

**A STUDY OF THE STATUS
OF EARTH SCIENCE
AND
EARTH SCIENCE TEACHERS
IN KANSAS SECONDARY SCHOOLS
1970-71**

by

613-8301

RICHARD ORLIN SMITH

B. S., Kansas Wesleyan University, 1961

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

**KANSAS STATE UNIVERSITY
Manhattan, Kansas**

1973

Approved by


Major Professor

LD
2668
R4
1973
S635
C.2
Docu-
ment

TABLE OF CONTENTS

	PAGE
LIST OF TABLES.....	111
LIST OF FIGURES.....	111
CHAPTER	
I. INTRODUCTION.....	1
Causes of Change.....	1
Rate of Change.....	2
Need for Study.....	3
Statement of Problem.....	3
Limitations of Study.....	4
Definition of Terms.....	4
II. REVIEW OF RELATED MATERIALS.....	7
Kansas Requirements for Certification.....	7
Recommendations of Groups.....	7
Recommendations of Individuals.....	9
Related Studies.....	10
III. METHODS AND MATERIALS.....	13
IV. SUMMARY.....	24
Conclusions.....	25
Recommendations.....	26
Possible Uses of This Report.....	26
REFERENCES CITED.....	28

LIST OF TABLES

TABLE	PAGE
I. Classroom Teachers and Earth Science Teachers.....	16
II. School District and Enrollment Information.....	16
III. Academic Preparation of Earth Science Teachers 1970-71.....	17
IV. Academic Preparation in Science Areas of Earth Science Teachers 1970-71.....	18
V. Academic Preparation in Earth Science Courses of Earth Science Teachers 1970-71.....	18

LIST OF FIGURES

FIGURE	PAGE
1. Academic Preparation of Earth Science Teachers 1970-71, Science Hours.....	20
2. Academic Preparation of Earth Science Teachers 1970-71, Earth Science Hours.....	21
3. Earth Science Teacher Distribution According to School Size.....	22
4. Years Experience of Earth Science Teachers.....	23

CHAPTER I

INTRODUCTION

Earth science is rapidly rising to the status of biology, chemistry, and physics to become the fourth basic science subject in the secondary level education. This addition to the science curriculum can be attributed to several influencing factors.

Causes for Change

Sputnik I and related events caused a great deal of activity in science education. The passing of The National Defense Education Act of 1958--Public Law 85-864--, the Amendments of 1964--Public Law 88-665--, and the Elementary and Secondary Education Act of 1965--Public Law 89-10--, have provided billions of dollars to strengthen education in general and science in particular. This money became available at a time when professional educators were responding to the sudden and rudely imposed responsibility to educate for life and the space age. (Casey, 1)

Elementary schools are now teaching science concepts that were once reserved for general science course at the secondary level. This is one of the reasons the traditional general science course is looked upon as having little value in today's schools where emphasis is being placed on creative investigations and student initiative. This rejection of general science has lead to the recognition of the potential of the earth sciences to provide a laboratory-oriented interdisciplinary approach to learning.

Reasons for the rapid increase include a general dissatisfaction with general science; an appreciation of the earth as an entity (fostered in part by the spectacular photographs from the space program); public realization that solution of current environmental problems requires a broad understanding of earth science; recognition of earth science as both an effective terminal science program for future citizens and a sound basic frame of reference for children who will study more science. One might almost say it represents a fourth "R"--that shibboleth of the '60's, Relevance. (Weitz, 15:1)

Dissatisfaction of the traditional eighth and ninth grade general science courses caused an awakening of the need for a more meaningful science approach at this level. Federal laws and interested groups, such as the Ford and Carnegie Foundations, provided the means for developing better courses, and educational studies provided the guidance in developing and initiating acceptance of the work.

Rate of Change

The speed at which earth science is being adopted into the secondary curriculum can be indicated by several studies. In 1963-64 there were 60 earth science teachers in Ohio. (Skinner, 13:113) By 1966-67 the number of teachers had increased to 170. (Schappell and Mayer, 10:8) The 1968-69 school year increased the number of earth science teachers in Ohio to over 600. (Skinner, 14:8)

The Pennsylvania Department of Instruction instituted a statewide program of earth science education in 1958, and by 1962-63 the program had expanded from an original nine schools, teaching 800 ninth graders to 550 schools offering earth science courses to 68,431. (Hubbard, 2:26)

The percent of ninth grade students taking earth science in the nation in 1968-69 approached 33%. (Weitz, 15:2) When we recognize

that this movement had its beginning about ten years ago, this is a phenomenal growth for educational implementation.

Need for Study

In a time such as this when much emphasis is being placed upon science in our society, a high school graduate without an understanding of the major concepts of science would be in effect culturally illiterate. (Hurd, 3:486-7) Educators, as well as our society as a whole, have become more interested in increasing the quality of education. The Kansas State Department of Education is presently evaluating requirements for certification of earth science teachers.

The competency of teachers to a large degree is dependent on background knowledge of the subject area or academic preparation. With many states such as Kansas having only minimal certification requirements, it can be anticipated that some teachers are now teaching who could not be judged academically qualified. The rapid growth of earth science in the schools has given rise to the problem of preparing earth science teachers that provide quality education. But, what academic preparation is needed for high quality teaching? What content background is needed by earth science teachers?

Statement of Problem

What is the academic preparation, experience, distribution, and number of earth science teachers who were teaching earth science in Kansas during the 1970-71 school year? What was the status of earth science programs in terms of offerings, school size, number of students,

class size, and the relationships of these factors? It is the purpose of this study to present this information and find correlations pertaining to the earth science programs in Kansas 1970-71.

Limitations of Study

This study was made of all 1970-71 earth science teachers in Kansas as reported by the Principal's Organizational Report on file in Certification Section of the Kansas State Department of Education which include public and nonpublic schools. This study was done on teachers of earth science over one year ago in order to insure the availability of more complete transcripts in the Records Section of the Kansas State Department of Education. An effort was made at the time of transcript examination to convert quarter hours to semester hours. The Curriculum Section of the Kansas State Department of Education provided the school district in which the earth science teacher was employed, years experience, classes of earth science taught, and class size. The validity of these reports determine the validity of the report.

Although it is realized that merely the number of credits in a teacher's subject, or field, does not necessarily make him a better or poorer teacher, it is felt that the number of academic credit hours does have some bearing as to the adequacy of preparation of the teacher and his desire to become a better teacher.

Definition of Terms

Credit. Semester hours received.

Chemical Science. As related to this study will include those

areas of study which can be used for the purpose of teacher certification in the chemical sciences in Kansas. (Gen. Chem., Inorganic & organic Chem.,)

Earth Science. The science that deals with the materials of our natural environment and the processes that bring about changes. (Gen. Geol., Phy. Geol., Astronomy, Hist. Geol.)

Full time earth science teacher. A teacher that spends at least four class periods per teaching day in the instruction of earth science.

General education. A general education includes all course work taken in the areas of oral and written communication, literature and language, and social sciences.

Qualification to teach. The qualification to teach is based on the requirements of the Kansas State Board of Education as stated in the Certification Handbook of January 1, 1970.

Physical Sciences. As related to this study will include those areas of science study which are not classified by the State Department of Education as being chemical or biological sciences. This does include earth sciences.

Secondary Schools. As related to this study, will include all junior and senior high schools listed in the Principal's Organizational Reports for 1970-71 school year and on file at the State Department of Education, Topeka.

Semester Hour. One semester hour credit is given upon successful completion of course work involving approximately one hour per week in class for a one semester period in an institute of higher learning.

Traditional approach. A teacher-oriented subject-centered classroom.

CHAPTER II

REVIEW OF RELATED MATERIALS

Studies that include academic preparation of Kansas secondary teachers pre-date to the current concern for proper earth science education. Smith (18) in 1962 reported the need for a revision of our state teacher qualifications. Watkins' (20) study in 1963 indicated better chemistry teacher preparation was found in larger schools. Walker (19) made a study in 1964 which also indicated a relationship between teacher qualification and larger schools. His study indicated up to 40% of schools with enrollments less than 100 students had unqualified science teachers. Rolfs (16) in 1964 concluded approximately one-half of the beginning biology teachers did not meet with AAAS' minimum recommendations in biological sciences. Rundus (17) in 1966 found a lack of training in beginning physics teachers and recommended a strengthening of teacher qualifications in physics.

Kansas Requirements for Certification

The Kansas requirements for teaching earth science as outlined by the Certification Handbook are six credit hours in the subject area taught and a total of twenty-four credit hours in the field of science. (4:69)

Recommendations of Groups

The Council on Education in the Geological Sciences formed the Panel on Earth Science Teacher Preparation for the Purpose of devising

and initiating programs to prepare and/or improve the preparation of earth science teachers. The panel worked closely with many science and geology education groups under the guidance of its chairman, William M. Merrill. The CEGS Panel on Earth Science Teacher Preparation gave these recommendations;

The program presented here can be accomplished in four years, but it would be more satisfactory to do it in five....

Average requirements, in addition to those in science and mathematics, include courses in English, social sciences, humanities and foreign language.... The language be elected from among French, German, or Russian....

The panel recommends that the curriculum include courses in methods of teaching science, to include earth science, and practice teaching in earth science.

The panel recommends that at least one year each of general chemistry, general physics and biology should be required....

The panel recommends that requirements in mathematics should include two semesters of calculus or combined calculus and analytical geometry, or one semester of calculus or combined calculus and analytical geometry plus an additional semester of either probability and statistics or computer programming.

A major in earth science should include selections among introductory courses in astronomy, meteorology, oceanography, geology, and/or physical geography--climatology and soils....

The earth science major should permit a student to specialize in astronomy, geology, meteorology, or oceanography. (Merrill, 8:31-2)

A report of conferences and discussions on teacher preparation held by the Earth Science Curriculum Project recommended basic requirements in the preparation of earth science teachers. The following is a summary of their recommended basic academic preparation.

A. EMPHASIS IN EARTH SCIENCE

Earth science is defined as the interdisciplinary study of materials, energy, and processes in four areas: (a) the solid earth and its interior, (b) the atmosphere, (c) the hydrosphere and (d) earth's environment in space. The study of earth science is based on physical and biological processes and their role in the evolution of the earth and its environs. The program of study in earth science should contain the following elements:

1. Studies including investigative laboratory work concerned with the solid earth and in at least two of the other three areas above, preferably all four.
2. At least one-half of the earth science study should be at the junior-senior level in one of the four areas above, or in an integrated program combining two or more of the four areas.
3. At least four weeks of full-time practical field experience in one of the four areas above.

B. EMPHASIS IN RELATED SCIENCES

The related sciences needed in support of an earth science major include college-level study to the point of understanding basic concepts in each of the following areas (a year of each is recommended): (a) biology, (b) chemistry, (c) mathematics and (d) physics.

In addition to the basic academic program, three recommendations that would further enhance teacher competency were made by conference participants: (1) a fifth year program, (2) study of the history and philosophy of science, and (3) experience with effective teaching procedures should be considered in the design of programs to prepare earth science teachers. (Shrum, 12:27)

It might be noted that both groups recommend a fifth year for the ultimate preparation. Also, a major containing earth science courses was a basic requirement.

Recommendations of Individuals

Victor J. Mayer (6) made a study in attempting to draw various recommendations. His study of academic program instructional methods, professional science education requirements, staffing of program equipment and facilities, and other characteristics could benefit an earth science

teacher preparation. A. A. Kline (5) stresses the desire of the teacher as primary for success. Schappell and Mayer (10) felt a minimum of 30 credit hours in earth science were needed to be adequately prepared. They also recommended the use of in-service institutes in furthering the quality of teaching.

Currently in Kansas a re-evaluation of teacher certification is taking place in the field of earth science. Dr. Tom Bridge, Associate Professor of Geology at Kansas State Teachers College of Emporia, has recommended that the minimum requirement for certification in Kansas for earth science teachers be changed from six semester hours in earth science and twenty-four semester hours in the science field to fifteen semester hours in earth science and thirty-two semester hours in the science field.

Related Studies

A study done by ESCP (11), Earth Science Curriculum Project, on the university training programs indicated a national average of 48.6 semester hours in science and mathematics were needed to be certified as an earth science teacher. Mayer (7) compiled questionnaire results of 397 responding institutes of higher learning offering or planning to offer preservice preparation of secondary-school earth science teachers with the following averages for earth science teacher preparation program:

Courses in the Earth Sciences

26 Semester Hours

Astronomy	3 hours
Physical geology	4 hours
Historical geology	4 hours
Meteorology	3 hours
Physical geography	3 hours
Minerology	3 hours
Paleontology	3 hours
Geomorphology	3 hours

Supporting Sciences

2.5 years

Chemistry	1 year
Physics	1 year
Biology	1 semester

Mathematics through trigonometry. (Mayer, 7:279)

A national study by Merrill and Shrum (9:24) on 2500 earth science teachers, indicated only 11% majored in one of the earth sciences, and only 55% majored in a science. Shae in his study in 1966 of 2,480 teachers of earth science found these observations:

Less than a third of the teachers have sufficient credits for a typical major (20 semester credits) in any of the earth sciences....

The newness of earth science in most school systems and to most teachers is shown by the fact that 75% of the schools had been offering it for less than five years and 90% of the teachers had been teaching it for less than five years....

Fifty-five percent of the current active science teachers received their bachelor's degrees from schools with enrollments of less than 2,500 and 80% from institutes with less than 10,000 students. Using these facts as guides, it seems likely that the schools which train most of the earth science teachers in the future do not currently have departments in all of the earth sciences and will probably not have them in the future. (Shae, 11:9-12)

These studies tend to show good earth science teacher preparation recommendations, but institutions that prepare teachers are unable generally

to carry out these recommendations. They also show the tremendous need for recruiting, training, and retaining of earth science teachers.

CHAPTER III

METHODS AND MATERIALS

The sample for this study was based on all Kansas earth science teachers as recorded from the 1970-71 High School Principals Organizational Reports on file at the State Department of Education in Topeka, Kansas. These reports are mandatory and in part used for the purpose of calculating the states financial aid to schools. The Curriculum Section of the State Department of Education provided the names of school districts teaching earth science, names of earth science teachers, years of experience, number of periods taught, and class enrollment. The Curriculum Section information was compiled and printed out in a work order bulletin number 138174 of the Curriculum Section. The Kansas Educational Directory 1970-71, Bulletin 340 listed school districts, school district enrollment, and total number of teachers in each school district. The transcripts of all earth science teachers of the 1970-71 school year were examined in the Certification Section of the State Department of Education for academic preparation with the total science hours, total hours in each of the major sciences, total hours in earth science, and hours of the various earth science areas being recorded. At the time of transcript examination, quarter hours were converted to semester hours. The 1970-71 school year was used to allow time enough for transcripts to be sent to the Certification and Records Section of the State Department of Education.

The variables considered were the number and size of school districts offering an earth science course; the number of earth science

teachers in Kansas schools 1970-71; the number of credit hours in science and earth science attained by earth science teachers; the years of experience of the earth science teachers; the number of earth science students; the class size; and the relationship between these factors.

Materials

The following relationships can be found by a comparison of the information presented in tables I and II.

In Kansas during the 1970-71 school year 43.5% of the school districts offered at least one class in earth science.

The average enrollment of all school districts in Kansas was 1,637.1 students while the average enrollment of those schools offering earth science was 2,058.0 students. Schools not offering earth science averaged 1,312.7 students. The school districts offering earth science averaged 745.3 students more than those schools not offering earth science.

There was 0.7% of the classroom teachers in Kansas assigned to teach at least one earth science class during the 1970-71 school year.

Only 17.8% or 39 of the 219 earth science teachers could be classified as being full time earth science teachers. (Teach four or more classes of earth science.)

Only 219 of the approximate 1,350 science teachers or 16% taught earth science.

The average number of earth science classes taught by an earth science teacher was 2.1 classes/teacher.

The average class size of earth science classes was 22.3 students/class period.

Information with relation to table III.

All earth science teachers 1970-71 have academic

preparation in some area of science. The average academic preparation being 64.0 semester hours in science.

All earth science teachers 1970-71 except one have had academic preparation in the biological science area. The average academic preparation in the biological science area of the earth science teachers was 24.9 semester hours.

There were 199 of the 219 earth science teachers 1970-71 that had academic preparation in the chemical science area. The mean academic preparation in chemistry of the earth science teachers was 16.5 semester hours.

Of the 219 earth science teachers 1970-71 213 had some academic preparation in the physical science area in which earth science is classified. The mean academic preparation in the physical science area for the earth science teachers was 23.0 semester hours.

Thirty-eight earth science teachers had no preparation in earth sciences.

Information with relation to table IV.

A total of 181 out of 219 earth science teachers had some academic preparation in earth science. 17.4% had no academic preparation in earth science courses of any type.

A total of 105 teachers or 47% of the 219 earth science teachers have completed a course in general geology.

About one-third or 75 out of 219 earth science teachers have completed a physical geology course.

General geology and physical geology are the only academic courses that have been completed by 20% of the earth science teachers.

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH DIAGRAMS
THAT ARE CROOKED
COMPARED TO THE
REST OF THE
INFORMATION ON
THE PAGE.**

**THIS IS AS
RECEIVED FROM
CUSTOMER.**

MATERIALS

TABLE I

CLASSROOM TEACHERS AND EARTH SCIENCE TEACHERS	
Total classroom teachers in Kansas--1970-71*	30,171
Total number of science teachers***	1,350
Total earth science teachers**	219
Total number of earth science classes**	472
Total number of full time earth science teachers**	39

* (21)
 ** (22)
 *** (23)

TABLE II

SCHOOL DISTRICT AND ENROLLMENT INFORMATION	
Number of school districts in Kansas*	315
Number of school districts offering earth science**	137
Enrollment of school districts in Kansas*	515,595
Enrollment of schools offering earth science*	281,942
Enrollment of earth science students**	10,261

* (21)
 ** (22)

TABLE III

ACADEMIC PREPARATION OF EARTH SCIENCE TEACHERS 1970-71				
Academic Area of Study	Total Number of Semester Hours	Number of Teachers With No Hours	Mean Hrs.	Median Hrs.
Science	14,021	0	64.0	61.0
Biology	5,447	1	24.9	
Chemistry	3,614	20	16.5	
Physical Science	5,038	6	23.0	
Earth Science	2,558	38	11.7	9.0

ILLEGIBLE DOCUMENT

**THE FOLLOWING
DOCUMENT(S) IS OF
POOR LEGIBILITY IN
THE ORIGINAL**

**THIS IS THE BEST
COPY AVAILABLE**

TABLE IV

ACADEMIC PREPARATION IN SCIENCE AREAS OF EARTH SCIENCE TEACHERS 1970-71		
Number of Teachers	Description of Academic Preparation	Total Hours Attained
219	Science hours of some type	14,021
218	Biological hours of some type	5,447
199	Chemical science hours of some type	3,614
213	Physical science hours of some type	5,038

TABLE V

ACADEMIC PREPARATION IN EARTH SCIENCE COURSES OF EARTH SCIENCE TEACHERS 1970-71		
Number of Teachers	Description of Academic Preparation	Total Hours Attained
181	Earth science hours of some type	2,558
105	General Geology	553
75	Physical Geology	374
70	Related earth science course (Methods, topics, petro., engr., etc.)	554
39	Earth science institute or workshop	287
38	Astronomy	120
37	Historical geology	141
27	Meteorology	92
26	Space science	89
22	Field geology	95
21	Mineralogy	86
20	Geomorphology	73
13	Paleontology, Invert, or Vert. geology	59
8	Stratigraphy	35
7	Oceanography	25

Information for Table IV and V was compiled from transcript examination in the Records Section of the State Department of Education.

Figure 1 shows that most earth science teachers have adequate academic preparation in science. The mean science preparation being 64.0 semester hours and a median of 61.0 semester hours for the 219 earth science teachers. Only three teachers had 20 or less science hours credit.

Figure 2 shows that training in earth science courses is lacking by most earth science teachers.

Figure 3 shows a fairly equal distribution of earth science teachers in large and small school districts. This ratio does not hold true for the number of students being taught as the teachers in larger school districts teach more students per class and have more classes to teach.

Figure 4 indicates most earth science teachers are relatively new to the teaching profession with the median being 5 years of experience in teaching.

Figure 1 Academic Preparation of
Earth Science Teachers

1970-71

Science Hours

Mean 64.0 hrs.
Median 61.0 hrs.

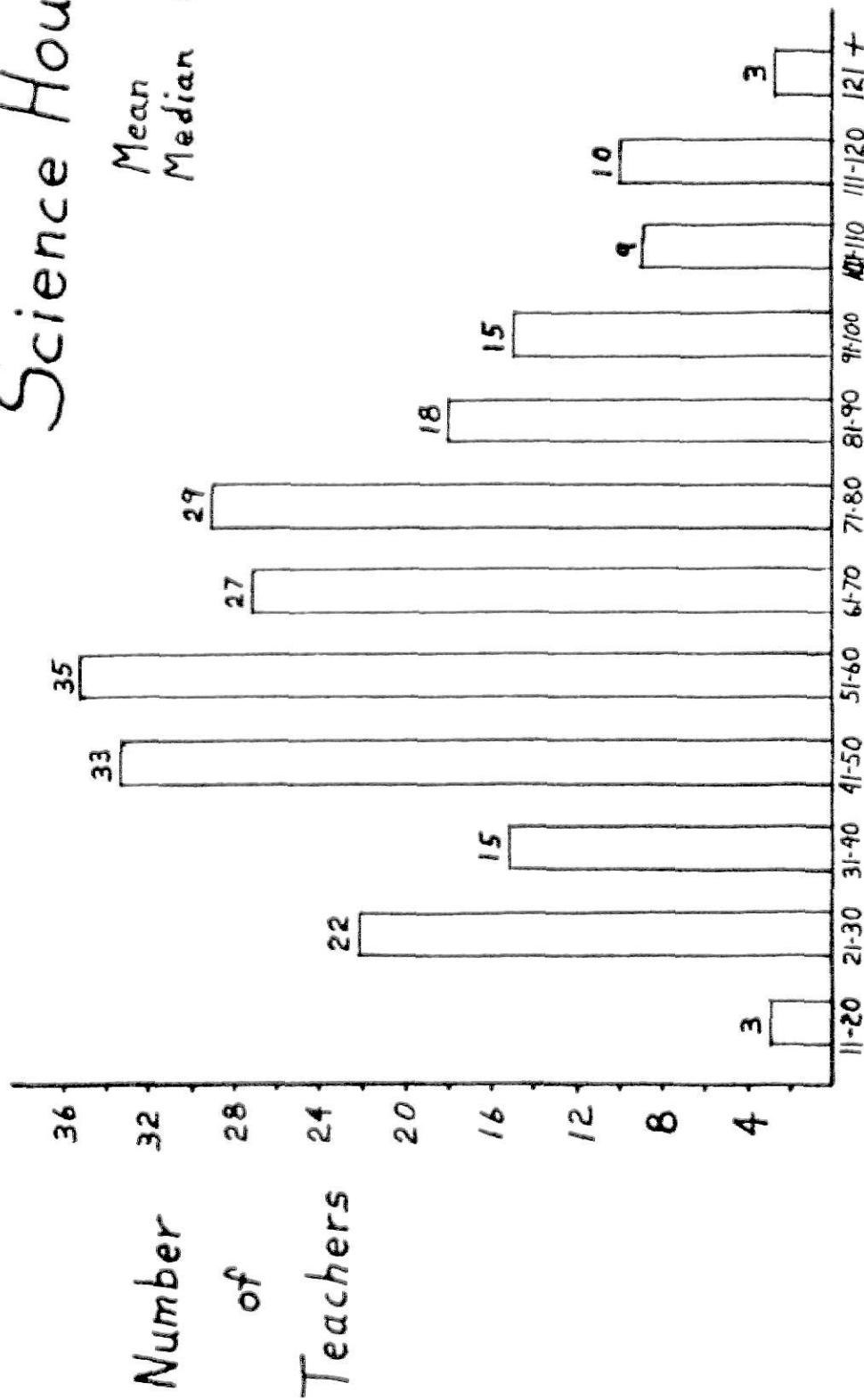
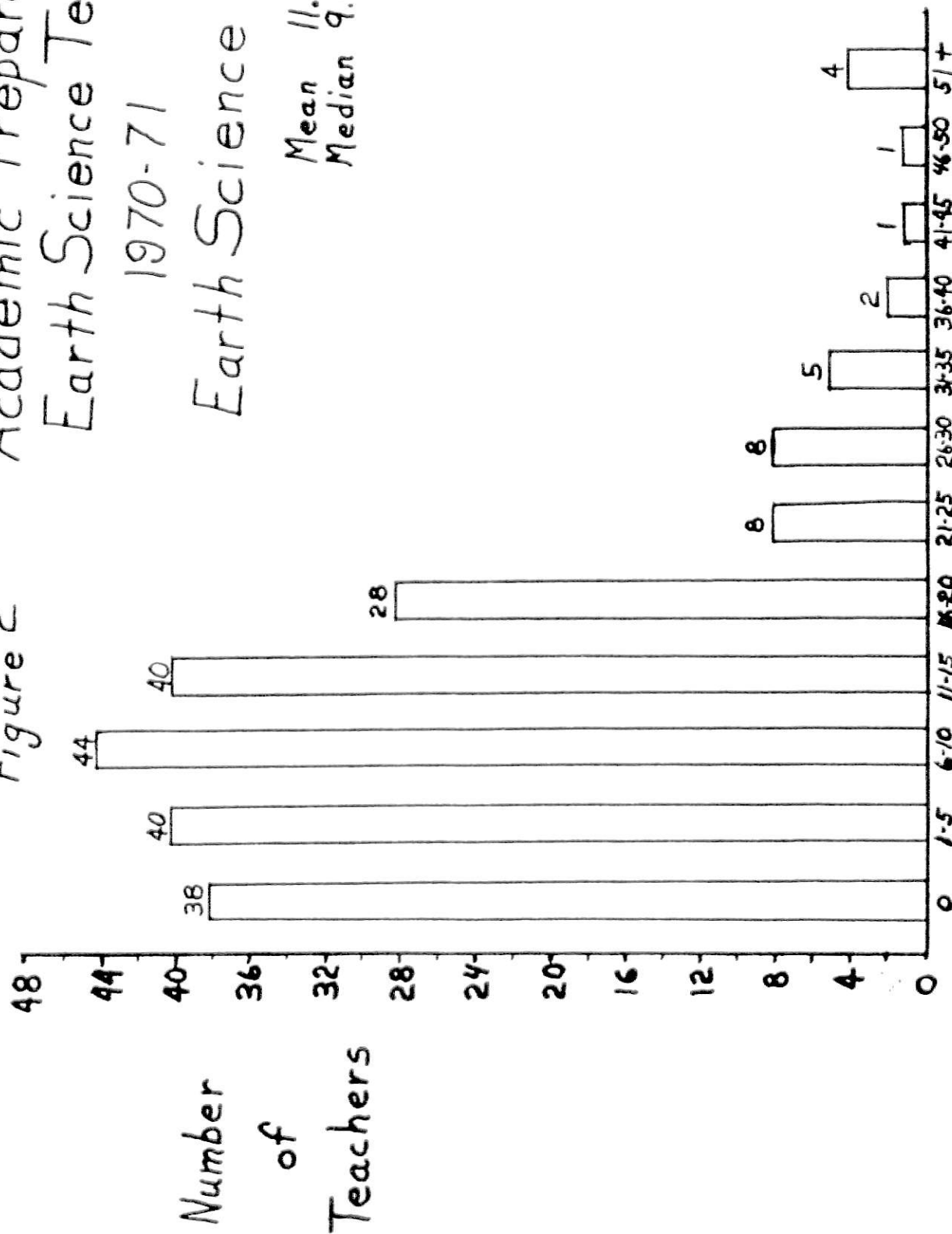


Figure 2 Academic Preparation of Earth Science Teachers

1970-71

Earth Science Hours

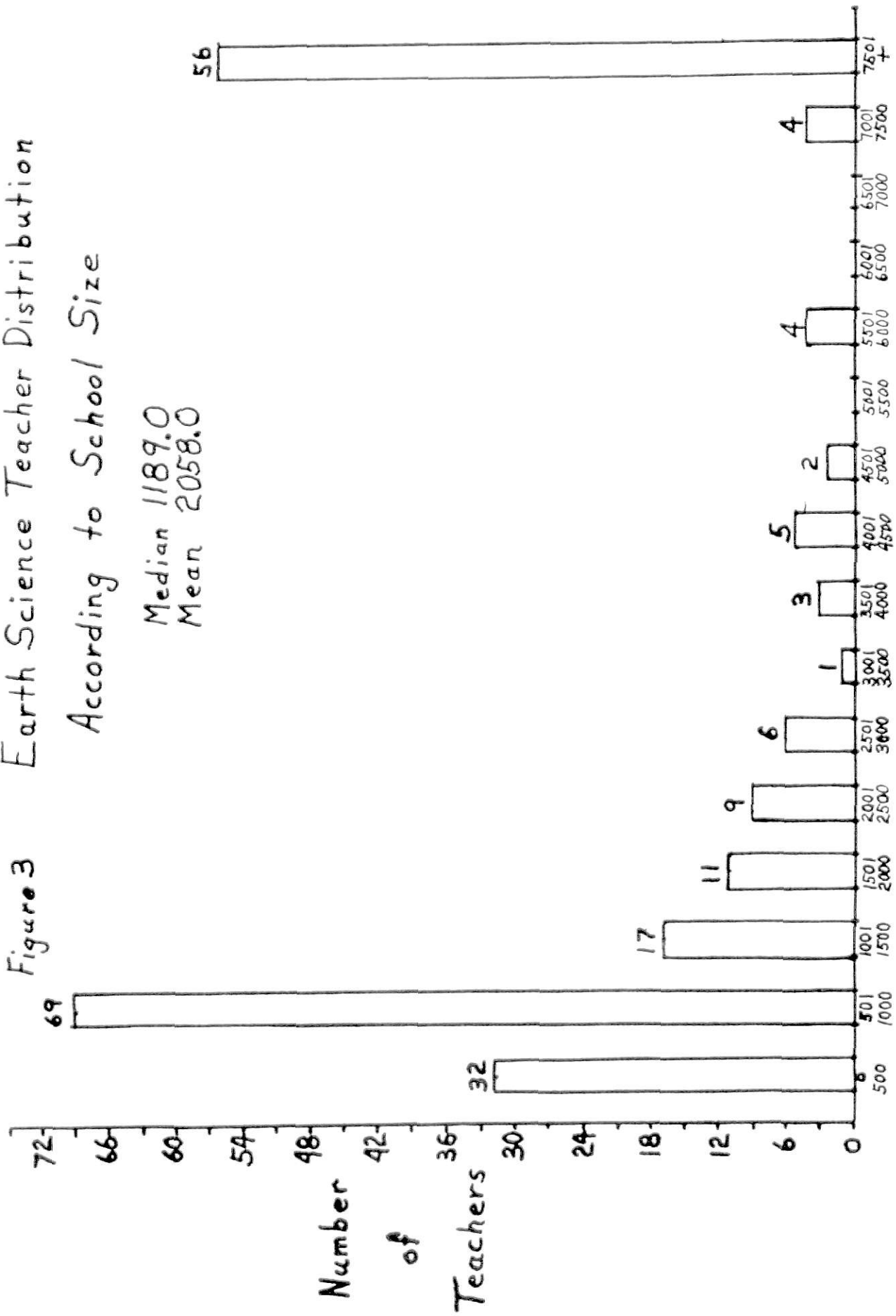
Mean 11.7 hrs.
Median 9.0 hrs.



Hours in Earth Sciences

Figure 3 Earth Science Teacher Distribution
According to School Size

Median 1189.0
Mean 2058.0



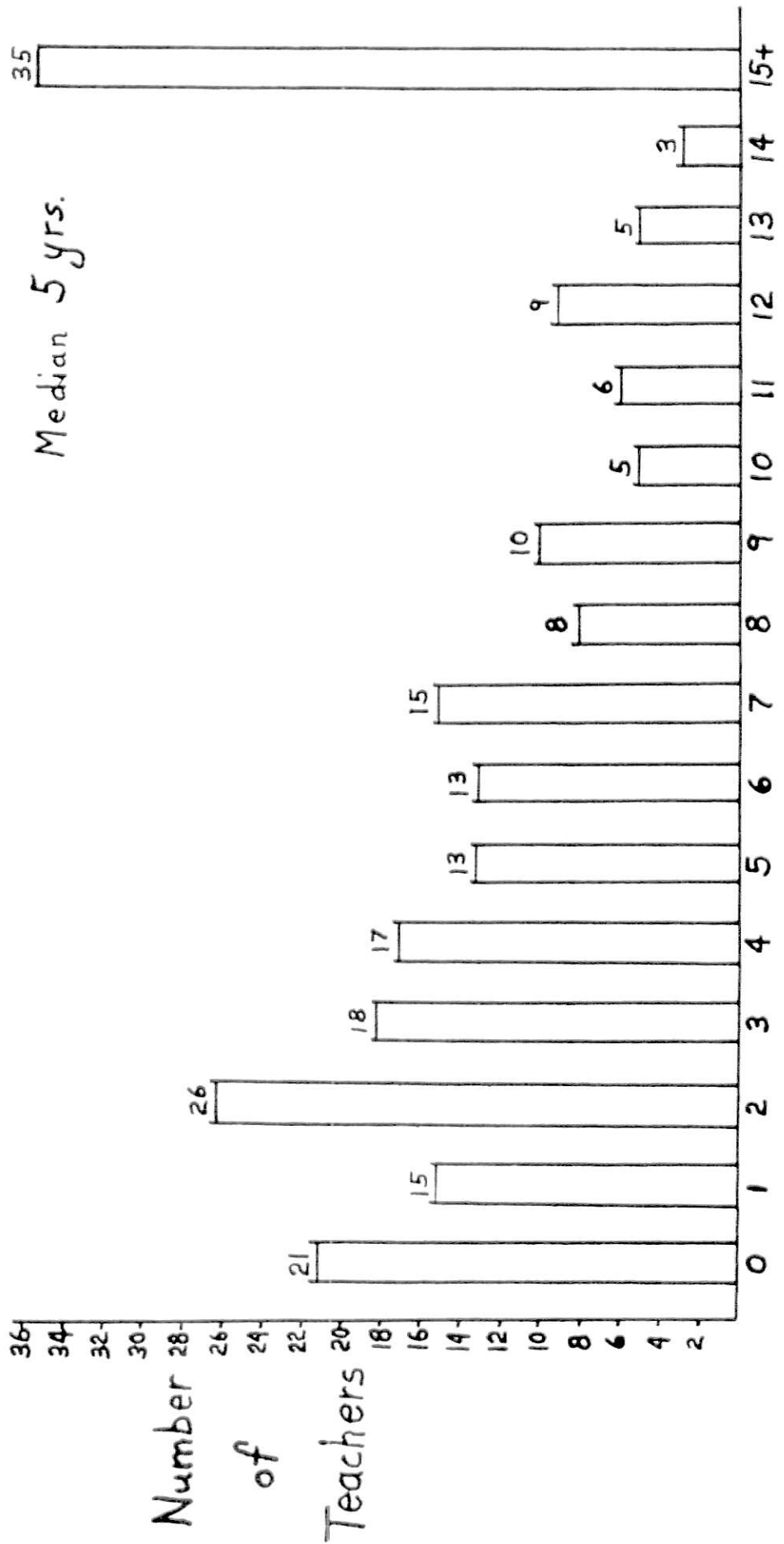
School District Enrollment K-12

Figure 4

Years Experience of Earth Science Teachers

1970-71

Median 5 yrs.



Years of Experience Teaching
 $\frac{1}{2}$ year rounded up

CHAPTER IV

SUMMARY

Conclusions

A total of 38 teachers or 17.4% of the earth science teachers in Kansas 1970-71 had no earth science semester hours of preparation. These teachers have no specific training in teaching earth science and it can be concluded are very inadequately trained to teach earth science.

Seventy-eight earth science teachers or 35.6% have five or less academic hours in earth science preparation. The requirement for certification in Kansas, which is felt to be a minimum preparation, is six hours of earth science. These teachers are not recognized by the State Department of Education as being adequately prepared.

If the recommendation of Dr. Tom Bridge of Kansas State Teachers College, Emporia of 15 semester hours in earth science is used, 115 of the 219 earth science teachers were not adequately prepared to teach earth science. This would include 53% of the teachers teaching earth science in 1970-71.

This study agrees with the study made by Shae. (11) Less than one in four earth science teachers in Kansas have more than a typical teaching major of 20 or more hours in earth science. There was only thirty-two or 14.6% of the earth science teachers with twenty or more semester hours in earth sciences.

If the recommendation of Schappell and Mayer (10) of having thirty semester hours preparation is used only 15 or 6.8% of the earth science teachers would meet standards for proper academic training.

Most of the earth science teachers in Kansas are adequately prepared in the related science areas. Only nine of the 219 earth science teachers had less than twenty-four semester hours in science. The teachers of Kansas have a mean of 64.0 hours in science preparation.

There is no single area of the earth sciences mentioned in table V that more than half of the earth science teachers have had academic preparation. General geology comes the closest with 47% of the earth science teachers having credit in general geology. This lack of continuity of preparation can also be shown by the mean of 11.7 hours of earth science. The median was only 9.0 hours. Most of the better academically prepared teachers are found in larger school districts. Seventy-six percent of those teachers with 24 or more semester hours of earth science are found in school districts larger than the state average.

It can be concluded that most earth science teachers will teach earth science on a part time bases. Only 17.8% of the earth science teachers taught four or more earth science classes.

Almost half, 43.5%, of the school districts offered a course in earth science. Those schools offering earth science had an average enrollment of 745.3 students more than those not offering earth science.

Those schools offering earth science that have above average enrollment will have better prepared teachers. This is in agreement with the study made by Walker. (19) Of those schools with an enrollment of over 2,000 only 24.4% of the teachers have less than six credit hours of earth science. This compares to an over-all percent of 35.6% of all earth science teachers.

The average earth science class is relatively small with an

average of 22.3 students per class.

One-half of the earth science teachers have five or less years experience teaching.

Only 219 of the approximate 1,350 science teachers were involved with teaching earth science.

Recommendations

It is the recommendation of the author that:

- (1) A recruitment program be initiated to insure that pre-service teachers to undertake careers in earth science. A recruitment program would help to insure that well-qualified and interested personnel will be available to fill the need.
- (2) The present earth-science-teacher-training programs in those institutes of higher learning be evaluated and updated to provide adequate earth science teacher training.
- (3) Cooperation between institutions of higher learning that can and cannot provide facilities and instruction in all or some phases of earth science should be increased. Student transfer and/or professor exchange could strengthen teacher preparation.
- (4) Programs be planned and implemented to assist inadequately prepared teachers faced with assignments to teach earth science.
- (5) The qualifications to teach earth science be raised to equal qualifications to teach other basic science courses.

Possible uses of this report

This report identifies areas of weakness in the academic

preparation of our present earth science teachers. This is an indication of where institutions of higher education could emphasize pre-service and in-service training. For some colleges and universities it may mean the evaluation and addition of education courses. This also shows the courses needed by present teachers of earth science and the graduating teacher majoring in earth sciences do not need the same workshop or in-service training courses.

This report indicates the need for certification requirements to be changed and give some recommendations that could be used.

This report can be useful in the future to follow the trend of earth science education in Kansas secondary schools.

REFERENCES CITED

Periodicals

1. Casey, J. E., "Federal \$ \$ Catalyze Science," American School Board Journal, 151:19-20, July 1965.
2. Hubbard, T. N., "Earth Science Now In Orbit," American School Board Journal, 151:26-27, July 1965.
3. Hurd, Paul De H., "Science Teachers for the New Era in Science," California Journal of Secondary Educators, 33:486-501, December 1958.
4. Kansas State Board of Education, Certificate Handbook, State Board of Education, Topeka, Kansas, January 1, 1970.
5. Kline, Arlyn A., "ESCP--Is It the Program for You?", Minnesota Journal of Education, Feb. 1968, 18-19.
6. Mayer, Victor J., "Criterion Model of an Earth Science Teacher Preparation Program," Science Education, 51:290-292, April 1967.
7. _____, "Science Requirements in Earth Science Teacher Preparation Programs," Journal of Research in Science Teaching, 5:276-281, (1967-1968).
8. Merrill, William M., "Recommendations: Academic Preparation of Secondary School Earth Science Teachers," Journal of Geological Education, Vol. XIV, No. 1, Feb. 1966, 29-32.
9. Merrill, William M., and Shrum, John W., "Planning for Earth Science Teacher Preparation," Journal of Geological Research XIV, Feb. 1966, 23-25.
10. Schappell, Dean L., and Mayer, Victor J., "The Growth of Earth Science," The Ohio School Board Journal, 12:8-11, August 1968.
11. Shae, James H., "Highlights of 1965 ESCP Survey of Earth Science Teachers," Journal of Geological Education XIV, Feb. 1966, 9-12.
12. Shrum, John W., "Recommendations for a Basic Academic Preparation for Earth Science Teachers," Journal of Geological Education, Vol. XIV, No. 1, Feb. 1966, 26-28.
13. Skinner, Ray, Jr., "Earth Science in Ohio's Secondary Schools," The Ohio Journal of Science, 67:113-120, March 1967.

14. "Ohio Earth Science Teaching," Earth Science Curriculum Project Newsletter, 19:8-9, May 1969.

15. Weitz, J. L., "Earth Science Education," Earth Science Curriculum Project Newsletter, No. 19, May 1969, 1-3.

Unpublished Reports

16. Rolfs, Ronald Dale, "The Academic and Professional Preparation of the Beginning High School Biology Teachers in Kansas," (K. S. U. Master's Report, 1964).

17. Rundus, Timothy Amos, "A Study of the Academic and Professional Preparation of the First Year Secondary School Physics Teachers in Kansas," (K. S. U. Master's Report, 1966).

18. Smith, James Alfred, "Academic Preparation of Kansas High School Teachers in Science, Social Studies, and Physical Education for the School Year 1960-61," (K. S. U. Master's Report, 1962).

19. Walker, Randol Rex, "A Study of Academic Preparation of Biology and General Science Teachers in Relation to School Size in Kansas, 1963-64," (K. S. U. Master's Report, 1964).

20. Watkins, Marilyn J., "Academic Preparation in Science of Chemistry Teachers in the Kansas High Schools, 1962-63," (K. S. U. Master's Report, 1963).

Bulletins

21. Kansas Educational Directory 1970-71, Kansas State Department of Education, Bulletin 340.

22. Teaching Assignment of Earth Science Teachers 1970-71, Kansas State Department of Education, Curriculum Section Bulletin 138174.

23. Science Directory for Kansas Schools 1970-71, Kansas State Department of Education, Topeka, Kansas.

A STUDY OF THE STATUS
OF EARTH SCIENCE
AND
EARTH SCIENCE TEACHERS
IN KANSAS SECONDARY SCHOOLS
1970-71

by

RICHARD ORLINN SMITH

B. A., Kansas Wesleyan University, 1961

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1973

Science education has changed rapidly in the past decade. Part of the broad change involves the addition of earth science to many secondary schools. A study was made of the earth sciences with relation to schools, teachers, teacher preparation, and students in Kansas secondary schools. Information on these factors were gathered from publications and the examination of records at the Kansas State Department of Education.

Studies have been made and guides formulated for the academic preparation of teachers of earth science. Most of these tend to overlook the limitations of time, money, and facilities of many of our colleges and universities.

Earth science teachers in Kansas seem to be better prepared to teach any of the basic sciences, physics, chemistry, or biology, than to teach earth science. They did have a good background in the science field and could be classed as part-time earth science teachers. The better academically prepared earth science teachers were found in the larger schools and taught larger and more classes. The average earth science class had about 22 students. Earth science teachers are relatively new to the teaching profession with five years experience being the median number of years taught.

Earth science classes were being offered by about one-half of the school districts in Kansas. The school district size did not determine whether or not earth science would be offered. The school district size did have a bearing on the number of classes and class size with the larger districts having more and larger classes.

This study was limited to Kansas schools, teachers, and students

and the obtainable records of these during the 1970-71 school year. Another study would be needed to follow the earth science trend in Kansas. If Kansas schools follow the trend of other states, they will increase the number of earth science classes. This will place an increasing burden on institutions of higher education to prepare a larger number and better academically prepared earth science teachers.