states were added to the area to be served. These two states were Nebraska and Arizona. Application forms were included in this mailing with which a school might apply for a visit by a Traveling Science Teacher. (See Appendix A.) Also included were forms whereby local science teachers might request materials to make application to become a Traveling Science Teacher. (See Appendix A.) Over 350 cards requesting application materials were completed and returned to

Oklahoma State University by teachers who were interested in becoming Traveling Science Teachers.

The following procedure was used to select thirty-two preliminary selectees from among the approximately 100 completed applications which were received before the April 10 deadline:

1. Only those applicants were considered for whom at least two letters of recommendation were received.
2. All applicants who received less than "outstanding" or "excellent" ratings from those who recommended them were eliminated.
3. All applicants who did not have some college preparation in at least four of the five fields of chemistry, physics, biology, mathematics and Education were eliminated.
4. All applicants who did not have at least ten years service remaining prior to retirement were eliminated.

These thirty-two applicants were invited to come to Oklahoma State University for a full day of personal interviews and to become more familiar with what might be expected of them as Traveling Science Teachers. A committee of staff members from the various science departments was formed to interview these applicants during the week of April 13-18, 1959. The applicants arrived in groups of five or six in time for a 6:00 P.M. dinner with the selection committee. Later the same evening the applicants were given complete physical examinations by a qualified physician. The next morning each applicant followed an individual schedule for at least five interviews with different members of the selection committee. At noon the committee met with the applicants for lunch and an extended discussion of current educational issues.

At the end of the week, the committee met together in order to review their notes, the applicants' health reports, transcripts, pictures, applications, and letters of reference. The twenty most desirable applicants were selected as Traveling Science Teachers for 1959-60.

All Traveling Science Teachers selected had had course work in at least three of the fields of chemistry, physics, biology, and mathematics. All but two had had work in all four fields and many had taught each subject in the public schools. The averages and range of the twenty selectees' qualifications are listed in Table I. More complete details are included in Appendix A.

TABLE I

QUALIFICATIONS OF 1959-60 SELECTEES

	Average	Range
Teaching Experience	11.0 Years	1-34
Biology	15.8 Semester Hours	0-95
Chemistry	22.0 Semester Hours	8-67
Physics	15.5 Semester Hours	7-50
Mathematics	23.9 Semester Hours	5-48
Education	34.0 Semester Hours	6-62
Earth Science	2.3 Semester Hours	0-8

It became known by March of 1960 that the Traveling Science Teacher Program would be continued during 1960-61. Nearly identical procedures were then used to select thirteen Traveling Science Teachers for 1960-61.

Thirteen Traveling Science Teachers were thus selected as well as thirteen state and locally sponsored summer trainees. These people were selected by various state and local systems of education contingent to acceptance by the administration of the Oklahoma State University Traveling Science Teacher Program. Qualifications of the 1960-61 Traveling Science Teachers are presented in Table II. More complete details are presented in Appendix B.

TABLE II

QUALIFICATIONS OF 1960-61 SELECTEES

	Average	Range
Teaching Experience	7.6 Years	1.5-19
Biology	18.8 Semester Hours	3.0-45
Chemistry	22.1 Semester Hours	6.0-50
Physics	14.3 Semester Hours	8.0-24
Mathematics	20.7 Semester Hours	6.0-41
Education	18.0 Semester Hours	0 -60
Earth Science	6.3 Semester Hours	0 -30

The Program of Training

The summer training program for the Traveling Science Teachers extended from June 22 to September 4, 1959. Their daily work schedules, field trips, practice teaching experiences, special conferences, and workshops are described in the following paragraphs.

During the summer training program, mornings were used primarily for formal lectures in the academic disciplines. The extent of these lectures by area and clock hours of lecture is listed in Table III.

TABLE III

EXTENT OF LECTURES

Area	Clock Hours
Physics	30
Chemistry	30
Mathematics	30
Geology	20
Biology	20
Meteorology	10
Radiological Science	24

Afternoons and evenings were spent, for the most part, in the following activities:

1. Learning to use new science demonstration equipment and techniques.
2. Constructing and using demonstration aids which ranged from the very simple to the very complex.
3. Library work.
4. Informal group laboratory activities wherein those with more extensive experience in a given area would coach those with less experience.

5. Practice lectures before other members of the group on which each lecturer was constructively criticized on his speech, presentation and demonstration technique.

Enrichment experiences for the twenty trainees were extensive and ranged from lectures by nationally known authorities on science to a field trip to the Redstone Arsenal in Huntsville, Alabama, and the Oak Ridge Laboratory in Oak Ridge, Tennessee. These enrichment experiences were not concentrated in any particular phase of the program but were distributed throughout the summer training program. (See Appendix B for a list of guest lecturers.)

The chief state school officer and an assistant from each of the eight states to be served in 1959-60 were invited to the campus on September 1-2 for a conference with the Traveling Science Teacher who would work in that state. The conference had two objectives:

1. To acquaint these people with the Traveling Science Teacher Program and the teachers that were to work in their respective states.
2. To acquaint the Traveling Science Teacher with the various state programs such as the Title III Programs of the National Defense Education Act or library and audio-visual loan programs. (See Appendix B for a list of people who attended this conference.)

The Traveling Science Teachers, in cooperation with the United States Office of Civil and Defense Mobilization, helped to conduct five regional workshops in Oklahoma for the benefit of science teachers who had received Office of Civil Defense Mobilization Radiological Monitoring Kits. These workshops were conducted simultaneously on

September 10-12, 1959, at Lawton, Woodward, Tulsa, Wilburton, and Oklahoma City. These workshops involved a total of 144 science teachers and gave the Traveling Science Teachers an opportunity to work with groups of teachers, as well as to become more familiar with the Office of Civil Defense Mobilization Radiological Monitoring Kits which were a part of their equipment. An on-campus Civil Defense Workshop was conducted during the summer of 1960, but the out-of-town experiences were deleted.

The Traveling Teachers were scheduled for practice teaching in teams of two or three at schools reasonably accessible to Stillwater. These schools ranged in enrollment from approximately 250 to 1,000 pupils. On September 8-9, 1959, the teams gave lecture-demonstrations in Guthrie, Hennessey, Ponca City, Chandler, Agra, Wellston, and Stillwater. The following week, they worked in Cushing, Blackwell, Coyle, Oilton, Perry, Yale, and Glencoe. In each school the members of the team alternated the lecture responsibility while the others audited the performance. A final conference was held on campus with faculty and Traveling Science Teachers participating before the Traveling Teachers were dispatched to their respective territories for the academic year program.

During the summer of 1960, the same basic procedures were used in training and equipping the Traveling Science Teachers. The state and locally sponsored trainees received the same training and equipment as did the regular Traveling Teachers.

<u>The Academic Year Program</u>

Twenty 1959-model station wagons were leased from the Oklahoma State University Car Pool to provide transportation for the Traveling

Science Teachers. It was necessary to equip these station wagons with overload springs in order to satisfactorily transport the demonstration apparatus and other reference materials. Thirteen of these same station wagons were used by the 1960-61 Traveling Science Teachers. The 1959-60 teachers traveled over 324,000 miles, averaging 16,200 miles per teacher. Individual mileage ranged from 8,000 in predominately metropolitan areas to nearly 30,000 miles in the more sparsely populated areas. The 1960-61 Traveling Science Teachers traveled a total of approximately 250,000 miles, a higher average since fewer teachers were used to cover a larger area. The 1960-61 state and locally sponsored trainees were returned to their employing agencies in September to use their training and equipment to improve their regular activities under the auspices of those agencies.

Approximately 1200 applications for a visit by a Traveling Science Teacher were received from schools in the eight states being served during 1959-60. Approximately the same number were considered for visits in 1960-61. Scheduling of about thirty schools to be visited by each Traveling Science Teacher was accomplished in late August. Applying schools ranged in size from less than thirty to over 3,000 pupils enrolled in high school. Each Traveling Science Teacher completed his own schedule with guidance and supervision from the administration and was instructed to have his schedule reflect the overall ratio of both large and small, urban and rural schools which had applied from within his territory. No school was to be excluded solely on the basis of isolated geographical location. Six of the twenty 1959-60 Traveling Science Teachers had to relocate their residencies (by individual agreement prior to employment) in order to assure maximum coverage of the assigned eight-state area. Three of the thirteen 1960-61 Traveling Science Teachers were similarly relocated for the academic year.

All schools that had applied were notified early in September whether or not they had been selected for a visit by a Traveling Science Teacher. Letters addressed to the principal of each selected school apprised him of some details concerning the Traveling Science Teacher and his visit. (See Appendix A.)

A typical school program would be as follows:

> From one to six weeks prior to the regular one-week visit, the school was previsited by the traveling teacher. The school had already been contacted by mail on two or more occasions. During this visit the traveling teacher met the school officials and teachers, and together they planned the program for the week which seemed to promise the most desirable results in that particular situation.
>
> About four lecture-demonstrations were scheduled for each day of the week. This usually included an assembly program for the senior high school and possibly one each for the junior high and upper grade schools. One or more civic clubs or other adult meetings were scheduled where practical. Finally, fifteen to twenty lectures were scheduled for the mathematics and science classes in the school. Usually a particular class heard from one to three lectures by the traveling teacher during the week, depending on the size of the school and the wishes of the school officials.[1]

Publicity packets were also sent to the principal of each school, usually during the week before a Traveling Science Teacher was to visit there for his extended stay. A description of the lecture areas for which the Traveling Science Teacher had been prepared was included in this packet. (See Appendix A.) Also included were photographs of the

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[1] 1959-60 Traveling Science Teacher Program, Report of the Director (Stillwater, Oklahoma, 1960), p. 16.

Traveling Science Teacher which were suitable for use in local newspapers.

Each Traveling Science Teacher, after completing his week's visit to a school, submitted a report on his week's activities. This report included descriptions of each lecture and each audience, as well as information concerning the school as a whole. (See Appendix A.) Appendix A contains an evaluation-information sheet which was sent to each principal and science teacher in schools visited by a Traveling Science Teacher.

Statement of the Problem

Are there significant changes in the attitudes of high school students toward science and scientists and are these changes associated with participation in the Traveling Science Teacher Program of Oklahoma State University?

Definition of Terms

The terms used in the statement of the problem and in this study are defined as follows:

Changes. Differences in item responses on a test of attitudes of high school students toward science and scientists between initial and final administration of the test.

Attitude. A state of mental or emotional readiness or concern for some particular activity or field of activity.

Science. That general branch of study concerned with the observation and classification of factual information and with the establishment of verifiable general laws as to the behavior of ourselves and our material surroundings.

Scientists. People whose occupations are intimately concerned with the applications, teaching, or extension of scientific knowledge.

Participation (in the Traveling Science Teacher Program). Being in attendance in a classroom in a school being served by the Traveling Science Teacher Program of Oklahoma State University.

Hypothesis

This study poses the null hypothesis that:

Attitudes of high school students toward science and scientists are not changed significantly as a result of participation in the Oklahoma State University Traveling Science Teacher Program.

The alternative or research hypothesis and methods of testing the hypotheses are treated with detail in Chapter IV and, therefore, will not be treated further at this point.

Assumptions

The assumptions on which this study are based are:

1. Attitudes of high school students toward science and scientists can be affected by exposing the students to an environment which involves science-based lectures, demonstrations or other educational media.
2. The attitudes of high school students toward science and scientists can be measured by written tests properly designed for that purpose.
3. The data-gathering instrument selected for measurement of the attitudes of high school students toward science and scientists

is valid and reliable.

4. Within the area to be served by the Oklahoma State University Traveling Science Teacher Program, there are certain similarities among the populations of the ten states involved. It is further assumed that these similarities will be likely to cause high school students in each of these states to react in a like manner to national or foreign scientific announcements or innovations concerning science and scientists.

Purpose and Goals of the Study

The purpose of this study shall be to test the hypotheses as stated. The specific goals which are sought in order to accomplish the stated purpose are listed below:

1. To determine the attitudes toward science and scientists of a representative sample of high school students within the geographical area which was served by the 1960-61 Traveling Science Teacher Program of Oklahoma State University.
2. To determine the stated attitudes of a representative sample of high school students who have participated in the 1960-61 Traveling Science Teacher Program of Oklahoma State University.
3. To determine what relationship, if any, exists between any changes which are found in the stated attitudes and participation in the Traveling Science Teacher Program of Oklahoma State University.

An additional goal which will be sought as collected data are analyzed is listed below:

4. To seek inferences which will be of value to professional

education and to its researchers and which will also be of value to those who conduct or sponsor future programs of experimentation and research, especially in science education.

Need for the Study

Introduction

The problems facing American education today are unique. Never, in fact, has mankind been faced with such a challenging task. H. G. Wells once said, "Civilization is a race between chaos and education."[2] In this section, the writer attempts to establish that the gap between the constituent forces in this race is shorter than at any time in the past, developing reasons for this dangerous situation, and the generalized solution most widely accepted. These factors directly reflect a general need for research in science education and specifically for an evaluation of the Oklahoma State University Traveling Science Teacher Program.

Need for Research in Science Education

Since shortly after the beginning of the nineteenth century, there have been increasing numbers of innovations and revolutions, both technical and cultural, which have caused sweeping changes in America's educational structure. Now, for the first time in the history of man, it is possible to be born, educated, and grow to adulthood in one world, and be faced with earning a living in a world neither conceived nor thought possible thirty years earlier. In referring to the preparation

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[2]H. G. Wells, quoted by Clifford P. Hooker, "To Create An Enduring Society," Phi Delta Kappan, XLII, No. 9 (June, 1961), p. 374.

of teachers, Mead said:

> Today we are living in a world where it is not enough to teach the children what the adults know--if we can't teach every student we've got something we don't know in some form, we haven't a hope of educating the next generation because what they are going to need is what we don't know.[3]

What was, fifty years ago, an education to be envied by the majority is now almost a necessity. In the words of Francis S. Chace, Dean of the Graduate School of Education at the University of Chicago, "The qualities essential to employability and productivity are coming closer and closer to the characteristics that have long been attributed to the educated person."[4]

In 1957, the average age of the 49,535,000 heads of households in the United States was 46.9 years.[5] These fifty million people determine its politics. This group, however, has only a ninth-grade education,[6] on the average, and that was attained between 1910 and 1925. Yet these people must try to shape the world of tommorow by determining how their youth shall be educated and how their elected leaders shall react to the needs of leadership in today's world.

This, then, is the crux of the first situation: How can we best

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[3]Margaret Mead, "Changing Teacher in a Changing World," _The Education of Teachers - New Perspectives_, Report of the Second Bowling Green Conference (Washington, D.C., 1958), p. 124.

[4]Francis S. Chace, quoted by Charles E. Silberman, "The Public Business - The Remaking of American Education," _Fortune_ Reprint (April, 1961), p. 5.

[5]United States Department of Commerce, Bureau of the Census, _A Statistical Abstract Supplement - Historical Statistics of the United States_ (Washington, D.C., 1960), p. 17.

[6]Ibid, p. 214.

educate today's youth for life in, and adequate adjustment to, the world of their adulthood? Considering the increasingly important place which science and technology enjoy in our current culture, we need constant evaluation and research aimed at improving our science education program as a whole.

A German researcher recently reached a conclusion which presents this problem in an excellent perspective.

> If a nation assigns an amount for education over a lengthy period which is higher or lower--in relation to population and national income--than the corresponding expenditure of other nations, this has without any doubt the most momentous consequences for the prospects of these nations in international competition.[7]

This recognized need for increased emphasis on research in education has had its effect in recent years. Current concern is, as will be shown, for increasing research.

Culp[8] defines education as the development of humanity's primary resource. He then defines man's primary resource as being individual creativity and calls for an emphasis on educating people so that they will appreciate and seek knowledge on their own, for its own sake, and to re-evaluate our aims in education in terms of what is truly lasting.

George R. Taylor[9] stresses the importance of teaching decision-making as opposed to the exclusive accumulation of facts. The President

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[7]Friedrich Edding, Internationale Tendenzen in der Entwicklung der Ausgaben fur Schulen und Hochschulen (International Trends in Educational Expenditure) (Kiel, Germany, 1958), p. 159.

[8]Harvey W. Culp, "The Dimensions of the Task in Education," Main Currents in Modern Thought, XIII, No. 3 (January, 1957), p. 60.

[9]George R. Taylor, "Teaching the Art of Decision-Making," The Journal of General Education, VIII, No 4 (July, 1955), p. 255.

of Sarah Lawrence College, Harold Taylor,[10] maintains that the lesson we should learn from Russia is not one of quantity but one of quality.

Glenn Giddings, in addressing the Sixty-ninth Annual Convention of the Association of Land-Grant Colleges and Universities, pleaded for an education that would be "to form the mind, not to fill it."[11] The National Council of Independent Schools lists as the first aim of our schools "developing intellectual integrity and intellectual power, including imagination and creative power as well as critical judgment and reason."[12]

Such a mosiac of opinion could be extended indefinitely, but as John Gardner wrote recently, "We have plenty of problems we haven't solved, not because we didn't know how but because we couldn't organize ourselves to apply what we know...The problem now is to get action."[13]

Massive efforts to improve the quality of education are currently extant in every field of education. Many seem to be accomplishing something desirable; some do not. We should bear in mind that, while striving toward improved quality in our education, we need to be constantly concerned about the quality as well as quantity of our efforts. Research should be used extensively to help us determine which of the

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[10]Harold Taylor, "Americans in Transition," The American Economy: An Appraisal of its Social Goals and the Impact of Science and Technology (New York, 1958), p. 9.

[11]Glenn W. Giddings, "The Need for Trained Intelligence," American Journal of Physics, XXIV, No. 5 (May, 1956), p. 334.

[12]Committee on Teacher Training of the National Council of Independent Schools, Preparation of Teachers for Secondary Schools (Boston, 1958), p. 7.

[13]John Gardner, quoted by Stanley Elam on editorial page, Phi Delta Kappan, XLII, No. 9 (June, 1961), p. 373.

many attempts are better, instead of merely bigger--which show promise of improving quality instead of quantity.

Need for Present Study

That more and better research relating to specific facets of science education is needed is unchallenged by current authorities. Considering the importance of science and technology in our modern world, one can hardly deny that a portion of the needed research should be directed toward the area of science education. A 1960 joint commission of the American Association for the Advancement of Science and the American Association of Colleges for Teacher Education stresses this point in reporting, "The list of subjects relating to science instruction which urgently need careful investigation remains distressingly long."[14]

The Traveling Science Teacher Program was only one of many efforts of the National Science Foundation to improve science instruction. The National Science Foundation is only one of many agencies endeavoring to improve science instruction in America. It should also be remembered that science instruction is only one of many areas deserving and receiving wholesale scrutiny and action with an eye to improvement. It is, therefore, imperative that close and continuous watch be kept, through research, to aid in lending desirable direction to these monumental efforts. Faulty efforts, no matter how well conceived, should be identified in order that they might be curtailed. Through research, we need to keep constantly in touch with how well we are doing that which we are

[14]American Association for the Advancement of Science and American Association of Colleges for Teacher Education, Improving Science and Mathematics Programs in American Schools (Washington, D.C., 1960), p. 37.

attempting.

It has been mentioned that one of the primary purposes of the Traveling Science Teacher Program was to improve the attitudes of participating students and adults toward science. In the final analysis, the course of a determination of the degree to which this purpose is realized would be to identify any relationship which exists between one's participation in the program and any changes in attitude toward science and scientists.

That such attitudes are deserving of attention is widely propounded. The Science Manpower Project was originally concerned with the production of scientific manpower. Yet, in a recent publication concerning science education, primary emphasis was placed on the need for a scientifically literate public with favorable attitudes toward science and scientists.[15]

Blanc, in reviewing research which deals with goals of science education lists five primary goals. Two of these are: "Development of interests and appreciations of the benefits of science," and "Development of democratic social attitudes toward the resources of science."[16] The editor of The Encyclopedia of Educational Research, after reviewing recent research in science education, concludes more specifically, "It seems evident that additional research is warranted. Some unanswered questions include: How do such attitudes come into existence?"[17]

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[15] Frederick L. Fitzpatrick, ed., Policies for Science Education (New York, 1960).

[16] Sam S. Blanc, "Review of the General Goals in Science Teaching," Science Education, XXXVII (1953), p. 104.

[17] Chester W. Harris, ed., Encyclopedia of Educational Research (New York, 1960), p. 1221.

Literature dealing with National Science Foundation Traveling Science Teacher Programs was reviewed. No studies were found which paralleled the current study. Directors and coordinators of the three Traveling Science Teacher Programs in the United States, other than at Oklahoma State University, were visited. None of these people knew of any such study which had been made or was being contemplated. The National Science Foundation officials concerned with the Traveling Science Teacher Programs expressed a feeling that such a study would be valuable to them in evaluating the Traveling Science Teacher Program and a desire that it be done.

The data-gathering instrument will be discussed more fully in Chapter III. It should be mentioned here, however, that its author in her recommendations stated expressly, "There is a grave need for a study of attitudes toward science and scientists before and after specific courses and methods in teaching science."[18] The current study constitutes just such a design, and will be more fully discussed in Chapter III.

Scope and Limitations

This study sought to determine whether there were significant changes in the attitudes of high school students toward science and scientists which were associated with participation in the Traveling Science Program of Oklahoma State University. Although Oklahoma State University Traveling Science Teachers presented lecture-demonstrations

[18]Dorothy G. Rodgers, "Youth's Attitudes Toward Science and Scientists Related to Religion, Family, Social Class, and Other Variables" (unpub. Ph.D. dissertation, Purdue University, 1958), p. 152.

to teachers, administrators, school patrons and civic leaders, the primary recipient of its presentations were students. Therefore, this study was limited exclusively to a consideration of changes of attitudes of students. Many Traveling Science Teachers presented lecture-demonstrations to elementary, junior and senior high school students, as well as to limited numbers of college students. In order to strengthen the specificity of this study, as well as to keep it of a manageable size for conduction by a single individual, a further limitation was imposed which excluded from the testing program all but high school students.

There were major differences in selection, training and scheduling Traveling Science Teachers at the different Traveling Science Teacher Centers. Each program was developed in the manner which its administration thought would best serve schools in their territories. This study is therefore limited to those students who participated in Traveling Science Teacher lecture-demonstrations presented by teachers who were trained and sponsored by Oklahoma State University. While some implications and inferences drawn from these data may hold true in other parts of the nation, this is true only as they deal with the students. Inferences drawn may not, of a necessity, be applicable to Traveling Science Teacher Programs as they were conducted by the centers in Michigan, Oregon, and Tennessee, or as they might be conducted in the future, except as they hold to the same pattern or modus operandi presently under evaluation, that at Oklahoma State University.

CHAPTER II

BACKGROUND AND PREPARATION FOR THE STUDY

Historical Background for Today's Emphasis on Science Education

During the closing years of the last century, the industrial revolution was bringing millions of people from rural to urban areas. At the same time, a gigantic influx of immigrants from Europe came to our major cities, as well as to our agricultural areas. These people, most of whom were very poorly educated, were also technologically and scientifically illiterate. They were, for the large part, accepted grudgingly by the nation's schools and forced into a pattern of curriculum which was neither designed for them nor well suited to their needs.

By 1900, our schools were predominately filled by students who, for one reason or another, were learning little about those scientific and technological factors which were becoming more and more important in their daily lives. The traditional secondary education which a few years previously had been reserved for the privileged few was coming to be demanded of a larger portion of our society. This new student body of the nation's schools was neither suited for, nor convinced of, a need for the traditional type of secondary education.

Such being the composition of American secondary education, it was no wonder that "progressive education" and "life adjustment" were so readily accepted by the American people. In the words of Charles

Silberman:

> The schools, tailoring their curriculum to the needs of the times, took the emphasis off intellectual discipline and broadened their function to include a concern for health, vocational training, and the quality of community life."[19]

Remote as they seem, these happenings near the turn of the century bear most directly upon the current pressing need for improved scientific and technological education which many feel is immediately imperative in order to preserve our very existence as a nation. This past half century of life adjustment emphasis has enabled the United States to make more smoothly than any other nation the difficult transition from an agrarian to an industrial society. It has, however, by its long tenure, made a change in emphasis extremely difficult. Research into the true values of curricular innovation became less and less acceptable to the schoolmen of the nation so that after fifty years of a phenomenally profitable curriculum, it was still true as Nicholas Murray Butler wrote in 1893, "School superintendents, principals and teachers are to the last degree impatient of criticism and suggestion."[20]

As early as 1894, the report of the famed Committee of Ten[21] called for sweeping improvement in the methods of instruction in the sciences in the nation's schools. The nation's schools, faced with the monumental task of creating masses of literate citizens was, for forty years,

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[19]Charles E. Silberman, "The Remaking of American Education," Fortune Reprint (April, 1961), p. 3.

[20]Nicholas Murray Butler, as quoted by Charles E. Silberman, p. 3 .

[21]National Education Association's Committee on Secondary School Studies, Report of the Committee (New York, 1894).

unable to accept the additional burden of preparing large masses of publically educated, scientifically literate citizens.

By 1939, increasing calls were being made for a return to emphasis on the academic. The Commission on the Secondary School Curriculum of the Progressive Education Association[22] had completely accepted the social utility of, and need for, an increased emphasis on science in education. Two years earlier, their preliminary report had emphasized and explored education in a democracy and its implications for the science program.[23] In 1932, the call for such improvement had been reflected in the Thirty-First Yearbook of the National Society for the Study of Education.[24]

The nation's educational leaders were pressing for change when World War II interrupted matters with its omnipotent demand for national action on a different front. From World War II emerged a Russia which was striving with all her might to become a world power equal to and greater than the United States. From World War II emerged a United States primarily interested in regaining the luxuries and physical comforts which had been curtailed.

By 1957, many agencies were attempting to alter the trend of the past fifty years and design a science education curriculum which would

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[22]Commission on the Secondary School Curriculum of the Progressive Education Association, Science in General Education (New York, 1938).

[23]Commission on the Secondary School Curriculum of the Progressive Education Association, Science in General Education, Preliminary Report (New York, 1937).

[24]National Society for the Study of Education, A Program for Teaching Science, Thirty-First Yearbook, Part I. (Bloomington, Illinois, 1932).

produce, in the words of Charles Silberman, "masses of intellectuals, [individuals] prepared today for work that doesn't yet exist."[25]

The Second Bowling Green Conference,[26] the Educational Policies Commission of the National Education Association,[27] the National Council of Independent Schools,[28] all issued statements calling for increased emphasis on what the Rockefeller Report[29] called the pursuit of excellence. All the above reports were of conferences or committees which, although published in 1958, were planned in 1957, prior to the launching of Sputnik by Russia.

After Russia successfully launched the first artificial satellite, the American public and American educators were besieged with demands that we "catch up," that we produce more scientists, that we improve instruction in the sciences for all our young people. Suddenly, the American educational system was faced with demands to "do something," even if it might be untried, unproved, and in many cases, wrong. Verbal support and demand for improvement in science education reached unheard-of and unexpected heights in 1958 and 1959, constantly emphasized as

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[25]Silberman, p. 5.

[26]National Commission on Teacher Education and Professional Standards and the National Education Association of the United States, The Education of Teachers - New Perspectives, Official Report of the Second Bowling Green Conference (Washington, D.C., 1958).

[27]The Educational Policies Commission of the National Education Association, The Contemporary Challenge to American Education (Washington, D.C., 1958).

[28]Committee on Teacher Training of the National Council of Independent Schools.

[29]The Rockefeller Report on Education, The Pursuit of Excellence, Panel Report V of the Special Studies Project (Garden City, N.Y., 1958).

Russia repeatedly outstripped us on the world space-technology scene.

Science Education: An Area of Current Great Concern

It has been stated that in the days and years following the launching of the first artificial satellite in 1957 by Soviet Russia, monumental public response demanded immediate improvement of our educational structure, particularly in the science and engineering fields. It has been shown that, in earlier decades, a few people had for years advocated changes that were finally adopted by the American educational system. This same trend held true in the years immediately following the launching of Sputnik. Among the many voices calling for immediate and drastic action were a few which indicated at least some research and study of the status quo before any drastic, unevaluated changes were made.

The statement by the President's Science Advisory Committee in May of 1959 contains a foreword by President Eisenhower: "This report makes it clear that the strengthening of science and engineering education requires the strengthening of all education."[30] The following year, the Fifty-Ninth Yearbook of the National Society for the Study of Education[31] reinforced President Eisenhower's statement. The yearbook, entitled Rethinking Science Education, outlined clearly and well the role of science in our culture, the kind of science education needed

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[30]Dwight D. Eisenhower's foreword to Education for the Age of Science (Washington, D.C., 1959).

[31]Nelson B. Henry, ed., Rethinking Science Education, The Fifty-Ninth Yearbook of the National Society for the Study of Education (Chicago, Ill., 1960).

for our changing times and the need for research into, and evaluation of, such efforts.

Nelson B. Henry, editor of Rethinking Science Education, very succinctly pointed the way when he said:

> Through the practical applications of scientific discovery, our civilization is undergoing constant change. In turn, these changes bring about situations which threaten the well-being of future generations. The welfare of our civilization is now almost wholly dependent upon scientific progress. Society must respond with adequate and intelligent control.[32]

The adequate and intelligent control mentioned by Dr. Henry seems to have been largely ignored. Rapid and frantic change, for the sake of change, seems to have been the rule, not the exception, during recent years. As Fletcher Watson expressed it in 1960:

> As yet, there has been no full-scale attempt to evaluate the educational task before us and to pinpoint the most appropriate lines of constructive action. Lacking this, we continue to have improvisations dominated by the personal enthusiasms of a few people for a particular subject, approach, or portion of the student population. These hasty efforts have provided us with the lulling sensation that something is being done, and they may offer us too little, too late.[33]

Surprisingly few agencies which were concerned with the improvement of science education heeded warnings such as Watson's. The National Science Foundation increased its budget from $20.5 millions in 1958 to $62.5 millions in 1959.[34] In their Ninth Annual Report,[35] no mention was made

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[32]Ibid., p. xiv.

[33]Fletcher G. Watson, "The Task Before Us," Laboratories in the Classroom (New York, 1960), p. 11.

[34]National Science Foundation, Ninth Annual Report for the Fiscal Year Ended June 30, 1959 (Washington, D.C., 1959), p. 64.

[35]National Science Foundation.

of money allocated for basic research in this area. Only a single mention was made of a need to know of our future needs for scientists and teachers.

Commitments were made by the Federal Government in 1958 to spend $641 millions for oceanographic research.[36] It was planned to increase the budget for medical research from $330 millions in 1957 to $900 millions annually by 1970.[37] Direct Federal Aid to educational institutions was increased by $400 millions in 1957.[38] The National Defense Education Act of 1958 obligated over a billion dollars in Federal Aid to education. The smallest single item among the designated areas of assistance was "Research in the Uses of Television, Radio, Movies, etc."[39] This was the only area in which any funds at all were earmarked for any kind of research.

While expenditures of the United States Office of Education for fellowships rose from zero in 1957 to $5.2 millions in 1958 to $12.6 millions in 1959, a congressional limit of fifty thousand dollars per state was imposed on aid for the improvement of Statistical Services (Title X).[40] Such listings could be continued indefinitely, indicating a willingness to spend large quantities for educational innovation in the

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[36] Ibid., p. 13.

[37] Ibid.

[38] U. S. Department of Commerce, Statistical Abstract of the United States, 1960 (Washington, D.C., 1960), p. 134.

[39] U.S. Department of Health, Education, and Welfare, Guide to the National Defense Education Act of 1958 (Washington, D.C., 1958).

[40] U.S. Department of Health, Education, and Welfare, Grants-in-Aid and Other Financial Assistance Programs (Washington, D.C., 1961), pp. 94, 104.

sciences, but little, if any, for basic research into the provable value of specific instances of innovation.

Numerous recent publications reflect concern over the apparent lack of attention to research into the effectiveness of modern innovation in science education. John B. Carroll of Harvard, in a recent article on "Neglected Areas in Educational Research," claims as his first concern that most "evaluations" in science education have been:

> Regressive maneuvers, not experiments...regressive maneuvers [which] occur when the investigator decides to do not an experimental study but a correlational study--an after-the-fact description of the results of treatments over which no one has real control.[41]

He cites as evidence the fact that in the first twenty-eight volumes of the Journal of Experimental Education, only about one in five of the articles can properly be considered reports of genuinely experimental studies and that there is no perceptible trend toward an increasing proportion of such studies.[42]

The 1961 committee report of the National Science Teachers Association, Planning for Excellence in High School Science, points out the need for experimentation by teachers with new methods.[43] In an earlier publication only the year before, a National Science Teachers Association publication on new developments in high school science teaching[44] pointed

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[41] John B. Carroll, "Neglected Areas in Educational Research," Phi Delta Kappan, XLII, No. 8 (May, 1960), p. 340.

[42] Ibid.

[43] National Science Teachers Association, Planning for Excellence in High School Science (Washington, D.C., 1961), p. 51.

[44] National Science Teachers Association, New Developments in High School Science Teaching (Washington, D.C., 1960), p. 3.

out that few of these developments were based on experimental evidence, even though more than a hundred current individual innovations were involved.

Implications for the Study

Since the National Science Foundation first supported the training of nineteen Traveling Science Teachers at Oak Ridge, Tennessee, in 1958, the Traveling Science Teacher idea has spread rapidly across the nation. In addition to the four centers mentioned in Chapter I which trained and supported over a hundred such teachers during 1959-60 and 1960-61, many states have inaugurated similar, if not duplicate, programs.

Georgia now supports the efforts of five Traveling Science Teachers as a part of the State Department of Education force of supervisor-consultants. Oklahoma, Illinois, Texas, Colorado, Missouri, Louisiana, and other state departments of education have sponsored the training of at least one of their personnel at a Traveling Science Teacher Center and put the person so trained on the road in their respective states as part of their science education force.

Recently, the National Aeronautics and Space Administration has inaugurated a fleet of traveling teachers who will tour the nation in "spacemobiles," presenting lecture-demonstrations. This is the same sort of program which was popularized by the Traveling Science Teacher Program.

No one will deny that the Traveling Science Teacher Programs' performances and activities are spectacular. A report of a poll by William Kinniell of 230 Texas schools which were visited by Traveling Science Teachers in 1959-60 reveals wholehearted praise by administrators and teachers. According to Kinniell, "The responses clearly indicate a positive attitude toward the program by the schools visited."[45] It should be pointed out that the greatest negative response was to the question concerning the lasting effect that the visit would have on the school's science program. Twenty-five percent of those polled responded negatively to this question.

The problem posed by the current paper is to determine whether the attitudes of the participating students toward science and scientists were actually altered by the Traveling Science Teacher Program. True, it was popular, but the same statement could be made for almost any program involving material which could be classified as either entertaining or spectacular.

The United States Department of Health, Education, and Welfare points out, "An unprecedented number of laws of significance to education were enacted by the States during 1957. Legislatures in all states except Virginia and Kentucky met in regular or special session, or both."[46] As indicated by the National Science Teachers Association,[47] the same phenomenal growth in number has been true in recent years of innovations in science education. Both these publications state that these moves, in the main, are not based on experimental evidence. Still further testimony is given in the Science Materials Center publication,

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[45]William Kinniell, "Report on the 1959-60 Traveling Science Teacher Program in Texas" (unpub. paper prepared for the Texas Education Agency, 1960), p. 3.

[46]U. S. Department of Health, Education, and Welfare, State School Legislation of 1957 (Washington, D.C., 1959), p. 1.

[47]National Science Teachers Association.

Laboratories in the Classroom.[48]

Earlier in this chapter, numerous citations have been given indicating that leaders in science and science education have been demanding that more research be done into the real effectiveness of the various recent innovations and movements in science education. The present study constitutes such an effort to evaluate scientifically one specific such innovation in the light of one of its professed objectives. The outcome of this study must, to some degree, either confirm or deny this objective, and to some extent, the Traveling Science Teacher Program.

If confirmation is indicated, the study will reinforce the desirability of such efforts as they are being expanded by the various state and federal agencies. If the study fails to support the contention that the Traveling Science Teacher Program has any effect on the attitudes of participating students toward science and scientists, the implications are, to a degree, obvious. Should such efforts continue, unmodified?

In the first year of the National Defense Education Act, supervisory personnel for science, mathematics, and foreign languages rose tremendously. As was pointed out earlier, many of the state supervisors and consultants thus added have been of the Traveling Science Teacher type. In the eight states served by the Oklahoma State University Traveling Science Teacher Program in its first year, ten such state-sponsored supervisors and consultants are now employed where not one such position existed in 1957. In some states, these people constitute the

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[48] Laboratories in the Classroom (New York, 1960).

major effort at improving science education which is directed from the state level at individual schools in the state.

If the Traveling Science Teacher Program constitutes an effective method for altering the attitudes of high school students toward science and scientists, then it should be awarded the status of experimental evidence that this is, indeed, so. If there is no evidence that the above statement is true, then this lack of experimental evidence should be seriously considered by those agencies which have given and continue to give, support to the continuance of this type of innovation in science education.

Review of Other Literature Pertinent to the Conduction of the Study

It has been mentioned in Chapter I that the directors of all the Traveling Science Teacher Program Centers in the United States were contacted concerning the proposed study. In discussing possible variations in study design, all such administrators contacted agreed that such a study would be valuable for its evaluative implications.

The National Science Foundation Office in Washington, D.C., was visited in a further effort to evaluate the desirability of the study. The officials thus contacted evidenced a desire that such a study be undertaken. They stated further that no study was being made by the National Science Foundation and that no other such studies were being contemplated.

In Chapter I, it was mentioned that one of the stated objectives of the Traveling Science Teacher Program was to improve the attitudes of high school students toward scientific endeavor in general; that is, science and scientists. Officials of the National Science Foundation and of the various Traveling Science Teacher Program Centers were generally agreed that such an outcome would, insofar as high school students were concerned, be the maximum desirable effect of the program. One could not expect students exposed to such a brief individual contact to profit greatly by acquisition of a concrete body of factual information.

For the purpose of gaining the proper perspective for the proposed study, a search of the literature concerning attitudes and their measurement was made. Some of the leading authors, researchers and publishers in this area were also contacted.

The importance of achieving desirable scientific attitudes as a part of participation in science instruction has been expounded and defended for many years. The National Society for the Study of Education as early as 1932 listed scientific attitudes as a major objective of science teaching.[49] Noll[50] placed attitudes above preparation for college or preparation for a scientific career in enumerating the purposes of science education for both the elementary and secondary schools.

A survey of studies of objectives by Keeslar[51] points out that whereas scientific method is related to procedural methods, scientific attitudes are related to the personalities of individuals concerned and deal with their points of view. Although procedural methods must be learned over a period of time and involve a certain degree of memorization, opinions may be altered by experiences not directly related to the

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[49] National Society for the Study of Education, p. 44.

[50] Victor H. Noll, The Teaching of Science in the Elementary and Secondary Schools (New York, 1939), p. 13-4.

[51] Oreon Keeslar, "A Survey of Research Studies Dealing with the Elements of Scientific Method as Objectives of Instruction in Science," Science Education, XXIX (July, 1945), pp. 212-6.

subject at hand.

That attitudes can be changed through exposure to an educational environment is well documented. Only one study could be found wherein the authors doubted this. Eberhard and Hunter[52] found no marked differences of attitudes among three groups of students exposed to different educational environments. This study, however, involved only twenty-one students in each group and the method of teaching was not disclosed. No preconceived and executed experimental differences were stated by the authors. The Encyclopedia of Educational Research does not include the research by Eberhard and Hunter as one of the 332 more important studies in this area.[53]

The great wealth of attitude tests developed and used by reputable science education research teams in colleges and universities attests the acceptability of the assumption that attitudes can be changed through educational environment. Studies of many of these tests have helped to establish their reliability as a matter of record. There remains the question of the approximate length of time which is minimal in causing such changes.

Frasier[54] found a significant change in scientific attitudes to be correlated with participation in science classes where teachers made a coordinated effort to alter the scientific attitudes. Five months of

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[52] J. Wesley Eberhard and George Hunter, "The Scientific Attitude as Related to the Teaching of General Science," Science Education, XXIV (October, 1940), pp. 275-81.

[53] Chester W. Harris, ed.

[54] James E. Frasier, "A Supervisory Program for the Improvement of Instruction in Certain Learning Activities of Junior High School Science," (unpub. Ph.D. dissertation, Colorado State College, 1954).

special teaching was involved in this study.

Barr[55] found three different methods to be successful in altering students' scientific attitudes. Four and one-half months of special emphasis teaching was used in validating each of these three methods.

Even before World War II gave added impetus to interest in scientific attitudes, several researchers established the validity of instruments which were designed to measure specific attitudes. Lurie[56] and Ferguson and his colleagues[57] verified these kinds of instruments using factor analysis. Reliability and validity of the particular instrument used in this study will be discussed in Chapter III and will not be included at this point.

The area served by the 1960-61 Traveling Science Teacher Program included Arizona, Arkansas, Colorado, Kansas, Louisiana, Missouri, Nebraska, New Mexico, Oklahoma, and Texas. This area has a population density of 27.7 people per square mile.[58] The population densities of the ten states vary from this figure in each case by less than a factor of three. Several of the states in the Eastern United States range up

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[55] Lincoln F. Barr, "Critical Selection and Evaluation of Enrichment Methods in Junior High School General Science," Science Education, XLIII (December, 1949), p. 333-43.

[56] W. A. Lurie, "A Study of Spranger's Value-Types by the Method of Factor Analysis," Journal of Social Psychology, VIII (1937), pp. 17-37.

[57] L. W. Gerguson, L. G. Humphreys, and F. W. Strong, "A Factorial Analysis of Interests and Values," Journal of Educational Psychology, XXXII (1941), pp. 197-204.

[58] Compiled from tables in the work of the U.S. Department of Commerce, Bureau of the Census, A Report of the Seventeenth Decennial Census of the United States, II, Part I (U. S. Summary): Characteristics of the Population (Washington, D.C., 1953).

CHAPTER III

METHOD AND PROCEDURE

Selection of an Instrument

For the purpose of measuring the attitudes of high school students toward science and scientists, a test was sought that was valid and reliable and which would indicate variations of the stated attitudes. Such tests dealing with these stated attitudes were found in the Report of Poll Number 50 of the Purdue Opinion Panel.[61]

These tests were administered to a nationwide sample of 8,500 high school students. A stratified sample of 2,000 students was randomly drawn from the larger group and from this sample, nationally representative norms were computed.[62] Dr. H. H. Remmers, Director of the Division of Educational Reference at Purdue University, considers this instrument to be valid in determining the attitudes of high school students toward science and scientists and has given permission for its use in this study. A copy of this instrument is presented in Appendix C. Henceforth, for the sake of brevity, this opinion-determining instrument will be referred to as a test.

A study by Rodgers showed this test to have a reliability of .90

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[61] H. H. Remmers et al., <u>High School Students Look at Science</u> (Lafayette, Indiana, 1957).

[62] Ibid., pp. 1, 10.

for the portion on attitudes toward science.[63] The portion on attitudes toward scientists showed a reliability of .92.[64]

Selection of Control and Experimental Test Groups

A table of random numbers[65] was used to select thirty high schools from among the 661[66] high schools within the state of Oklahoma. Appendix C contains information concerning these thirty schools. Schools which had been visited by a Traveling Science Teacher in either 1958-59 or 1959-60 were deleted, as were any schools which were scheduled to be visited by a Traveling Science Teacher during 1960-61. Three schools were thus deleted. (See Appendix C.) The control group of schools was taken from among these remaining twenty-seven schools.

Each of the principals of the twenty-seven remaining schools was contacted by individually typed, personal letters, and asked to cooperate. (See Appendix C.) As is indicated by the letter, no mention was made of the Traveling Science Teacher Program since it was felt that this knowledge might affect the efficacy of the testing program. Seventeen of these principals agreed to cooperate and administered the tests satisfactorily and these seventeen schools constitute the control group.

Each of the thirteen Traveling Science Teachers for 1960-61

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[63]Rodgers, p. 92.

[64]Ibid.

[65]Merle W. Tate, Statistics in Education (New York, 1955), p. 568-9.

[66]Oklahoma State Department of Education, Oklahoma Educational Directory, 1960-61 (Oklahoma City, Oklahoma, 1960).

was allowed to complete his own schedule of schools to be visited from among those applying for the program. The school to be visited by each Traveling Science Teacher which was scheduled for the first visit of at least three days following November 4, 1960, was designated as an experimental school. This date was selected as it provided the longest period during which schools would not be interrupted by long holiday sessions or semester changes. The Traveling Science Teachers were not told of this specification. They were not informed of the fact that a study was being conducted as it was felt that such knowledge might cause some of them to alter their regular types of presentation in order to impress more favorably the school or student body. Appendix C lists the location, number of students, and the names of pertinent personnel in these schools.

The principals of the thirteen schools selected as experimental schools were contacted by personal, typed letters and apprised of this fact. (See Appendix C for a sample letter.) They were asked not to divulge the fact that they were being thus utilized to the Traveling Science Teacher who was to visit their school.

In both control and experimental schools, the students to be tested were designated in the following manner. In each high school, the science course offered at the lowest grade level was selected. If only one section of that course existed, then that class comprised that school's test group. If two or more sections existed, then one was selected at random and designated as that school's test group. Thus, if a small high school offered only General Science, then the test group was a General Science class. If a school offered only biology to their lowest grade level designated as a high school class, then all previous correspondence with control schools, written on College of Arts and Sciences Extension letterhead paper. The experimental school correspondence was in all cases written on Traveling Science Teacher letterhead paper. A copy of the letter to the experimental schools concerning the post-test is presented in Appendix C.

Procedure for Recording and Tabulating of Data

Prior to the actual administration of the tests, a system of coding and keying was devised by which appropriate information could be punched into International Business Machine cards. Code numbers for appropriate multiple-response categories are contained in Appendix C. Appendix C also contains the complete coding information for the tabulation of all the information contained on both pre-tests and post-tests. The cards containing all test data and information comprised the primary deck which was subsequently treated in the manner described in Chapter IV.

The comments section of the weekly report of each of the Traveling Science Teachers for the week of December 5-9, 1960, was studied in order to see if there was any evidence that the teacher had been aware of the testing program. As can be seen by reading their comments in Appendix C, no such knowledge was evident.

Table IV shows the code number, class size, and subject taught in the seventeen control schools. In several cases, the class size in the school was actually larger. However, if a student took the pre-test but was absent when the post-test was administered, his test was rejected. Twelve post-tests were thus rejected from the control group. The class size shown in Table IV represents the number of valid pre-post test pairs received from that school.

TABLE IV

CODE NUMBER, NUMBER OF STUDENTS, AND SUBJECT TAUGHT IN CONTROL SCHOOLS

School Code (17 Schools)	Number Students	Subject Currently Being Taught to Class
03	17	General Science
04	27	Biology
05	32	Biology
06	16	Biology
08	27	General Science
10	20	General Science
11	28	Biology
12	17	Biology
13	23	Biology
15	28	General Science
18	13	Biology
19	34	General Science
20	24	Biology
21	18	Chemistry
25	36	General Science
26	17	Biology
27	21	Biology
Total	398	

Table V shows the code number, class size, and subject taught in the thirteen experimental schools. The class size figures, as in the case of the control schools, represent the number of valid pre-post test pairs received from that school.

Experimental school number 09, as mentioned by Mr. Roy in Appendix C, suffered a breakdown in their water plant and closed for the remainder of the week. As Mr. Roy had previously put on an assembly and made plans to make a subsequent visit to the school, it was not deleted.

TABLE V

CODE NUMBER, NUMBER OF STUDENTS, AND SUBJECT TAUGHT IN EXPERIMENTAL SCHOOLS

School Code (13 Schools)	Number Students	Subject Currently Being Taught to Class
01	30	General Science
02	23	Chemistry
03	26	Biology
04	25	General Science
05	30	Biology
06	22	Physics
07	22	Chemistry
08	19	General Science
09	13	Biology
10	28	General Science
11	13	General Science
12	20	General Science
13	27	Biology
	Total 298	

Since other researchers might desire to do further research into the area of present concern, a letter was sent to all experimental schools, soliciting further information about the test administrators, the class, and the school community. A copy of this letter is included in Appendix C.

An examination of the test will show that some data, such as age and sex, were gathered concerning the participating schools and students which is not directly related to the stated problem explored by the current study. In Chapter II, it was repeatedly pointed out that research design has been an area of great concern by many authoritative writers in recent years. In line with this concern, it has previously been mentioned that the information indicated by Table VI was obtained for the possible future benefit of researchers or reviewers, as was the additional information on the test, itself. Also, the pre-test and post-test responses of each respondent were checked, using these data, to insure that the same student had completed the post-test which was marked with his code number.

All data gathered during the conduction of the present study, including even those data which may be extraneous to this study, were punched onto International Business Machine cards. These cards have been put on file in the Oklahoma State University Library at Stillwater, Oklahoma.

TABLE VI

ADDITIONAL INFORMATION FROM EXPERIMENTAL SCHOOLS

	School Code Number												
	01	02	03	04	05	06	07	08	09	10	11	12	13
No. of Class-type Lectures	2	1	1	0	2	2	1	2	0	2	4	4	2
No. of Assembly Lectures Rec'd.	1	0	1	2	1	0	1	0	0	1	1	1	1
Sex of Regular Teacher	F	M	F	M	M	M	M	M	M	M	M	M	F
No. of Yrs. Tchr. Has Taught	10	4	18	5	27	15	5	15	2	4	2	2	30
Highest Degree Held by Teacher	BS	MS	BA	BA	MS	MS	MA	MA	BS	BS	BS	MS	MA
Age of Teacher	34	26	39	28	55	42	35	50	25	27	28	30	60

Local Newspaper Generally Read by Townspeople:

01 - Harrison "Daily Times" - Harrison, Arkansas
02 - "Copper Era" - Safford, Arizona
03 - Bernice "News-Journal" - Bernice, Louisiana
04 - Llano "News" - Llano, Texas
05 - "Kiowa County Signal" - Greensburg, Kansas
06 - Scottsbluff "Star-Herald" - Scottsbluff, Nebraska
07 - "Montezuma Valley Journal" - Cortez, Colorado
08 - Wortham "Journal" - Wortham, Texas
09 - "The Missourian" - Washington, Missouri
10 - "Kansas City Star" and "Kansas City Kansan" - Kansas City, Kansas
11 - "Daily Sentinel" - Grand Junction, Colorado
12 - "Avalanche Journal" - Lubbock, Texas
13 - "Anadarko Daily News" - Anadarko, Oklahoma

CHAPTER IV

ANALYSIS AND INTERPRETATION OF THE DATA

Introduction

The stated purpose of this study was to determine if there were any changes in the opinions of high school students toward science and scientists and if any such changes were associated with the student's participation in the Traveling Science Teacher Program. In order to make this determination, identical tests were given to two groups (control and experimental). The tests were administered simultaneously to both groups twice, with approximately six weeks of time lapsing between the first and second tests. An effort was made to assure that the only applicable difference between the two groups was that in the interim the experimental schools were visited by a Traveling Science Teacher.

Natural factors at work in any school might tend to constantly alter, to a degree, the attitudes of the students involved. If the experimental students' opinions were altered to a statistically greater degree than were those of the control group, then this should be made evident by an examination of the two groups' responses to each of the items which comprise the test. Thus, any hypothesis concerning changes in attitudes toward science and scientists must be tested for each of the thirty-one items in the data-collecting instrument.

This study poses the null hypothesis that: Attitudes of high school students toward science and scientists are not changed as a result of participation in the Oklahoma State University Traveling Science Teacher Program. The alternative or research hypothesis is, therefore, that: Attitudes of high school students toward science and scientists are changed significantly as a result of participation in the Oklahoma State University Traveling Science Teacher Program. This research hypothesis will be empirically tested at the .05 level of confidence for each of the thirty-one items in the data-gathering instrument. On any item whereby the null hypothesis is rejected, the alternative hypothesis will be considered to that extent to be validated, and conversely, in any case whereby the null hypothesis cannot be rejected, it will be considered valid and the alternative hypothesis will be considered infirm. In each case, a two-tailed[67] test of significance will be used.

Each of the thirty-one items in the test is answered with one of the following four responses: (1) Agree, (2) Undecided, probably agree, (3) Undecided, probably disagree, (4) Disagree. The one exception is item number 31, wherein "Yes" is substituted for "Agree" and "No" is substituted for "Disagree." These responses lack the specificity and exactness of an interval scale and, therefore, cannot be tested acceptably with a t-test.[68] All responses are, however, ranked

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[67]According to Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York, 1956), a two-tailed test is one which rejects or accepts a statistical population as being specifically "less than," or "more than," instead of merely "different from" a given population.

[68]The t-test is a method of determining the statistical difference between two populations, or groups of data. Henry E. Garrett, Statistics in Psychology and Education (New York, 1958).

in such a way that any response can be said to be greater, or less, than any other response (between total disagreement and total agreement). These responses are, therefore, ordinal, and may be statistically treated as such.

The Mann-Whitney U Test

In order to test the research hypotheses, a statistical method was sought which would be suitable for use with the kind of ordinal data recorded. Such a test was found in the Mann-Whitney U Test.[69] Siegel[70] states that its power-efficiency approaches that of the t-test and involves fewer restrictive assumptions. It should be mentioned here that this test was proposed previously by K. K. Mathen[71] in 1946. Mann and Whitney, however, contend that Mathen's premise was incomplete and incorrect in several ways.[72] Mathen's accuracy or inaccuracy is of no real consequence but his work should be mentioned. The Mann-Whitney U Test was derived for, and used data from, a control-experimental, pre-post research study[73] and has been accepted by researchers,[74]

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[69] H. B. Mann and D. R. Whitney, "On A Test of Whether One of Two Random Variables Is Stochastically Larger than the Other," Annals of Mathematical Statistics , XVIII (1947), pp. 50-60.

[70] Siegel, p. 126.

[71] K. K. Mathen, San Khyā (Indian Journal of Statistics), (Calcutta, 1946), p. 329.

[72] H. B. Mann and D. R. Whitney, p. 60.

[73] Ibid., p. 50.

[74] Bruce J. Biddle and Ann M. Simpson, A Program for the Processing of Ordinal Data and Computation of Significance for Selected Central Tendency Differences (Columbia, Mo., 1961).

respected in their fields, for use with similar ordinal data.

The basic procedure for application of the Mann-Whitney U Test to the data acquired in the present study is as follows:

1. Let n_1 = the number of cases in the smaller of the two groups (experimental group).
2. Let n_2 = the number of cases in the larger of the two groups (control group).
3. Combine both the above group observations and rank these in order of increasing size. (The lowest rank, of one, is assigned to the largest negative numbers, if there are any.)
4. Compute U (the statistic used in this test) with the following precept. U = the number of times that a score in the group with n_2 cases precedes a score in the group with n_1 cases. This value (U') need be computed and used as the statistic only if the value of U is too large to fit the table of significance of U values.
5. Use the "Table of Critical Values of U in the Mann-Whitney Test," which is identified as "Table K" of Nonparametric Statistics by Siegel.[75] This table uses the arithmetic value of n_1 and n_2 to indicate the critical values of U as being significant at the .05 level of confidence.

Computing the values for U in each of thirty-one tests which have values of n_1 and n_2 greater than 10 is extremely tedious. An alternate procedure for computing U is available which gives identical results.[76]

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[75] Siegel, p. 276.

[76] Ibid., pp. 119-121.

This procedure, which was used with the data in this study, is as follows:

1. Assign a rank of one to the lowest score in the $(n_1 + n_2)$ group.
2. Assign a rank of two to the next lowest score in the $(n_1 + n_2)$ group.
3. Continue to assign ascending rank numbers to each of the arithmetically ascending consecutive values in the $(n_1 + n_2)$ group until each has been assigned a rank.
4. Compute $\underline{U}$ and $\underline{U}'$ by using the formulas below. The computed $\underline{U}$ with the lower value is $\underline{U}$ and the one with the higher value is $\underline{U}'$.

   a. $\underline{U} = n_1 n_2 + \dfrac{n_1(n_1 + n_2)}{2} - R_1$

   b. $\underline{U}' = n_1 n_2 + \dfrac{n_2(n_1 + n_2)}{2} - R_2$

   Where R_1 = the sum of the ranks assigned to the group whose sample size is n_1,

   and R_2 = the sum of the ranks assigned to the group whose sample size is n_2.
5. The values of $\underline{U}$ and $\underline{U}'$ may be checked by the formula: $\underline{U} = n_1 n_2 - \underline{U}'$
6. The null hypothesis may be rejected if the computed value of $\underline{U}$ is equal to or smaller than the number shown to be appropriate for the data being tested; that is, n_1, n_2, and the level of significance being used. As each item involves responses from thirteen experimental schools (n_1) and seventeen control schools (n_2), the value of $\underline{U}$ at the .05

level of significance will, in each case, be 63.[77]

Specific applications of the above formulas to the data collected will be shown in the following sections.

Preliminary Processing of Data

In Chapter III, brief mention was made of the fact that test data were punched onto International Business Machine cards. This process of converting the data into a less cumbersome form constituted the first phase of treatment. As only twelve columns were required to record school number, student number, test group, and other identification, and each card contained eighty columns, there were enough columns to allow both pre-test and post-test responses for an individual to be punched onto one card.

After all pre-tests were returned, the identifying data were coded by hand according to code numbers in Appendix C. These coded data were then punched onto International Business Machine cards according to the column designations indicated in Appendix C (first forty-three columns, only). 398 pre-tests were thus recorded for the control group of seventeen schools, and 298 pre-tests were recorded for the experimental group of thirteen schools. These cards will henceforth be referred to as deck one cards.

When all post-tests had been returned, they were coded in the same manner as were the pre-tests. Each post-test was checked against the pre-test to assure that the same student had participated in both tests. The post-test data were then punched onto columns forty-four through

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[77] Ibid., p. 276.

seventy-five on an unpunched series of International Business Machine cards. These cards were then checked against the cards in deck one to assure that each student's pre-test represented in deck one had a counterpart post-test response. The post-test card data were then transferred to columns forty-three through seventy-five on the matching card in deck one. Deck one now contained student identification, as well as both the pre- and post-test response of the student to each of the thirty-one items in the test for each of the 398 control group students and the 298 experimental group students.

At this stage in the processing of the data, the secondary phase of treatment was commenced. A card program was written (punched) by the staff of the Oklahoma State University Computer Center whereby both control and experimental group cards were subjected to the following treatment:

1. Determine the shift, between pre-test and post-test, of student number 01, school number 01, for item one in the test. Considering a shift to the left to be negative and a shift to the right to be positive, the possible shifts were -3, -2, -1, 0, +1, +2, +3.
2. Determine the shift on test item one, between pre-test and post-test, of each student in school number 01 in the same manner described in 1, above.
3. Determine the arithmetic total of the positive or negative responses on test item one made by the students in school number 01.
4. Divide the arithmetic total in 3, above, by the number of students in that school group. This gave the average shift

(positive or negative) made by school number 01 students on their responses to test item one between the pre-test and the post-test.

5. Determine, as outlined in 1 through 4, above, the average shift made by students in each school in their responses to test item one. This was done for each control school and for each experimental school.

6. Determine, as outlined in 1 through 5, above, the average student-response shift, at each of the control and experimental schools, for each of the thirty-one items on the test.

The average shift (positive or negative) made by students at each of the control and experimental schools in their responses to test items will henceforth be referred to as that school's rating on that particular test item. Thus, each school has a rating on each test item which, theoretically, could range between extremes of -3 and +3. As there were only four possible responses to each item, the maximum positive shift in any individual case would be from the first block on the left (agree) to the last block on the right (disagree), a total of three blocks shift to the right (+ 3). An opposite theoretical extreme in pre-post response would yield a three block shift to the left (-3).

Tables VII through XXXVII present the ratings of each school as it pertains to an item. These tables also contain the rank of each school. The rank, as described earlier in this chapter, indicates which school had the most negative rating, the second most negative rating, and so on to the most positive rating. As there were thirteen experimental schools and seventeen control schools, the most positive rating would be given a rank of seventeen. The assigning of ranks was done manually and checked by machine.

At this point in the processing of data, the secondary phase was completed. The secondary phase was terminated by punching all the information contained in Tables VII through XXXVII onto a set of International Business Machine cards. These cards constitute deck two of the data cards.

TABLE VII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER ONE

School Code	Group Code*	Rating	Rank
11	1	.5000-	1
13	2	.4815-	2
12	2	.2500-	3
07	2	.1818-	4
19	1	.1176-	5
27	1	.0952-	6
05	1	.0625-	7
26	1	.0588-	8
12	1	.0000	10
05	2	.0000	10
11	2	.0000	10
10	2	.0357	12
13	1	.0435	13
06	1	.0625	14
02	2	.0870	15
21	1	.1111	16
03	1	.1176	17
25	1	.1389	18
15	1	.1429	19
03	2	.1538	20
18	1	.2308	21.5
09	2	.2308	21.5
20	1	.2500	23
01	2	.2667	24
10	1	.3500	25
04	2	.3600	26
06	2	.3636	27
08	2	.4211	28
04	1	.6667	29
08	1	1.5556	30

*1 = Control Schools, 2 = Experimental Schools

TABLE VIII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWO

School Code	Group Code*	Rating	Rank
11	1	.7143-	1
21	1	.5000-	2
04	2	.4400-	3
27	1	.3810-	4
12	2	.3500-	5
13	1	.3043-	6
12	1	.2500-	7
19	1	.2424-	8
11	2	.2308-	9
07	2	.2273-	10
06	1	.1875-	11
03	1	.1765-	12
01	2	.1667-	13
02	2	.1304-	14
26	1	.1176-	15
08	2	.0556-	16
20	1	.0417-	17
18	1	.0000	19
09	2	.0000	19
13	2	.0000	19
05	1	.0313	21
25	1	.0556	22
06	2	.0909	23
10	2	.1071	24
05	2	.1333	25
15	1	.1429	26
03	2	.1538	27
04	2	.2222	28.5
08	1	.2222	28.5
10	1	.3500	30

*1 = Control Schools, 2 = Experimental Schools

TABLE IX

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER THREE

School Code	Group Code*	Rating	Rank
13	2	.7407-	1
12	1	.3125-	2
18	1	.3077-	3
13	1	.2609-	4
08	1	.2593-	5
11	1	.2143-	6
26	1	.1765-	7
05	1	.1563-	8
06	2	.1364-	9
20	1	.1304-	10.5
02	2	.1304-	10.5
12	2	.1000-	12
04	1	.0370-	13
21	1	.0000	15.5
04	2	.0000	15.5
08	2	.0000	15.5
11	2	.0000	15.5
10	2	.0714	18
15	1	.1071	19
03	1	.1176	20
01	2	.1333	21
06	1	.1429	22
05	2	.1667	23
03	2	.2308	24
19	1	.2353	25
25	1	.2857	26.5
27	1	.2857	26.5
10	1	.3500	28
07	2	.3636	29
09	2	.4615	30

*1 = Control Schools, 2 = Experimental Schools

TABLE X

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER FOUR

School Code	Group Code*	Rating	Rank
01	2	.7143-	1
27	1	.5238-	2
04	2	.3600-	3
13	2	.2800-	4
02	2	.2609-	5
09	2	.2308-	6
25	1	.2000-	7
12	1	.1765-	8
05	1	.1563-	9
18	1	.1538-	10.5
13	2	.1538-	10.5
10	2	.1429-	12
04	1	.1111-	13
20	1	.0909-	14.5
07	2	.0909-	14.5
05	2	.0345-	16
11	1	.0000	17.5
21	1	.0000	17.5
19	1	.1176	19
12	2	.1500	20
06	2	.2273	21
26	1	.2353	22
15	1	.2500	23
08	2	.2632	24
10	1	.3000	25
03	1	.3529	26
11	2	.4167	27
06	1	.5625	28
08	1	.5926	29
13	1	.6087	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XI

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER FIVE

School Code	Group Code*	Rating	Rank
13	2	.3333-	1
06	2	.3182-	2
09	2	.3077-	3
10	1	.2500-	4.5
20	1	.2500-	4.5
08	1	.1852-	6
13	1	.0870-	7
18	1	.0769-	8.5
11	2	.0769-	8.5
11	1	.0000	10.5
10	2	.0000	10.5
04	1	.0741	12
07	2	.0909	13
03	2	.1200	14
15	1	.1429	15.5
27	1	.1429	15.5
01	2	.1667	17
08	2	.2222	18
26	1	.2353	19
05	1	.2500	20.5
06	1	.2500	20.5
05	2	.2759	22
21	1	.2778	23
12	1	.2941	24
19	1	.3235	25
25	1	.3611	26
02	2	.3913	27
04	2	.4583	28
03	1	.5294	29
12	2	.6000	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER SIX

School Code	Group Code*	Rating	Rank
12	1	.4706-	1
04	1	.3077-	2
26	1	.2941-	3
27	1	.2857-	4
08	1	.2593-	5
20	1	.2083-	6
01	2	.1724-	7
11	1	.1429-	8
13	1	.1304-	9
13	2	.1111-	10
06	2	.0909-	11
09	2	.0769-	12
10	2	.0741-	13
05	1	.0625-	14
21	1	.0556-	15
03	1	.0000	18
15	1	.0000	18
02	2	.0000	18
03	2	.0000	18
07	2	.0000	18
05	2	.0333	21
06	1	.0625	22
18	1	.0769	23
04	2	.1250	24
25	1	.1429	25
08	2	.1579	26
19	1	.2059	27
11	2	.3846	28
12	2	.5500	29
10	1	.5789	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XIII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER SEVEN

School Code	Group Code*	Rating	Rank
13	2	.5185-	1
10	2	.4643-	2
11	1	.4444-	3
01	2	.3667-	4
02	2	.3182-	5
26	1	.2941-	6
18	1	.2308-	7.5
11	2	.2308-	7.5
12	2	.2105-	9
12	1	.1176-	10
19	1	.0882-	11
08	1	.0370-	12.5
15	1	.0370-	12.5
03	1	.0000	15.5
04	1	.0000	15.5
06	1	.0000	15.5
09	2	.0000	15.5
05	1	.0313	18
06	2	.0476	19
08	2	.0526	20
27	1	.0952	21
20	1	.1667	22
03	2	.1923	23
21	1	.2222	24
05	2	.2333	25
13	1	.3182	26
04	2	.3750	27
25	1	.4412	28
07	2	.4545	29
10	1	.4737	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XIV

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER EIGHT

School Code	Group Code*	Rating	Rank
13	2	.5000-	1
08	1	.4615-	2
08	2	.3889-	3
06	1	.3750-	4
04	1	.3704-	5
03	1	.2353-	7
12	1	.2353-	7
26	1	.2353-	7
02	2	.1304-	9
04	2	.1200-	10
21	1	.0556-	11.5
25	1	.0556-	11.5
27	1	.0500-	13
13	1	.0435-	14
11	1	.0347-	15
15	1	.0000	16.5
06	2	.0000	16.5
03	2	.0385	18
05	1	.0645	19
05	2	.0690	20
07	2	.0909	21
10	1	.1000	22.5
01	2	.1000	22.5
20	1	.1250	24
10	2	.1429	25
19	1	.2727	26
12	2	.3333	27
09	2	.3846	28
18	1	.4615	29.5
11	2	.4615	29.5

*1 = Control Schools, 2 = Experimental Schools

TABLE XV

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER NINE

School Code	Group Code*	Rating	Rank
11	1	.4643-	1
13	2	.3704-	2
25	1	.3143-	3
12	2	.2000-	4
21	1	.1111-	5
06	2	.0909-	6
05	1	.0000	7.5
10	2	.0000	7.5
04	2	.0417	9
08	2	.0556	10
27	1	.1000	11
04	1	.1481	12
19	1	.1515	13
12	1	.1765	14
07	2	.1818	15
15	1	.2500	16
03	2	.2692	17
02	2	.2857	18
10	1	.3000	19
20	1	.3043	20
08	1	.3077	21
03	1	.4118	22
13	1	.4286	23
06	1	.4375	24
05	2	.4483	25
11	2	.5833	26
26	1	.5882	27
01	2	.6207	28
18	1	.7692	29
09	2	.8462	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XVI

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TEN

School Code	Group Code*	Rating	Rank
13	2	.5926-	1
10	1	.5000-	2
15	1	.2222-	3
03	2	.1923-	4
02	2	.1739-	5
08	2	.1579-	6
09	2	.1538-	7
04	1	.1481-	8
06	2	.1364-	9.5
07	2	.1364-	9.5
04	2	.1200-	11
26	1	.1176-	12
21	1	.1111-	13
01	2	.1034-	14
05	2	.1000-	15
10	2	.0741-	16
11	1	.0370-	17
12	1	.0000	18
19	1	.0882	19
03	1	.1765	20
06	1	.2500	21.5
18	1	.2500	21.5
05	1	.2813	23
27	1	.3333	24
13	1	.4348	25
11	2	.5385	26
25	1	.5556	27
12	2	.6316	28
20	1	.7500	29
08	1	.8148	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XVII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER ELEVEN

School Code	Group Code*	Rating	Rank
11	1	.7037-	1
11	2	.5385-	2
03	2	.2692-	3
06	1	.2500-	4
01	2	.2333-	5
08	1	.1852-	6
05	2	.1667-	7
10	1	.1579-	8
05	1	.1563-	9
09	2	.0769-	10
03	1	.0588-	11
25	1	.0556-	12
27	1	.0476-	13.5
06	2	.0476-	13.5
02	2	.0435-	15
04	1	.0000	16.5
15	1	.0000	16.5
12	1	.1176	18
04	2	.1200	19
19	1	.1471	20
21	1	.1667	21
07	2	.1818	22
20	1	.2083	23
12	2	.2105	24
13	2	.2222	25
13	1	.2609	26
08	2	.2778	27
26	1	.2941	28
18	1	.4615	29
10	2	.5714	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XVIII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWELVE

School Code	Group Code*	Rating	Rank
11	1	.7143-	1
08	1	.4231-	2
04	1	.2963-	3.5
13	2	.2963-	3.5
12	2	.2632-	5
04	2	.2000-	6
25	1	.1714-	7
11	2	.1538-	8
07	2	.1364-	9
05	2	.1333-	10
09	2	.0769-	11
12	1	.0588-	12
13	1	.0435-	13
06	2	.0000	14
01	2	.0345	15
15	1	.0357	16
02	2	.0455	17
26	1	.0588	18
05	1	.0625	19
19	1	.0909	20
06	1	.1250	21
03	2	.1538	22
21	1	.1667	23
10	2	.1852	24
10	1	.2105	25
20	1	.2917	26
08	2	.3684	27
27	1	.3810	28
03	1	.4118	29
18	1	.4615	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XX

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL
SCHOOLS ON ITEM NUMBER FOURTEEN

School Code	Group Code*	Rating	Rank
10	1	.9000-	1
13	2	.6667-	2
06	2	.3636-	3
21	1	.3333-	4
03	1	.2941-	5
18	1	.2500-	6
12	1	.2353-	7
08	1	.2222-	8
04	1	.1111-	9
19	1	.0968-	10
11	1	.0357-	11
02	2	.0000	12
26	1	.0588	13
05	1	.0625	14.5
06	1	.0625	14.5
01	2	.0667	16
09	2	.0769	17
15	1	.1071	18
20	1	.1250	19
07	2	.1364	20
13	1	.2174	21
25	1	.2222	22
10	2	.2593	23
03	2	.2692	24
27	1	.3333	25
12	2	.3500	26
04	2	.3600	27
08	2	.4211	28
05	2	.5667	29
11	2	.6667	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXI

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER FIFTEEN

School Code	Group Code*	Rating	Rank
26	1	.7500-	1
12	1	.6250-	2
03	1	.5882-	3
03	2	.4615-	4
27	1	.4000-	5
19	1	.3824-	6
05	1	.2813-	7
13	1	.2609-	8
10	2	.2143-	9
12	2	.2000-	10
15	1	.1481-	11.5
13	2	.1481-	11.5
06	2	.0909-	13
02	2	.0870-	14
10	1	.0000	15
18	1	.0769	16
11	2	.0909	17
07	2	.1818	18
04	1	.1852	19
06	1	.1875	20
20	1	.2174	21
08	2	.2632	22
05	2	.2759	23
08	1	.2963	24
09	2	.3077	25
11	1	.3704	26
21	1	.3889	27
04	2	.4000	28
25	1	.4412	29
01	2	.6667	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER SIXTEEN

School Code	Group Code*	Rating	Rank
02	2	.3636-	1
19	1	.3235-	2
01	2	.3103-	3
11	1	.2500-	4
18	1	.2308-	5
10	2	.1786-	6
05	2	.1333-	7
20	1	.1304-	8
11	2	.0769-	9
26	1	.0588-	10
05	1	.0313-	11
03	1	.0000	12.5
27	1	.0000	12.5
04	1	.0385	14.5
13	2	.0385	14.5
06	2	.0455	16
21	1	.0556	17
25	1	.0833	18
13	1	.1304	19
08	1	.1481	20
15	1	.1852	21
03	2	.1923	22
10	1	.2105	23
09	2	.2308	24
12	2	.3000	25
12	1	.3125	26
04	2	.3200	27
08	2	.3889	28
06	1	.4667	29
07	2	.5000	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXIII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER SEVENTEEN

School Code	Group Code*	Rating	Rank
18	1	.5385-	1
27	1	.3810-	2
08	1	.3704-	3
11	1	.2857-	4
13	2	.2593-	5
05	1	.2500-	6
13	1	.2273-	7
04	1	.2222-	8
06	2	.1364-	9
26	1	.1176-	10
20	1	.0417-	11
05	2	.0333-	12
03	2	.0000	13
11	2	.0769	14
19	1	.0882	15
07	2	.0909	16
21	1	.1111	17
12	1	.1250	18
15	1	.1429	19.5
10	2	.1429	19.5
10	1	.1500	21
12	2	.2000	22
01	2	.2069	23
02	2	.2174	24
09	2	.2308	25
04	2	.2800	26
25	1	.3889	27
08	2	.5789	28
06	1	.6250	29
03	1	.8824	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXIV

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL
SCHOOLS ON ITEM NUMBER EIGHTEEN

School Code	Group Code*	Rating	Rank
12	1	.8125-	1
04	1	.4074-	2
25	1	.3889-	3
19	1	.3529-	4.5
26	1	.3529-	4.5
01	2	.3333-	6
13	1	.3043-	7
15	1	.2500-	8.5
20	1	.2500-	8.5
11	2	.1538-	10
11	1	.1429-	11
06	2	.1364-	12.5
07	2	.1364-	12.5
06	1	.1250-	14
03	1	.1176-	15
08	1	.1154-	16
08	2	.1053-	17
09	2	.0769-	18
05	2	.0667-	19
05	1	.0645-	20
04	2	.0400-	21
03	2	.0385-	22
21	1	.0000	23
27	1	.1000	24
10	2	.1071	25
02	2	.1739	26
10	1	.2000	27.5
12	2	.2000	27.5
18	1	.2308	29
13	2	.2593	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXV

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER NINETEEN

School Code	Group Code*	Rating	Rank
01	2	.6667-	1
09	2	.5385-	2
25	1	.5278-	3
05	2	.3667-	4
11	1	.2857-	5
15	1	.2500-	6
03	2	.2308-	7
08	2	.1579-	8
08	1	.1481-	9
26	1	.1176-	10
07	2	.0909-	11
06	2	.0476-	12
04	1	.0370-	13.5
13	2	.0370-	13.5
13	1	.0000	15
04	2	.0400	16
10	1	.1000	17
06	1	.1250	18.5
20	1	.1250	18.5
02	2	.1304	20
27	1	.1429	21
03	1	.1765	22
12	1	.1875	23
19	1	.2353	24
05	1	.2813	25
18	1	.3846	26
10	2	.4643	27
21	1	.5000	28.5
12	2	.5000	28.5
11	2	.6154	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXVI

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY

School Code	Group Code*	Rating	Rank
08	2	.3684-	1
21	1	.2222-	2
27	1	.1905-	3
12	1	.1875-	4
11	1	.1429-	5
04	1	.1111-	6
10	1	.1000-	7
13	1	.0870-	8
02	2	.0435-	9
10	2	.0370-	10
15	1	.0357-	11
20	1	.0000	13
25	1	.0000	13
26	1	.0000	13
03	2	.0385	15
03	1	.0588	16
05	2	.0667	17
18	1	.0769	18
04	2	.0800	19
06	2	.0909	20
19	1	.1176	21
05	1	.1250	22
01	2	.1333	23
07	2	.1364	24
09	2	.1538	25
13	2	.1852	26
08	1	.2222	27
06	1	.2500	28
12	2	.4000	29
11	2	.9231	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXVII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-ONE

School Code	Group Code*	Rating	Rank
02	2	.4091-	1
21	1	.3889-	2
12	1	.3750-	3
03	1	.2353-	4
08	2	.2105-	5
08	1	.1481-	6
20	1	.0833-	7
19	1	.0588-	8
18	1	.0000	9.5
06	2	.0000	9.5
25	1	.0286	11
13	1	.0870	12
05	2	.1000	13
11	1	.1071	14
04	1	.1154	15.5
03	2	.1154	15.5
07	2	.1364	17
12	2	.1500	18
09	2	.1538	19
01	2	.1724	20
05	1	.1875	21
13	2	.2222	22
11	2	.2308	23
15	1	.2500	24
06	1	.3333	25
26	1	.3529	26
10	1	.4000	27
27	1	.4762	28
04	2	.4800	29
10	2	.5714	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXVIII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-TWO

School Code	Group Code*	Rating	Rank
25	1	.2500-	1
21	1	.2222-	2
10	1	.2000-	3
12	2	.1579-	4
02	2	.0909-	5
11	2	.0769-	6
08	1	.0741-	7.5
13	2	.0741-	7.5
19	1	.0625-	9
08	2	.0526-	10
06	2	.0476-	11
13	1	.0435-	12
03	2	.0385-	13
12	1	.0000	15
27	1	.0000	15
07	2	.0000	15
04	2	.0417	17
15	1	.0714	18
09	2	.0769	19
20	1	.0833	20
03	1	.1176	21
18	1	.1538	22
05	1	.1563	23
01	2	.1667	24
04	1	.2222	25
05	2	.2333	26
26	1	.2353	27
06	1	.2500	28.5
11	1	.2500	28.5
10	2	.5000	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXIX

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-THREE

School Code	Group Code*	Rating	Rank
13	2	1.4815-	1
11	1	.7407-	2
03	2	.3846-	3
27	1	.3333-	4
03	1	.2941-	5.5
12	1	.2941-	5.5
01	2	.2667-	7
06	2	.1905-	8
05	2	.1379-	9
13	1	.1304-	10
04	1	.1154-	11
10	1	.1000-	12
02	2	.0909-	13
04	2	.0833-	14
18	1	.0000	15.5
09	2	.0000	15.5
25	1	.0278	17
05	1	.0938	18
08	1	.1200	19
10	2	.1481	20
12	2	.1500	21
07	2	.1818	22
15	1	.2500	23.5
20	1	.2500	23.5
08	2	.3684	25
06	1	.4000	26
26	1	.4118	27
11	2	.4615	28
19	1	.5000	29
21	1	.5556	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXX

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-FOUR

School Code	Group Code*	Rating	Rank
04	2	.7600-	1
13	2	.5926-	2
01	2	.5333-	3
03	1	.5294-	4
15	1	.4444-	5
12	2	.3500-	6
03	2	.2692-	7
11	1	.2143-	8
06	2	.1818-	9
09	2	.1538-	10
05	1	.0938-	11
19	1	.0882-	12
26	1	.0588-	13
20	1	.0417-	14
08	1	.0370-	15
10	2	.0357-	16
12	1	.0000	18
13	1	.0000	18
25	1	.0000	18
18	1	.0769	20
02	2	.0909	21.5
07	2	.0909	21.5
04	1	.1111	23
10	1	.1500	24.5
27	1	.1500	24.5
08	2	.1579	26
05	2	.1724	27
11	2	.2308	28
06	1	.2667	29
21	1	.3889	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXXI

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-FIVE

School Code	Group Code*	Rating	Rank
09	2	.5385-	1
05	1	.4688-	2
06	1	.4375-	3
10	1	.3684-	4
25	1	.3056-	5
20	1	.2917-	6
26	1	.2353-	7
11	1	.1786-	8
02	2	.1739-	9
01	2	.1667-	10
03	2	.1538-	11
07	2	.0952-	12
06	2	.0909-	13
13	2	.0370-	14
15	1	.0000	16
27	1	.0000	16
05	2	.0000	16
13	1	.0455	18
12	2	.0500	19
12	1	.0588	20
04	1	.0741	21
08	1	.0769	22.5
11	2	.0769	22.5
10	2	.1481	24
04	2	.1667	25
19	1	.2353	26
18	1	.3077	27
03	1	.3529	28.5
08	2	.3529	28.5
21	1	.3889	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXXII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-SIX

School Code	Group Code*	Rating	Rank
21	1	.3333-	1
15	1	.2857-	2
05	2	.1667-	3
03	2	.1538-	4
11	1	.1429-	5
19	1	.0882-	6
08	1	.0741-	7
20	1	.0435-	8.5
02	2	.0435-	8.5
13	1	.0000	10.5
27	1	.0000	10.5
07	2	.0455	12
26	1	.0625	13
01	2	.0667	14
09	2	.0769	15
06	2	.0909	16
13	2	.1111	17
04	1	.1154	18
03	1	.1176	19
06	1	.1333	20
10	2	.1429	21
12	2	.1500	22
10	1	.2000	23
08	2	.2105	24
05	1	.2813	25
04	2	.4800	26
25	1	.6111	27
18	1	.6154	28.5
11	2	.6154	28.5
12	1	.9375	30

*1 = Control Schools, 2 = Experimental Schools

XXXIII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL
SCHOOLS ON ITEM NUMBER TWENTY-SEVEN

School Code	Group Code*	Rating	Rank
13	2	.8889-	1
11	1	.6667-	2
05	1	.5625-	3
08	2	.4737-	4
13	1	.3636-	5
12	1	.3529-	6
03	2	.3462-	7
21	1	.3333-	8
04	2	.3200-	9
04	1	2593-	10
20	1	.2083-	11
09	2	.1538-	12
06	2	.0455-	13.5
07	2	.0455-	13.5
15	1	.0357-	15
03	1	.0000	16.5
08	1	.0000	16.5
05	2	.0333	18
10	1	.0526	19
01	2	.1000	20
26	1	.1250	21
02	2	.1304	22
10	2	.1481	23
06	1	.1875	24
27	1	.2381	25
25	1	.2500	26
18	1	.3846	27.5
11	2	.3846	27.5
12	2	.4000	29
19	1	.4118	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXXIV

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY EIGHT

School Code	Group Code*	Rating	Rank
05	2	.5333-	1
06	1	.5000-	2
12	1	.4706-	3
18	1	.4615-	4
11	1	.3571-	5
26	1	.2353-	6
07	2	.2273-	7
08	1	.2222-	8
10	2	.1786-	9
20	1	.0833-	10
13	2	.0741-	11
08	2	.0556-	12
12	2	.0500-	13
02	2	.0455-	14
13	1	.0435-	15
01	2	.0345-	16
21	1	.0000	18
27	1	.0000	18
06	2	.0000	18
03	1	.0625	20
05	1	.0645	21
03	2	.0769	22
19	1	.0882	23
15	1	.1071	24
25	1	.1111	25
09	2	.1538	26
04	2	.1667	27
10	1	.2500	28.5
11	2	.2500	28.5
04	1	.4074	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXXV

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER TWENTY-NINE

School Code	Group Code*	Rating	Rank
03	2	.3077-	1
07	2	.2727-	2
13	2	.2593-	3
04	2	.2400-	4
02	2	.1739-	5
03	1	.1176-	6
06	1	.0625-	7
27	1	.0476-	8
01	2	.0345-	9
25	1	.0278	10
04	1	.0385	11
21	1	.0556	12
18	1	.0769	13
13	1	.0870	14
15	1	.1071	15
10	1	.1500	16
08	2	.1579	17
06	2	.1905	18
26	1	.2500	19
11	1	.2857	20
05	2	.3000	21
20	1	.3333	22
12	1	.3529	23
08	1	.3846	24
19	1	.4118	25
09	2	.4615	26.5
11	2	.4615	26.5
05	1	.5000	28.5
10	2	.5000	28.5
12	2	.7368	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXXVI

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER THIRTY

School Code	Group Code*	Rating	Rank
08	2	.3889-	1
01	2	.2667-	2
13	2	.2593-	3
13	1	.2174-	4
20	1	.2083-	5
05	2	.1667-	6
03	2	.0769-	7
06	2	.0455-	8.5
02	2	.0455-	8.5
10	2	.0357-	10
19	1	.0000	11.5
12	2	.0000	11.5
08	1	.0370	13
15	1	.0741	14
04	1	.1111	15
07	2	.1364	16
18	1	.1538	17
05	1	.1613	18
04	2	.2000	19
11	1	.2143	20
09	2	.2308	21
03	1	.2353	22
25	1	.2500	23
21	1	.2778	24
27	1	.3333	25
06	1	.3750	26
26	1	.4118	27
12	1	.5294	28
11	2	.5385	29
10	1	.7500	30

*1 = Control Schools, 2 = Experimental Schools

TABLE XXXVII

RATINGS AND RANKS OF CONTROL AND EXPERIMENTAL SCHOOLS ON ITEM NUMBER THIRTY-ONE

School Code	Group Code*	Rating	Rank
10	2	.3929-	1
08	1	.1852-	2
02	2	.1304-	3
21	1	.1111-	4
12	2	.1000-	5
07	2	.0909-	6
03	2	.0769-	7.5
09	2	.0769-	7.5
06	2	.0455-	9
04	1	.0370-	10
20	1	.0417	11
10	1	.0500	12
12	1	.0588	13
05	1	.0625	14
05	2	.0667	15
04	2	.0800	16
13	1	.0870	17
26	1	.1176	18
06	1	.1250	19
11	2	.1538	20
01	2	.1667	21
03	1	.1765	22
27	1	.1905	23
25	1	.1944	24
19	1	.2353	25
15	1	.2500	26
13	2	.2593	27
11	1	.3214	28
18	1	.3333	29
08	2	.3684	30

*1 = Control Schools, 2 = Experimental Schools

Item Analysis and Findings

The third phase in the treatment of the data was the use of the ranks on each item of each of the schools to compute any significant difference which might exist between the ranks of the control group and those of the experimental group. A card program was written (punched) by the staff of the Oklahoma State University Computing Center whereby the value of U and U' could be computed for each item in the test instrument using the information in deck two.

The null hypothesis was tested, on each of the thirty-one items, in the following manner. Values of U, the pertinent datum for each of the thirty-one test items, are shown in Table XXXVIII, together with other significant items. As shown earlier in this chapter, a value of U which is equal to, or less than, sixty-three is required before a shift in opinions by the experimental group (as compared with the control group) is significant at the .05 level of confidence.

Only on items 10, 14, and 30 was there any significant shift at the .05 level of confidence in the attitudes of the experimental group (as compared with the control group) toward science and scientists. In order to utilize a broader perspective in presenting the data, the computed values of U were tested at the .001 level of confidence,[78] the .01 level,[79] and the .10 level,[80] as well as the .05 level. Table XXXIX contains these data on those items which are applicable.

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[78]Ibid., p. 274.

[79]Ibid., p. 275.

[80]Ibid., p. 277.

TABLE XXXVIII

VALUES FOR THE STATISTIC U AND RELATED VALUES

Item	R_1	R_2	U = Lowest	U^1 = Highest
1	202.5	262.5	262.5	111.5
2	207.0	258.0	105.0	116.0
3	224.0	241.0	88.0	133.0
4	164.0	301.0	148.0	73.0
5	194.0	271.0	118.0	103.0
6	235.0	230.0	77.0	144.0
7	187.0	278.0	125.0	96.0
8	230.5	234.5	81.5	139.5
9	197.5	267.5	114.5	106.5
10	152.0	313.0	160.0	61.0
11	202.5	262.5	109.5	111.5
12	171.5	293.5	140.5	80.5
13	190.0	275.0	122.0	99.0
14	257.0	208.0	55.0	166.0
15	224.5	240.5	87.5	133.5
16	212.5	252.5	99.5	121.5
17	236.5	228.5	75.5	145.5
18	246.5	218.5	65.5	155.5
19	180.0	285.0	132.0	89.0
20	248.0	217.0	64.0	157.0
21	222.0	243.0	90.0	131.0
22	187.5	277.5	124.5	96.5
23	186.5	278.5	125.5	95.5
24	178.0	287.0	134.0	87.0
25	205.0	260.0	107.0	114.0
26	211.0	254.0	101.0	120.0
27	199.5	265.5	112.5	108.5
28	204.5	260.5	107.5	113.5
29	191.5	273.5	120.5	100.5
30	142.5	322.5	169.5	51.5
31	168.0	297.0	144.0	77.0

Note: In each instance, $n_1 = 13$, and $n_2 = 17$.

TABLE XXXIX

LEVELS OF SIGNIFICANCE FOR ITEMS 10, 14, 18, 20, AND 30

Item Number	Significance of U at Different Levels of Confidence			
	.001	.01	.05	.10
10	No	No	Yes	Yes
14	No	Yes	Yes	Yes
18	No	No	No	Yes
20	No	No	No	Yes
30	No	Yes	Yes	Yes

The test items wherein the experimental group evidenced a greater shift only at the .10 level of confidence than the control group were item 18, "Science courses are boring," and item 20, "The goal of science is to benefit mankind."

The test item wherein the experimental group evidenced a greater shift only at the .05 level of confidence was item 10, "Scientists are usually impractical in the way they try to solve the problems of everyday living."

The test items wherein the experimental group evidenced a greater shift only at the .01 level of confidence were: "Scientists are likely to be more radical about matters outside of their own field than non-scientists," (Item 14) and "Science is immoral because it rejects some of the teachings of the Bible." (Item 30)

Many of the test items are similar in content in that several may relate, similarly, to a given topic. An example is that item 6 states

TABLE XXXIX

LEVELS OF SIGNIFICANCE FOR ITEMS 10, 14, 18, 20, AND 30

Item Number	Significance of U at Different Levels of Confidence			
	.001	.01	.05	.10
10	No	No	Yes	Yes
14	No	Yes	Yes	Yes
18	No	No	No	Yes
20	No	No	No	Yes
30	No	Yes	Yes	Yes

The test items wherein the experimental group evidenced a greater shift only at the .10 level of confidence than the control group were item 18, "Science courses are boring," and item 20, "The goal of science is to benefit mankind."

The test item wherein the experimental group evidenced a greater shift only at the .05 level of confidence was item 10, "Scientists are usually impractical in the way they try to solve the problems of everyday living."

The test items wherein the experimental group evidenced a greater shift only at the .01 level of confidence were: "Scientists are likely to be more radical about matters outside of their own field than non-scientists," (Item 14) and "Science is immoral because it rejects some of the teachings of the Bible." (Item 30)

Many of the test items are similar in content in that several may relate, similarly, to a given topic. An example is that item 6 states that scientists are not religious and item 30 states that science rejects some of the teachings of the Bible. Although each item is given in Appendix C, they are reproduced below in order to group them according to such similarities. This is done to clarify accompanying statements concerning significance of certain shifts made by the experimental group.

Items 6, 7, 9, 12, 15, 27, 29, and 30, below, relate science or scientists to religion or morality. Only item 30 evoked a significantly greater shift in opinions in the experimental group than in the control group.

Item 6: Most scientists are not religious.
Item 7: The scientist's attitude of questioning is all right for problems of physics and chemistry, but should not be applied to such things as religion and morals.
Item 9: The scientist seeks to find out the truth with no thought of the consequences of his work.
Item 12: Things like the development of the atom bomb indicate that scientists have little regard for humanity.
Item 15: Scientists are more willing than non-scientists to sacrifice the welfare of others to further their own interests.
Item 27: Since man has a soul, it is immoral to study him by scientific methods.
Item 29: The widespread cruelty of man to his fellow man is largely a result of the immoral use of scientific findings.
Item 30: Science is immoral because it rejects some of the teachings of the Bible.

Items 1, 2, 5, 8, 10, 11, 13, 14, 16, and 23, below, relate to the practicality, efficacy, or other conformations to normalcy, of science and scientists. Only items 10 and 14 evoked a significantly greater shift in opinions in the experimental group than in the control group.

Item 1: The scientist is not able to have a normal family life.
Item 2: Scientists are more likely to be mentally ill than people who are engaged in other types of work.
Item 5: Scientists are more likely than most people to listen to both sides of an argument.

Item 8: Most scientists are geniuses.
Item 10: Scientists are usually impractical in the way that they try to solve the problems of everyday living.
Item 11: Most scientists are more than a little bit "odd."
Item 13: Scientists who work in colleges and universities are so removed from everyday life that they have little to contribute to practical problems.
Item 14: Scientists are likely to be more radical about matters outside of their own field than non-scientists.
Item 16: The willingness of the scientist to reject traditional beliefs may lead to confusion and disorder.
Item 23: Scientific studies are conducted in the laboratory rather than in the actual world.

Items 3, 4, 17, and 21, below, relate science or scientists to nationalistic purposes and goals. None of these items evoked a significantly greater shift of opinions by the experimental group than that evidenced by the control group.

Item 3: The scientist is more likely to be unpatriotic than other people.
Item 4: All scientists should be employed by the government so that control can be kept over their findings.
Item 17: I would view with suspicion any findings reported by a scientist of certain other countries.
Item 21: Scientific training leads to good citizenship.

Items 19, 20, 22, 24, 25, 26, and 28, below, relate science or scientists to humane endeavor. Only item 20 evoked a greater shift in opinions by the experimental group than the control group. This shift was at the .10 level of confidence and is not considered significant for the purposes of this study.

Item 19: Since every person is different, it is impossible to establish scientific laws of human action.
Item 20: The goal of science is to benefit mankind.
Item 22: If it were not for science, we would still be living in ignorance and disease.
Item 24: Although science may be able to understand and control some things in the physical world, it can never hope to understand and control human action.
Item 25: Science has its place but there are many things that can never be understood by the human mind.

Item 26: Scientific methods should be applied to human problems like segregation and poverty as well as to machines and modern conveniences.
Item 28: Money should not be given for scientific research unless it has immediate practical value.

Items 18 and 31 each relate science or scientists to the individual student. Only item 18 evoked a greater shift in opinions by the experimental group than by the control group. This shift was at the .10 level of confidence and is not considered significant for the purposes of this study.

Item 18: Science courses are boring.
Item 31: Do you think that you would like to be a scientist?

As is indicated by the foregoing statements, the research hypothesis was rejected by twenty-eight of the thirty-one stated tests made. Only in three instances was the research hypothesis validated at the .05 level of confidence.

In the light of this general rejection of the research hypothesis by the great majority of the tests made, it is considered to be infirm and not supported by the findings of this study. The findings of this study, therefore, are considered to be in support of the null hypothesis, that the attitudes of high school students toward science and scientists are not changed significantly as a result of participation in the Oklahoma State University Traveling Science Teacher Program.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary of the Study and Findings

This study attempted to determine if there were any changes in the opinions of high school students toward science and scientists and if any such changes were associated with the student's participation in the Traveling Science Teacher Program of Oklahoma State University. In order to make this determination, the Purdue High School Opinion (toward science and scientists) Poll was administered to two groups of high school students, a control group and an experimental group. The control group was composed of seventeen high schools in Oklahoma. The experimental group was composed of the thirteen high schools being visited by the thirteen Oklahoma State University Traveling Science Teachers during the week of November 4, 1960. These schools were located in a ten-state area, Arizona, Arkansas, Colorado, Kansas, Louisiana, Missouri, Nebraska, New Mexico, Oklahoma, and Texas.

The opinion poll was administered simultaneously to the control and the experimental groups during the weeks of October 17, and December 5, 1960, in a pre-post test situation. An effort was made to assure that the only major difference between the two groups which was applicable was that the experimental group had, during the interim, been visited by a Traveling Science Teacher.

The Mann-Whitney U Test was used to determine if a statistically significant shift in opinions had been made by the experimental group, as compared to the control group. This test of significance, at the .05 level of confidence, was made for each of the thirty-one items which constitute the opinion poll. No significant changes in opinion toward science or scientists was found to be indicated by twenty-eight of the items so tested. On three items, a significantly greater change in opinions by the experimental group was noted.

When all thirty-one items were grouped into five broad areas, as shown below, no more than one-fifth of the items in any one category evoked a significantly greater change of opinions by the experimental group as noted.

1. Eight items related science or scientists to religion or morality. One of these items evoked a significantly greater shift in opinions in the experimental group than in the control group.

2. Ten items related to the practicality, efficacy, or other conformations to normalcy, of science or scientists. Two of these items evoked a significantly greater shift in opinions in the experimental group than in the control group.

3. Four items related science or scientists to nationalistic goals or purposes. None of these items evoked a significantly greater shift of opinions by the experimental group than by the control group.

4. Seven of the items related science or scientists to humane endeavor. None of these items evoked a significantly greater shift of opinions by the experimental group than by the

control group.

5. Two items related science or scientists to the individual students. None of these items evoked a significantly greater shift of opinions by the experimental group than by the control group.

Conclusions Drawn from the Study

In the light of the findings of this study, it was concluded that the Oklahoma State University Traveling Science Teacher Program had no significant effect on the opinions of high school students toward science and scientists, as measured by the Purdue Opinion Poll under the conditions stated. This conclusion must be viewed in the light of certain limitations. These limitations, many of which suggest further study as indicated in the final section of this paper, are discussed below.

The Purdue Opinion Poll used in this study was the subject of careful validation on a national scale. This validation, however, was made just prior to the launching of Sputnik I by Russia. In the five years since that time, the minds of everyone in the United States have been subjected to a more intense barrage of information about scientific innovation than ever before in history. Satellites, astronauts, and solar probes have become so commonplace in the national communication media as to scarcely merit special attention. Public school text books, always ten years behind the frontiers of science, have, in the past five years, increasingly brought fallout, nuclear energy, and radiation biology into the minds of high school students. Two possibilities exist. First, it might well be that the opinions of today's high school students have been so thoroughly buffeted as to preclude the possibility that the Purdue Opinion Poll used remains a valid instrument of detection. Secondly, it is possible that, while the poll remains valid, its use might be limited to continuous analysis of opinion changes over a continuum of time.

Another limitation involves the fact that the experimental group was exposed to lectures by only thirteen people. Although these thirteen people were carefully selected, the criteria were, of a necessity, very similar to those applied in the selection of any "good" science teacher. It is possible that factors of personality or ability which are not known could, when applied as criteria to the selection of such people, result in much greater changes in the opinions of their audiences toward science and scientists.

The primary conclusion drawn from the findings of this study might be construed to mean that the Traveling Science Teacher Program, or any other brief, intensive, series of lecture-demonstrations on science, would be ineffective. This should not be the case. Only one visit was made by a Traveling Science Teacher to a given school. It is possible that if such a program were continued over a period of years, different results could be obtained.

Another limitation to the above attachment of a "good" or "bad" label to this type of effort involves the goals of the educational enterprise. It is not known that a student's opinions about science and scientists <u>must</u> change before he elects to pursue a career in science. Although on the surface, this seems obvious, no research has established this as fact. It is possible that, while having little effect on the total group's opinions, the Traveling Science Teacher

Program will actually cause a greater percent of participating students to elect to pursue scientific careers.

It was pointed out in Chapter III that the current study design was the exact type recommended by one of the earlier researchers who used the Purdue Opinion Poll; that is, a pre-post design, involving special experiences for the experimental group in the interim. A previous test-retest study had established a very high reliability for the instrument. As is so often the case, the current further study using the Poll implies even more areas of research which are potentially fruitful and which, it is hoped, will be undertaken by subsequent researchers. Specific recommendations for these studies are given in the final section of this paper.

Implications of the Study for Science Education

Earlier in this study, it was pointed out that many cities, counties, and states have adopted the same type of effort which was involved in the Traveling Science Teacher Program in an effort to increase student interest in science. The National Aeronautics and Space Administration, as was mentioned, is currently embarking upon a massive effort which is very similar. The current study indicates that such an effort might not be truly effective in affecting the opinions of participating students.

It would seem advisable that any agency which is financing such a program involving brief, spectacular lecture-demonstrations on science should make a conscious effort to include simultaneous evaluation efforts in their programs. Although the current study definitely does not negate the possible worth of such efforts, it does definitely point out the need for concurrent evaluation in any such effort.

It was pointed out in Chapter II that many authorities are concerned that more concurrent evaluation be involved with programs involving educational innovation. Above all else, the current study emphasizes this need. So often a program might seem to be, at the very least, a vast improvement over the status quo. Such was the Traveling Science Teacher Program of Oklahoma State University. Although the current study definitely does not indicate that the program was not successful, it does fail to establish its worth as fact.

The implications of this study should be attended by the whole of science education, not just those aspects which involve short term, somewhat spectacular lecture-demonstrations. Attempts at educational innovation such as are currently widespread at all levels should give serious thought to the fact that without supporting evidence, statements of worth are nothing more than opinion.

Recommendations for Further Study

Because of the nature of this study, it has become evident that further research on many specific factors should be investigated. Those specific areas which seem most able to yield pertinent data which would be useful in the broad field of science education are presented.

The first and possibly the most important research problem indicated by the study involves the development and/or verification of an instrument which will measure changes in the opinions of high school students (and others) toward science, scientists, and the scientific endeavor. It is not now conclusively evident that such an instrument exists.

The second area involves a long-range investigation to determine if changes in response to an instrument as described above are reflected in later years by the pursuits and activities of the students involved. Such a study should involve control and experimental groups and seek to determine if significant changes in attitudes toward science and scientists are actually reflected in larger numbers of the participating students pursuing such careers.

A third area of need is a determination of the extent to which the often quoted need for a scientifically literate and sympathetic public is fulfilled by such an effort as the Traveling Science Teacher Program. This study would be structured and executed in the same manner as the second recommended study, above. The end product, however, would not deal with the extent to which participating students pursued science, but the extent to which they would, in later years, maintain sympathy with the scientific enterprise. If it is true, as claimed by many authorities quoted in previous chapters of this paper, that successfully continuing expansion of the scientific effort is dependent upon an intelligent awareness on the part of the general public, then achievement of such goals should be determined. Do "inspired" students, although they may not pursue a scientific career, maintain sympathy with the causes and goals which science and scientists pursue?

A fourth area of need involves a hypothetical assumption. If it is assumed that an effort (either brief or prolonged) to change the stated opinions of students is successful, how long after the termination of that effort are the altered opinions maintained? It is possible that in the study described by this paper, opinions of the experimental students were changed drastically during the week or so following their participation in the Traveling Science Teacher Program. The current study only indicates that no significant evidence of any such changes was apparent four weeks later. It is recommended that any future study undertaken with similar goals involve stratification of groups so that the pre- and post-tests will be administered at varying lengths of time from exposure to the experimental factor involved.

A fifth need is for the development of different forms of any opinion-testing instrument which might be developed or verified in response to the first recommendation made above. As identical instruments were used in the pre- and post-tests of the current study, it is possible that recognition from the earlier exposure evoked responses that were not truly representative. Any instrument which measures change should involve two valid and reliable forms so as to prevent the necessity of using the identical instruments in both the pre-test and the post-test.

A sixth recommendation is that future researchers in the area of opinions of secondary school students toward science and scientists involve larger numbers of students in the research. Factors such as grade level, rural or urban locale, and variations in the experimental factor, should each involve at least three to five hundred students and preferably more.

A seventh need, although it does not involve recommendations for a specific study, is one of utmost importance and one which is clearly indicated by the current study. This is the need for inclusion in any plans for innovation in science education, concurrent plans for an evaluative effort to be conducted in conjunction with the program involved. This need bolsters the statements of many of the authorities quoted earlier in this paper, that the worth of innovation in science education should be provable and proved, that change merely for the sake of change is, at the best, highly questionable.

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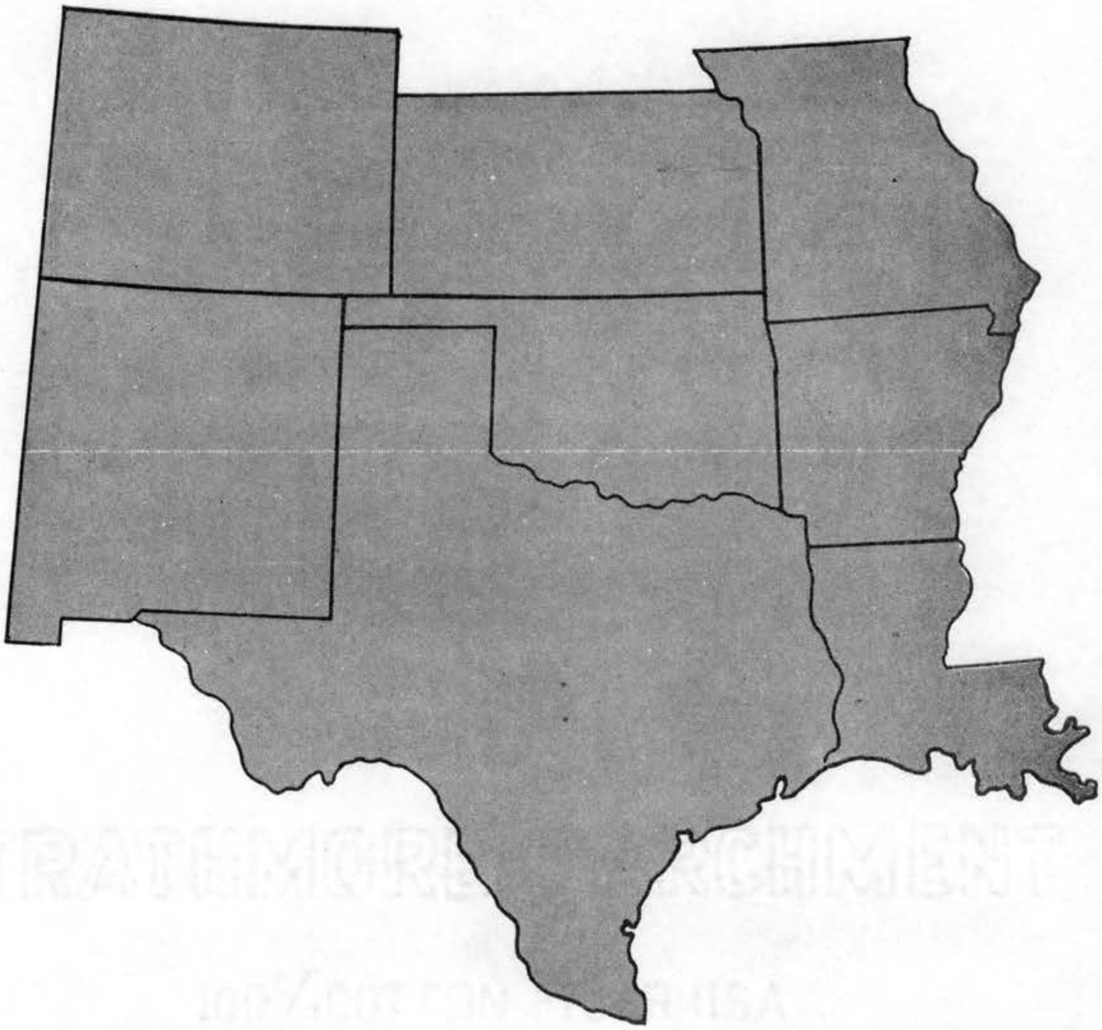
Expresses the belief that world understanding must become a goal of education, and urges that we hasten to include proper units into our school plans.

APPENDIX A

TRAVELING SCIENCE TEACHER PROGRAM MATERIALS



Traveling Science Teacher Program

(Traveling Science Demonstration Lecture Program)

Sponsored by **THE NATIONAL SCIENCE FOUNDATION** and **OKLAHOMA STATE UNIVERSITY**

Traveling Science Demonstration Lecture Program

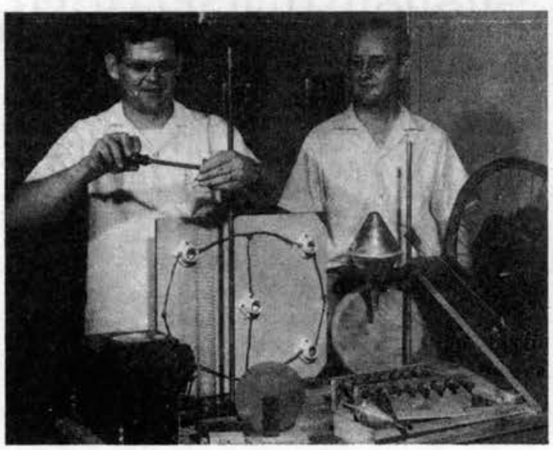
The Traveling Science Demonstration Lecture Program has been sponsored for three successful years by the Oak Ridge Institute of Nuclear Studies in cooperation with the National Science Foundation, Atomic Energy Commission and others.

During 1959-60, this program is being expanded by the National Science Foundation to include four separate program centers which will serve particular regions of the United States. In addition to Oklahoma State University, other centers will be located at the University of Oregon, Michigan State University and the Oak Ridge Institute of Nuclear Studies. The Oklahoma State University center will serve the region composed by the states of Oklahoma, Texas, New Mexico, Colorado, Kansas, Missouri, Arkansas and Louisiana.

How the Program Operates A specially trained and equipped traveling science teacher will be scheduled in a school system for approximately one week during the 1959-60 school year. Prior to the scheduled appearance, the traveling teacher will pre-visit the school and in conference with local teachers work out the program for that school and community.

A typical program for a school would include three or four scheduled appearances per day, Monday through Friday, including (1) a general high school assembly, (2) a teachers' meeting, (3) a science club program, (4) one or two civic group appearances, and (5) ten to fifteen lecture-demonstrations on science and mathematics to particular classes or special interest groups within the school.

The program for a given school and community



is very flexible and can be designed to require a minimum number of disruptions or irregularities to the regular school schedule.

Oklahoma State University is now sponsoring a traveling science teacher in Oklahoma in cooperation with the Oak Ridge program and with financial support from the Frontiers of Science Foundation of Oklahoma. We are convinced of the program's merit and are glad to have the opportunity to direct an expanded regional program. These are typical comments from the schools we have served:

"We do not hesitate to recommend the program to any city."

"Excellent, it was presented in a most effective and challenging way."

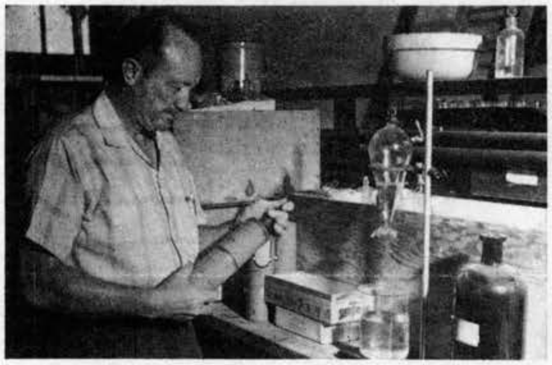
"The traveling teacher did a wonderful job. He was well liked and appreciated by both faculty and students."

"He stimulated the interest of our community leaders and business men."

"We especially profited from seeing his demonstration equipment and learning about sources for materials."

Request for Visit. The enclosed form provides your school the opportunity to request participation in the 1959-60 Traveling Science Demonstration Lecture Program. All high schools in the eight-state region are eligible for consideration regardless of school enrollment or size of science department. Sponsored by the National Science Foundation and Oklahoma State University, the program will be free to participating schools.

Each of twenty traveling science teachers will serve about thirty schools next year. This will bring the program to approximately 600 schools during the 1959-60 school year. Selection of the schools to participate will be made from applications received to provide good geographic distribution in the region and to include schools of all sizes and characteristics. All schools desiring to be considered for participation in the 1959-60 program should complete and return the program request form before May 30, 1959. Be sure the form is completed in full and bears the signatures of a high school science teacher and the principal. Acknowledgment of requests will be made and schedules announced on or about September 1, 1959.



The Traveling Science Teachers

Twenty teachers will be selected by Oklahoma State University on a regional basis to carry out the Traveling Science Demonstration Lecture Program operated by the OSU center. Selection will be made by a committee of scientists working with the program.

A group of thirty or forty preliminary selectees will be invited to Oklahoma State University at our expense for personal interviews and physical examination. These interviews and examinations will be given during the week of April 20-24, 1959. Final appointments will be announced on or before April 27, 1959.

The traveling teachers will receive annual salaries up to about $7000 for the 12-month period from June 22, 1959 to June 21, 1960. They will also receive additional benefits including insurance, social security and retirement. Expenses incurred while on program business will be reimbursed. Each traveling teacher will be provided with a station wagon and lecture-demonstration apparatus and supplies for the travel phase of the appointment.

Appointees will undergo a three-month intensive training period at Oklahoma State University beginning June 22, 1959. The training program will be specifically designed to equip the traveling teachers with the latest scientific information, laboratory techniques and demonstration apparatus to allow them to enhance the science programs in the schools which they will visit. The training period will include lectures, laboratory experiences, field trips, library assignments, and actual construction or assembly of demonstration apparatus to be used in the high schools. Practice lecture-demonstrations will be given to high school science classes within a reasonable radius of the Oklahoma State University campus during the final two weeks of the training period.

On or about September 18, the traveling teachers will return to their home states and begin the travel phase of the program in scheduled schools within a reasonable radius of their homes. In many instances the traveling teacher will find it necessary to stay over night from Monday through Friday in the community in which he is scheduled, but he will always be able to return home for weekends. He will be scheduled in each school system for approximately one week.

The traveling teacher will be allowed time to previsit scheduled high schools and plan activities in cooperation with the local science staff and administration to meet the special needs and wishes of each school. He will also anticipate being scheduled for civic club and other community group appearances.

Applicants should be in good health and hold a bachelor's or master's degree with a strong background in the physical sciences. He should have a good personality and ability to lecture effectively. He

should have at least one year of successful science teaching experience and be especially interested in upgrading science education at the high school level.

An experimental traveling teacher program in BIOLOGY is being inaugurated in Oak Ridge this year. If you are primarily a biology teacher, you may wish to apply to become one of the eight teachers in this program. For application material, write immediately to: Traveling Teacher Program, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tenn.

Interested science teachers should return the enclosed form for application material. Deadline for receipt of this form is March 20, 1959.

Oklahoma State University

Oklahoma State University, located in Stillwater, was founded in 1890. It is on the list of approved institutions of the Association of American Universities. Normal enrollment is approximately 10,000 resident students in the colleges of Agriculure, Arts and Sciences, Business, Engineering, Home Economics, Veterinary Medicine, and The Graduate School. Over 1000 students are engaged in graduate study. Master's degrees may be earned in fifty fields and the Ph. D. or Ed. D. in twenty-two areas of study.

The College of Arts and Sciences

The Traveling Science Demonstration Lecture Program will operate as a part of the overall program of the College of Arts and Sciences.

The College of Arts and Sciences provides for both a broad, liberal education and for concentration in special areas for which students are qualified and have interest. In its general program the College of Arts and Sciences endeavors to acquaint the student with the nature and extent of knowledge in all the principal fields, and to give him some idea of the methods used in controlling and extending that knowledge. In the period of concentration the student is expected to acquire basic knowledge and techniques in a particular field.

Instruction is offered in twenty-four different fields of study in the College of Arts and Sciences. Pre-professional work in dentistry, law, library science, medicine, medical technology, nursing, personnel work, public administration, teaching and veterinary medicine is offered for students who plan advanced study in a professional field.

Below — Air view of the Oklahoma State University main campus. Inset — Recently-completed apartment housing units.

PROGRAM REQUEST POSTCARD

PROGRAM REQUEST FORM
Traveling Science Demonstration Lecture Program

School ____
(Name) (Public, Private, etc.) (City) (State)

Grades Taught___High School Enrollment___No. of Science Teachers______

Science Classes	General Science	Biology	Chemistry	Physics	Math	
No. of Classes						
No. of Students						

List below the known dates during the 1959-60 school year when your school will be dismissed due to holidays, teachers' meetings, etc.

____

This request involves no commitment on the part of Oklahoma State University to schedule the school as a participant. The school will be notified in September whether or not it has been selected. Those schools which are selected will be visited by the Traveling Science Teacher prior to the actual time the program is scheduled at the school. No cost to the school is attached to participating in the program.

______ (Date) ______ (Signature of Science Teacher) ______ (Signature of Principal)

APPLICATION FOR APPOINTMENT AS TRAVELING TEACHER

OKLAHOMA STATE UNIVERSITY TRAVELING SCIENCE TEACHER PROGRAM

1959 - 1960

PLEASE PROVIDE AS COMPLETE INFORMATION AS POSSIBLE. THE APPLICATION MUST BE SIGNED BY THE APPLICANT. PLEASE USE TYPEWRITER OR PRINT IN INK.

DEADLINE FOR FILING APPLICATION IS APRIL 10, 1959. PRELIMINARY SELECTEES WILL BE ANNOUNCED BY APRIL 17 AND FINAL APPOINTMENTS WILL BE MADE ON APRIL 27, 1959.

I. PERSONAL DATA

NAME ________________ SEX ______ DATE OF BIRTH ____________ AGE ______

HOME ADDRESS ________________ (STREET) (CITY) (STATE) PHONE __________

SCHOOL ADDRESS ________________ PHONE __________

SOCIAL SECURITY NUMBER ____________ CITIZENSHIP __________ MARITAL STATUS: ☐ SINGLE ☐ MARRIED

DRAFT STATUS ________________ RESERVE COMMITMENTS ________________

IN CASE OF EMERGENCY NOTIFY ________________ RELATIONSHIP __________

ADDRESS ________________ PHONE __________

NUMBER OF DEPENDENTS __________ (THIS SHOULD CORRESPOND WITH THE NUMBER OF DEPENDENTS CLAIMED ON FEDERAL INCOME TAX RETURN.)

LIST OF DEPENDENTS:

NAME	AGE	RELATIONSHIP TO APPLICANT

II. TRAINING

COLLEGE OR UNIVERSITY EDUCATION:

INSTITUTION	YEARS FROM	YEARS TO	DEGREES	MAJOR SUBJECTS

MAJOR TEACHING FIELD OR FIELDS ________________

III. EXPERIENCE (BEGIN WITH PRESENT EMPLOYMENT)

EMPLOYER	ADDRESS	POSITION (SUBJECT TAUGHT)	DATES

IV. ACADEMIC PREPARATION

IN THIS SECTION, SHOW FOR EACH FIELD THE APPROPRIATE (A) COURSE TITLES (DESCRIPTIVE TITLE, NOT COURSE NUMBER), (B) THE YEAR IN WHICH TAKEN, (C) NUMBER OF CREDIT HOURS, (D) WHETHER IT WAS AN UNDERGRADUATE (U) OR GRADUATE (G) COURSE, AND (E) GRADE RECEIVED, APPROXIMATE IF NOT KNOWN. INDICATE CREDIT HOURS BY RECORDING NUMBER OF CREDITS IN COLUMN U OR G. PLEASE USE ONLY SEMESTER HOURS. TO CONVERT QUARTER HOURS TO SEMESTER HOURS, TAKE 2/3 TIMES THE NUMBER OF QUARTER HOURS. OBTAIN GRADES FROM TRANSCRIPTS, IF POSSIBLE. (USE ADDITIONAL PAGES IF NEEDED.) IF SELECTED, COMPLETE TRANSCRIPTS MUST BE PROVIDED.

COURSE TITLE	YEAR	U	G	GRADE	COURSE TITLE	YEAR	U	G	GRADE
BIOLOGICAL SCIENCES					MATHEMATICS				
CHEMISTRY					EDUCATION				
PHYSICS					EARTH SCIENCES (ASTRONOMY, GEOLOGY, METALLURGY, ETC.)				

V. REFERENCES

LIST 2 PERSONS WHOM YOU HAVE ASKED TO WRITE TO US BY APRIL 10 IN BEHALF OF YOUR APPLICATION, ONE OF WHOM SHOULD BE YOUR PRINCIPAL, SUPERVISOR, OR SUPERINTENDENT.

NAME	ADDRESS	OCCUPATION

VI. SUPPLEMENTARY APPLICATION INFORMATION

ARE YOU LICENSED TO DRIVE AN AUTOMOBILE? ____________ HAVE YOU HAD AN ACCIDENT IN THE PAST 5 YEARS? ____________

EXPLAIN ____________

I WOULD BE IN A POSITION TO TRAVEL IN: ☐ ARKANSAS; ☐ COLORADO; ☐ KANSAS; ☐ LOUISIANA; ☐ MISSOURI; ☐ NEW MEXICO; ☐ OKLAHOMA; ☐ TEXAS.

COMMENTS ____________

WHAT ARE YOUR HOBBIES? ____________

HOW DO YOU USE YOUR LEISURE TIME? ____________

WHAT ARE YOUR COMMUNITY ACTIVITIES? ____________

WHAT ARE YOUR PROFESSIONAL ACTIVITIES? ____________

WHAT PROFESSIONAL MEETINGS HAVE YOU ATTENDED IN THE PAST YEAR? ____________

WHAT MAGAZINES AND NEWSPAPERS DO YOU READ REGULARLY? ____________

OCCASIONALLY? ____________

DESCRIBE IN A BRIEF ESSAY SOME OF THE TECHNIQUES WHICH YOU HAVE USED FOR STIMULATING SCIENCE STUDENTS TO BETTER WORK:

____

OUTLINE YOUR CURRENT AND LONG RANGE PROFESSIONAL GOALS ______________________________

____

____

____

____

VII. CONDITION OF YOUR HEALTH? ______________________________

PHYSICAL DISABILITIES, IF ANY ______________________________

PRELIMINARY APPOINTEES WILL BE GIVEN A PHYSICAL EXAMINATION WHEN THEY REPORT TO OKLAHOMA STATE UNIVERSITY FOR INTERVIEWS DURING THE WEEK OF APRIL 20 - 24.

VIII. IF YOU ARE SELECTED, WHAT TYPE OF HOUSING WOULD YOU NEED THIS SUMMER? ______________________________

____

____

______________________________ DATE

______________________________ SIGNATURE OF APPLICANT

I AM FAMILIAR WITH THE AIMS AND PURPOSE OF THE TRAVELING SCIENCE TEACHER PROGRAM AS DESCRIBED IN THE INFORMATION BROCHURE AND AM PLEASED TO APPROVE THIS APPLICATION AS AN INDICATION OF THE SCHOOL'S INTEREST IN THE PROGRAM AND AS AN ENDORSEMENT OF THE APPLICANT.

______________________________ DATE

______________________________ SCHOOL OFFICIAL, TITLE

OKLAHOMA STATE UNIVERSITY
Traveling Science Teacher Program
STILLWATER

Phone FR 2-6211, Extension 220

September 1, 1960

We are pleased to inform you that your application for the Traveling Science Teacher Program has been selected for scheduling. Mr. ______________________________ will visit ____________________ __________________ during the period of ____________________________, inclusive. He will pre-visit your school on or about __________________ ____________ to help work out a detailed schedule for his lecture-demonstrations.

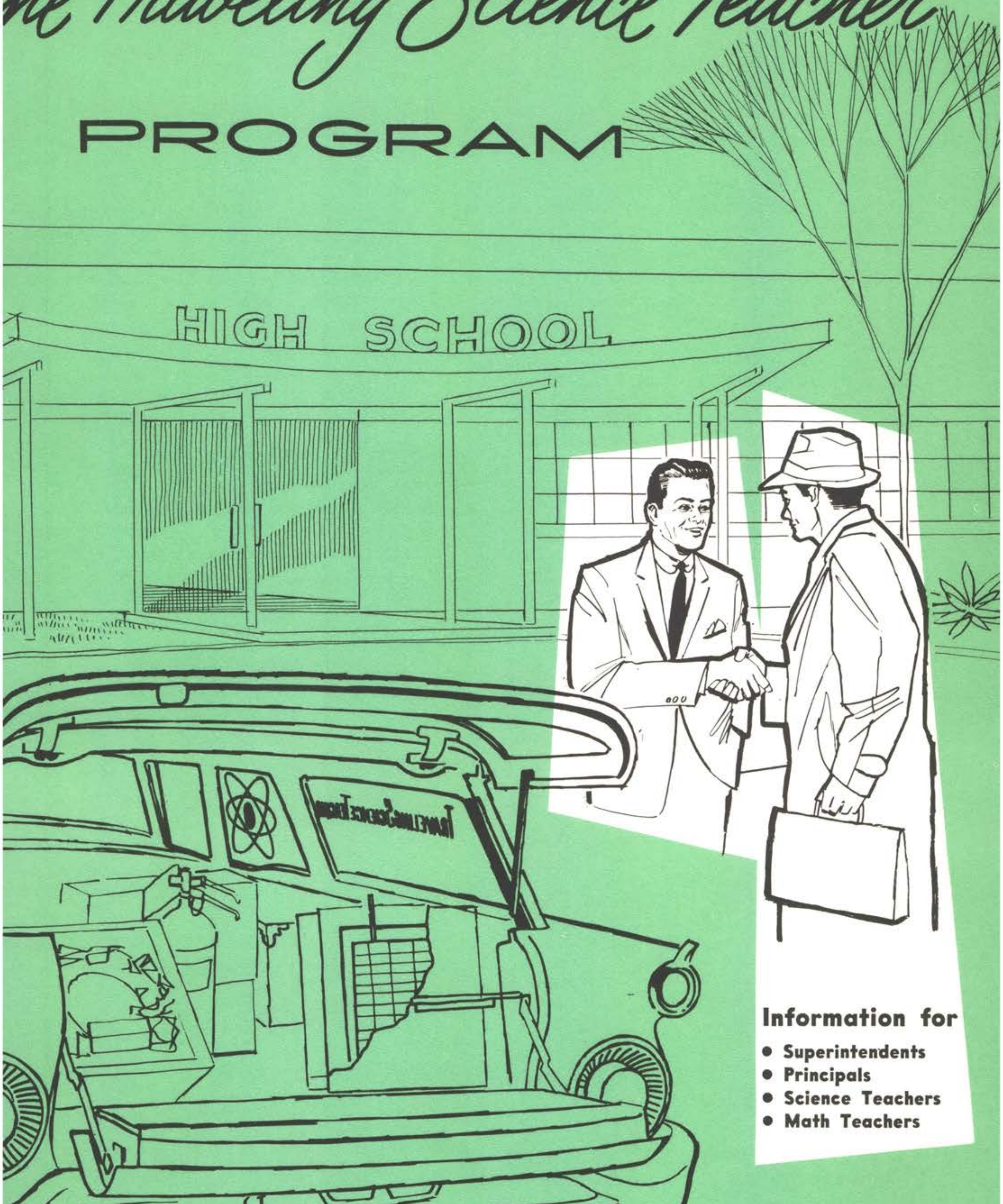
Traveling Science Teachers can make good presentations to civic clubs. You are invited to schedule Mr. ____________________________ immediately at one or more such functions during the period of his visit in your community.

Sincerely yours,

Claude W. Gatewood, Coordinator
Traveling Science Teacher Program

CWG:ps
Enc.
Copy to:

The Traveling Science Teacher PROGRAM



Information for

- Superintendents
- Principals
- Science Teachers
- Math Teachers

Sponsored by the National Science Foundation and Oklahoma State University

General Information

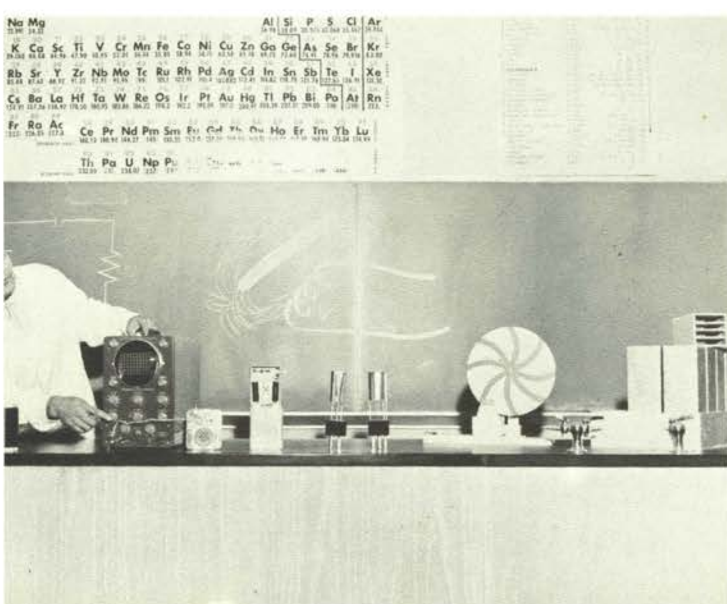
Your school has requested the services of the Oklahoma State University Traveling Science Teacher Program, which is supported by the National Science Foundation. A demonstration-lecturer has been scheduled in your school and community for approximately one week to present a variety of science topics to your students and civic organizations at no cost to you or your school.

You may share the traveling teacher's experience and training, as simple and inexpensive materials and equipment are used, much of which can be duplicated by science teachers and students, to demonstrate fundamental scientific principles. After being selected from scores of science teachers throughout an eight-state area, your traveling science teacher received thirteen weeks of intensive training at Oklahoma State University. This training included fundamental concepts and recent developments in mathematics and the sciences. A short course in civil and defense mobilization prepared and licensed the traveling teacher in radiological detection and radioisotope handling. During this time the traveling teacher constructed most of the demonstration equipment which will be used with the lectures.

You are encouraged to schedule the traveling science teacher for your regular classes, student assemblies, science clubs, teachers' meetings, PTA meetings, and civic clubs. We hope you will invite students and teachers from neighboring schools to participate in this program when facilities, time, and interest permit.

The traveling science teacher will make a preliminary visit to your school to complete arrangements for the programs to be presented during the scheduled period. Local school administrators and teachers should assist the traveling teacher in selecting topics to compliment rather than duplicate the regular science program, and the demonstration-lecturers should be scheduled to cause the least possible disruption to the regular school program.

Limited time will not permit the traveling teacher to present all topics listed here during one week. The following summaries describe briefly the subject-matter areas from which demonstration-lectures may be selected.



Summaries of Demonstration Lectures

The following demonstration - lecture topics and annotations are intended only as general guides in the subject-matter areas included in the program. Flexibility of presentation, allowing for an expression of the traveling teacher's individual technique and organization, are desirable. Topics should be selected in conference with the traveling teacher which will supplement the regular program in any particular school. To insure the best utilization of this activity by your school, presentations may vary considerably from the order and content summarized below.

1. SOLAR ENERGY — Students are made to realize the necessity for conserving fossil fuels. They are stimulated to become aware of the developments and possibilities in the field of solar energy. Solar energy devices such as the solar battery, developed by the Bell Telephone Laboratories, and simple solar "furnaces" are demonstrated. These demonstrations are intended to encourage students to do original research in the utilization of solar energy.

2. ROCKETS, SATELLITES, AND SPACE TRAVEL — Several principles and problems related to this topic of timely interest are discussed, including physical, chemical, and biological aspects of travel in outer space. Interesting demonstrations with inexpensive apparatus illustrate laws of motion, energy changes and fuels, effect of atmosphere and pressure on physiological processes, and other cause-effect relationships currently anticipated.

3. MOLECULES AND MOTION — The Kinetic aspects of matter viewed from the molecular level are treated. The gas laws are explained with illustrations of their applicability to problems in science. Demonstrations of atmospheric pressure, diffusion, and related phenomena emphasize and clarify fundamental concepts.

4. RATES OF CHEMICAL REACTION — Chemical kinetics, a study of the rate at which reactions proceed, is a most important field of chemistry. The factors determining chemical reactivity are discussed and appropriate demonstrations are utilized. These include oxidation reactions, reactions between a solid and a liquid, between two gases, and experiments to show catalysis.

5. ATOMIC STRUCTURE — Cathode-ray tubes are used to explain properties of electrons as a prelude to the development of the nuclear-atom concept. The Bohr atom theory and its implications are illustrated with various demonstration equipment.

6. THE NUCLEUS AND RADIOACTIVITY — Current concepts of nuclear structure are investigated. Nuclear energy is discussed and explained through simple experiments in radioactivity and transmutation. Radioactivity detection and measurement instrumentation, including "homemade" Geiger counters, are used and discussed.

7. FISSION, FUSION, AND REACTORS - The origin, development, and application of nuclear energy resulting from atomic fission controlled in a nuclear reactor are discussed and demonstrated with models of the Oak Ridge graphite and "swimming-pool" reactors.

8. RADIATION BIOLOGY — The effects of radiation on living matter are discussed in conjunction with, or as an extension of, the discussions on radioactivity. Uses of radioisotopes in agriculture, medicine, biological research, and other areas are illustrated by experiments using radioactive materials.

9. SPACE AGE BIOLOGY — Man's biological needs in space are treated with the inter-dependence of animals and plants, as well as mechanisms by which the necessities for life may be provided.

10. GEOLOGY AND GEOCHEMISTRY — Geologic strata, sedimentary build-ups, igneous intrusions, veins, pegmatites, mineral concentrations, and physical geography are treated with chalk-talk. A kit of different kinds of rocks, minerals, and crystals augments this lecture.

11. THE WHAT, WHY, AND HOW OF CHEMISTRY — This presentation is designed to enlighten and to inspire students to appreciate the importance of chemistry in our modern world. Students are encouraged to take high school chemistry as a part of their general education whether or not they intend to become chemists. Those who may want to be chemists can be counseled concerning the many phases of modern industrial and research chemistry.

12. ELECTRICITY AND CHEMISTRY — It has long been known that electricity and chemical change are intimately associated. Electrolysis and battery action are two of the more common examples of such a relationship. The principles involved in these and related fields are presented and include important concepts involved in electrolytic processes. Suitable demonstrations are included in the presentation.

13. ELECTRICITY AND ELECTRONICS — Simple experiments illustrate the kinds and behaviors of charges. Demonstration devices are used to explain static and current electricity as well as DC, AC, and rectified currents. Several "homemade" electronic circuits, using both vacuum tubes and transistors, are shown in operation.

14. PREVIEW OF PHYSICS — This presentation is designed to emphasize the importance of physics in every day life. Students are encouraged to take high school physics as a part of their general education whether or not they intend to study science in college. Atomic physics and its impact on modern life is presented in proper perspective.

15. WAVE MOTION — Waves and wave motion of different types and in several media are demonstrated in simple experiments. The phenomenon of diffraction is discussed qualitatively and is illustrated through procedures in which students participate.

16. MATHEMATICAL INVESTIGATIONS — An introduction to mathematical procedures, methods, and tools is given which leads students to the realization that the more complex manipulations are interesting and represent an additional mode of expression. The evolution of number systems and their applications are presented. Exponents are discussed as a means of more rapid calculation and as the basis for logarithms. The slide rule is discussed and students will be encouraged to construct simple slide rules leading to an understanding of logarithmic scales as the foundation for a slide rule. A few of the interesting topics in topology may be treated.

17. APPLICATIONS OF MATHEMATICS TO SCIENCE
A general treatment of mathematics emphasizes its relationship to and use in the other sciences.

18. SCIENCE TODAY: YOUR WORLD TOMORROW — The objective of this lecture is to inform students and adults about the rapid pace of scientific advancement today. Some things which most people consider "science fiction" are shown actually to be fact. A forecast is advanced about what the world will be like in a generation or two.

19. SCIENCE EDUCATION IN TODAY'S WORLD — The rapid progress of science in the modern world is outlined in this lecture. Emphasis is placed on the need for "John Doe, Average Citizen," to support the schools, particularly the rapidly expanding science education programs at the local level. This material is primarily intended for presentation to civic and service groups.

Your traveling science teacher wishes to provide a real service to you and your community. If you have questions concerning the program, please call them to his attention or write directly to:

Traveling Science Teacher Program
Oklahoma State University
Stillwater, Oklahoma

The Teachers


Allsman


Arriaga


Brooks


Calvird


Compton


Estergard


Folmar


Gill


Harlan


Harvey


Jones


Landry


McGuire


Patti


Robinson


Shinpoch


Thaxton


Williams


Wagner


Watley

TST-1

School Visit Report Form

TRAVELING SCIENCE TEACHER PROGRAM

Oklahoma State University
Stillwater, Oklahoma

School ______________________ Address ______________________

Superintendent ______________________ Principal ______________________

Traveling Teacher ______________________ Dates of Visit ______________________

LECTURE TOPICS*

	Topic	Do Not Write Here		Topic	Do Not Write Here
1.	Solar Energy	______	11.	The What, Why, and How of Chemistry	______
2.	Rockets, Satellites, and Space Travel	______	12.	Electricity and Chemistry	______
3.	Molecules and Motion	______	13.	Electricity and Electronics	______
4.	Rates of Chemical Reaction	______	14.	Preview of Physics	______
5.	Atomic Structure	______	15.	Wave Motion	______
6.	The Nucleus and Radioactivity	______	16.	Mathematical Investigations	______
7.	Fission, Fusion, and Reactors	______	17.	Applications of Mathematics to Science	______
8.	Radiation Biology	______	18.	Science Today: Your World Tomorrow	______
9.	Space Age Biology	______	19.	Science Education in Today's World	______
10.	Geology and Geochemistry	______	20.	The Petrified River	______

AUDIENCE TYPE*

- P—Physics
- C—Chemistry
- GS—General Science
- B—Biology
- M—Mathematics
- A—Assembly
- Ci—Civic groups
- T—Teachers

Lecture No.	Date and Time	Lecture Topics*	Audience No.	Audience Type*	Audience Grade
1					
2					
3					
4					
5					
6					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

Summary

Number of different physics classes	______
Number of different chemistry classes	______
Number of different biology classes	______
Number of different general science classes	______
Number of different math classes	______
Number of different other classes	______
Total number of different classes	______

	Total Aud.	New Audience
Number of physics students	______	______
Number of chemistry students	______	______
Number of biology students	______	______
Number of general science students	______	______
Number of math students		
Number of other students	______	______
(______) Assembly presentations No.	______	______
Total number of students	______	
Total number of different students		______
(______) Number of civic groups No.	______	______
(______) Number of teachers meetings No.	______	______
Number of different teachers in all activities		______
Number of schools represented in all activities		______

School Summary

	Elem.	Jr. Hi.	H. S.	Phys. Sec.	Gen. Sci. Sec.
Grades				Chem. Sec.	Math. Sec.
No. Pupils				Biol. Sec.	Other Sci. Sec.
Sci. Teacher(s)					

COMMENTS

Please give comments on the school's or on the individual teacher's appreciation, need, and interest in the Traveling Science Teacher Program. You might wish to include an evaluation of the relative success of each lecture given. An indication of the faculty reaction would be helpful. Any activities you have participated in, such as, teacher's meetings, assemblies, service clubs, and other groups would be of distinct interest. Include special events of significance or amusement.

Do not hesitate to express yourself freely or to use additional pages.

TST-2

TRAVELING SCIENCE TEACHER PROGRAM

Oklahoma State University—Stillwater

Weekly Report of Travel and Purchases

Traveling Teacher ______________________ Date of Report__________ Week of Report__________

Fill in if different from previous instructions.
Mail check to—Name ______________________ Beginning ______________________

Address ______________________ ______________________

Report below actual travel explaining under "comments" any deviation from schedule or side trip. If travel is by commercial means, attach explanation and include receipts for tickets and other transportation costs.

Departed: ______________________
Date Time City and State Speedometer Reading

Returned: ______________________
Date Time City and State Speedometer Reading

List points visited during the week: ______________________

SUBSISTENCE: (Lodging receipts must be attached.)

Date	Breakfast	Dinner	Supper	Lodging	Total Daily Subsistence	Location

CASH PURCHASES: Cash purchases may be made not to exceed $10.00 per purchase. **Receipts must be attached.** Need for materials or services costing in excess of $10.00 should be reported to Traveling Science Teacher Program, Oklahoma State University.

Date	Item and Explanation	Vendor	Amount

CREDIT CARD PURCHASES: (Enter speedometer reading on all receipts and attach to this report.)

Date	City and State	Amount

COMMUNICATIONS: All communications to OSU should be made collect (FR 2-6211, Ext., 220). List below other communications necessary to the program.

Date	From (Name and Place)	To (Name and Place)	Amount

NOTIFICATION OF RECEIPT: List below items of equipment and supplies received by purchase order or from OSU. Attach shipping receipts or other pertinent documents.

Date	Item	Received From	Prepaid	COD

I certify that all expenses listed herein were incurred on official business of the Traveling Science Teacher Program of Oklahoma State University.

____
Signature

REPORT ON PREVISITS:

Date ______ City ______ School ______
Superintendent ______ Remarks: ______
Principal ______
Science Teacher ______

Date ______ City ______ School ______
Superintendent ______ Remarks: ______
Principal ______
Science Teacher ______

Date ______ City ______ School ______
Superintendent ______ Remarks: ______
Principal ______
Science Teacher ______

Date ______ City ______ School ______
Superintendent ______ Remarks: ______
Principal ______
Science Teacher ______

Date ______ City ______ School ______
Superintendent ______ Remarks: ______
Principal ______
Science Teacher ______

Date ______ City ______ School ______
Superintendent ______ Remarks: ______
Principal ______
Science Teacher ______

TST-3
1959-60

Traveling Science Teacher Program
Oklahoma State University
Stillwater

The completion of this questionnaire by the principal and/or science teacher will be greatly appreciated. The information you provide will be used as a part of the total evaluation of the traveling teacher and the Traveling Science Teacher Program. A self-addressed envelope is enclosed for your convenience.

I. General Information:

(a) Was the procedure satisfactory for obtaining school applications, making schedules, and informing selected schools? Yes ☐, No ☐.

If no, please explain ________________

(b) Were the brochures, news releases, picture mats, state schedules, etc., of value to your school? Yes ☐, No ☐. Explain ________________

(c) Were one or more news items about the program carried in local newspapers? Yes ☐, No ☐. If yes, list name(s) of newspapers and give date(s) if practical: ________________

II. The Previsit:

(a) Do you think the previsit by the traveling teacher was of sufficient value to your school to justify the time and expense involved? Yes ☐, No ☐.

Explain: ________________

(b) Program planning during the previsit was accomplished by the following. Indicate by appropriate checks.

- Traveling Teacher ☐
- Superintendent ☐
- High School Principal ☐
- Junior High Principal ☐
- High School Science Teacher ☐
- High School Math Teacher ☐
- ________ ☐ Other

(c) During the previsit, was the traveling science teacher

1. Effective in describing the program? Yes ☐, No ☐
2. Cooperative in developing the schedule? Yes ☐, No ☐
3. Successful in gaining rapport with teachers? Yes ☐, No ☐

(d) If you were not completely familiar with the Traveling Science Teacher Program beforehand, did the teacher's previsit adequately prepare you for the program? Yes ☐, No ☐. Explain ________________

—over—

III. The Program:

(a) What is your opinion concerning the selection of lecture-demonstration topics? ____________

____

____

(b) What is your opinion concerning the selection of demonstrations and types of equipment used? ____________

____

____

(c) Do you think the program helped to stimulate interest in science and scientific careers among your students? Yes ☐, No ☐. Explain____________

____

____

(d) Was the program of benefit to teachers? Yes ☐, No ☐. Explain ____________

____

____

(e) Do you think the program improved community thinking toward support of education? Yes ☐, No ☐. Explain ____________

____

____

(f) Please rate the traveling science teacher in each of the following characteristics. Your opinions will be kept confidential.

	Excellent				Poor
Personality (circle appropriate number)	5	4	3	2	1
Neatness	5	4	3	2	1
Enthusiasm as a teacher	5	4	3	2	1
Ability to interest others	5	4	3	2	1
Knowledge of subject matter	5	4	3	2	1

IV. Suggestions:

(a) How can the previsit be made more effective? ____________

____

(b) How can the program be improved? ____________

____

(c) General comments: ____________

____

____

Date ____________ Name ____________

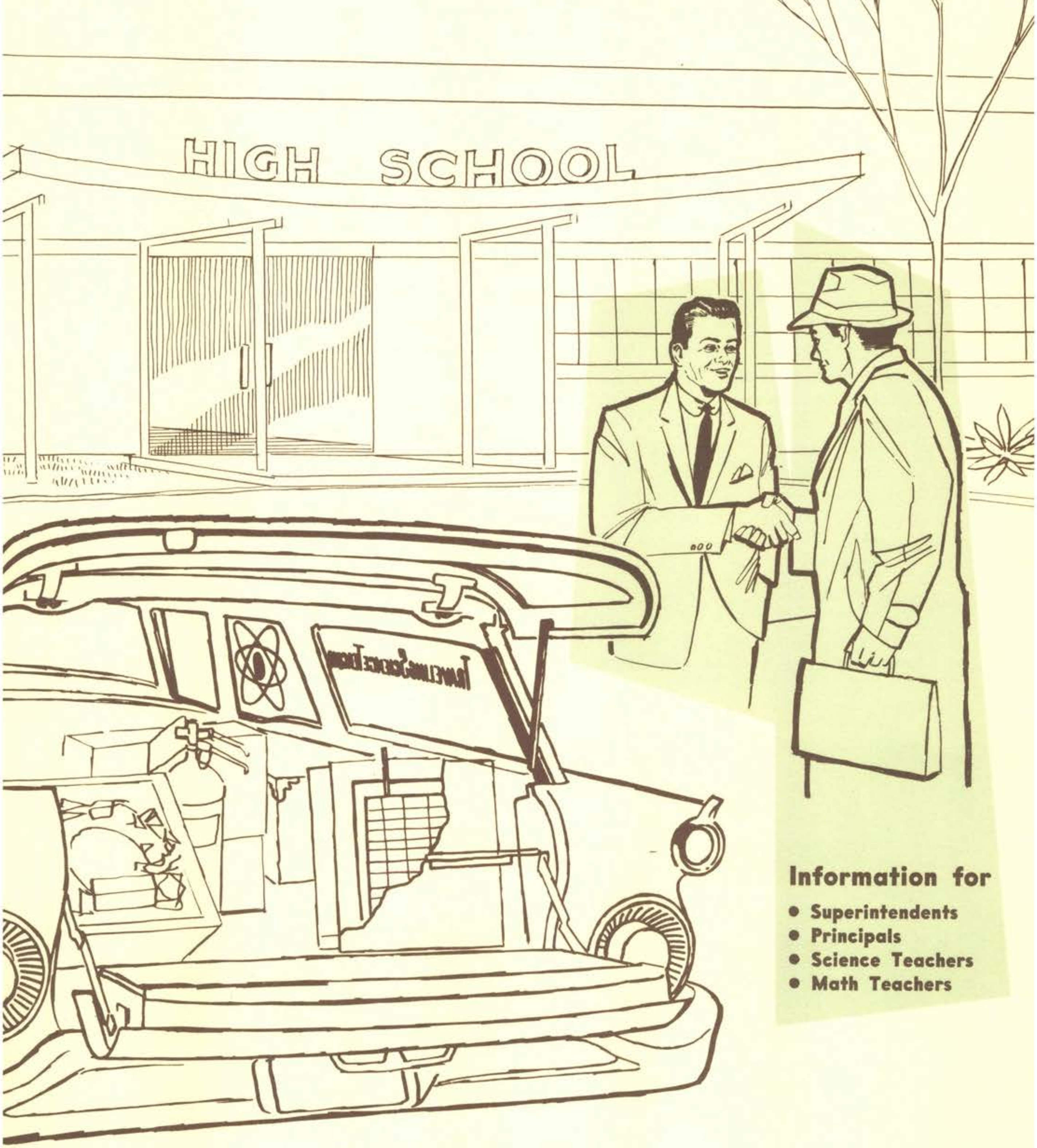
Title ____________

School ____________

Return to:

Traveling Science Teacher Program
Oklahoma State University
Stillwater, Oklahoma

The Traveling Science Teacher PROGRAM



Information for

- **Superintendents**
- **Principals**
- **Science Teachers**
- **Math Teachers**

Sponsored by the National Science Foundation and Oklahoma State University

General Information

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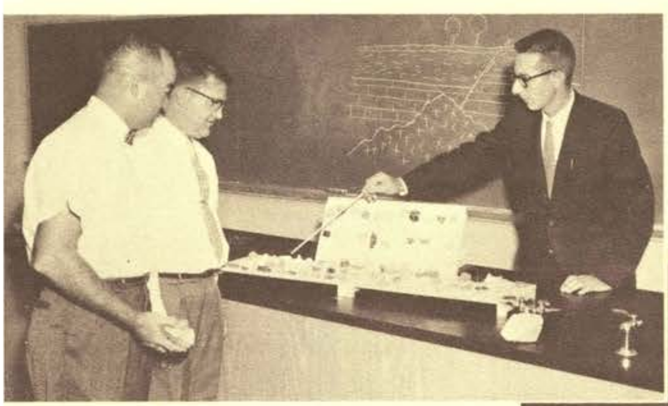
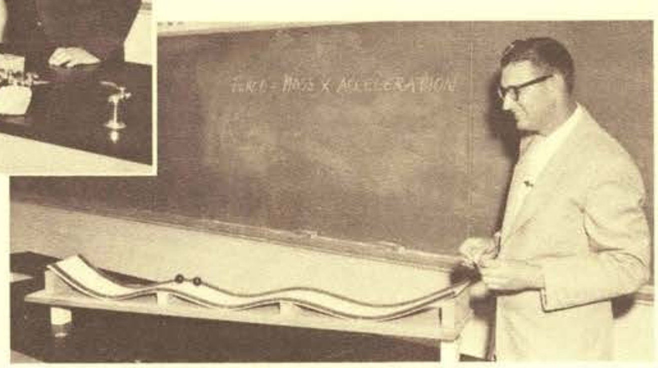
The traveling science teacher will make a preliminary visit to your school to complete arrangements for the programs to be presented during the scheduled period. Local school administrators and teachers should assist the traveling teacher in selecting topics to complement rather than duplicate the regular science program, and the demonstration-lectures should be scheduled to cause the least possible disruption to the regular school program.

Limited time will not permit the traveling teacher to cover thoroughly all the subject areas listed here during one week. This has been planned to permit adaptation to the variety of school schedules encountered by the traveling teacher.





Summaries of Demonstration Lectures

The following demonstration-lecture areas and topics are intended only as general guides in the subject-matter areas included in the program. Flexibility of presentation, allowing for an expression of the traveling teacher's individual background and organization, are desirable. Specific topics should be selected in conference with the traveling teacher which will supplement the regular program in any particular school. To insure the best utilization of this activity by your school, presentations may vary considerably in content or in technical detail so as to make them more desirable for varying grade-levels. Demonstrations are, wherever practical, integrated into each lecture.

1. BIOLOGY — Lectures on modern aspects of biology, which deal with any one of several specific topics, may be presented. Some examples are: "Radiation Biology," "Space-Age Biology," or "Biological Implications of Other Modern Sciences."

2. CHEMISTRY — Chemistry students could be given lectures on such special topics within the discipline of chemistry as 'Electricity and Chemistry," "Atomic Structure," "Rates of Chemical Reaction," or "Molecules in Motion."

A general lecture entitled "The What, Why, & How of Chemistry" could be presented to non-chemistry students. The purpose of this talk would be to enlighten and inspire them to appreciate the importance of chemistry in our modern world. This lecture could either give beginning students a preview of chemistry in our modern world or be used to inspire more pre-chemistry students to take a chemistry course.

3. EARTH SCIENCE — Lectures on various facets of the earth sciences might be given to almost any class. "Geology and Geochemistry" might be presented to one group, whereas "Rocks, Minerals, and Fossils" might be more successful at a different grade level.

"Meteorology" or "weather" might be used as topics for lectures on the elements of climate and weather according to the desires and needs of a particular class.

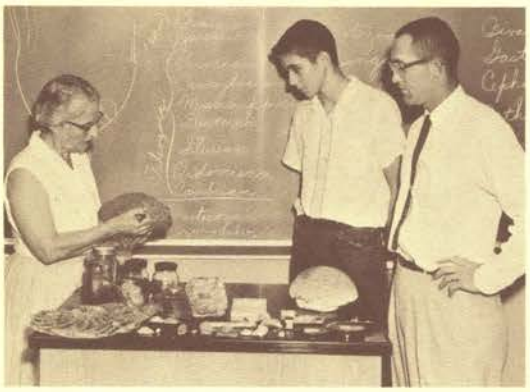
4. MATHEMATICS — A lecture on "Mathematical Investigations" could be used to introduce the evolution of number systems, calculators, exponents, slide rules, or other tools of the mathematician. "Applications of Mathematics to Science" would serve to demonstrate the integration of mathematics into the various fields of modern scientific endeavor.

5. PHYSICS — Various areas of classical physics such as The Gas Laws, Diffusion, Electricity and Electronics, or Wave Motion could be emphasized in classes where specific emphasis on these topics is desired.

Demonstration-lectures may also be presented on topics in modern physics such as "Atomic Structure," "The Nucleus and Radioactivity," "Fusion, Fission, and Reactors," "Solar Energy," or "Rockets, Satellites, and Space Travel."

A presentation under the title of "Preview to Physics" could be aimed at showing pre-physics students just what is involved in a study of physics. This sort of presentation could well serve to increase future enrollment of physics classes.

6. GENERAL LECTURES — To civic and service clubs would emphasize the support needed from "John Doe, Average Citizen" for public schools. The effect that the rapid pace of science has had on education is emphasized. The purposes and methods of the Traveling Science Teacher Program are presented briefly. Assembly programs for schools can be presented to any group from elementary to senior high level in a manner that is intended to emphasize the need for students to learn more about science and its implications. Excerpts from various topical lectures commonly constitute the bulk of the assembly presentations.



Your traveling science teacher wishes to provide a real service to you and your community. If you have questions concerning the program, please call them to his attention or write directly to:

Traveling Science Teacher Program
Oklahoma State University
Stillwater, Oklahoma

The Teachers


Barham


Brewster


Cook


Freeman


Gamble


George


Osner


Pace


Roy


Seifert


Sharpe


Spreadbury


Wall

APPENDIX B

PERSONNEL INFORMATION

1959-60 TRAVELING SCIENCE TEACHER SELECTEES

Name and Address of Traveling Teacher	Age	Three Strongest Areas and Semester Hours In Each		Degrees Held
Ava Lee Allsman Harrisonville, Missouri (relocated from Woodward, Oklahoma)	23	Biology Chemistry Physics	38 30 10	B.S.
Jesse Arriaga San Antonio, Texas	25	Chemistry Mathematics Physics	41 21 16	B.S.
Alice Brooks Ozark, Arkansas	34	Chemistry Biology Mathematics	33 25 20	B.S., M.S.
Harry Calvird Denison, Texas (relocated from Walsenburg, Colorado)	34	Mathematics Physics Chemistry	42 12 8	B.S.
Charles Compton Andrews, Texas	28	Mathematics Physics Chemistry	34 16 8	B.S., M.Ed.
LeRoy Estergard Jones Mills, Arkansas (relocated from Agua Dulce, Texas)	41	Mathematics Biology Physics	26 18 15	B.S., M.N.S.
Jack Folmar Beaumont, Texas	47	Mathematics Chemistry Physics	25 20 7	B.S., M.A.
Jessie Jean Gill Lake Providence, Louisiana	39	Chemistry Mathematics Physics	34 21 10	B.S., M.Ed.
William Harlan Liberty, Texas	50	Mathematics Chemistry Biology	33 22 8	B.S., M.Ed.
Donald Harvey Gate, Oklahoma	39	Mathematics Physics Chemistry	30 19 10	B.S., M.Ed.

1959-60 TRAVELING SCIENCE TEACHER SELECTEES (Continued)

Name and Address of Traveling Teacher	Age	Three Strongest Areas and Semester Hours In Each		Degrees Held
Claude Jones Yale, Oklahoma	35	Biology Chemistry Mathematics	95 34 17	B.S., M.S.
Joe Landry Baker, Louisiana	25	Mathematics Biology Chemistry	18 16 16	B.S.
Walter McGuire Dora, New Mexico	54	Mathematics Physics Chemistry	22 20 16	B.S., M.S.
Frank Patti Salina, Kansas (relocated from Hammond, Louisiana)	32	Mathematics Chemistry Biology	29 16 11	B.S.
W. C. Robinson Albuquerque, New Mexico (relocated from Clovis, New Mexico)	44	Physics Mathematics Chemistry	50 42 17	B.S., M.S.
John Shinpoch Flat River, Missouri (relocated from Mangum, Oklahoma)	27	Biology Mathematics Chemistry	27 12 11	B.S.
Ben Thaxton Denver, Colorado	40	Mathematics Chemistry Physics	48 22 14	B.S., M.S.
John Wagner Sulphur Springs, Texas	50	Physics Chemistry Biology	20 14 10	B.S.
Norman Watley Tulsa, Oklahoma	33	Mathematics Physics Chemistry	29 20 8	B.S., M.S.
Samuel Williams Houston, Texas	44	Chemistry Physics Mathematics	67 12 8	B.S., M.S.

GUEST LECTURERS

June 29 - Richard F. Buck, Project Director of the Oklahoma State University Research Foundation. "Space Research"

July 6-7 - Ellsworth Obourn, Science Education Specialist, U. S. Department of Health, Education and Welfare. "Science Education"

July 14 - Daryl C. Chapin, Research Scientist, Bell Telephone Laboratories. "Solar Batteries"

August 3 - H. T. Orville, Retired Navy Captain and Chairman of the President's Committee on Meteorology. "Meteorology and Weather Control"

August 10 - Herbert A. Bevis, Division of Occupational Health, Texas State Health Department. "Health Physics"

August 26-28 - Tom Taylor, Radiological Training Officer, Region V, U. S. Office of Civil and Defense Mobilization.

Irene Boone, Los Alamos National Laboratory.

Tom Shipman, Los Alamos National Laboratory.

Ed Kanady, Oklahoma Office of Civil Defense.

Tillman Witt, Region V, U. S. Office of Civil and Defense Mobilization. "Radiological Defense"

GUESTS ATTENDING THE CONFERENCE OF STATE DEPARTMENT OFFICIALS

W. M. Locke, Supervisor of Instruction, Arkansas State Department of Education

Curtis C. Love, Supervisor of Instruction, Arkansas State Department of Education

Chauncey Coor, Director of Secondary Education, Arizona State Department of Education

Frank Anderson, Coordinator of Science Activities, Colorado State Department of Education

G. L. Cleland, Division of Instructional Services, Kansas State Department of Education

C. C. Rice, Curriculum Director, Kansas State Department of Education

H. Pat Wardlaw, Assistant Commissioner of Education, Missouri State Department of Education

Clarence Lange, Specialist in Science, Missouri State Department of Education

S. K. Alexander, Nebraska State Department of Education

Raymond A. McGuire, Curriculum Director and Coordinator, Title III, Nevada State Department of Education

George McBane, Director, Title III, NDEA, New Mexico State Department of Education

George P. White, Assistant Superintendent of Public Instruction, New Mexico State Department of Education

Oliver Hodge, Oklahoma State Superintendent of Public Instruction

Earl Cross, Administrator of Defense Education, Oklahoma State Department of Education

J. W. Edgar, Commissioner of Education, Texas Education Agency

Paul Kantz, Director of Guidance and Supervision, Texas Education Agency

1960-61 TRAVELING SCIENCE TEACHER SELECTEES

Name and Address of Traveling Teacher	Age	Areas of Preparation and Number of Semester Hours In Each		Degrees Held
Frank L. Brewster Tucson, Arizona	34	Chemistry Physics Biology Mathematics	36 12 11 16	B.A.
Grover M. Barham Monette, Arkansas	28	Chemistry Physics Biology Mathematics Education	8 14 8 27 30	B.S.
Charles Cook Ruston, Louisiana	43	Chemistry Physics Biology Mathematics	17 13 16 7	B.S.
E. D. Freeman Austin, Texas	38	Chemistry Physics Biology Mathematics Earth Science	16 16 30 13 7	B.S., M.Ed.
Dean Dee Gamble Hutchinson, Kansas	28	Chemistry Physics Biology Mathematics Earth Science	50 18 8 30 7	B.S., M.S.
Lloyd E. George Julesburg, Colorado	28	Biology Chemistry Physics Mathematics Education Earth Sciences	26 13 10 8 20 19	B.S.
Richard Osner Albuquerque, New Mexico	36	Chemistry Physics Biology Mathematics Earth Science	43 13 3 41 5	B.S., M.Ed.

1960-61 TRAVELING SCIENCE TEACHER SELECTEES (Continued)

Name and Address of Traveling Teacher	Age	Areas of Preparation and Number of Semester Hours In Each		Degrees Held
Lee Roy Pace	31	Chemistry	31	B.S., M.Ed.
Lindale, Texas		Physics	8	
		Biology	19	
		Mathematics	36	
		Education	60	
Jack E. Roy	29	Chemistry	13½	B.S., M.S.
Greenfield, Missouri		Physics	16	
		Biology	25	
		Mathematics	26¼	
		Education	43¼	
Edward H. Seifert, Jr.	38	Chemistry	13	A.B.
Cameron, Missouri		Physics	16	
		Biology	31	
		Mathematics	6	
		Education	15	
Glyn H. Sharpe	35	Chemistry	23	B.A., M.S.
Stillwater, Oklahoma		Physics	24	
		Biology	6	
		Mathematics	33	
		Education	51	
		Earth Science	14	
Wendall Spreadbury, Jr.	27	Chemistry	6	B.A.
Austin, Texas		Physics	8	
		Biology	17	
		Mathematics	10	
		Education	12	
		Earth Science	30	
Charles E. Wall	46	Chemistry	19	B.S., M.S.
Perkins, Oklahoma		Physics	18	
		Biology	45	
		Mathematics	16	

1960-61 SUPERVISORY PERSONNEL TRAINEES

Name and Address of Supervisor	Age	Areas of Preparation and Number of Semester Hours In Each		Degrees Held	Years Teaching Experience
J. F. Bischof	60	Chemistry	54	A.B., A.M.	37
Colorado Springs, Colorado		Physics	10 2/3		
		Mathematics	17 2/3		
		Education	26		
Edward F. Bryan	52	Chemistry	4	B.S., M.A.	34
Oklahoma City, Oklahoma		Physics	4		
		Biology	18		
		Mathematics	24		
		Education	51		
		Earth Science	4		
Joe A. Cardenas	29	Chemistry	16	B.A., M.Ed.	10
San Antonio, Texas		Physics	4		
		Biology	9		
		Mathematics	6		
		Education	78		
Katherine P. Chambers	57	Chemistry	18	A.B., M.S., Ph.D.	35
Overland, Missouri		Physics	16		
		Biology	80		
		Mathematics	8		
		Education	70		
		Earth Science	6		
Hampton Crowder	45	Chemistry	8	B.A., M.Ed.	20
Stillwater, Oklahoma		Physics	4		
		Biology	23		
		Mathematics	31		
		Education	49		

1960-61 SUPERVISORY PERSONNEL TRAINEES (Continued)

Name and Address of Supervisor	Age	Areas of Preparation and Number of Semester Hours In Each		Degrees Held	Years Teaching Experience
Denman C. Evans Stillwater, Oklahoma	48	Chemistry	40	B.S., M.Ed., M.S.	26
		Physics	22		
		Biology	22		
		Mathematics	24		
		Education	72		
		Earth Science	11		
Claude F. Jones Stillwater, Oklahoma	38	Chemistry	32	B.S., M.S.	9
		Physics	14		
		Biology	91		
		Mathematics	17		
		Education	27		
William T. Kinniell Austin, Texas	31	Chemistry	33	B.S., M.Ed.	10
		Physics	11		
		Biology	27		
		Mathematics	13		
		Education	60		
Kaye H. Martin Carlsbad, New Mexico	34	Chemistry	28	B.S., M.S.	8
		Physics	20 1/3		
		Biology	47 1/3		
		Mathematics	9		
		Education	27		
		Earth Science	3		

1960-61 SUPERVISORY PERSONNEL TRAINEES (Continued)

Name and Address of Supervisor	Age	Areas of Preparation and Number of Semester Hours In Each		Degrees Held	Years Teaching Experience
Dewey H. Miner	62	Chemistry	16	B.S., M.S.	37
Kansas City, Missouri		Physics	13		
		Biology	62		
		Mathematics	12		
		Education	33		
Joseph A. Struthers	29	Chemistry	28	B.A., M.B.S.	3
Colorado Springs, Colorado		Physics	33		
		Biology	22		
		Mathematics	31		
		Education	24		
J. F. Thompson	54	Chemistry	7	B.S., M.S.	30
Claremore, Oklahoma		Physics	4		
		Biology	16		
		Mathematics	10		
		Education	50		
		Earth Science	6		
Edward James Vaughn	32	Chemistry	53	B.S., M.Ed.	3
Jefferson City, Missouri		Physics	8		
		Biology	1		
		Mathematics	15		
		Education	45		

APPENDIX C

ITEMS PERTAINING SPECIFICALLY TO THE CURRENT STUDY

HIGH SCHOOL OPINION POLL

(Reprinted from Report of Poll No. 50 of the Purdue Opinion Panel by permission of Dr. H. H. Remmers.)

:TIONS: Read each statement **carefully.** Then place an "X" in the space to the right by the answer you choose.

Statement	AGREE	UNDECIDED, PROBABLY AGREE	UNDECIDED, PROBABLY DISAGREE	DISAGREE	
The scientist is not able to have a normal family life.					1.
Scientists are more likely to be mentally ill than people who are engaged in other types of work.					2.
The scientist is more likely to be unpatriotic than other people.					3.
All scientists should be employed by the government so that control can be kept over their findings.					4.
Scientists are more likely than most people to listen to both sides of an argument.					5.
Most scientists are not religious.					6.
The scientist's attitude of questioning is all right for problems of physics and chemistry, but should not be applied to such things as religion and morals.					7.
Most scientists are geniuses.					8.
The scientist seeks to find out the truth with no thought of the consequences of his work.					9.
Scientists are usually impractical in the way that they try to solve the problems of everyday living.					10.
Most scientists are more than a little bit "odd."					11.
Things like the development of the atom bomb indicate that scientists have little regard for humanity.					12.
Scientists who work in colleges and universities are so removed from everyday life that they have little to contribute to practical problems.					13.
Scientists are likely to be more radical about matters outside of their own field than non-scientists.					14.
Scientists are more willing than non-scientists to sacrifice the welfare of others to further their own interests.					15.
The willingness of the scientist to reject traditional beliefs may lead to confusion and disorder.					16.
I would view with suspicion any findings reported by a scientist of certain other countries.					17.
Science courses are boring.					18.
Since every person is different, it is impossible to establish scientific laws of human action.					19.
The goal of science is to benefit mankind.					20.

(over)

		AGREE	UNDECIDED, PROBABLY AGREE	UNDECIDED, PROBABLY DISAGREE	DISAGREE	
21.	Scientific training leads to good citizenship.					2
22.	If it were not for science, we would still be living in ignorance and disease.					2
23.	Scientific studies are conducted in the laboratory rather than in the actual world.					2
24.	Although science may be able to understand and control some things in the physical world, it can never hope to understand and control human action.					2
25.	Science has its place but there are many things that can never be understood by the human mind.					2
26.	Scientific methods should be applied to human problems like segregation and poverty as well as to machines and modern conveniences.					2
27.	Since man has a soul, it is immoral to study him by scientific methods.					2
28.	Money should not be given for scientific research unless it has immediate practical value.					2
29.	The widespread cruelty of man to his fellow man is largely a result of the immoral use of scientific findings.					2
30.	Science is immoral because it rejects some of the teachings of the Bible.					3

31. Do you think that you would like to be a scientist?

YES	☐	3
UNDECIDED, PROBABLY YES	☐	
UNDECIDED, PROBABLY NO	☐	
NO	☐	

STUDENT DATA — PLACE AN "X" IN CORRECT SPACES

Age		Present Grade		Name of Science Course You Are Now Taking		Science Courses Already Completed	
12	☐	Eight	☐	Physics	☐	Physics	☐
13	☐	Nine	☐	Chemistry	☐	Chemistry	☐
14	☐	Ten	☐	Biology	☐	Biology	☐
15	☐	Eleven	☐	General Science	☐	General Science	☐
16	☐	Twelve	☐	BOY	☐	8th Grade Science	☐
17	☐			GIRL	☐	7th Grade Science	☐
18	☐						

STUDENTS — DO NOT MARK IN THESE SPACES

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(8)	(9)	(10)	(11)	(12)	(13)	(14)

SELECTION OF THIRTY OKLAHOMA HIGH SCHOOLS FOR CONTROL GROUP

The "List of Oklahoma High Schools" numbered 1-661, which was compiled from the 1959-60 Oklahoma Educational Directory, Bulletin 109-1, was used for this selection. Thirty school numbers were selected at random, using the "Table of Random Numbers" on pages 568-9 of Statistics In Education, by Merle W. Tate, the MacMillan Company, New York, 1955. Start, Row 1, Columns 15, 16, 17, (number is 716) and proceed down, thence to Columns 18, 19, 20, until thirty numbers are selected. The numbers selected and schools in the list of Oklahoma high schools whose numbers match these random numbers are:

School	Number	School Name	Post Office Address	County	Number of High School Teachers	Traveling Science Teacher Visit Scheduled 58-59	59-60	60-61
1.	275	Duke High	Duke	Jackson	5	No	No	No
2.	60	Delhi High	Delhi	Beckham	4½	No	No	No
3.	424	Red Rock High	Red Rock	Noble	7	No	No	No
4.	164	Bristow High	Bristow	Creek	3	No	No	No
5.	500	Wyandotte High	Wyandotte	Ottawa	13	No	No	No
6.	237	Jefferson High	Jefferson	Grant	4½	No	No	No
7.	181	Clinton High	Clinton	Custer	26	No	Yes	No
8.	546	Rattan High	Rattan	Pushmataha	6	No	No	No
9.	476	Preston High	Preston	Okmulgee	5	No	No	No
10.	442	Arcadia High	Arcadia	Oklahoma	4	No	No	No
11.	359	Turner High	Burneyville	Love	4½	No	No	No
12.	569	Trilby High	Macomb	Pottawatomie	3	No	No	No
13.	45	Helena High	Helena	Alfalfa	11	No	No	No
14.	496	Fairland High	Fairland	Ottawa	11	No	No	No
15.	422	Orlando High	Orlando	Noble	5	No	No	No
16.	218	Lindsay High	Lindsay	Garvin	24	No	No	No
17.	95	Hinton High	Hinton	Caddo	9	No	No	No
18.	448	Edmond High	Edmond	Oklahoma	22	No	No	No
19.	356	Greenville High	Marietta	Love	3	No	No	No
20.	531	Latta High	Ada	Pontotoc	8	No	No	No

SELECTION OF THIRTY OKLAHOMA HIGH SCHOOLS FOR CONTROL GROUP (Continued)

School	Number	School Name	Post Office Address	County	Number of High School Teachers	Traveling Science Teacher Visit Scheduled 58-59	59-60	60-61
21.	194	Oakwood High	Oakwood	Dewey	4	No	No	No
22.	345	Prague High	Prague	Lincoln	8	No	No	No
23.	116	Lone Grove High	Lone Grove	Carter	7	No	No	No
24.	250	Arnett High	Hollis	Ellis	5	No	Yes	No
25.	73	Bennington High	Bennington	Bryan	10	No	No	No
26.	64	Sayre High	Sayre	Beckham	15	No	No	Yes
27.	271	Wetumka High	Wetumka	Hughes	11½	No	No	No
28.	252	Hollis High	Hollis	Harmon	16	No	No	No
29.	160	Ketchum High	Ketchum	Craig	4	No	No	No
30.	138	Noble High	Noble	Cleveland	16	No	No	No

Note: Control group will exclude Numbers 7, 24, and 26, above, since they have been scheduled for a Traveling Science Teacher visit.

SUMMARY OF DATA ON EXPERIMENTAL SCHOOLS

School Code Number	School Name Address Traveling Science Teacher	School Personnel *Signer of Test Permission Card	Pupils and Grades	Visit and Pre-visit Dates
1	Harrison High School Harrison, Arkansas Grover Barham	Prin.: Joe Kraus Sci. Tchr.: JoAnne S. Rife*	500 (9-12)	Nov. 7-11 Sept. 20
2	Clifton High School Clifton, Arizona Frank Brewster	Supt.: Guido P. Cislaghi*	250 (7-12)	Nov. 7-10 Sept. 20
3	Bernice High School Bernice, Louisiana Charles Cook	Prin.: James B. Graves* Sci. Tchr.: Loette McIntosh	107 (1-12)	Nov. 7-11 Oct. 31
4	Llano High School Llano, Texas Ed Freeman	Supt.: C. M. Nalls* Prin.: J. E. Moore Sci. Tchr.: J. A. Gulden	226 (9-12)	Nov. 7-9 Oct. 11-14
5	Greensburg High School Greensburg, Kansas Dean Gamble	Supt.: D. L. Miller* Prin.: None Sci. Tchr.: D. L. Miller	167 (9-12)	Nov. 7-10 Sept. 20
6	Scottsbluff High School Scottsbluff, Nebraska Lloyd George	Prin.: Harold Reeves Sci. Tchr.: Holland Payne (accepted by telephone)	911 (9-12)	Nov. 7-11 Oct. 24-26
7	Montezuma Co. High School Cortez, Colorado Richard Osner	Prin.: Delbert E. Borrelli* Sci. Tchr.: D. M. Totman	600 (9-12)	Nov. 7-11 Oct. 31-Nov. 4
8	Wortham High School Wortham, Texas Lee Roy Pace	Prin.: V. W. Goodwin*	80 (1-12)	Nov. 7-9 Oct. 31-Nov. 4
9	Reorganized School Dist. 1 Augusta, Missouri Jack Roy	Supt.: Sydney J. Wade* Sci. Tchr.: R. H. Leonard	59 (7-12)	Nov. 7-11 Oct. 31-Nov. 4

SUMMARY OF DATA ON EXPERIMENTAL SCHOOLS (Continued)

School Code Number	School Name Address Traveling Science Teacher	School Personnel *Signer of Test Permission Card	Pupils and Grades	Visit and Pre-visit Dates
10	Piper High School Piper, Kansas Edward Seifert	Prin.: Merle Harlan* Sci. Tchr.: V. I. Morey	75 (9-12)	Nov. 7-9 Oct. 24
11	DeBeque High School DeBeque, Colorado Glyn Sharpe	Supt.: Dariel Clark* Prin.: Armand DeBeque Sci. Tchr.: E. J. Bodnar	53 (7-12)	Nov. 7-10 Sept. 19-24
12	Whiteface High School Whiteface, Texas Wendall Spreadbury	Supt.: W. A. Skinner* Prin.: Charles Booz Sci. Tchr.: Charles Puckett	125 (9-12)	Nov. 7-9 Nov. 4
13	Riverside Indian School Anadarko, Oklahoma Charles Wall	Supt.: Albert Pyles Prin.: Walter Owsley Sci. Tchr.: Virginia W. Dell	225 (9-12)	Nov. 7-11 Oct. 3-4

SAMPLE OF INITIAL CONTACT LETTER TO CONTROL SCHOOLS

OKLAHOMA STATE UNIVERSITY
College of Arts and Sciences
STILLWATER

Arts and Sciences Extension October 5, 1960

Mr. Roy Rousey, Principal
Fairland High School
Fairland, Oklahoma

Dear Mr. Rousey:

I am undertaking a project to measure the changes in attitudes of high school students toward science and scientists over a specified period of time. Fairland High School was selected, using random procedures, to take this test. Your cooperation will be greatly appreciated.

This will involve your administering a brief opinion poll to one of your classes on two specified dates. The time required for each testing is approximately thirty minutes. Detailed instructions will accompany the test packet which will be mailed to reach you on or before October 17. The second packet will reach you on or before December 5.

Results of the entire testing poll will be sent to you at a later date if you desire. We honestly believe that some worthwhile and significant conclusions may be drawn from this study.

Sincerely yours,

Claude W. Gatewood

CWG:ps

SAMPLE OF INITIAL CONTACT LETTER TO EXPERIMENTAL SCHOOLS

OKLAHOMA STATE UNIVERSITY - STILLWATER

Traveling Science Teacher Program
FRontier 2-6211, Ext. 220

October 4, 1960

Mr. Holland Payne, Science Instructor
Scottsbluff High School
Scottsbluff, Nebraska

Dear Holland:

High schools which will be visited by a Traveling Science Teacher during the week of November 7, 1960, have been selected to participate as test schools in the evaluation study which was mentioned in our earlier correspondence. This group includes Scottsbluff High School.

The tests are brief, requiring only about a half hour of class time and will need to be given to only one class. Detailed instructions will accompany the test packet which you will receive on or before Monday, October 17. You will receive the second packet of tests on or before Monday, December 5.

As the tests deal with attitudes toward science and scientists, the results of this pre- and post-testing will be indicative of changes in these attitudes. It is, therefore, imperative that the participating students do not know the real significance of the tests. The tests bear no identifying marks. Mr. George, the Traveling Science Teacher, does not know which schools have been selected and should not be told as this might well lessen the efficacy of the testing program.

Your cooperation in this matter is most sincerely appreciated.

Respectfully yours,

Claude W. Gatewood
Coordinator
Traveling Science Teacher
Program

CWG/rlj

SAMPLE OF SECOND LETTER TO CONTROL SCHOOLS

OKLAHOMA STATE UNIVERSITY
College of Arts and Sciences
STILLWATER

Arts and Sciences Extension October 14, 1960

Mr. William O. Tomlinson
Noble High School
Noble, Oklahoma

Dear Mr. Tomlinson:

The enclosed tests are the ones mentioned in my letter of October 5, 1960.

These tests should be given on Wednesday, October 19. If this date is impractical, then they should be given on the eighteenth or twentieth. The "Instructions for Administering the High School Opinion Poll" should be read by the person administering the test before the day they are to be given since the instructions include the determination of which class is to be given the tests. The results should not be discussed with students until after the second test is given in December. The students should not be told there will be another test.

If you would like to have a copy of the results of this study, let me know and I will be happy to send one as soon as the study is completed. The stamped return envelope is enclosed for your convenience in returning the tests.

Again, thank you for your cooperation and efforts in this study.

Sincerely yours,

Claude W. Gatewood

CWG/mg
Enc.

SAMPLE OF SECOND LETTER TO EXPERIMENTAL SCHOOLS

OKLAHOMA STATE UNIVERSITY - STILLWATER

Traveling Science Teacher Program
FRontier 2-6211, Ext. 220

October 14, 1962

Mrs. JoAnne S. Rife
Harrison High School
Harrison, Arkansas

Dear Mrs. Rife:

The enclosed tests are the ones mentioned in my letter of Oct. 4, 1960.

These tests should be given on Wednesday, October 19. If this date is impractical, then they should be given on the eighteenth or twentieth. The "Instructions for Administering the High School Opinion Poll" should be read by the person administering the test before the day they are to be given since the instructions include the determination of which class is to be given the tests.

The Traveling Science Teacher, Mr. Grover Barham, does not now know about these tests and should not be told. The students should also be kept unaware of the true significance of these tests. The local teacher should not discuss results of this test with the students until after the second test is given in December. The students should not know there is going to be another test.

The stamped return envelope is enclosed for your convenience in returning the tests.

Sincerely yours,

Claude W. Gatewood

Claude W. Gatewood

CWG/mg
Enc.

INSTRUCTIONS FOR ADMINISTERING THE HIGH SCHOOL OPINION POLL

To the Teacher:

This is the initial test in a pre-post test situation and should be given on or about October 19. The second test is to be sent to you on or about December 5 to be administered on December 7. The students should not know of this second test. You should not discuss the test or the test results with students until after the second test has been administered. Procedure for selecting the test class and administering the test are listed below. Since each student's data for both tests must be punched onto the same IBM card, it is imperative that you identify each student's paper with some number or symbol. (Item 3-A below shows one way in which this can be done.) These identifying numbers will be marked on the second tests before they are sent to you in December so that a given student's paper can later be matched with his earlier test.

1. Selection of the Class To Be Given the Test:
   The test class should be a class in whatever science is offered this year at your lowest senior high grade level. (General Science or Biology in most cases.) If only one section of that science course exists, then that section is the test group. If more than one section exists, then one of them should be selected by tossing a coin or by some other random method. The test should be given at the first of the period so that ample time is allowed for students to answer all items and complete the student data section.

2. After the Test Papers Have Been Distributed to the Class:
   You should read the following instructions aloud to the class. (You may read twice if requested.)

   "This is a test to determine what your personal opinions or attitudes are concerning the 31 statements listed. Please read each item carefully, then mark an 'X' in the column which most nearly expresses your opinion about the statement. There should be no questions or discussion of these statements as we are seeking your own opinion about them. When you have finished the 31 questions, complete the student data section, on the back of the page, and hand your paper in."

3. As Students Turn In Their Papers, the Teacher Should:
   Make sure the test is completed, then turn the test over and in the numbered blocks at the bottom of the back page of each student's paper:

   A. Put in Block Number 1 the student's number, according to your roll call book. (The second test to be sent to you in December will be marked with this number so that a given student's score on both tests can be identified by this number.)

B. Put in <u>Block Number</u> 4 one of the numbers as indicated below:
"1" if the student is in the upper fourth of the class.
"2" if the student is in the second quartile of the class.
"3" if the student is in the third quartile of the class.
"4" if the student is in the lowest quartile of the class.

4. There Are 40 Tests In The Packet.
Please return the unused tests, together with the completed ones, in the stamped, return envelope provided for this purpose.

SAMPLE OF THIRD LETTER TO CONTROL AND EXPERIMENTAL SCHOOLS

OKLAHOMA STATE UNIVERSITY
College of Arts and Sciences
STILLWATER

November 26, 1960

Mr. William O. Tomlinson
Noble High School
Noble, Oklahoma

Dear Mr. Tomlinson:

Thank you for your cooperation in administering the first of the two opinion tests. The second (and final) packet of tests is enclosed. They should be given during the week of December 5-9, preferably on Wednesday, December 7. This should be done by the same person who administered the first packet of tests.

An instruction sheet is included in the test packet and should be read prior to the administration of the test since it contains instructions for making sure each student receives the correct paper.

Thank you for your cooperation and efforts in this study. A copy of the results will be mailed to you as soon as they are published.

Sincerely yours,

Claude Gatewood

Claude W. Gatewood

CWG/mg
Enc.

INSTRUCTIONS FOR THE SECOND ADMINISTERING OF THE HIGH SCHOOL OPINION POLL

To The Teacher:

This is the second test in a pre-post test situation and should be given on or about December 7, 1960. Please read the following instructions carefully.

1. Be sure that the same class which took the first test is the one which takes the second test.

2. Block number (1) at the bottom of the reverse side of the sheet is marked with the same number which you placed in the corresponding block on the first test. Be sure each paper is given to the student whose number is in this block.

3. After the test papers have been distributed to the class, you should read the following instructions aloud to the class. You may read it twice if requested.

   "This is a test to determine what your personal opinions or attitudes are concerning the 31 statements listed. Please read each item carefully, then mark an 'X' in the column which most nearly expresses your opinion about the statement. There should be no questions or discussion of these statements as we are seeking your own opinion about them. When you have finished the 31 questions, complete the student data section on the back of the page and hand your paper in."

4. Important: If the students recognize this test as being identical to the one which they previously took, point out to them that they should not try to remember how they answered before but answer in the light of their present feelings.

5. If a student was absent for the first test, he will simply be excluded from participating in this test. If a student took the first test but is absent during the second one, mark "Absent" on his paper and return it with the rest.

CODES USED IN STUDENT DATA

	Code Number
Category: "Present Grade"	
Eight	1
Nine	2
Ten	3
Eleven	4
Twelve	5
Category: "Name of Science Course You Are Now Taking"	
General Science	1
Biology	2
Chemistry	3
Physics	4
General Science and Biology	5
Chemistry and Physics	6
Chemistry and Biology	7
Chemistry and General Science	8
Biology and Physics	9
Category: "Science Courses Already Completed"	
Seventh Grade Science	1
Eighth Grade Science	2
General Science	3
Biology	4
Chemistry	5
Physics	6
Seventh, Eighth Grade Science	7
Seventh Grade Science, General Science	8
Eighth Grade Science, General Science	9
Seventh, Eighth Grade Science, General Science	10
Seventh, Eighth Grade Science, Biology	11
Seventh Grade Science, General Science, Biology	12
Eighth Grade Science, General Science, Biology	13
Seventh, Eighth Grade Science, General Science, Biology	14
Eighth Grade Science, General Science, Chemistry, Physics	15
Biology, Chemistry	16
Biology, Physics	17
Chemistry, Physics	18
Chemistry, Physics, Biology	19
Seventh, Eighth Grade Science, Biology, Chemistry	20
Seventh, Eighth Grade Science, Physics	21
General Science, Biology	22
Seventh, Eighth Grade Science, General Science, Chemistry	23

CODES USED IN STUDENT DATA (Continued)

	Code Number
Category: "Science Courses Already Completed"	
Seventh, Eighth Grade Science, General Science, Physics	24
General Science, Biology, Chemistry	25
Eighth Grade Science, Biology	26
Seventh, Eighth Grade Science, General Science, Biology, (Physics or Chemistry)	27
Seventh Grade Science, Biology	28
Seventh, Eighth Grade Science, Biology	29
Eighth Grade Science, General Science, Chemistry	30
Eighth Grade Science, Chemistry	31
Seventh Grade Science, General Science, Biology	32
None	33

IBM CODE SHEET

Name of Project: An Evaluation of the Traveling Science Teacher Program Date: 1960

Project Leader: Claude Gatewood Dept. No: 2265

No. of Cards: 1,392 Project No.: 40701

Initial Column	Final Column	No. of Cols.	ITEM	Remarks
1	2	2	Student Number	Coded
3	4	2	School Number	Coded
5	5	1	Control = 1, Experimental = 2	Coded
6	6	1	Quartile of Student	Coded
7	7	1	Student's Age (Second digit only)	Coded
8	8	1	Student's Present Grade	Coded
9	9	1	Science Course Now Taking	Coded
10	10	1	Sex (Boy = 1, Girl = 2)	
11	12	2	Science Courses Completed	Coded
13	13	1	Pre-Question 1, Affirmative - 1; Probably Affirmative - 2; Probably Negative - 3; Negative - 4.	
14	14	1	Pre-Question 2, A - 1, PA - 2, PN - 3, N - 4	
15	15	1	Pre-Question 3, A - 1, PA - 2, PN - 3, N - 4	
16	16	1	Pre-Question 4, A - 1, PA - 2, PN - 3, N - 4	
17	17	1	Pre-Question 5, A - 1, PA - 2, PN - 3, N - 4	
18	18	1	Pre-Question 6, A - 1, PA - 2, PN - 3, N - 4	
19	19	1	Pre-Question 7, A - 1, PA - 2, PN - 3, N - 4	
20	20	1	Pre-Question 8, A - 1, PA - 2, PN - 3, N - 4	
21	21	1	Pre-Question 9, A - 1, PA - 2, PN - 3, N - 4	

IBM CODE SHEET (Continued)

Initial Column	Final Column	No. of Cols.	ITEM	Remarks
22	22	1	Pre-Question 10, A - 1, PA - 2, PN - 3, N - 4	
23	23	1	Pre-Question 11, A - 1, PA - 2, PN - 3, N - 4	
24	24	1	Pre-Question 12, A - 1, PA - 2, PN - 3, N - 4	
25	25	1	Pre-Question 13, A - 1, PA - 2, PN - 3, N - 4	
26	26	1	Pre-Question 14, A - 1, PA - 2, PN - 3, N - 4	
27	27	1	Pre-Question 15, A - 1, PA - 2, PN - 3, N - 4	
28	28	1	Pre-Question 16, A - 1, PA - 2, PN - 3, N - 4	
29	29	1	Pre-Question 17, A - 1, PA - 2, PN - 3, N - 4	
30	30	1	Pre-Question 18, A - 1, PA - 2, PN - 3, N - 4	
31	31	1	Pre-Question 19, A - 1, PA - 2, PN - 3, N - 4	
32	32	1	Pre-Question 20, A - 1, PA - 2, PN - 3, N - 4	
33	33	1	Pre-Question 21, A - 1, PA - 2, PN - 3, N - 4	
34	34	1	Pre-Question 22, A - 1, PA - 2, PN - 3, N - 4	
35	35	1	Pre-Question 23, A - 1, PA - 2, PN - 3, N - 4	
36	36	1	Pre-Question 24, A - 1, PA - 2, PN - 3, N - 4	
37	37	1	Pre-Question 25, A - 1, PA - 2, PN - 3, N - 4	
38	38	1	Pre-Question 26, A - 1, PA - 2, PN - 3, N - 4	
39	39	1	Pre-Question 27, A - 1, PA - 2, PN - 3, N - 4	
40	40	1	Pre-Question 28, A - 1, PA - 2, PN - 3, N - 4	
41	41	1	Pre-Question 29, A - 1, PA - 2, PN - 3, N - 4	
42	42	1	Pre-Question 30, A - 1, PA - 2, PN - 3, N - 4	
43	43	1	Pre-Question 31, A - 1, PA - 2, PN - 3, N - 4	Coded
44	44	1	Post-Question 1, A - 1, PA - 2, PN - 3, N - 4	
45	45	1	Post-Question 2, A - 1, PA - 2, PN - 3, N - 4	

IBM CODE SHEET (Continued)

Initial Column	Final Column	No. of Cols.	ITEM	Remarks
46	46	1	Post-Question 3, A - 1, PA - 2, PN - 3, N - 4	
47	47	1	Post-Question 4, A - 1, PA - 2, PN - 3, N - 4	
48	48	1	Post-Question 5, A - 1, PA - 2, PN - 3, N - 4	
49	49	1	Post-Question 6, A - 1, PA - 2, PN - 3, N - 4	
50	50	1	Post-Question 7, A - 1, PA - 2, PN - 3, N - 4	
51	51	1	Post-Question 8, A - 1, PA - 2, PN - 3, N - 4	
52	52	1	Post-Question 9, A - 1, PA - 2, PN - 3, N - 4	
53	53	1	Post-Question 10, A - 1, PA - 2, PN - 3, N - 4	
54	54	1	Post-Question 11, A - 1, PA - 2, PN - 3, N - 4	
55	55	1	Post-Question 12, A - 1, PA - 2, PN - 3, N - 4	
56	56	1	Post-Question 13, A - 1, PA - 2, PN - 3, N - 4	
57	57	1	Post-Question 14, A - 1, PA - 2, PN - 3, N - 4	
58	58	1	Post-Question 15, A - 1, PA - 2, PN - 3, N - 4	
59	59	1	Post-Question 16, A - 1, PA - 2, PN - 3, N - 4	
60	60	1	Post-Question 17, A - 1, PA - 2, PN - 3, N - 4	
61	61	1	Post-Question 18, A - 1, PA - 2, PN - 3, N - 4	
62	62	1	Post-Question 19, A - 1, PA - 2, PN - 3, N - 4	
63	63	1	Post-Question 20, A - 1, PA - 2, PN - 3, N - 4	
64	64	1	Post-Question 21, A - 1, PA - 2, PN - 3, N - 4	
65	65	1	Post-Question 22, A - 1, PA - 2, PN - 3, N - 4	
66	66	1	Post-Question 23, A - 1, PA - 2, PN - 3, N - 4	
67	67	1	Post-Question 24, A - 1, PA - 2, PN - 3, N - 4	
68	68	1	Post-Question 25, A - 1, PA - 2, PN - 3, N - 4	
69	69	1	Post-Question 26, A - 1, PA - 2, PN - 3, N - 4	

IBM CODE SHEET (Continued)

Initial Column	Final Column	No. of Cols.	ITEM	Remarks
70	70	1	Post-Question 27, A - 1, PA - 2, PN - 3, N - 4	
71	71	1	Post-Question 28, A - 1, PA - 2, PN - 3, N - 4	
72	72	1	Post-Question 29, A - 1, PA - 2, PN - 3, N - 4	
73	73	1	Post-Question 30, A - 1, PA - 2, PN - 3, N - 4	
74	74	1	Post-Question 31, A - 1, PA - 2, PN - 3, N - 4	Coded

COMMENTS BY TRAVELING SCIENCE TEACHERS ABOUT
SCHOOLS SERVED NOVEMBER 7, 8, AND 9
(Taken from weekly reports)

1. Frank Brewster, Clifton High School, Clifton, Arizona:

Beginning math is for students who have not learned to add, multiply, etc., and intermediate math is a continuation of this course. Algebra II (one section--six students) is taught one year and solid geometry and trig taught the next year--allowing solid and trig one semester each. General Science is taught in seventh and eighth grades and the general feeling was that ninth grade general science was merely a repetition of seventh and eighth grade science--hence--physiology in ninth, biology in tenth, physics or chemistry eleventh and twelfth grades (they are taught on alternate years). I talked to the Kiwanis Club at 7:30 P. M. on Thursday.

2. Dean Gamble, Greensburg High School, Greensburg, Kansas:

The interest in science at Greensburg is very good. I had some very good students here. They had the ability to reason better than in most schools that I have visited. As you can see, I did spend a busy week. On Wednesday afternoon Mullinville brought their seventh and eighth grades over for the lectures and on Thursday, they brought over the physics students for the second physics lecture. Thursday evening I gave a Civil Defense lecture at the high school during the open house they had in conjunction with American Education Week.

3. Lloyd George, Scottsbluff High School, Scottsbluff, Nebraska:

Everything went off very good. The teachers really enjoyed the program.

4. Richard Osner, Montezuma County High School, Cortez, Colorado:

Have a Rotary Club Program tonight I didn't know anything about until I got here. May have a radio program later this week. Heard a radio broadcast about last night's Rotary Club meeting, very favorable--local radio station. Had a fifteen-minute radio program on Thursday morning. Teachers have enjoyed using the two films. Loaned them my copies of electronic kits to be copied. Radio program went off very well. School was out one-half day Friday for a football game.

5. Jack Roy, Francis Howell High School, Weldon Springs, Missouri:

I arrived at the Augusta High School Monday, only to find the place abandoned. It seemed as though the water works was out of commission. The report was that they might be back in session Wednesday. Tuesday, they discovered that the trouble was more serious than at first thought and probably would be no school during the week. Playing the part of the true-blue, never-say-die Traveling Science

Teacher, I immediately set off in search of an alternate target. I located one some ten miles to the north, Francis Howell High School, near Weldon Springs, Mo. I also located an A. E. C. uranium processing plant that I didn't know existed in our state. (I told them that I knew Claude Gatewood, formerly with one of their other installations at Oak Ridge, but it didn't get me inside the gate.) I worked with the junior high all day Wednesday and the senior high Thursday. Program apparently went over very well.

6. Edward Seifert, Piper High School, Piper, Kansas:

I gave an assembly for the student body of Piper High School this week on Monday morning. There were twenty students and a science teacher from Bansing High School there for the assembly. The science teacher's name was Bill Brown. Also from Basehor High School, there were fourteen students and their instructor. The reporter from the Kansas City "Star" was there to take pictures of the assembly. Mr. Harlan, the principal, is trying to promote his science department. Mr. Perry, the science teacher, is very concerned that he does a good job. This is his first year back to teaching after a couple of years layout. He seemed like he was very interested in the program and I encouraged him to attend a NSF summer institute to update his science education. Had a good three days there.

7. Wendall Spreadbury, Whiteface High School, Whiteface, Texas:

Monday was spent at Whiteface, drove to Austin Tuesday. Remaining time spent in Austin with convention.

8. Charles L. Cook, Bernice High School, Bernice, Louisiana:

The superintendent and three other principals of the parish visited the program Thursday. They complimented the program highly. They didn't know what the program was about and they enjoyed going through all of my junk. I have waited until Sunday night to fill in this note. The integration situation is in full swing and the State Superintendent has called for a holiday tomorrow, so I have a day off. The Negro science teacher, Louis Collier, called and said they would not have school tomorrow.

9. Grover Barham, Harrison High School, Harrison, Arkansas:

Mrs. Rife coordinated the program in all phases. The principal only met me to shake hands; therefore, I am without any idea of what he thought of the program. I think Mrs. Rife was grateful of the demonstrations, although she has quite a few of her own. She asked me to her home for coffee and pie with her husband Friday afternoon.

10. Edd Freeman, Llano High School, Llano, Texas:

Organized a Science Club, fifty-nine paid members. Spoke to the group on values, purposes, and possible projects. Got the Rotary Club to sponsor this club with awards and promotion. Very fine week.

Our display was popular at Austin.

11. Lee Roy Pace, Wortham High School, Wortham, Texas:

(No pertinent comment.)

12. Glyn Sharpe, DeBeque Public Schools, DeBeque, Colorado:

DeBeque is a small school, but I feel that our program probably did more good here than anywhere I've visited this year. The science teacher is doing a good job on a shoestring (building most of his own equipment). He is very much interested in becoming a Traveling Science Teacher and just about talked my arm off about everything. Beautiful weather on the western slope but a snow pack on most of the passes (not bad). I had a good reception at Gunnison. Towels, the principal, took me to the college and introduced me to the science departments. I have a science methods class scheduled for there.

13. Ephraim Wall, Riverside Indian School, Anadarko, Oklahoma:

Program very well received at Riverside. (No other pertinent comments.)

FINAL LETTER TO EXPERIMENTAL GROUP

OKLAHOMA STATE UNIVERSITY - STILLWATER

Traveling Science Teacher Program
FRontier 2-6211, Ext. 220

January 18, 1961

Both the pre- and post-tests involved in the Traveling Science Teacher evaluation have been received. Your cooperation has been most helpful. The data listed below is all that is needed to complete the survey. I would appreciate very much your filling in the blanks. A return envelope is enclosed for your convenience.

INFORMATION CONCERNING THE CLASS WHICH WAS GIVEN THE TESTS

This class was given _____ class-type lectures by the Traveling Teacher.

This class (as part of an assembly or other large group) received _____ additional lectures from the Traveling Science Teacher.

INFORMATION ABOUT THE REGULAR TEACHER OF THIS CLASS

The regular teacher is ____________ (male/female).

The teacher has taught __________ years.

The highest degree held by the teacher is _____________.

The age of the teacher is _____________.

MISCELLANEOUS INFORMATION

The name of the local newspaper generally read by the people in your community is ____.

This paper is published in what town? __________________________________.

Sincerely yours,

Claude Gatewood

Claude W. Gatewood

CG/rj
Enc.

VITA

Claude West Gatewood

Candidate for the Degree of

Doctor of Education

Thesis: A STUDY OF THE EFFECT OF THE OKLAHOMA STATE UNIVERSITY TRAVELING SCIENCE TEACHER PROGRAM ON THE ATTITUDES OF HIGH SCHOOL STUDENTS TOWARD SCIENCE AND SCIENTISTS

Major Field: Teacher Education

Biographical:

Personal Data: Born at Nacogdoches, Texas, June 10, 1926, the son of Claude Walker and Grace Gatewood.

Education: Received the Bachelor of Science degree from Stephen F. Austin State College, Nacogdoches, Texas, with majors in chemistry and business administration in May, 1952; did graduate study at the University of Houston from 1953 to 1955; did graduate study at the Massachusetts Institute of Technology in the summer of 1955; did graduate study at The Colorado College, Colorado Springs, Colorado, during the summers of 1956 and 1957; received the Master of Science degree from Oklahoma State University in Natural Science in May, 1957; completed requirements for the Doctor of Education degree at Oklahoma State University in May, 1962.

Professional Experiences: Science teacher at the Mary Brantley Smiley High School, Houston, Texas, from 1953 to 1955; science teacher at John H. Reagan High School, Houston, Texas, during the 1955-56 school year; instructor in experimental high school mobile laboratory for Oklahoma State University during the 1957-58 school year; traveling lecturer in Oklahoma for Oklahoma State University during the 1958-59 school year; assistant director of the Traveling Science Teacher Program for Oklahoma State University from 1959 to 1962; supervisor of student teachers in secondary science at Oklahoma State University during the 1961-62 school year.

Professional Organizations: National Science Teachers Association, Association for the Education of Teachers of Science, Oklahoma Science Teachers Association, Oklahoma Academy of Science, Phi Delta Kappa, Oklahoma Education Association, Association for Student Teaching.