AN ABSTRACT OF THE THESIS OF

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Title CHARACTERISTICS OF TEACHERS SUBMITTING APPLICATIONS FOR ACADEMIC YEAR INSTITUTE PROGRAMS AT OREGON STATE UNIVERSITY

Abstract approved [redacted] (Major professor)

This investigation was designed to provide information about applicants to Academic Year Institute Programs at Oregon State University.

The study involved both acceptees and rejectees for the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes. Only acceptees for the 1960-61 year were included. The population for the study included all acceptees and a systematic random selected one-half of the rejectees.

In terms of 35 personal and professional applicant characteristics, a statistical comparison was made between or among: (a) acceptees and rejectees for each year, (b) acceptees for each year, (c) rejectees for each year, and (d) applicants from Oregon, Washington, California, and all other geographical areas.

Characteristics having a numeric continuum were analyzed by the analysis of variance. The chi square formula was utilized to analyze those characteristics not having a numeric continuum.

Applicants from Oregon, Washington, and California were investigated to determine the number that met their respective state certification requirements in terms of subject matter preparation in areas of science and mathematics.

Using recommendations of the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science as a guideline, the academic background of all applicants, grouped by major, was analyzed to determine the nature and amount of science and mathematics academic preparation.

The following conclusions were drawn from the data analyzed in this investigation:

1. Acceptees and rejectees during 1957-58 were significantly different with respect to periods taught per week in minor. During 1958-59 significant differences existed between acceptees and rejectees on the basis of teaching residence; undergraduate science grade point average; undergraduate science credits; and membership in the National Science Teachers Association, state educational, national educational, and national science organizations. Significant differences between acceptees and rejectees during 1959-60 were evident

on the basis of teaching residence and years since receiving last degree. Acceptees and rejectees during 1961-62 were significantly different on the basis of teaching residence, experience, subject matter major, and credits in undergraduate science. For 1962-63, acceptees and rejectees were significantly different with respect to undergraduate science grade point average, membership in state and national science organizations, and membership in the National Science Teachers Association.

2. Significant differences among acceptee groups was noted with respect to number of summer institutes attended and the reading of general science journals.

3. Rejectee groups were significantly different on the basis of age; summer institutes attended; years since receiving last degree; credits in graduate science; membership in national mathematics organizations; and reading of general science and education journals.

4. Applicants from Washington, Oregon, California, and other geographical areas were significantly different with respect to age; summer institutes attended; credits in biology; undergraduate and graduate science credits; undergraduate science grade point average; marital status; membership in national education and state mathematics organizations; and reading of education journals.

5. Applicants from Washington, Oregon, and California met their respective state certification requirements in terms of

academic preparation in science and/or mathematics.

6. In terms of AAAS recommendations, many applicants are lacking in depth and breadth of preparation in science and mathematics.

CHARACTERISTICS OF TEACHERS SUBMITTING APPLICATIONS FOR ACADEMIC YEAR INSTITUTE PROGRAMS AT OREGON STATE UNIVERSITY

by

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TABLE OF CONTENTS

LIST OF TABLES

CHARACTERISTICS OF TEACHERS SUBMITTING APPLICATIONS FOR ACADEMIC YEAR INSTITUTE PROGRAMS OREGON STATE UNIVERSITY

CHAPTER I

INTRODUCTION

Since World War II, the impact of rapid developments in science and technology has resulted in a great deal of public attention being directed toward science education and, as a result, upon the teachers of science and mathematics. There has developed an awareness of the need for qualified teachers who are adept at preparing their students to assume a useful role in a science-orientated society. Along with being skilled in the presentation of materials, science and mathematics teachers must have a strong background in their teaching field.

Not only is there need for a beginning teacher in science and mathematics to be well prepared, but there exists the problem of maintaining a level of competency among experienced teachers. Science and mathematics teachers need frequent opportunities to obtain supplemental training in order to keep abreast of the rapid progress in their teaching fields. This is exemplified by the number of public and private agencies offering programs designed to assist the science and mathematics teachers in maintaining a high level of

competency.

Of the many programs now in existence, those sponsored by the National Science Foundation are undoubtedly the most extensive.

Established in 1950 under Public Law 507, the National Science Foundation was charged with the responsibility (18, p. 69) "... to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences." As a result, the National Science Foundation is involved in a number of programs designed to improve education in the areas of science and mathematics.

One of the educational programs sponsored by the National Science Foundation is the supplemental training of science and mathematics teachers. The training of these teachers has been supported in three ways: (a) individual fellowships, (b) research participation in scientific laboratories, and (c) institutes.

The institute programs are of three general types: (a) inservice institutes, where teachers attend classes in the evenings or on Saturdays, (b) summer institutes, where teachers attend summer sessions at colleges or universities on a full-time basis, and (c) academic year institutes, where teachers are engaged in full-time study for an entire school year and, in many cases, a related summer session.

The nature of the institutes is primarily determined by the college or university administering it, with the financial assistance

coming from the National Science Foundation. The general objective of institute programs is (14, p. 9) to enable teachers to obtain additional instruction in their subject matter fields and to become acquainted with new developments in science, mathematics, and engineering.

Beginning in 1956-57 with two programs, the Academic Year Institute has expanded to include 58 institutes during 1963-64. Initially, the participants were experienced secondary school teachers. However, structural changes during the years have resulted in the 1963-64 programs being attended by (19, p. 1) experienced secondary school teachers, experienced college teachers, science supervisors, and pre-service certified teachers in science and mathematics.

Academic Year Institutes have been conducted at Oregon State University each year since 1957-58. Over 3000 teachers completed and submitted application materials for the first six programs. This study is concerned with the applicants to these six Academic Year Institutes at Oregon State University.

The Problem

Statement of the Problem

The purpose of this study was to:

1. Isolate some of the characteristics of applicants to Academic Year Institute programs at Oregon State

University, and using these characteristics as a basis for comparison, determine any differences that may exist between or among selected groups.

2. Determine to what extent the applicants from Washington, Oregon, and California met their respective state certification requirements.

3. Determine the nature and amount of subject matter preparation of the applicants.

The first of the above stated problems was divided into four subproblems for specific analysis. In order to test these problems, the following null hypotheses were proposed:

1. In terms of the selected characteristics, there is no difference between the acceptees and rejectees for each of the years included in this study.

2. In terms of the selected characteristics, there is no difference among the acceptees of any one year and the acceptees of any other year included in this study.

3. In terms of the selected characteristics, there is no difference among the rejectees of any one year and the rejectees of any other year included in this study.

4. In terms of the selected characteristics, there is no difference among the applicants from Washington, Oregon, California, and all other geographical areas.

Importance of the Study

There has been an awareness for many years of the need for continued growth, both professionally and academically, of the men and women who are presently teaching science and mathematics in our nation's secondary schools. Within recent years, rapid developments in the sciences have intensified the concern for better

preparation of these teachers. During the past few years, millions of dollars from both private and public funds have been spent to improve the competency of science and mathematics teachers. The National Science Foundation and private agencies have sponsored programs designed to improve the effectiveness of science and mathematics teachers.

In a study completed in late 1962, Orr and Young (20, p. 40) reported that "...of an estimated total of 169,000 mathematics/science teachers in the nation, some 32 per cent had applied for and/or attended National Science Foundation Teacher-Training Programs."

Also, there are many teachers who have attended programs sponsored by agencies other than the National Science Foundation. However, there does exist a sizable portion of experienced science and mathematics teachers who have had no recent training. The demands being made upon these teachers will necessitate the continuation of various programs that will provide opportunities for increasing numbers of them to receive training which will contribute to their effectiveness in the classroom.

Because of the rapid developments in science education, teachers who have already attended these programs will soon be in need of more re-education. Furthermore, the pre-service training of science and mathematics teachers will need to undergo continual

appraisal and readjustment.

Brown and Obourn (4, p. vii) have pointed out that:

> The programs planned and utilized by colleges for this broad endeavor have been carried out largely without exact information about the nature of the background preparation of men and women who are now teaching science and mathematics. There can be little doubt that these undertakings have been worthwhile and that they have served to improve the background preparation of many of these teachers. It is equally true that the programs would have benefited had data been available on the actual shortcomings in that preparation.

This study is therefore designed to provide information about applicants to Academic Year Institute Programs at Oregon State University which will (a) be of value in the planning of future Academic Year Institutes or programs of a similar nature, (b) assist in the redesigning of pre-service programs, and (c) provide background information about the individuals who have expressed a desire to improve their effectiveness as classroom teachers.

Definition of Terms

The following terms are used throughout this study and their meanings are restricted as follows:

Major. As a result of reviewing a number of college and university requirements for a subject matter major, the investigator of this study has arbitrarily established that a subject matter major shall consist of a minimum of 30 semester hours in any one of the

following areas: biology, chemistry, physics, mathematics, or general science. A general science major consists of at least ten semester hours in each of biological and physical sciences, with the combined total exceeding or meeting the minimum 30 semester hours. A biology major consists of at least ten semester hours in each of botany and zoology, with the combined total exceeding or meeting the 30 semester hour minimum.

Minor. As in the case of the major, the investigator has arbitrarily defined a minor as a minimum of ten semester hours in any one of the following areas: biology, chemistry, physics, mathematics, and general science. A general science minor consists of preparation in both the physical and biological sciences, with the combined total exceeding or meeting the ten semester hour minimum. A biology minor consists of a minimum of one course in each of botany and zoology, with the combined total exceeding or meeting the ten semester hour minimum.

Summer Institute. Educational programs conducted during summer sessions at colleges or universities for science and/or mathematics teachers and whose participants received financial remuneration from the National Science Foundation.

Acceptees. Those individuals who applied and became an active participant in the Academic Year Institute at Oregon State University.

Rejectees. Those individuals who applied and did not become an active participant in the Academic Year Institute at Oregon State University.

Applicant. Any individual who submitted an official application form to attend an Academic Year Institute at Oregon State University.

Dependent. Those individuals listed on the applicant's official application form as dependents. Unborn children, even though birth was expected prior to the beginning of the Academic Year Institute, were excluded.

Married. Those individuals classifying themselves as being married or married and living separately.

Single. Those individuals classifying themselves as being single or divorced.

Educational Organization. A professional organization designed to serve educators in general.

Mathematics Organization. A professional organization designed to serve individuals who are associated with the teaching of mathematics.

Science Organization. A professional organization having a design which would be of value to individuals who are associated with the teaching of science.

Education Journal. A journal containing material which is primarily orientated to educators in general.

Special Science Journal. A journal containing material which is directed toward one specific area of science or mathematics.

General Science Journal. A journal which does not restrict its material to any one discipline of science. Also, those journals having content directed primarily toward science education.

Grade-point. For purposes of computing grade-point averages, the following scale was used: A = 4, B = 3, C = 2, D = 1.

Basic Assumptions

This study is based upon the assumptions that:

1. The information recorded by the applicants on the official National Science Foundation Academic Year Institute application form was accurate.

2. A representative sample of the rejectees was obtained by placing the application forms of all rejectees, by year, in alphabetical order and selecting every other one for use in the study.

3. It is possible, by using course title, to determine the nature of the applicant's subject matter preparation.

Delimitation of the Problem

The problems in this study have been delimited as follows:

1. The study was limited to include only those applicants whose completed application form was on file in the Department of Science Education at Oregon State University for the years 1957-58 to 1962-63 inclusive.

2. The problem was further limited to include only the acceptees for the 1960-61 Academic Year Institute.

3. The characteristics of applicants were limited to include the following: sex; marital status; teaching residence; subject matter major; membership in state and national educational organizations; membership in state and national mathematics organizations; membership in state and national science organizations; membership in the National Science Teachers Association; reading of educational, scientific, and general science journals; age; number of summer institutes attended; years of teaching experience; periods taught per week in major; periods taught per week in minor; periods taught per week outside major and minor; years since receiving last degree; semester credits earned in biology, chemistry, physics, earth science, and mathematics; semester credits earned in undergraduate science and mathematics; semester credits earned in graduate science and mathematics; science and mathematics undergraduate grade point average; and science and mathematics graduate grade point average.

CHAPTER II

REVIEW OF THE LITERATURE

Interest in and concern for the establishment of an educational system that will provide our youth with an adequate background in science and mathematics has focused a great deal of attention upon the improvement of science and mathematics teaching. However, relatively few studies have been conducted to determine the characteristics of these teachers. This is especially true of those teachers applying for and participating in the National Science Foundation Institutes.

A survey of the literature was made to (a) determine the need for this study, (b) determine the information that existed on the topic, and (c) examine the methods of research employed in similar studies.

The present chapter presents a review of the research concerned with characteristics of:

1. Science and mathematics teachers in various geographical areas throughout the United States.
2. Applicants and participants in National Science Foundation Institutes.

Science and Mathematics Teachers in General

During the 1960-61 school year, the American Association for the Advancement of Science and the National Association of State

Directors of Teacher Education and Certification (2, p. 1-32) conducted a national survey of 3012 randomly selected teachers of secondary school science and mathematics. Their report pointed out that if 18 semester hours were considered as a minimum in subject matter preparation, then 21 percent of the biology classes, 23 percent of the mathematics classes, 34 percent of the chemistry classes, and 65 percent of the physics classes were being taught by inadequately prepared teachers. Of the 58 percent whose highest degree held was the bachelors, 61 percent had ten or more semester credits beyond the degree. Thirty-nine percent of the sample held a master's degree, with 54 percent having ten or more semester credits beyond the degree. Fifty-seven percent of the sample received their baccalaureate degree since 1950. Of the teachers in the sample, 20 percent had attended at least one National Science Foundation Summer Institute.

Brown and Obourn (4, p. 5-28) studied qualifications and teaching loads of 1393 mathematics and science teachers in Maryland, New Jersey, and Virginia. They reported that 32.7 percent of the science and/or mathematics teachers had the master's degree, while fewer than two percent had no degree. Although the mathematics teacher had an average of 23 semester hours in college mathematics, 39 percent had not taken any mathematics as advanced as calculus and seven percent had no college preparation in mathematics. The

science teacher had an average of 47. 4 semester credits of college science, however, 1. 5 percent had no college training in science. The average number of semester credits in education for the science and the mathematics teacher was 29 and 31 respectively.

Pella (21, p. 106-137) analyzed the academic preparation in science and mathematics of teachers who were teaching science in the Wisconsin High Schools during the 1955-56 and 1956-57 school years. Of the 258 teachers of physics studied, 93 percent had some academic preparation in physics. The average number of credits in physics was 13. 5. The range in the number of credits in science earned by the teachers of physics was from 5 to 85, with a mean of 46. 9. The 367 teachers of biology had an average of 20. 5 credits in biology, with all but 2. 2 percent having some academic preparation in biology. The teachers of biology had earned an average of 41. 8 credits in science and had a range in science credits of 5 to 100. Of the 261 teachers of chemistry, 96. 2 percent had some academic preparation in chemistry. The average number of credits in chemistry was 18. 5. The range in the number of credits in science was from 5 to 94, with a mean of 43. 3. All except one of the 407 teachers of general science had some preparation in science, with 92. 4 percent having some preparation in three or more of the science areas. With respect to academic preparation in the various areas of science, 76. 2 percent of the teachers of general science had credit in physics,

87. 7 percent had some chemistry, 86. 2 percent had biology, and 55. 8 percent had preparation in earth science. The range in the number of credits in science was from 0 to 84, with a mean of 38. 5.

As part of a study concerning the academic preparation of high school teachers in Colorado, Romine (22, p. 20) reported that 14 percent of the 296 teachers of mathematics did not meet the minimum 12 semester credits as required by the North Central Association of Colleges and Secondary Schools. The range of college preparation in mathematics for this group of teachers was from 0 to 70 semester hours. Median preparation was in the category of 20 to 24 semester hours.

Romine (22, p. 23-25) further reported that the 266 teachers of science had a range in preparation of eight semester hours to 183 semester hours in science. Median preparation was in the category of 35 to 39 semester hours. Only two percent of the science teachers did not meet the minimum of 12 semester credits in science as required by the North Central Association of Colleges and Secondary Schools. However, slightly over ten percent did not meet the requirement of having at least five semester hours of preparation in the subject in which they were instructing.

In a study of undergraduate preparation of high school chemistry teachers in Alabama, DeLoach and Hall (9, p. 27-28) pointed out that 18 of the 167 teachers studied had no chemistry preparation.

Although 38 of the teachers had what the authors considered to be a well-rounded undergraduate program of general, qualitative and quantitative analysis, organic and physical chemistry.

As part of a study of 1037 teachers of mathematics in the state of Kansas, Burger (5, p. 139-142) reported that 433 of the teachers had completed no calculus, but 838 had completed college algebra and trigonometry. Twenty-one teachers had no mathematics credit, whereas 406 teachers had completed over 24 hours. A baccalaureate degree had been received by 75. 3 percent, while 39. 5 percent had received a master's degree. Sixty percent of the teachers were over 35 years of age.

In a study of 1144 science teachers in the state of Kansas, Brooks and Baker (3, p. 277-280) reported that 53 percent had less than nine years of experience. Forty-nine percent were under the age of 36 and 53 percent of the sample had graduated from college within the past ten years. Chemistry teachers appeared to be the best prepared, with 96 percent having had some college chemistry. Qualitative analysis had been taken by 80 percent of the teachers of chemistry and 56 percent of them had taken organic chemistry. Of the biology teachers, 7. 6 percent had no college training in general biology, botany, or zoology. No background in general biology, botany, or zoology was noted for 17. 7 percent of the general science teachers.

Koelsche (15, p. 134-139) found that of the 476 Ohio science teachers studied, ten percent had more than 16 years experience. The complete sample had a mean of 4.9 years of teaching experience. Of those teachers teaching general science, 98 percent had some credit in science and a median of 36 semester credits. Ninety-nine percent of the biology teachers had some science background with a median of 36 semester credits. Of the physics teachers, 98 percent had some science background, with a median of 47 semester credits. The median number of credits for the chemistry teachers was 48, with only 0.5 percent having no science preparation.

In a similar study of Ohio science teachers, Gardner and Richardson (10, p. 67-70) reported that less than half of the 2,222 science teachers in the 1957-58 school year had desirable academic backgrounds for their teaching area. Of the biology teachers, 42 percent had 30 or more semester hours of academic preparation in biology. In chemistry, 25 percent had 30 or more semester hours in their teaching area. The physics teachers had the poorest preparation, with only 15 percent having 30 or more semester hours. The low level of training in their teaching field did not seem to indicate the level of general educational attainment, since more than 35 percent of the teachers had a master's degree and only 29 of the 2,222 teachers had not earned the equivalent of a baccalaureate degree.

In a study of 1957-58 Idaho mathematics and science teachers,

Shoun (4, p. 34) reported that of the 296 mathematics teachers, 39.5 percent had fewer than 15 semester hours of college mathematics. Whereas 19.4 percent of the 305 science teachers had fewer than 15 semester hours of specialization in college science.

Crawley (4, p. 38), reported in a study of 782 Iowa chemistry and/or physics teachers that 14.9 percent did not have sufficient science training to meet the then current State requirements. The 423 physics teachers had an average of nine semester hours of college physics, with 40 percent having majored in college physics. Of the 175 chemistry teachers studied, 63 percent had majored in college chemistry. Average preparation for all of the chemistry teachers was 12 semester hours in college chemistry. College preparation in chemistry and physics for the 186 teachers who taught both chemistry and physics was 14 and 10 semester hours respectively.

In a study of New Hampshire science and/or mathematics teachers, the State Department of Education (4, p. 2-24) reported that those teachers had a median age of 39 years. Forty-seven percent of the men science and/or mathematics teachers and 34 percent of the women science and/or mathematics teachers, held the master's degree. Ten percent of the physics teachers, 19 percent of the biology teachers, and 34 percent of the chemistry teachers had majored in their respective fields. Eight percent of the physics teachers, 36 percent of the chemistry teachers, and 36 percent of

the biology teachers had fewer than nine semester hours of college training in their respective fields. Approximately the same percentage of teachers had 21 or more semester hours of college training in their teaching areas. The study pointed out that only 21 percent of the mathematics teachers had majored in mathematics, with 14 percent having fewer than nine semester hours of college mathematics and 49 percent having 21 or more semester hours.

Information gathered by the Washington State Department of Education (4, p. 39) revealed that their 1956-57 science teachers had an average of 9. 5 years of teaching experience. The biology teacher had an average of 34. 8 quarter hours in college biology and 30. 9 quarter hours in other college sciences. Teachers of chemistry had an average of 32. 8 quarter hours in college chemistry and 39. 3 quarter hours in other college sciences. Physics teachers had an average of 23. 1 quarter hours in college physics and 43. 9 quarter hours in other college sciences.

Thaw (25, p. 48, 86) conducted a study of 424 Oregon science teachers and reported that 35 percent of the biology teachers, nine percent of the chemistry teachers, 31 percent of the general science teachers, and seven percent of the physics teachers failed to meet the minimum requirements of Oregon certification. Only one teacher in the sample had not received a bachelor's degree, and more than one-third had received a master's degree. More than 80 percent

had completed some work at the graduate level.

In a study of 485 Oregon science teachers, Cummins (8, p.200-212) stated that the typical science teacher in the high schools of Oregon during the 1958-59 school year was a married man in the 25 to 34 year age group and had from four to nine years of teaching experience. All teachers in the sample had earned the baccalaureate degree, while 42 percent had a master's degree. Over 80 percent belonged to the National Education Association and the Oregon Education Association. Approximately one-third were members of the National Science Teachers Association.

As part of a study related to 51 randomly selected biology teachers in the state of Oregon, Howe (13, p. 100-106) reported that 21 teachers in the sample held a master's degree. The median preparation in biology was in the category of 40 to 49 quarter hours, with only five teachers having fewer than 30 quarter hours of biology preparation. Eleven of the teachers had no preparation in chemistry, whereas, 22 teachers had no preparation in physics. However, four had sufficient depth and breadth to fulfill the American Association for the Advancement of Science suggested preparation. With respect to membership in professional organizations, 39 belonged to the National Education Association, 18 to the National Science Teachers Association, eight to the Oregon Science Teachers Association, and 17 to the National Association of Biology Teachers and the American

Institute of Biological Sciences.

Summary

A review of related literature revealed that most investigations of teacher characteristics were concerned primarily with academic preparation. Also, the designs of these studies were varied to the extent that comparisons were difficult to make. However, from the research concerning science and mathematics teacher characteristics, the following general conclusions may be drawn:

1. There is a wide range in the academic preparation of science and mathematics teachers, with some having no preparation in their teaching areas.

2. Many science and mathematics teachers were teaching in areas other than those for which they received training.

3. In terms of college credit, the biology teachers were the best prepared, whereas, the physics and mathematics teachers were the least prepared.

4. Approximately one-third of the science and mathematics teachers had a master's degree.

5. Approximately 50 percent of the science and mathematics teachers had received their baccalaureate degree within the last ten years.

6. The average age of science and mathematics teachers was

approximately 35 years.

7. The average science and mathematics teacher had from five to ten years of teaching experience.

Applicants to National Science Foundation Institutes

The first study concerned with qualifications of applicants to National Science Foundation Institutes was conducted by the Corporation for Economic and Industrial Research (7). This report, prepared for the National Science Foundation, included applicants to all 1957 Summer Institutes and 1957-58 Academic Year Institutes. For purposes of the study, applicants were divided into three groups; (a) those who applied to institutes and were rejected, (b) those who applied to institutes and were accepted, and (c) those who were accepted to institutes but withdrew. Included in this study were the following facts:

1. The average accepted applicant had 17 undergraduate quarter credits in chemistry, 13 in physics, 21 in mathematics, 25 in education, four in earth science, and 21 in biology; all with an average grade of B. The typical applicant who withdrew or was rejected had a few less hours in certain subjects and slightly lower grades.

2. The average accepted applicant had 16 graduate quarter credits in education, four in biology, three in mathematics, one in

physics, one in chemistry, and less than one in earth science; with an average grade of approximately 3. 4. The applicants who withdrew had more hours of credit, whereas, the rejected applicants had fewer hours.

3. The average accepted applicant had 6. 8 years of teaching experience, those who withdrew had 6. 6 years of experience, and the rejected applicant had an average of 6. 1 years.

4. Approximately 15 percent of all applicants belonged to regional organizations devoted to science in general. Of those who withdrew, 1. 2 percent belonged to regional organizations devoted to specific sciences, whereas, 0. 7 percent of the acceptees and rejectees belonged. Membership in regional educational organizations was 64. 6 percent for the rejectees, 68. 1 percent for the acceptees, and 72. 1 percent for those who withdrew. Membership at the national level was approximately the same as the regional level for the classifications for specific science and science in general. The pattern of membership in national educational organizations was 53. 7 percent for the rejectees, 57. 4 percent for the acceptees, and 60. 4 percent for those who withdrew.

5. Educational journals were read by 36. 7 percent of the applicants who withdrew, 40. 5 percent of the acceptees, and 41. 6 percent of the rejectees. Journals classified as being of a general science nature were read by 3. 4 percent of those applicants who

withdrew, 5. 3 percent of the acceptees, and 6. 2 percent of the rejectees. Specific science journals were read by 1. 4 percent of the rejectees, 1. 7 percent of the acceptees, and 1. 9 percent of those who withdrew.

6. With respect to area of interest, relatively little difference was noted between groups. Chemistry and physics were the most popular and earth science the least popular.

In 1961, Science Research Associates (23, p. 119-139) conducted a comprehensive study of the applicants to the summer, academic year, and in-service institute programs sponsored by the National Science Foundation. Representative samples were selected and grouped according to the teaching levels represented in each of the three institute programs. On the basis of applicant characteristics, differences between accepted and rejected groups were tested for significance. Included in the study were the following results:

1. With respect to age, significant differences existed between the accepted and rejected groups in the in-service elementary sample and in the summer institute junior high sample. In both samples the acceptees as a group were older than the rejectees.

2. In the summer institute high school sample, significantly more acceptees than rejectees were not married.

3. Acceptees in the summer institute high school sample had a significantly lower mean number of dependents than did the rejectees.

4. With respect to undergraduate credits in science, mathematics, and education, the rejectees in the summer institute junior high school sample had a significantly higher mean number of credits in mathematics than did the acceptees. Acceptees of the summer institute high school sample had a significantly higher mean number of credits in chemistry and physics than did the rejectees. Acceptees in the summer institute junior college group had a significantly higher mean number of credits in mathematics than did rejectees. Acceptees of the academic year high school group had a significantly higher mean number of credits in physics and mathematics than did the rejectees. However, rejectees of this same group had a significantly higher mean number of credits in biology than did the acceptees.

5. Accepted groups in the summer and academic year institute high school sample had significantly higher undergraduate grade-point average means than the rejected groups. The accepted group for the summer institute junior high sample had significantly higher undergraduate grade-point average means than the rejected group in chemistry, mathematics, and earth science.

6. Acceptees in the academic year college sample had a significantly higher mean number of graduate education credits than did the rejectees. Rejectees in the summer institute college and elementary samples had a significantly higher mean number of graduate

education credits than the acceptees. Accepted groups in the summer institute college and academic year high school samples had significantly higher mean number of graduate credits in mathematics than did the rejectees.

7. In the summer institute junior high sample, acceptees had significantly higher mean graduate grade-point averages in mathematics and education than did the rejectees. Acceptees in the summer institute high school sample had significantly higher mean graduate grade-point averages in biology, physics, chemistry, and mathematics than did the rejectees. Acceptees of the summer institute elementary sample had significantly higher mean graduate grade-point averages in biology, chemistry, physics, and education than did the rejectees. Acceptees in the academic year college sample had significantly higher mean graduate grade-point averages in mathematics and education than did the rejectees.

8. Significantly more acceptees in the summer institute high school and academic year high school samples majored in science and mathematics than did the rejectees. Significantly more rejectees in these two groups majored in education.

9. In the summer institute junior high sample, acceptees as a group had earned the bachelor's degree significantly earlier than the rejected group.

10. Mathematics was the most frequent first choice for further

study in all of the groups except the rejected group in the in-service elementary sample where the most frequent first choice was general science.

11. Within the summer institute junior high sample, significantly more acceptees had attended no summer institutes, whereas, significantly more rejectees had attended one. Significantly more rejectees in the academic year high school sample had attended no summer institutes.

12. Significantly more acceptees than rejectees had been reading education journals only in the in-service elementary sample; special science journals only in the summer institute college sample; and a combination of special science, general science, and education journals in the academic year high school sample.

13. In the summer institute college sample, significantly more rejectees were members of education organizations only, while significantly more acceptees were members of special science organizations only. Significantly more rejectees in the academic year high school sample did not belong to any organization and significantly more acceptees were members of education and special science organizations.

Greulach (12, p. 300-301) reported on the characteristics of applicants applying for biology training in the 1957-58 Academic Year Institute and 1958 Summer Institute at the University of North

Carolina. Of the 141 applicants to the academic year institute, 117 taught biology, of which, 19 taught only biology. The remaining 24 were general science teachers. The 183 summer institute applicants consisted of 66 general science teachers, 30 full time biology teachers, and 87 who taught biology part time.

This study furthur pointed out that academic year institute applicants had a mean age of 33. 9 years and a mean of 5. 3 years teaching experience, whereas, the summer institute applicant's mean age and teaching experience was 39. 8 and 11. 5 respectively. While only 12 percent of the academic year institute applicants had a master's degree, 44 percent of the summer institute applicants had obtained this degree. All of the summer institute applicants had received some college credit in biology, while two percent of the academic year institute applicants lacked course background in this area. The academic year institute applicant read an average of 1. 3 scientific journals and 1. 9 educational journals, while the comparable figures for the summer institute applicant was 2. 3 and 1. 3 respectively.

In a study concerning characteristics of high school science teachers submitting applications to the 1962 Summer Institute and 1962-63 Academic Year Institute at the University of Georgia, Koelsche (17) reported the following information:

1. Of the 407 applicants included in the academic year sample, 90. 5 percent were male. In the summer institute sample, 83 percent

of the 339 applicants were male.

2. With respect to marital status, 79 percent of the academic year applicants were married, whereas, 84. 6 percent of the summer institute applicants were married.

3. Applicants to the academic year institute ranged in age from 23 to 53 years, with a median age of 30. 1 years. Summer institute applicants ranged in age from 23 to 64 years, with a median age of 34 years.

4. In the academic year institute sample, 69. 8 percent of the applicants reported having children. The average number of children per applicant, for the individuals reporting children, was 2. 35. Seventy-five percent of the summer institute applicants reported children, with the average children per applicant being 2. 23.

5. All applicants to the academic year institute had received a baccalaureate degree, whereas, four applicants to the summer institute had no degree. Twenty and one-tenth percent of the academic year institute applicants and 37. 5 percent of the summer institute applicants held a master's degree.

6. Using only those teachers who had earned credit in the science area, the average academic year applicant had a median of 18 undergraduate semester credits in biology, 10. 7 in chemistry, 8. 2 in physics, and five in earth science. Summer institute applicants had a median of 14. 7 credits in biology, 12. 3 in chemistry,

8. 3 in physics, and 4. 5 in earth science. At the graduate level, the academic year applicant had a median of 8. 1 credits in biology, 6. 6 in chemistry, six in physics and five in earth science. Summer institute applicants had a median of 8. 2 graduate credits in biology, 5. 5 in chemistry, 5. 5 in physics, and 3. 6 in earth science.

7. The median number of years taught was 4. 3 for the academic year applicants and six for the summer institute applicants.

8. Membership in an educational or professional science organization was held by 96. 1 percent of the academic year applicants and 93. 2 percent of the summer institute applicants. National Science Teacher Association membership was held by 18. 4 percent of the applicants to the academic year institute and 18. 6 percent of the summer institute applicants.

9. With respect to choices of an area for further study, academic year applicants responded most frequently to biology, whereas, mathematics was most popular with the summer institute group.

A second study by Koelsche (16) involved the reporting of information on the elementary and junior high school applicants submitting applications to the 1962 Summer Institute programs at the University of Georgia. Included in the study was the following information:

1. Of the 273 applicants included in the junior high sample, 88 percent were male. Sixty-two percent of the 648 applicants in the

elementary sample were male.

2. In the junior high sample 89. 7 percent were married while 80. 3 percent of the elementary applicants were married.

3. Applicants in the junior high group ranged in age from 23 to 59, with a median age of 33. 5 years. The elementary teachers ranged in age from 23 to 60, with a median age of 37. 8 years.

4. The average number of children per family, for those applicants reporting children, was 2. 35 in the junior high sample and 2. 44 in the elementary group.

5. Eight of the applicants in the junior high group had no degree, while 22 of the applicants in the elementary were without degrees. Approximately one-third of the junior high applicants and slightly more than one-half of the elementary applicants had received a master's degree.

6. Using only those teachers who had earned credit in the science area under consideration, the junior high applicant had a median of 13 undergraduate credits in biology, eight in chemistry, six in physics, and five in earth science. At the graduate level, the junior high applicant had a median of six credits in biology, three in physics, and three in earth science. The elementary applicant had a median of 8. 6 undergraduate semester credits in biology, seven in chemistry, 4. 4 in physics, and 4. 7 in earth science. At the graduate level, the elementary applicant had a median of 5. 9

credits in biology, 3. 8 in chemistry, 3. 3 in physics, and 3. 2 in earth science.

7. The median number of years taught was seven for the junior high sample and nine for the elementary group.

8. Membership in educational or professional science organizations was held by 90. 8 percent of the junior high sample and 89. 5 percent of the elementary group. National Science Teachers Association membership was held by 22 percent of the junior high applicants and five percent of the elementary applicants.

9. General science was the most popular choice for further study for both the junior high and elementary applicant.

In 1962, Timmerman (26, p. 70-73) conducted a study of 1723 applicants to the 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes at Ohio State University. Although there was no application of statistical analyses, it was his opinion that:

1. The ratio of females to males of the accepted applicants was significantly higher than that of the rejected group, with the exception of the 1962-63 group.

2. Accepted groups had attended significantly more mathematics and science training programs than had the rejectees.

3. Acceptees had significantly more advanced degrees than did the rejectees.

4. Acceptees had significantly more undergraduate preparation

in science and mathematics, with the exception of earth science.

5. Acceptees had significantly more total teaching experience than did the rejectees.

6. Acceptees had significantly more science and mathematics teaching experience than did the rejectees.

7. Acceptees taught significantly more science and mathematics classes than did the rejectees.

8. There was no significant difference between the acceptees and rejectees with respect to age, number of dependents, and marital status.

Summary

While there is no consistent agreement on all the characteristics included in the investigations reviewed, the literature does support the following general conclusions:

1. In comparing acceptees to rejectees, the acceptees generally had more academic preparation; higher grade-point averages; more teaching experience; read more professional journals; were older; and belonged to more science or education organizations.

2. Rejectees generally had more dependents; fewer master's degrees; and more memberships in educational organizations than did the acceptees.

3. With respect to summer and academic year applicants, the

summer institute applicants were older; had more teaching experience; and received more master's degrees.

4. For all applicants, the greatest amount of academic preparation was in the biological sciences, followed in decreasing order by chemistry, physics, and earth science.

CHAPTER III

DESIGN OF THE STUDY

This study involved the analysis of official application forms filed by applicants to the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes at Oregon State University. Since the application forms of rejectees for the 1960-61 Academic Year Institute had been returned to the National Science Foundation, they are not included in this study. However, the acceptees for the 1960-61 Academic Year Institute were included. Therefore, all acceptees from 1957 to 1962 were included in this study with the exception of one 1961-62 participant whose application form was missing.

During the period from 1957 to 1962 a total of 2802 applicants were rejected. Of this total, 440 were in the 1960-61 group that was returned to the National Science Foundation. The remaining 2362 rejectees' application forms were placed in alphabetical order by year, with the rejectee population used in this study being obtained by selecting every other one. Fifty-one of those selected application forms were omitted because they were either incomplete or illegible.

Therefore, a total of 291 acceptees and 1130 rejectees were included in the study. Table I presents a distribution by year, of applicants, acceptees, and rejectees.

Table I. Distribution of applicants, acceptees, and rejectees by year.

Year	Total Applicants	Total Acceptees	Total Rejectees	Rejectees Used In Study
1957-58	436	54	382	161
1958-59	415	50	365	173
1959-60	406	50	356	177
1960-61	488	48	440	---
1961-62	650	44	606	303
1962-63	698	45	653	316
Total	3093	291	2802	1130

The data, obtained from the official National Science Foundation application form, were recorded for each applicant according to a predetermined coding for transfer to IBM cards. The cards, one for each applicant, were punched and verified by a trained key-punch operator. An IBM 1410 computer was then utilized to process the perforated cards.

Under the guidance of statistics experts at Oregon State University and using procedures outlined by Wert (27), the null hypotheses stated in Chapter I, page 4, of this study were tested for statistical signficance.

Those variables not having a numeric continum were tested by the chi square formula for significance of difference between or among groups. For purposes of interpretation in this study, computed values less than the one percent tabled value for chi square were treated as accepting the hypothesis being tested. Significant

differences which fell between the five and one percent level of confidence have been noted, but have been interpreted as having doubtful significance.

Where a significant difference among groups was detected at the one percent level of confidence, the chi square formula was further utilized to determine between which groups the significant difference existed.

The following variables were tested by the chi square formula: sex; marital status; teaching residence; subject matter major; membership in state educational organization; membership in national educational organization; membership in state mathematics organization; membership in national mathematics organization; membership in state science organization; membership in national science organization; reading of educational journals; reading of scientific journals; reading of general science journals; and membership in the National Science Teachers Association.

In the coding of teaching residence, the categories were Washington, Oregon, California, and other areas. The subject matter major was broken down into categories of biology, chemistry, physics, mathematics, general science, and non-science major. Where an individual met the defined requirements of a major in more than one area, the area in which the greatest number of credits had been obtained was accepted as the major.

Analysis of variance was utilized to determine significant differences between and among groups for those variables having a numeric continuum. Significant differences at both one and five percent level of confidence were noted. Only those obtained values less than one percent tabled value for the distribution of F were treated as accepting the null hypotheses that there were no significant differences among or between the means being tested.

Where a significant difference among groups was detected at the one percent level of confidence, further analyses was conducted to determine between which groups the significant difference existed.

The following variables were tested by analysis of variance: age; number of dependents; number of summer institutes attended; years of teaching experience; periods taught per week in major; periods taught per week in minor; periods taught per week outside major and minor; years since receiving last degree; semester credits earned in chemistry; semester credits earned in mathematics; semester credits earned in biology; semester credits earned in physics; semester credits earned in earth science; undergraduate semester credits earned in science; graduate semester credits in science; undergraduate semester credits earned in mathematics; graduate semester credits earned in mathematics; science undergraduate grade point average; science graduate grade point average; mathematics undergraduate grade point average; and mathematics

graduate grade point average.

Mid-point intervals were used as representative values in categories of age, teaching experience, years since receiving degree, and credits earned. Since most high school and junior high school classes are taught five periods per week, categories of periods taught per week in major, minor, and outside major and minor were rounded off to the nearest multiple of five. Grade point averages were computed to the nearest tenth. With respect to number of dependents and summer institutes attended, the actual values were used.

Applicants not having had course work in mathematics and graduate science were not included in the sample number when computing grade point averages for those areas. Therefore, the degrees of freedom for undergraduate mathematics grade point average, graduate mathematics grade point average, and graduate science grade point average are not consistent with the remaining categories.

A further problem of this study was to determine the number of applicants from Washington, Oregon, and California that met their respective state certification requirements in respect to subject matter preparation in the areas of science and mathematics normally taught in junior and senior high schools.

Washington State (11) had no specific requirements for mathematics and science teachers other than those of any qualified teacher.

This consisted of five years of college preparation. However, it was highly recommended that teachers in the field of science and/or mathematics have a major or at least a minor in their teaching field.

With respect to Oregon (24), the requirements that were in effect during the period covered by this study were as follows:

> Mathematics--Eighteen quarter hours including specifically college algebra, and geometry (analytic, non-Euclidean, or projective); and elective courses selected from the following areas: trigonometry, introduction to calculus, mathematics of finance and statistics, history of mathematics, and basic concepts of secondary mathematics.
>
> Biology--Eighteen quarter hours in biology or departmental courses to include botany, zoology, physiology, and related courses.
>
> Chemistry--Eighteen quarter hours to include 12 quarter hours in chemistry and six quarter hours in physics.
>
> Physics--Eighteen quarter hours to include 12 quarter hours in physics and six quarter hours in chemistry.
>
> Physical science--Eighteen quarter hours with at least six quarter hours in physics and six quarter hours in chemistry.
>
> Ninth grade science--Twenty-four quarter hours to include at least nine quarter hours in the biological sciences and nine quarter hours in the physical sciences.

The State of California (6) had separate requirements for junior and senior high school teachers. Subject matter requirements for junior high school teachers were specified as a major and a minor in subjects taught in high school, or a major in education and two minors in high school subjects. A major, for purposes of certification in California junior high schools, was defined as being not less

than 24 semester hours of work. A minor consisted of not less than 12 semester hours of work.

High school certification requirements in California consisted of one major and one minor in teaching fields commonly taught in California senior or four year high schools, or a major in a field not commonly taught and two minors in acceptable teaching fields. The minimum requirements for a major at the high school level of teaching was 36 semester hours. Twelve semester hours of work for the major must be upper division or graduate work. The minimum requirement for a minor was 20 semester hours. Teachers in the biological areas must have some preparation in the general physical science field, whereas, the physical science teacher must have some background in the biological science.

In order to analyze the subject matter backgrounds of the applicants, it was necessary to establish a system for classifying their preparation into categories according to the nature of course work taken. The system utilized in this study was based upon the recommendations of the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science (1, p. 1024-1029).

Categories of subject matter preparation for each of the teaching areas included in this study are as follows:

Biology

Group A. Principles of biology: characteristics of living organisms, cell theory, structural system of plants and animals, metabolism, maintenance of individual.

Group B. Plant and animal physiology, anatomy, and morphology: comparative study of functional processes of cells and tissues, structure and behavior among the major groups of plants and animals, including the microorganisms. Microbiology with emphasis on bacteriology, virology, and protozoology.

Group C. Ecology and conservation: environment, soil, populations, relationships of species, distribution of communities.

Group D. Developmental anatomy and genetics: growth and development, principles of heredity, evolution.

Group E. Preparation and use of biological materials: microtechnique, cell and tissue culture, field collections, preparation and care of small organisms.

Group F. Elective courses which will be of benefit to teachers: history of science, problems of atomic age, laboratory techniques, and advanced work in biological topics.

Group G. Supporting science courses: principles of inorganic and organic chemistry, physics, earth science, and mathematics.

Chemistry

Group A. General principles: composition and structure of matter, atomic and molecular theory, states and transitions of matter, stoichiometry, nature of solutions, periodic tables and relationships, rates of reactions and equilibrium, ionic equilibrium and properties of electrolytes, oxidation-reduction and electro-chemistry, energy relationships and colloidal state.

Group B. Organic chemistry: nomenclature, hydrocarbon series, functional groups and their basic reactions, typical methods of preparation, and application.

Group C. Analytical chemistry: gravimetric and volumetric and instrumental methods, their applications and limitations.

Group D. Physical chemistry: determination of precise physical properties and the application of these data to problems of reaction rates, equilibrium systems, and structure determinations.

Group E. Advanced work: should include such courses as advanced inorganic chemistry, biochemistry, and radiochemistry.

Group F. Supporting science courses: basic courses in physics, biology, and mathematics.

Physics

Group A. Introductory courses: should pursue in depth the important and basic principles of physics, and provide for problem solving and laborabory experiences.

Group B. Intermediate courses: at least one course in each of the following areas: physical mechanics, heat and thermodynamics, optics, electricity and magnetism.

Group C. Modern physics: atomic and nuclear physics.

Group D. Supporting science courses: general, organic, and physical chemistry; biology, and mathematics including calculus.

General Science

Group A. Biology: general courses in botany and zoology; some work in genetics.

Group B. Chemistry: general course in inorganic chemistry with some work in organic chemistry.

Group C. Physics: general course in introductory physics with some work in modern physics.

Group D. Mathematics: trigonometry, college algebra, and analytical geometry.

Group E. Advanced work: upper division courses in at least two areas of science.

Mathematics

Group A. Analysis: trigonometry, college algebra, analytical geometry, calculus, advanced calculus, differential equations, and infinite series.

Group B. Algebra: abstract algebra (groups, rings, fields, linear algebra, vector spaces), matrices, theory of equations, and number theory. Geometry: metric, projective, affine, and inversive geometry; non-Euclidean geometries, differential geometry,

and topology. Foundations of mathematics: theory of sets, mathematical or symbolic logic, postulates for geometry, postulates for algebra, postulates for arithmetic, the real and complex number systems, and the history of the development of mathematical ideas.

Group C. Probability and statistics.

Group D. Applications: courses from mechanics, mathematical physics, mathematical astronomy, actuarial mathematics (finite differences, empirical formulas and interpolation, numerical analysis), and mathematics as used in the behavioral sciences (theory of games, linear programing, operations analysis, and econometrics).

Group E. Supporting courses: physics; further study in logic, symbolic logic, and philosophy; and course work in such areas as chemistry, astronomy, biology, geology, and meteorology.

Information regarding the nature and amount of subject matter background of each applicant was recorded on IBM cards. An IBM sorter was utilized to determine those applicants meeting requirements of certification for their respective states.

The final problem of this study was to determine the nature and amount of subject matter preparation for all applicants. Applicants were grouped according to their major. The previously described system of classifying type of course work was used in this portion of the study. Course work that did not correspond to defined categories was included in the total number of hours of subject matter preparation in any given field of study.

An IBM sorter was utilized in obtaining the frequency counts for this portion of the study.

CHAPTER IV

PRESENTATION AND INTERPRETATION OF DATA

The purpose of this chapter is to present and interpret the data collected during the course of this study. The areas of investigation and order of presentation are as follows:

1. Comparison between acceptees and rejectees.
2. Comparison among groups of acceptees.
3. Comparison among groups of rejectees.
4. Comparison among the applicant groups from Washington, California, and other areas.
5. Certification qualifications of applicants from Washington, Oregon, and California.
6. Subject matter preparation of applicants.

Comparison between Acceptees and Rejectees

In terms of the selected characteristics, this portion of the study presents the statistical analysis of the comparison between acceptees and rejectees for the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes at Oregon State University. The null hypothesis specifying that no differences existed between the acceptees and rejectees for each of the years included in the study was tested by the analysis of variance for those characteristics

having a numeric continuum, and by the chi square formula for those characteristics not having a numeric continuum. .

Age

The F-ratios (Table II) computed by the analysis of variance revealed that there was no signficant difference between the mean ages of the acceptees and rejectees for each of the years included in this study. Mean ages ranged from a maximum of 34. 0 years to a minimum of 31. 8 years.

Dependents

Mean number of dependents for 1958-59 acceptees and rejectees were 2. 4 and 3. 0 respectively. An F-ratio (F = 6. 32, Table II) with 1 and 221 degrees of freedom indicated that at the five percent level of confidence there was a significant difference. It should be noted that this computed F-ratio (F = 6. 32) closely approaches the table F-value (F = 6. 67) for the one percent level of confidence. For the remaining years, there was no significant difference between the means.

Mean number of dependents ranged from a low of 2. 4 to a high of 3. 0.

Table II. Analysis of variance of age, dependents, summer institutes, teaching experience, and years since receiving last degree of acceptees and rejectees.

Academic Year	Age	Dependents	Summer Institutes	Teaching Experience	Years Since Last Degree
1957-58					
Acceptee mean	32.7	2.7	0.00	6.2	7.0
Rejectee mean	34.0	2.9	0.04	6.7	7.7
F (df: 1, 213)	1.56	0.32	2.07	0.35	0.59
1958-59					
Acceptee mean	33.0	2.4	0.22	6.0	6.6
Rejectee mean	33.7	3.0	0.27	6.4	7.2
F (df: 1, 221)	0.64	6.32*	0.32	0.40	0.58
1959-60					
Acceptee mean	32.7	3.0	0.38	6.8	8.3
Rejectee	32.1	2.8	0.40	5.8	6.3
F (df: 1, 225)	0.27	0.21	0.30	3.47	7.06**
1961-62					
Acceptee mean	33.5	2.7	0.93	7.3	7.2
Rejectee mean	31.8	2.7	0.69	5.5	6.0
F (df: 1, 345)	2.82	0.00	3.76	8.49**	2.89
1962-63					
Acceptee mean	32.7	2.7	0.96	7.1	5.2
Rejectee mean	32.4	2.9	0.90	6.1	6.1
F (df: 1, 359)	0.07	2.07	0.14	2.21	1.48

*Difference between means significant at the five percent level of confidence.
**Difference between means significant at the one percent level of confidence.

Summer Institutes Attended

As would be expected, the mean number of summer institutes attended ranged from no institutes for the 1957-58 acceptees to 0. 96 for the 1962-63 acceptees, with a gradual increase each year. The rejectees followed the same general pattern.

Application of the analysis of variance revealed (Table II) that there was no signficant difference between the mean number of summer institutes attended by the acceptees and rejectees for each of the years included in this study.

Teaching Experience

The 1961-62 acceptees had a mean of 7. 3 years of teaching experience whereas the rejectees of the same year had a mean of 5. 5 years. The F-ratio ($F = 8.49$, Table II) with 1 and 345 degrees of freedom indicated that there was a significant difference between the two means at the one percent level of confidence. It should be noted that the F-ratio ($F = 3.47$, Table II) for the 1959-60 acceptees and rejectees closely approaches the tabel F-value ($F = 3.89$) for the five percent level of confidence with 1 and 225 degrees of freedom. For the remaining years, there was no signficant difference between the means.

Mean number of years of teaching experience ranged from a

high of 7. 3 to a low of 5. 5.

Years Since Receiving Last Degree

Acceptees and rejectees for 1959-60 had respective means of 8. 3 and 6. 3 years since receiving their last degree. As indicated by the F-ratio (F = 7. 06, Table II) with 1 and 225 degrees of freedom, there was a significant difference between the two means at the one percent level of confidence. No significant differences were found for the remaining years of this study.

Mean number of years since receiving their last degree ranged from 5. 2 to 8. 3.

Periods Taught Per Week in Major

With respect to number of periods taught per week in a subject matter major, the acceptee mean ranged from 9. 6 periods per week to 11. 8 periods per week, whereas the means of the rejectees ranged from 8. 9 to 10. 6 periods per week.

As indicated by the computed F-ratios (Table III), there was no significant difference between the means for each of the years included in the study.

Periods Taught Per Week in Minor

Mean number of periods taught per week in a minor area was

Table III. Analysis of variance of periods taught per week in major, minor, and outside of major and minor of acceptees and rejectees.

Academic Year	In Major	In Minor	Outside Major And Minor
1957-58			
Acceptee mean	9.6	14.4	1.5
Rejectee mean	9.1	10.4	3.4
F (df: 1, 213)	0.12	6.94**	4.61*
1958-59			
Acceptee mean	10.7	13.7	2.5
Rejectee mean	8.9	10.0	4.2
F (df: 1, 221)	1.15	4.78*	2.42
1959-60			
Acceptee mean	9.7	13.7	2.4
Rejectee mean	9.8	9.6	3.3
F (df: 1, 225)	0.00	6.28*	0.81
1961-62			
Acceptee mean	10.4	10.6	3.9
Rejectee mean	9.9	9.6	3.3
F (df: 1, 345)	0.06	0.32	0.25
1962-63			
Acceptee mean	11.8	10.0	1.5
Rejectee mean	10.6	8.9	3.0
F (df: 1, 359)	0.53	0.40	2.41

*Difference between means significant at the five percent level of confidence.

**Difference between means significant at the one percent level of confidence.

14. 4 for the 1957-58 acceptee and 10. 4 for the 1957-58 rejectee. The computed F-ratio (F = 6. 94, Table III) with 1 and 213 degrees of freedom indicated that at the one percent level of confidence there was a significant difference between the two means. The 1958-59 acceptees had a mean of 13. 7 periods taught per week in their minors whereas rejectees for the same year had a mean of 10. 0 periods. As indicated by the F-ratio (F = 4. 78, Table III) with 1 and 221 degrees of freedom, there was a significant difference between the two means at the five percent level of confidence. Acceptees and rejectees of the 1959-60 applicants had a mean number of periods taught per week in their minors of 13. 7 and 9. 6 respectively. The computed F-ratio (F = 6. 28, Table III) with 1 and 223 degrees of freedom denoted that there was a significant difference between the two means at the five percent level of confidence. For the 1961-62 and 1962-63 applicants, there was no significant difference between the acceptee and rejectee means.

Mean number of periods taught per week in the minor areas ranged from a maximum of 14. 4 for the 1957-58 acceptee to a minimum of 8. 9 for the 1962-63 rejectee.

Periods Taught Per Week Outside of Major and Minor

The 1957-58 acceptees had a mean of 1. 5 periods taught per week outside of their major and minor while the rejectees for the

same year had a mean of 3. 4 periods. The F-ratio (F = 4. 61, Table III) with 1 and 213 degrees of freedom indicated that there was a significant difference between the two means at the five percent level of confidence. For the remaining years of the study, there was no significant difference between the means.

With the exception of the 1961-62 applicants, the rejectees taught more periods per week outside their major and minor than did the acceptees. Means ranged from a minimum of 1. 5 to a maximum of 4. 2.

Semester Hours in Biology

With respect to hours in biology, the computed F-ratios (Table IV) indicated that there was no significant difference between the acceptees and rejectees for each of the years included in this study.

Mean biology hours ranged from a low of 19. 5 to a high of 25. 1.

Semester Hours in Chemistry

Mean number of hours in chemistry for the 1958-59 acceptees and rejectees was 17. 7 and 13. 3 respectively. The computed F-ratio (F = 4. 70, Table IV) with 1 and 221 degrees of freedom indicated that there was a significant difference between the two means at the five percent level of confidence. Acceptees and rejectees for 1961-62

Table IV. Analysis of variance of semester hours in biology, chemistry, physics, earth science, and mathematics of acceptees and rejectees.

Academic Year	Biology	Chemistry	Physics	Earth Science	Mathematics
1957-58					
Acceptee mean	21.9	13.7	11.3	4.0	15.7
Rejectee mean	19.5	13.0	9.7	4.0	14.1
F (df: 1, 213)	0.73	0.23	1.17	0.00	0.94
1958-59					
Acceptee mean	25.1	17.7	10.4	6.7	13.9
Rejectee mean	21.3	13.3	8.8	4.0	14.0
F (df: 1, 221)	1.36	4.70*	1.49	3.90*	0.00
1959-60					
Acceptee mean	21.5	15.9	9.4	3.9	14.2
Rejectee mean	22.7	13.6	7.5	3.9	12.8
F (df: 1, 225)	0.17	1.58	2.58	0.00	0.67
1961-62					
Acceptee mean	20.8	15.3	10.9	6.2	16.3
Rejectee mean	20.3	11.6	8.2	4.0	14.1
F (df: 1, 345)	0.03	5.59*	4.84*	3.91	1.13
1962-63					
Acceptee mean	24.6	15.0	10.7	4.7	14.6
Rejectee mean	22.5	14.0	9.2	5.1	15.2
F (df: 1, 359)	0.48	0.29	1.38	0.06	0.08

*Difference between means significant at the five percent level of confidence.

had respective mean number of hours in chemistry of 15. 3 and 11. 6. At the five percent level of confidence, the F-ratio (F = 5. 59, Table IV) with 1 and 345 degrees of freedom denoted a significant difference between the two means. For the remaining years included in the study, there was no significant difference between the acceptees and rejectees.

Mean number of hours in chemistry ranged from a maximum of 17. 7 to a minimum of 11. 6. For each year included in the study, the acceptee mean was greater than the rejectee mean.

Semester Hours in Physics

Mean number of hours in physics ranged from a high of 11. 3 for the 1957-58 acceptee to a low of 7. 5 for the 1959-60 rejectee.

Acceptees and rejectees for 1961-62 had respective mean number of hours in physics of 10. 9 and 8. 2. The computed F-ratio (F = 4. 84, Table IV) with 1 and 345 degrees of freedom indicated that there was a significant difference between the two means at the five percent level of confidence. For the remaining years of the study, there was no significant difference between the means of the acceptees and rejectees.

Semester Hours in Earth Science

For the 1958-59 applicants, the acceptees and rejectees had

respective mean hours in earth science of 6. 7 and 4. 0. At the five percent level of confidence, the computed F-ratio (F = 3. 90, Table IV) indicated that there was a significant difference between the two means. Further utilization of the analysis of variance revealed that there was no signficant difference between the acceptee and rejectee means for the remaining years included in this study.

Mean number of hours in earth science ranged from a maximum of 6. 7 to a minimum of 3. 9.

Semester Hours in Mathematics

Mean number of hours in mathematics ranged from a high of 16. 3 for the 1961-62 acceptee to a low of 12. 8 for the 1959-60 rejectee.

The computed F-ratios (Table IV) indicated that there was no significant difference between the acceptee and rejectee means for each of the years included in this study.

Semester Hours in Undergraduate Science

Acceptees and rejectees for 1958-59 had respective means of 53. 0 and 42. 2 undergraduate science hours. As indicated by the F-ratio (F = 8. 14, Table V) with 1 and 221 degrees of freedom, there was a significant difference between the two means at the one percent level of confidence. For the 1961-62 applicants, the acceptees had

Table V. Analysis of variance of undergraduate and graduate science and mathematics semester hours of acceptees and rejectees..

Academic Year	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
1957-58				
Acceptee mean	46.8	4.1	14.6	1.0
Rejectee mean	42.3	3.7	13.5	0.6
F (df: 1, 213)	2.53	0.13	0.54	0.93
1958-59				
Acceptee mean	53.0	6.6	13.4	0.6
Rejectee mean	42.2	5.0	12.7	1.2
F (df: 1, 221)	8.14**	0.86	0.16	0.98
1959-60				
Acceptee mean	45.2	4.5	13.5	0.9
Rejectee mean	41.3	6.3	11.7	0.9
F (df: 1, 225)	1.70	1.20	1.37	0.00
1961-62				
Acceptee mean	47.0	6.1	14.2	2.1
Rejectee mean	38.6	5.4	12.7	1.3
F (df: 1, 345)	8.55**	0.26	0.79	1.48
1962-63				
Acceptee mean	45.5	8.8	12.7	1.6
Rejectee mean	43.1	7.4	13.6	1.8
F (df: 1, 359)	0.57	0.65	0.31	0.08

** Difference between means significant at the one percent level of confidence.

a mean of 47. 0 undergraduate science hours whereas the rejectees had a mean of 38. 6. At the one percent level of confidence, the computed F-ratio (F = 8. 55, Table V) indicated that there was a significant difference between the two means. For the remaining years of this study there was no significant difference between the acceptee and rejectee means.

Mean number of hours in undergraduate science ranged from a high of 53. 0 for the 1958-59 acceptee to a low of 38. 6 for the 1961-62 rejectee.

Semester Hours in Graduate Science

The mean number of graduate science hours ranged from a maximum of 8. 8 for 1962-63 acceptees to a minimum of 3. 7 for 1957-58 rejectees. The computed F-ratios (Table V) indicated that there was no significant difference between the acceptee and rejectee means for each of the years included in this study.

Semester Hours in Undergraduate Mathematics

Relatively little difference was noted between the mean number of undergraduate hours in mathematics. The maximum mean was 14. 6 for the 1957-58 acceptees whereas the 1959-60 rejectees had the minimum of 11. 7. Application of the analysis of variance indicated that there was no significant difference between the means

(Table V) for each of the years included in this study.

Semester Hours in Graduate Mathematics

With respect to graduate mathematics hours, the means ranged from a minimum of 0. 6 hours for the 1957-58 rejectees to a maximum of 2. 1 hours for the 1961-62 acceptees. The computed F-ratios (Table V) indicated that there was no significant difference between the acceptee and rejectee means for each of the years included in this study.

Undergraduate Science Grade Point Average

For the 1958-59 applicants, acceptees had a grade point mean of 2. 8 whereas rejectees had a grade point mean of 2. 4. The F-ratio ($F = 8.02$, Table VI) with 1 and 221 degrees of freedom indicated that there was a significant difference between the two means at the one percent level of confidence. The 1962-63 acceptees had a mean of 3. 0 for the undergraduate science grade point average while rejectees for the same year had a 2. 5 mean. The F-ratio ($F = 17.35$, Table VI) with 1 and 359 degrees of freedom indicated that there was a significant difference between the two means at the one percent level of confidence. For the remaining years of the study, there was no significant difference between the means of acceptees and rejectees.

Table VI. Analysis of variance of undergraduate and graduate science and mathematics grade point average of acceptees and rejectees.

Academic Year	U. Grad. Science	Grad. Science[§]	U. Grad. Math.[§]	Grad. Math.[§]
1957-58				
Acceptee mean	2.7	3.4	2.7	3.5
Rejectee mean	2.5	3.2	2.6	3.5
F-ratio	1.17	0.69	0.84	0.01
Degrees of F.	1, 213	1, 73	1, 177	1, 15
1958-59				
Acceptee mean	2.8	3.4	2.6	3.2
Rejectee mean	2.4	3.3	2.4	3.2
F-ratio	8.02**	0.54	1.05	0.03
Degrees of F.	1, 221	1, 90	1, 184	1, 39
1959-60				
Acceptee mean	2.8	3.4	2.6	3.3
Rejectee mean	2.5	3.2	2.4	3.2
F-ratio	3.17	1.80	2.57	0.12
Degrees of F.	1, 225	1, 110	1, 188	1, 33
1961-62				
Acceptee mean	2.8	3.2	2.7	3.1
Rejectee mean	2.5	3.2	2.5	3.2
F-ratio	3.80	0.00	4.27*	0.19
Degrees of F.	1, 345	1, 163	1, 283	1, 63
1962-63				
Acceptee mean	3.0	3.4	2.4	3.1
Rejectee mean	2.5	3.2	2.4	3.0
F-ratio	17.35**	2.13	0.15	0.24
Degrees of F.	1, 359	1, 193	1, 312	1, 72

*Difference between means significant at the five percent level of confidence.

**Difference between means significant at the one percent level of confidence.

§For variance in degrees of freedom see p. 38.

Undergraduate science grade point means ranged from a high of 3. 0 for 1962-63 acceptees to a low of 2. 4 for 1958-59 rejectees.

Graduate Science Grade Point Average

Relatively little difference was noted for the grade point average in graduate science courses. Means ranged from a high of 3. 4 to a low of 3. 2. The computed F-ratios (Table VI) indicated that there was no signficant difference between the acceptee and rejectee means for each of the years included in the study.

Undergraduate Mathematics Grade Point Average

The 1961-62 acceptees and rejectees had respective mean undergraduate grade point averages in mathematics of 2. 7 and 2. 5. At the five percent level of confidence, the F-ratio ($F = 4.27$, Table VI) with 1 and 283 degrees of freedom indicated that there was a significant difference between the two means. For the remaining years included in the study, the computed F-ratios (Table VI) revealed that there was no significant difference between the acceptee and rejectee means.

Mean undergraduate grade point average in mathematics ranged from a maximum of 2. 7 to a minimum of 2. 4.

Graduate Mathematics Grade Point Average

The number of applicants having taken graduate work in mathematics was considerably less than in other areas of study. Furthermore, relatively little difference was noted between the acceptee and rejectee grade point means. The computed F-ratios (Table VI) indicated that there was no significant difference between the acceptee and rejectee means for each of the years included in the study.

Sex

With respect to sex (Table VII), no significant differences were found between acceptees and rejectees for each of the years included in this study.

Marital Status

Application of the chi square formula to the variable, marital status (Table VII), revealed that there was no significant difference between acceptees and rejectees for each of the years included in this study.

Teaching Residence

The computed chi square (chi square = 8. 240, Table VII) with three degrees of freedom indicated that at the five percent level of

Table VII. Sex, marital status, and teaching residence of acceptees and rejectees.

	Sex		Marital Status		Teaching Residence			
Academic Year	Male	Female	Married	Single	Wash.	Ore.	Calif.	Other
1957-58								
Acceptee	49	5	44	10	13	15	4	22
Rejectee	155	6	140	21	21	28	15	97
Chi Square	2.549		0.982		8.240*			
1958-59								
Acceptee	46	4	41	9	8	16	7	19
Rejectee	160	13	150	23	16	11	19	127
Chi Square	0.013		0.699		30.439**			
1959-60								
Acceptee	45	5	43	7	8	14	13	15
Rejectee	171	6	156	21	10	21	24	122
Chi Square	3.694		0.164		25.341**			
1961-62								
Acceptee	40	4	37	7	9	10	6	19
Rejectee	290	13	259	44	26	33	43	201
Chi Square	1.900		1.900		12.971**			
1962-63								
Acceptee	44	1	41	4	6	9	5	25
Rejectee	306	10	264	52	36	28	45	207
Chi Square	0.118		1.721		5.782			

*Computed chi square significant at the five percent level of confidence.
**Computed chi square significant at the one percent level of confidence.

confidence there was a significant difference between the acceptees and rejectees for 1957-58.

As indicated by the chi square (chi square = 30.489, Table VII) with three degrees of freedom, there was a significant difference between acceptees and rejectees for 1958-59 at the one percent level of confidence. Further application of the chi square formula pointed out that significantly more acceptees resided in Oregon and significantly fewer acceptees resided in states other than Washington, Oregon, and California than would be expected by chance.

For the 1959-60 academic year, the computed chi square (chi square = 25.341, Table VII) with three degrees of freedom indicated that at the one percent level of confidence there was a significant difference between acceptees and rejectees. Significantly more acceptees came from Washington, Oregon, and California than would be expected by chance.

Application of the chi square formula to 1961-62 applicants indicated that there was a significant difference (chi square = 12.971, Table VII) between acceptees and rejectees at the one percent level of confidence with three degrees of freedom. Significantly more acceptees resided in Washington than would be expected by chance, and significantly fewer acceptees came from states other than Washington, Oregon, and California.

There was no significant difference between 1962-63 acceptees

and rejectees with respect to residence.

Subject Matter Majors

With respect to majors (Table VIII), no significant differences between acceptees and rejectees were noted with the exception of the 1961-62 applicants. For this group, the computed chi square (chi square = 16.251, Table VIII) with five degrees of freedom indicated that at the one percent level of confidence there was a significant difference between acceptees and rejectees. Further application of the chi square formula revealed that significantly more acceptees had a major in general science than would be expected by chance. Also, significantly fewer acceptees had no science major than would be expected by chance.

Membership in State Educational Organizations

Investigation of membership in state educational organizations (Table IX) indicated that there were no significant differences between acceptees and rejectees for the 1957-58, 1959-60, 1961-62, and 1962-63 academic years. For 1958-59 applicants, the computed chi square (chi square = 9.671, Table IX) with one degree of freedom indicated that there was a significant difference between acceptees and rejectees at the one percent level of confidence. Significantly fewer acceptees did not belong to a state educational organization

Table VIII. Majors of acceptees and rejectees.

Academic Year	Biology	Chemistry	Physics	General Science	Mathematics	Non-Science	Chi Square
1957-58							
Acceptee	20	7	3	12	5	7	8.607
Rejectee	45	11	5	34	16	50	
1958-59							
Acceptee	19	6	0	13	6	6	10.870
Rejectee	49	14	4	30	18	58	
1959-60							
Acceptee	16	5	1	10	4	14	2.367
Rejectee	61	15	1	25	18	57	
1961-62							
Acceptee	13	4	1	17	6	3	16.251**
Rejectee	85	18	4	59	38	99	
1962-63							
Acceptee	13	4	1	13	2	12	5.430
Rejectee	100	27	7	59	47	76	

**Computed chi square significant at the one percent level of confidence.

Table IX. Membership in professional organizations of acceptees and rejectees.

Academic Year	State			National			
	Education	Mathematics	Science	Education	Mathematics	Science	NSTA
1957-58							
Acceptee							
Yes	45	3	10	39	4	21	19
No	9	51	44	15	50	33	35
Rejectee							
Yes	122	12	19	102	9	43	39
No	39	149	142	59	152	118	122
Chi Square	1.332	0.224	1.563	1.409	0.235	2.870	2.466
1958-59							
Acceptee							
Yes	48	1	12	39	5	33	29
No	2	49	38	11	45	17	21
Rejectee							
Yes	132	7	28	100	14	57	49
No	41	166	145	73	159	116	124
Chi Square	9.671**	0.470	1.609	6.739**	0.181	17.604**	15.020**
1959-60							
Acceptee							
Yes	44	2	10	32	2	21	18
No	6	48	40	18	48	29	32
Rejectee							
Yes	143	7	41	108	8	63	45
No	34	170	136	69	169	114	132
Chi Square	1.396	0.000	0.224	0.147	0.025	0.686	2.175

Table IX. Continued.

Academic Year	State			National			NSTA
	Education	Mathematics	Science	Education	Mathematics	Science	
1961-62							
Acceptee							
Yes	37	6	10	28	6	20	19
No	7	38	34	16	38	24	25
Rejectee							
Yes	240	23	36	177	56	100	81
No	63	280	267	126	247	203	222
Chi Square	0.569	1.833	3.930*	0.433	0.615	2.633	5.068*
1962-63							
Acceptee							
Yes	34	3	16	32	4	24	21
No	11	42	29	13	41	21	24
Rejectee							
Yes	231	21	52	185	34	105	76
No	85	295	264	131	282	211	240
Chi Square	0.122	0.000	9.399**	2.594	0.146	6.934**	10.253**

*Computed chi square significant at the five percent level of confidence.

**Computed chi square significant at the one percent level of confidence.

than would be expected by chance.

Membership in State Mathematics Organizations

In regards to membership in state mathematics organizations (Table IX), there was no significant difference between acceptees and rejectees for each of the years included in this study.

Membership in State Science Organizations

Investigation of this variable (Table IX) indicated that there was no significant difference between acceptees and rejectees for the 1957-58, 1958-59, 1959-60, and 1961-62 academic years at the one percent level of confidence. There was a significant difference between 1961-62 acceptees and rejectees at the five percent level of confidence.

For 1962-63 applicants, the computed chi square (chi square = 9. 399, Table IX) with one degree of freedom indicated that there was a significant difference between acceptees and rejectees at the one percent level of confidence. Significantly more acceptees belonged to state science organizations than would be expected by chance.

Membership in National Educational Organizations

The computed chi square (chi square = 6. 739, Table IX) with

one degree of freedom indicated that there was a significant difference between 1958-59 acceptees and rejectees at the one percent level of confidence. Significantly fewer acceptees did not belong to national educational organizations than would be expected by chance. For the remaining years included in this study, there were no significant differences between acceptees and rejectees.

Membership in National Mathematics Organizations

Application of the chi square formula to the variable, membership in national mathematics organizations (Table IX), revealed that there were no significant difference between acceptees and rejectees for each of the years included in this study.

Membership in National Science Organization

With respect to membership in national science organizations (Table IX), there were no significant differences between acceptees and rejectees for the 1957-58, 1959-60, and 1961-62 academic years. For 1958-59 and 1962-63 academic years, the respective computed chi squares (chi square = 17.604, 6.934, Table IX) with one degree of freedom indicated that there was a significant difference between acceptees and rejectees at the one percent level of confidence. In both years, significantly fewer acceptees did not belong to national science organizations than would be expected by chance.

Membership in the National Science Teachers Association

For the variable, membership in the National Science Teachers Association (Table IX), there were no significant differences at the one percent level of confidence between acceptees and rejectees for the 1957-58, 1959-60, and 1961-62 academic years. However, there was a significant difference between 1961-62 acceptees and rejectees at the five percent level of confidence.

The computed chi squares (chi square = 15.020, 10.253, Table IX), for 1958-59 and 1962-63 respectively, with one degree of freedom indicated that there was a significant difference between acceptees and rejectees for each of these two years. In both years, significantly more acceptees belonged to the National Science Teachers Association than would be expected by chance.

Reading of Educational Journals

With respect to the reading of educational journals (Table X), there was no significant difference between acceptees and rejectees for each of the years included in this study.

Reading of General Science Journals

With regards to the reading of general science journals (Table X), there was no significant difference between acceptees and

Table X. Reading of professional journals by acceptees and rejectees.

Academic Year	Educational	Special Science	General Science
1957-58			
Acceptee			
Yes	40	23	37
No	14	31	17
Rejectee			
Yes	128	56	98
No	33	105	63
Chi Square	0.698	1.061	1.012
1958-59			
Acceptee			
Yes	45	25	38
No	5	25	12
Rejectee			
Yes	140	70	111
No	33	103	62
Chi Squre	2.260	1.442	2.452
1959-60			
Acceptee			
Yes	37	22	47
No	13	28	3
Rejectee			
Yes	126	68	143
No	51	109	34
Chi Square	0.152	0.508	4.986*
1961-62			
Acceptee			
Yes	32	19	36
No	12	25	8
Rejectee			
Yes	201	97	238
No	102	206	65
Chi Square	0.711	2.154	0.247
1962-63			
Acceptee			
Yes	33	18	41
No	12	27	4
Rejectee			
Yes	212	110	264
No	104	206	52
Chi Square	0.704	0.464	1.721

*Computed chi square significant at the five percent level of confidence.

rejectees at the one percent level of confidence for each of the years included in this study. However, there was a significant difference between 1959-60 acceptees and rejectees at the five percent level of confidence.

Reading of Special Science Journals

Investigation of the variable, reading of special science journals (Table X), revealed that there was no significant difference between acceptees and rejectees for each of the years included in this study.

Summary

Selected applicant characteristics were analyzed by either the analysis of variance or the chi square formula for the purpose of determining if significant differences existed between acceptees and rejectees for each of the years included in this study. The results of these analyses may be summarized as follows:

1. No significant differences between acceptees and rejectees were noted on basis of sex; marital status; subject matter major; membership in state and national mathematics organizations; reading of educational and special science journals; age; summer institutes attended; periods taught per week in major; credits earned in biology and mathematics; credits earned in graduate science,

undergraduate and graduate mathematics; and graduate science grade point average.

2. With respect to 1957-58 acceptees and rejectees, significant differences at the five percent level of confidence were noted for teaching residence and periods taught per week outside of the major and minor. At the one percent level of confidence, a significant difference was noted for periods taught per week in minor.

3. Acceptees and rejectees for 1958-59 were significantly different at the five percent level of confidence with respect to number of dependents, periods taught per week in minor, and credits in chemistry and earth science. Significant differences were revealed at the one percent level of confidence in areas of teaching residence; membership in state and national education organizations, national science organizations, and the National Science Teachers Association; credits in undergraduate science; and undergraduate science grade point average.

4. For the 1959-60 acceptees and rejectees, significant differences at the five percent level of confidence were detected in areas of reading special science journals and periods taught per week in minor. At the one percent level of confidence, significant differences were noted for teaching residence and years since receiving last degree.

5. Acceptees and rejectees for 1961-62 were significantly

different at the five percent level of confidence with respect to membership in state science organizations and the National Science Teachers Association; credits in physics and chemistry; and undergraduate mathematics grade point average. Significant differences at the one percent level of confidence were noted in areas of teaching residence; subject matter major; teaching experience; and credits in undergraduate science.

6. With respect to 1962-63 acceptees and rejectees, significant differences at the one percent level of confidence were noted for membership in state and national science organizations; membership in the National Science Teachers Association; and undergraduate science grade point average.

Of the 35 characteristics analyzed, three were found to be significant during 1957-58, 11 in 1958-59, four in 1959-60, nine in 1961-62, and four in 1962-63 (Appendix A).

Comparisons Among Acceptees

In terms of selected characteristics, this portion of the study presents the statistical analyses of comparisons among acceptee groups for the 1957-58, 1958-59, 1959-60, 1960-61, 1961-62, and 1962-63 Academic Year Institutes at Oregon State University. The null hypothesis specifying that no differences existed between acceptees of any one year and acceptees of any other year included in this

study was checked by the analysis of variance for those characteristics having numeric continuum, and by the chi square formula for those characteristics not having a numeric continuum.

Age

Mean ages of acceptees for each of the six years included in this study showed little variation. The computed F-ratio (Table XI) indicated that there was no significant differences among the mean ages of acceptee groups.

Table XI. Analysis of variance of age, dependents, teaching experience, and summer institutes of acceptees.

Academic Year	Mean			
	Age	Dependents	Teaching Experience	Summer Institutes
1957-58	32. 7	2. 7	6. 2	0. 00
1958-59	33. 0	2. 4	6. 0	0. 22
1959-60	32. 7	3. 0	6. 8	0. 38
1960-61	32. 1	2. 7	6. 2	1. 08
1961-62	33. 5	2. 7	7. 3	0. 93
1962-63	32. 7	2. 7	7. 1	0. 96
F(df:5, 285)	0. 98	0. 66	0. 97	19. 12**

**Difference among means significant at the one percent level of confidence.

Dependents

Mean number of dependents for acceptees ranged from a high of 3. 0 to a low of 2. 4. Application of the analysis of variance

(Table XI) revealed that there was no signficant difference among means.

Teaching Experience

Although there appeared to be a general pattern of the more recent acceptees having more experience, the F-ratio (Table XI) indicated that there was no significant difference among means.

Summer Institutes Attended

The computed F-ratio ($F = 19.12$, Table XI) with 5 and 285 degrees of freedom indicated that at the one percent level of confidence there was a significant difference among mean number of summer institutes attended. Further application of the analysis of variance revealed that the means for the first three years were significantly different from the means of the last three years.

As would be expected, there was a pattern of a general increase in the number of summer institutes attended.

Years Since Receiving Last Degree

While no general pattern was established with respect to length of time since receiving the last degree, the F-ratio ($F = 2.32$, Table XII) with 5 and 285 degrees of freedom indicated that there was a significant difference among means at the five percent level of

confidence. Further analysis indicated that there was a significant difference between 1962-63 and 1959-60 acceptees at the one percent level of confidence.

Table XII. Analysis of variance of years since receiving last degree, periods taught per week in major, in minor, and outside of major and minor of acceptee.

Academic Year	Mean			
	Years Since Last Degree	In Major	In Minor	Outside Major And Minor
1957-58	7.0	9.6	11.4	1.5
1958-59	6.6	10.7	13.7	2.5
1959-60	8.3	9.7	13.7	2.4
1960-61	6.6	12.2	9.1	3.8
1961-62	7.2	10.4	10.6	3.9
1962-63	5.2	11.8	10.0	1.5
F(df: 5, 235)	2.32*	0.46	2.34*	1.59

*Difference among means significant at the five percent level of confidence.

Periods Taught Per Week in Major

As indicated by the F-ratio (F = 0.46, Table XII) there was no significant difference among mean number of periods taught per week by acceptee groups for each of the years included in this study.

Periods Taught Per Week in Minor

The computed F-ratio (F = 2.34, Table XII) with 5 and 285

degrees of freedom indicated that at the five percent level of confidence there was a significant difference among means. Further investigation revealed that at the one percent level of confidence a significant difference did exist between the 1960-61 and 1957-58 acceptee means.

It should be noted that there appears to be a definite trend of acceptees teaching fewer periods per week in their minor areas of subject matter preparation.

Periods Taught Per Week Outside of Major and Minor

As indicated by the F-ratio ($F = 1.59$, Table XII) there was no significant difference among mean number of periods taught per week outside the major and minor by acceptee groups for each of the years included in this study.

Semester Hours in Biology, Chemistry, Physics, Earth Science and Mathematics

With respect to hours in various subject matter areas, the F-ratios (Table XIII) indicated that no significant differences existed among means of acceptee groups for each of the years included in this study.

Table XIII. Analysis of variance of semester hours in biology, chemistry, physics, earth science, and mathematics of acceptees.

Academic Year	Biology	Chemistry	Physics	Earth Science	Math.
1957-58	21.9	13.7	11.3	4.0	15.7
1958-59	25.1	17.7	10.4	6.7	13.9
1959-60	21.5	15.9	9.4	3.9	14.2
1960-61	23.1	14.2	12.5	2.6	15.4
1961-62	20.8	15.3	10.9	6.2	16.3
1962-63	24.6	15.0	10.7	4.7	14.6
F(df: 5, 285)	0.45	0.98	0.71	1.48	0.29

Semester Hours in Undergraduate Science, Graduate Science Undergraduate Mathematics, and Graduate Mathematics

With respect to undergraduate and graduate work in the areas of science and mathematics, the computed F-ratios (Table XIV) indicated that there were no significant differences among means of these acceptee characteristics.

Table XIV. Analysis of variance of undergraduate and graduate science and mathematics mean semester hours of acceptees.

Academic Year	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
1957-58	46.8	4.1	14.6	1.0
1958-59	53.0	6.6	13.4	0.6
1959-60	45.2	4.5	13.5	0.9
1960-61	45.6	7.5	13.4	1.8
1961-62	47.0	6.1	14.2	2.1
1962-63	45.5	8.8	12.7	1.6
F(df: 5, 285)	1.36	2.03	0.25	1.06

Although the difference was not significant, there did appear to be a general increase in the number of graduate science hours for the more recent acceptees.

Grade Point Average in Undergraduate Science, Graduate Science, Undergraduate Mathematics, and Graduate Mathematics.

As indicated by the F-ratios (Table XV) there was no significant difference among mean grade point averages of the acceptee groups in their undergraduate and graduate work in the areas of science and mathematics.

Table XV. Analysis of variance of undergraduate and graduate science and mathematics grade point average of acceptees.

Academic Year	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
1957-58	2. 7	3. 4	2. 7	3. 5
1958-59	2. 8	3. 3	2. 6	3. 2
1959-60	2. 8	3. 4	2. 6	3. 3
1960-61	2. 8	3. 3	2. 7	3. 5
1961-62	2. 8	3. 2	2. 7	3. 1
1962-63	3. 0	3. 4	2. 4	3. 1
F	0. 89	0. 36	1. 43	0. 78
Degrees of F	5, 285	5, 155[§]	5, 245[§]	5, 49[§]

[§]For variance in degrees of freedom see p. 38.

Sex, Marital Status, and Teaching Residence

Application of the chi square formula to the variables of sex, marital status, and teaching residence (Table XVI) revealed that there was no significant difference among acceptee groups for each of the years included in this study.

Table XVI. Sex, marital status, and teaching residence of acceptees.

Academic Year	Sex		Marital Status	
	Male	Female	Married	Single
1957-58	49	5	44	10
1958-59	46	4	41	9
1959-60	45	5	43	7
1960-61	44	4	41	7
1961-62	40	4	37	7
1962-63	44	1	41	4
Chi Square	2.532		2.251	

	Teaching Residence			
	Wash.	Ore.	Calif.	Other
1957-58	13	15	4	22
1958-59	8	16	7	19
1959-60	8	14	13	15
1960-61	11	10	5	22
1961-62	9	10	6	19
1962-63	6	9	5	25
Chi Square	16.297			

Subject Matter Majors

Investigation of acceptee majors revealed that with the exception of the 1961-62 group, biology was the most common area of concentration. Physics was consistently the least common.

The computed chi square (Table XVII), indicated that there was no significant difference among acceptee groups for each of the years included in this study.

Table XVII. Majors of acceptees.

Academic Year	Biol.	Chem.	Phys.	Gen. Sci.	Math.	Non-Sci.
1957-58	20	7	3	12	5	7
1958-59	19	6	0	13	6	6
1959-60	16	5	1	10	4	14
1960-61	22	6	3	4	6	7
1961-62	13	4	1	17	6	3
1962-63	13	4	1	13	2	12

Chi Square = 30.815

Membership in Professional Organizations

With respect to membership in state and national professional organizations, utilization of the chi square formula (Table XVIII) revealed that there was no significant difference among acceptee groups for each of the years included in this study.

Table XVIII. Membership of acceptees in professional organizations.

Academic Year	State			National			
	Education	Mathematics	Science	Education	Mathematics	Science	NSTA
1957-58							
Yes	45	3	10	39	4	21	19
No	9	51	44	15	50	33	35
1958-59							
Yes	48	1	12	39	5	33	29
No	2	49	38	11	45	17	21
1959-60							
Yes	44	2	10	32	2	21	18
No	6	48	40	18	48	29	32
1960-61							
Yes	38	4	10	30	4	27	24
No	10	44	38	18	44	21	24
1961-62							
Yes	37	6	10	28	6	20	19
No	7	38	34	16	38	24	25
1962-63							
Yes	34	3	16	32	4	24	21
No	11	42	29	13	41	21	24
Chi Square	9. 387	6. 188	4. 952	4. 343	3. 000	10. 377	7. 744

In regards to the reading of professional journals, the application of the chi square formula (Table XIX) indicated that there was no significant difference among acceptee groups for each of the years included in this study in the areas of educational and special science journals. With respect to general science journals, the computed chi square (chi square = 17. 795, Table XIX) with five degrees of freedom indicated that there was a significant difference among the acceptees at the one percent level of confidence. Further investigation indicated that significantly more 1957-58 and 1958-59 acceptees did not read general science journals than would be expected by chance.

Table XIX. Reading of professional journals by acceptees.

Academic Year	Educational	General Science	Special Science
1957-58			
Yes	40	37	23
No	14	17	31
1958-59			
Yes	45	38	25
No	5	12	25
1959-60			
Yes	37	47	22
No	13	3	28
1960-61			
Yes	32	43	23
No	16	5	25
1961-62			
Yes	32	36	19
No	12	8	25
1962-63			
Yes	33	41	18
No	12	4	27
Chi Square	8. 062	17. 795**	1. 319

Summary

Characteristics of acceptees for the years 1957 to 1962 were analyzed by either the analysis of variance or the chi square formula to determine if any one year of acceptees was significantly different than the remaining years.

The results of these analyses indicated that:

1. With respect to the number of summer institutes attended, there was a significant difference at the one percent level of confidence. Although no definite pattern was established, there did appear to be a general trend for acceptees to have attended an increasingly greater number of summer institutes.

2. At the five percent level of confidence, there did exist a significant difference among acceptee groups with respect to the number of years since receiving their last degree. No trend or pattern was apparent.

3. At the five percent level of confidence, a significant difference did exist in regards to the number of periods taught per week in the acceptees' minor areas of subject matter preparation. The trend appeared to be one of the more recent acceptees teaching fewer periods per week in their minor areas.

4. With respect to the reading of general science journals, there was a significant difference among acceptee groups at the one

percent level of confidence. Acceptees of the 1957 and 1958 Academic Year Institutes read fewer general science journals than would be expected by chance.

Of the 35 characteristics analyzed, two were found to be significant at the one percent level of confidence and two at the five percent level of confidence (Appendix B).

Comparisons Among Rejectees

This portion of the study presents the statistical analyses of the comparison among groups of rejectees for the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes at Oregon State University. The null hypothesis specifying that no differences existed between the rejectees of any one year and the rejectees of any other year included in this study was checked by the analysis of variance for those characteristics having a numeric continuum, and by the chi square formula for those characteristics not having a numeric continuum.

Age

Mean age of rejectees for each of the five years included in this study indicated a general trend of decreasing age. The computed F-ratio ($F = 4.68$, Table XX) with 4 and 1125 degrees of freedom revealed that there was a significant difference among mean

ages of rejectee groups at the one percent level of confidence. Further investigation indicated that the 1957-58 and 1958-59 rejectees were significantly older than the rejectees of 1959-60, 1961-62, and 1962-63.

Table XX. Analysis of variance of age, dependents, teaching experience, and summer institutes of rejectees.

Academic Year	Mean			
	Age	Dependents	Teaching Experience	Summer Institutes
1957-58	34. 0	2. 9	6. 7	0. 04
1958-59	33. 7	3. 0	6. 4	0. 27
1959-60	32. 1	2. 8	5. 8	0. 40
1961-62	31. 8	2. 7	5. 5	0. 69
1962-63	32. 4	2. 9	6. 1	0. 90
F(df: 4, 1125)	4. 68**	1. 20	2. 61*	48. 17**

*Difference among means significant at the five percent level of confidence.

**Difference among means significant at the one percent level of confidence.

Dependents

Mean number of dependents for rejectees ranged from a high of 3. 0 to a low of 2. 7. The computed F-ratio (Table XX) indicated that there was no significant difference among rejectee groups with respect to number of dependents.

Teaching Experience

With respect to teaching experience, the F-ratio (F = 2.61, Table XX) with 4 and 1125 degrees of freedom indicated that there was a significant difference among rejectee means at the five percent level of confidence. Although there was not a conclusive pattern established, there did appear to be a general trend of rejectees having fewer years of teaching experience.

Summer Institutes Attended

As indicated by the F-ratio (F = 48.17, Table XX) with 4 and 1125 degrees of freedom, there was a significant difference among means at the one percent level of confidence. Further application of the analysis of variance indicated that rejectees for each year had attended significantly more summer institutes than the rejectees of the preceeding years.

A trend of an increase in summer institutes attended was definitely indicated.

Years Since Receiving Last Degree

The computed F-ratio (F = 5.10, Table XXI) with 4 and 1125 degrees of freedom indicated that there was a significant difference among means at the one percent level of confidence. Further

analysis indicated that rejectees for 1957-58 and 1958-59 had a significantly greater time elapse since their last degree than had the rejectees for 1959-60, 1961-62, and 1962-63.

A trend of the more recent rejectees having fewer years since their last degree appeared to have been established.

Table XXI. Analysis of variance of years since receiving last degree, periods taught per week in major, in minor, and outside of major and minor of rejectee.

Academic Year	Mean Years Since Last Degree	Mean In Major	Mean In Minor	Mean Outside Major And Minor
1957-58	7.7	9.1	10.4	3.4
1958-59	7.2	8.9	10.0	4.2
1959-60	6.3	9.8	9.6	3.3
1961-62	6.0	9.9	9.6	3.3
1962-63	6.1	10.6	8.9	3.0
F(df: 4, 1125)	5.10**	0.97	0.66	0.93

**Difference among means significant at the one percent level of confidence.

Periods Taught Per Week in Major

As indicated by the F-ratio (F = 0.97, Table XXI) there was no significant difference among mean number of periods taught per week by rejectee groups for each of the years included in this study.

Periods Taught Per Week in Minor

Mean number of periods taught per week in their minor subject matter areas of preparation for rejectees ranged from a low of 8.9 to a high of 10.4. Although the F-ratio ($F = 0.66$, Table XXI) indicated that there was no significant difference among means, there does appear to be a trend of the rejectees teaching fewer periods per week in their minor areas.

Periods Taught Per Week Outside of Major and Minor

The computed F-ratio ($F = 0.93$, Table XXI) indicated that there was no significant difference among means of the rejectee groups with respect to number of periods taught per week outside of their major and minor areas of subject matter preparation.

Semester Hours in Biology, Chemistry, Physics, Earth Science and Mathematics

With respect to hours of preparation in the various subject matter areas, the F-ratios (Table XXII) indicated that there was no significant difference among means of rejectee groups for each of the years included in this study.

Table XXII. Analysis of variance of mean semester hours in biology, chemistry, physics, earth science, and mathematics of rejectees.

Academic Year	Biology	Chemistry	Physics	Earth Science	Math.
1957-58	19.5	13.0	9.7	4.0	14.1
1958-59	21.3	13.3	8.8	4.0	14.0
1959-60	22.7	13.6	7.5	3.9	12.8
1961-62	20.3	11.6	8.2	4.0	14.1
1962-63	22.5	14.0	9.2	5.1	15.2
F(df: 4, 1125)	1.15	1.92	2.25	1.07	1.15

Semester Hours in Undergraduate Science, Graduate Science, Undergraduate Mathematics, and Graduate Mathematics

With respect to undergraduate science and mathematics, computed F-ratios (Table XXIII) indicated that there was no significant difference among rejectee groups for each of the years included in this study.

As indicated by the F-ratio ($F = 2.84$, Table XXIII) with 4 and 1125 degrees of freedom, there was a significant difference among graduate mathematics means at the five percent level of confidence.

In the area of graduate science work, the F-ratio ($F = 4.48$, Table XXIII) with 4 and 1125 degrees of freedom indicated that there was a significant difference among means at the one percent level of confidence. Further analysis revealed that 1957-58 rejectees had significantly fewer hours of graduate science than did 1962-63

rejectees.

Table XXIII. Analysis of variance of mean semester hours of undergraduate and graduate science and mathematics of rejectees.

Academic Year	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
1957-58	42. 3	3. 7	13. 5	0. 6
1958-59	42. 2	5. 0	12. 7	1. 2
1959-60	41. 3	6. 3	11. 7	0. 9
1961-62	38. 6	5. 4	12. 7	1. 3
1962-63	43. 1	7. 4	13. 6	1. 8
F(df: 4, 1125)	2. 15	4. 48**	1. 12	2. 84*

*Difference among means significant at the five percent level of confidence

**Difference among means significant at the one percent level of confidence.

At the graduate level, there appeared to be a trend towards more preparation in science and mathematics.

Grade Point Average in Undergraduate Science, Graduate Science, Undergraduate Mathematics and Graduate Mathematics

The F-ratios (Table XXIV) indicated that there was no significant difference among mean grade point averages of rejectees in their undergraduate and graduate work in the areas of science and mathematics.

Table XXIV. Analysis of variance of undergraduate and graduate science and mathematics grade point average of rejectees.

Academic Year	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
1957-58	2.5	3.2	2.6	3.5
1958-59	2.4	3.3	2.4	3.2
1959-60	2.5	3.2	2.4	3.2
1961-62	2.5	3.2	2.5	3.2
1962-63	2.5	3.2	2.4	3.0
F-ratio	0.54	0.11	1.85	1.54
Degrees of F	4, 1125	4, 502[§]	4, 946[§]	4, 185[§]

[§]For variance in degrees of freedom see p. 38.

Sex, Marital Status, and Teaching Residence

With respect to sex and marital status, the chi squares (Table XXV) indicated that there was no significant difference among rejectee groups for each of the years included in this study.

For the variable, teaching residence, the computed chi square (chi square = 22.610, Table XXV) with 12 degrees of freedom indicated that there was a significant difference among rejectee groups at the five percent level of confidence.

Subject Matter Majors

As was the case with the acceptees, biology was the most common major with rejectees and physics the least common.

Table XXV. Sex, marital status, and teaching residence of rejectees.

Academic Year	Sex		Marital Status		Teaching Residence			
	Male	Female	Married	Single	Wash.	Ore.	Calif.	Other
1957-58	155	6	140	21	21	28	15	97
1958-59	160	13	150	23	16	11	19	127
1959-60	171	6	156	21	10	21	24	122
1961-62	290	13	259	44	26	33	43	201
1962-63	306	10	264	52	36	28	45	207
Chi Square	5.880		2.422		22.610*			

*Computed chi square significant at the five percent level of confidence.

However, the frequency counts in the category of non-science major exceeded biology in 1957-58, 1958-59, and 1961-62.

Analysis using the chi square formula (Table XXVI) indicated that there was no significant difference among rejectee groups for each of the years included in this study on the basis of subject matter majors.

Table XXVI. Majors of rejectees.

Academic Year	Biol.	Chem.	Phys.	Gen. Sci.	Math.	Non-Sci.
1957-58	45	11	5	34	16	50
1958-59	49	14	4	30	18	58
1959-60	61	15	1	25	18	57
1961-62	85	18	4	59	38	99
1962-63	100	27	7	59	47	76

Chi Square = 20.751

Membership in Professional Organizations

With respect to membership in state and national professional organizations, no significant differences were noted for state and national educational organizations, state mathematics organizations, national science organizations, and the National Science Teachers Association. At the five percent level of confidence, the chi square (chi square = 12.875, Table XXVII) with four degrees of freedom indicated that there was a significant difference among rejectee

Table XXVII. Membership of rejectees in professional organizations.

Academic Year	State			National			
	Education	Mathematics	Science	Education	Mathematics	Science	NSTA
1957-58							
Yes	122	12	19	102	9	43	39
No	39	149	142	59	152	118	122
1958-59							
Yes	132	7	28	100	14	57	49
No	41	166	145	73	159	116	124
1959-60							
Yes	143	7	41	108	8	63	45
No	34	170	136	69	169	114	132
1961-62							
Yes	240	23	36	177	56	100	81
No	63	280	267	126	247	203	222
1962-63							
Yes	231	21	52	185	34	105	76
No	85	295	264	131	282	211	240
Chi Square	5.116	4.468	12.875*	1.635	31.889**	3.355	1.434

*Computed chi square significant at the five percent level of confidence.

**Computed chi square significant at the one percent level of confidence.

groups on the basis of membership in state science organizations.

For the variable, membership in national mathematics organizations, the chi square (chi square = 31.889, Table XXVII) with four degrees of freedom revealed that there was a significant difference among rejectee groups at the one percent level of confidence. Further application of the chi square formula revealed that fewer 1959-60 rejectees belonged to national mathematics organizations than would be expected. Also, more 1961-62 rejectees belonged to national mathematics organizations than would be expected.

Reading of Professional Journals

As indicated by the chi square (chi square = 19.554, Table XXVIII) with four degrees of freedom, there was a significant difference among rejectee groups at the one percent level of confidence with respect to the reading of educational journals. Further analysis pointed out that a greater number of rejectees during 1958-59 read educational journals than would be expected.

With respect to the reading of general science journals, the computed chi square (chi square = 46.001, Table XXVIII) with four degrees of freedom indicated that there was a significant difference among rejectee groups at the one percent level of confidence. Additional application of the chi square formula revealed that fewer rejectees during 1957-58, 1958-59, and 1959-60 read general science

journals than would be expected by chance.

Table XXVIII. Reading of professional journals by rejectees.

Academic Year	Educational	Special Science	General Science
1957-58			
Yes	128	56	98
No	33	105	63
1958-59			
Yes	140	70	111
No	33	103	62
1959-60			
Yes	126	68	143
No	51	109	34
1961-62			
Yes	201	97	238
No	102	206	65
1962-63			
Yes	212	110	264
No	104	206	52
Chi Square	19.554**	4.230	46.001**

**Computed chi square significant at the one percent level of confidence.

Application of the chi square formula to the variable, reading of special science journals (Table XXVIII), revealed that there was no significant difference among rejectee groups on the basis of this characteristic.

Summary

Characteristics of rejectees for the 1957-58, 1958-59, 1959-60,

1961-62, and 1962-63 Academic Year Institutes were analyzed by either the analysis of variance or the chi square formula to determine if any one group of rejectees was significantly different than the remaining groups.

The results of these analyses indicated that:

1. Rejectees for the years 1957-58 and 1958-59 were significantly older at the one percent level of confidence.

2. There appeared a general trend of the more recent rejectees having less teaching experience. At the five percent level of confidence, there was a significant difference among rejectee groups.

3. As would be expected with respect to number of summer institutes attended, there was a significant difference among rejectee groups at the one percent level of confidence. Rejectees for each year had attended significantly more summer institutes than any of the preceeding rejectee groups.

4. At the one percent level of confidence, 1957-58 and 1958-59 rejectees had a significantly greater time elapse since receiving their last degree.

5. With respect to credits earned in graduate mathematics, there was a significant difference among rejectee groups at the five percent level of confidence.

6. At the one percent level of confidence, 1957-58 rejectees had earned significantly less credit in graduate science than had the

1962-63 rejectees.

7. Concerning teaching residence, there was a significant difference at the five percent level of confidence.

8. With respect to membership in state science organizations, there was a significant difference at the five percent level of confidence. At the one percent level of confidence, significantly fewer 1959-60 rejectees belonged to national mathematics organizations, whereas a significantly greater number of 1961-62 rejectees were members.

9. At the one percent level of confidence, significantly more 1958-59 rejectees read education journals, while significantly less 1957-58, 1958-59, and 1959-60 rejectees read general science journals.

Of the 35 characteristics analyzed, seven were found to be significant at the one percent level of confidence and four at the five percent level of confidence (Appendix B).

Comparisons Among Applicants from Washington, Oregon, California, and Other Areas

In terms of selected characteristics, this portion of the study presents the statistical analyses of the comparison among the applicants from Washington, Oregon, California, and other geographical areas. The population utilized in this segment of the study consisted

of applicants to the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes at Oregon State University.

The null hypothesis specifying that no differences existed among applicants from Washington, Oregon, California, and all other geographical areas was checked by the analysis of variance for those characteristics having a numeric continuum, and by the chi square formula for those characteristics not having a numeric continuum.

Age

The computed F-ratio ($F = 6.15$, Table XXIX) with 3 and 1369 degrees of freedom indicated that there was a significant difference among mean ages of the applicant groups at the one percent level of confidence. Further analysis revealed that applicants from areas other than the three western states were significantly younger than those from Washington and California.

Dependents

Applicants from Washington had the highest mean number of dependents with 3.04, whereas applicants from areas other than the three western states had the lowest with a 2.74 mean. The F-ratio ($F = 1.99$, Table XXIX) indicated that there was no significant difference among means.

Table XXIX. Analysis of variance of age, dependents, summer institutes, teaching experience, and years since receiving last degree of applicants from Washington, Oregon, California, and other areas.

Characteristic	Wash.	Ore.	Calif.	Other Areas	F(df:3,1369)
Mean Age	33.6	33.0	34.1	32.1	6.15**
Mean Dependents	3.0	2.8	3.0	2.7	1.99
Mean Summer Institutes	0.38	0.36	0.61	0.58	6.44**
Mean Teaching Experience	6.0	6.1	7.1	6.0	2.99*
Mean Years Since Last Degree	7.0	6.6	7.1	6.4	1.39

*Difference among means significant at the five percent level of confidence.

**Difference among means significant at the one percent level of confidence.

Summer Institutes Attended

At the one percent level of confidence, the F-ratio (F = 6.44, Table XXIX) indicated a significant difference among applicant groups. Applicants from Washington and Oregon had attended significantly fewer summer institutes than had those from California and other areas.

Teaching Experience

Mean years of teaching experience ranged from a high of 7.1 for applicants from California to a low of 6.0 for those from

Washington and areas other than the three western states. The computed F-ratio (F = 2. 99, Table XXIX) indicated that there was a significant difference among means at the five percent level of confidence.

Years Since Receiving Last Degree

The mean number of years since receiving their last degree ranged from 6. 4 to 7. 1. The F-ratio (F = 1. 39, Table XXIX) indicated that there was no significant difference among means.

Periods Taught Per Week in Major

Periods taught per week in subject matter major varied from a low of 9. 5 for the Oregon applicants to a high of 10. 6 for applicants from California. The computed F-ratio (F = 0. 39, Table XXX) indicated that there was no significant difference among means.

Table XXX. Analysis of variance of periods taught per week in major, minor, and outside of major and minor of applicants from Washington, Oregon, California, and other areas.

Applicants	In Major	In Minor	Outside Major And Minor
Washington	9. 7	11. 0	3. 4
Oregon	9. 5	11. 3	2. 6
California	10. 6	8. 8	4. 5
Other Areas	9. 9	10. 0	3. 1
F (df: 3, 1369)	0. 39	2. 12	2. 31

Periods Taught Per Week in Minor

As indicated by the F-ratio (F= 2. 12, Table XXX) there was no significant difference among means. The mean number of periods taught per week in minor subject matter areas ranged from a low of 8. 8 for California applicants to a high of 11. 3 for applicants from Oregon.

Periods Taught Per Week Outside of Major and Minor

The range in mean number of periods taught per week outside of major and minor areas of subject matter preparation varied from a low of 2. 6 for Oregon applicants to a high of 4. 5 for those applicants from California. The F-ratio (F = 2. 31, Table XXX) indicated that there was no significant difference among means.

Semester Hours in Biology

Mean hours in biology ranged from a low of 19. 9 for the Oregon applicants to a high of 26. 8 for applicants from California. As indicated by the F-ratio (F = 5. 72, Table XXXI) with 3 and 1369 degrees of freedom, there was a significant difference among means at the one percent level of confidence. Further investigation pointed out that applicants from California had a significantly greater semester hour mean in biology than did the applicants from the three remaining

areas.

Table XXXI. Analysis of variance of mean semester hours in biology, chemistry, physics, earth science and mathematics of applicants from Washington, Oregon, California, and other areas.

Subject	Wash.	Ore.	Calif.	Other Areas	F (df:3, 1369)
Biology	19. 9	20. 7	26. 8	21. 0	5. 72**
Chemistry	14. 8	13. 3	14. 0	13. 2	1. 01
Physics	9. 6	10. 2	9. 2	8. 6	2. 36
Earth Science	4. 3	4. 4	5. 9	4. 2	2. 27
Mathematics	12. 9	15. 1	13. 3	14. 6	1. 48

**Difference among means significant at the one percent level of confidence.

Semester Hours in Chemistry

Preparation in chemistry ranged from a 13. 2 mean for applicants from areas other than the three western states to a 14. 8 mean for the applicants from Washington. The computed F-ratio (F = 1. 01, Table XXXI) revealed that there was no significant difference among means.

Semester Hours in Physics

Range in physics preparation varied from a high of 10. 2 for Oregon applicants to a low of 8. 6 for applicants from areas other than the three western states. As indicated by the F-ratio (F = 2. 36,

Table XXXI) there was no significant difference among means.

Semester Hours in Mathematics

Preparation in mathematics ranged from a 15. 1 mean for Oregon applicants to a 12. 9 mean for applicants from Washington. The computed F-ratio (F = 1. 48, Table XXXI) indicated that there was no significant difference among means.

Semester Hours in Earth Science

Range in mean hours of earth science varied from a high of 5. 9 for California applicants to a low of 4. 2 for applicants from areas other than the three western states. As indicated by the F-ratio (F = 2. 27, Table XXXI) there was no significant difference among means.

Semester Hours in Undergraduate Science

Mean hours of preparation in undergraduate science ranged from a high of 47. 9 for California applicants to a low of 40. 9 for applicants from Oregon. At the one percent level of confidence, the F-ratio (F = 5. 73, Table XXXII) with 3 and 1369 degrees of freedom indicated that there was a significant difference among means. Additional utilization of the analysis of variance pointed out that applicants from California had a significantly greater mean than did

applicants from other groups.

Table XXXII. Analysis of variance of undergraduate and graduate science and mathematics semester hours of applicants from Washington, Oregon, California, and other areas.

Applicants	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
Washington	43.5	4.5	12.0	0.9
Oregon	40.9	6.8	13.6	1.6
California	47.9	8.2	12.0	1.3
Other Areas	41.5	5.4	13.3	1.3
F-ratio (df: 3, 1369)	5.73**	6.00**	1.54	0.83

**Difference among means significant at the one percent level of confidence.

Semester Hours in Graduate Science

Mean hours of graduate science ranged from a high of 8.2 to a low of 4.5. The F-ratio (F = 6.00, Table XXXII) with 3 and 1369 degrees of freedom indicated that there was a significant difference among means at the one percent level of confidence. Further investigation revealed that California applicants had a significantly higher mean than did the applicants of other groups. Also, the mean of Oregon applicants was significantly greater than the mean of applicants from Washington and those from areas other than the three western states.

Semester Hours in Undergraduate Mathematics

Preparation in undergraduate mathematics ranged from a high mean of 13.6 for Oregon applicants to a low of 12.0 for applicants from Washington. As indicated by the F-ratio ($F = 1.54$, Table XXXII) there were no significant difference among means.

Semester Hours in Graduate Mathematics

The range in mean hours of graduate mathematics varied from a high of 1.6 to a low 0.9. The computed F-ratio ($F = 0.83$, Table XXXII) indicated that there was no significant difference among means.

Undergraduate Science Grade Point Average

Mean grade point averages ranged from a high of 2.7 for applicants from the three western states to a low of 2.5 for applicants from other areas. At the one percent level of confidence, the F-ratio ($F = 8.43$, Table XXXIII) with 3 and 1369 degrees of freedom indicated that there was a significant difference among means. Further analysis pointed out that applicants from Oregon, Washington, and California had a significantly higher grade point average than did the remaining group of applicants.

Table XXXIII. Analysis of variance of undergraduate and graduate science and mathematics grade point average of applicants from Washington, Oregon, California, and other areas.

Applicants	U. Grad. Science	Grad. Science	U. Grad. Math.	Grad. Math.
Washington	2. 7	3. 0	2. 0	3. 0
Oregon	2. 7	2. 9	2. 1	3. 1
California	2. 7	2. 9	2. 1	3. 2
Other Areas	2. 5	2. 7	2. 1	3. 0
F-ratio	8. 43**	2. 99*	0. 38	0. 58
Degrees of Freedom	3, 1369	3, 799§	3, 1150§	3, 255§

*Difference among means significant at the five percent level of confidence.

**Difference among means significant at the one percent level of confidence.

§For variance in degrees of freedom see p. 38.

Graduate Science Grade Point Average

The range of graduate science grade point means varied from a high of 3. 0 for Washington applicants to a low of 2. 7 for applicants from areas other than the three western states. The computed F-ratio (F = 2. 99, Table XXXIII) with 3 and 779 degrees of freedom indicated that there was a significant difference among means at the five percent level of confidence.

Undergraduate Mathematics Grade Point Average

Relatively little variance existed with respect to the undergraduate mathematics grade point average means. Washington applicants had a mean of 2. 0 whereas all other groups had a mean of 2. 1. The F-ratio (F = 0. 38, Table XXXIII) indicated that there was no significant difference among means.

Graduate Mathematics Grade Point Average

Mean grade point averages in graduate mathematics were much the same for all groups. As indicated by the F-ratio (F = 0. 58, Table XXXIII) there was no significant difference among means.

Sex

With respect to sex (Table XXXIV), analysis by the chi square formula indicated that there was no significant difference among the four applicant groups.

Marital Status

The computed chi square (chi square = 13. 288, Table XXXIV) with three degrees of freedom indicated that there was a significant difference among applicant groups at the one percent level of confidence. Further application of the chi square formula pointed out

that significantly more of the applicants from areas other than the three western states were single than would be expected.

Table XXXIV. Sex and marital status of applicants from Oregon, Washington, California, and other areas.

	Sex		Marital Status	
Applicants	Male	Female	Married	Single
Washington	162	2	151	13
Oregon	185	10	177	18
California	178	8	157	29
Other Areas	825	51	731	145
Chi Square	6.383		13.288**	

**Computed chi square significant at the one percent level of confidence.

Subject Matter Majors

With respect to subject matter majors, the chi square (chi square = 27.685, Table XXXV) with 15 degrees of freedom indicated that there was a significant difference among applicant groups at the five percent level of confidence.

Table XXXV. Majors of applicants from Washington, Oregon, California, and other areas.

Majors	Wash.	Ore.	Calif.	Other Areas
Biology	47	61	77	258
Chemistry	20	14	13	70
Physics	6	7	4	13
General Science	35	34	23	184
Mathematics	16	24	15	111
Non-science	40	55	54	240
Chi Square	27.685*			

*Computed chi square significant at the five percent level of confidence.

Membership in Professional Organizations

Utilization of the chi square formula (Table XXXVI) revealed that there was no significant difference among applicant groups with respect to membership in state educational organizations, national mathematics organizations, state and national science organizations, and the National Science Teachers Association.

The computed chi square (chi square = 48.238, Table XXXVI) with three degrees of freedom indicated that there was a significant difference among groups at the the one percent level of confidence on the basis of membership in national educational organizations. Further analysis pointed out that significantly fewer applicants from California belonged to national educational organizations than would

Table XXXVI. Membership in professional organizations of applicants from Washington, Oregon, California, and other areas.

Applicants	State			National			NSTA
	Education	Mathematics	Science	Education	Mathematics	Science	
Washington							
Yes	134	11	22	121	15	69	62
No	30	153	142	43	149	95	102
Oregon							
Yes	157	24	40	142	20	72	59
No	38	171	155	53	175	123	136
California							
Yes	139	14	23	80	14	66	52
No	47	172	163	106	172	120	134
Other Areas							
Yes	684	40	159	529	97	307	247
No	192	836	717	347	779	569	629
Chi Square	3. 104	16. 993**	6. 769	48. 238**	2. 356	3. 041	6. 412

**Computed chi square significant at the one percent level of confidence.

be expected.

With respect to membership in state mathematics organizations, the computed chi square (chi square = 16.993, Table XXXVI) with three degrees of freedom indicated that there was a significant difference among applicant groups at the one percent level of confidence. Further application of the chi square formula revealed that significantly fewer applicants from areas other than the three western states belonged to state mathematics organizations than would be expected.

Reading of Professional Journals

In regard to the reading of educational journals, the computed chi square (chi square = 16.237, Table XXXVII) with three degrees of freedom revealed that there was a significant difference among applicant groups at the one percent level of confidence. Further analysis pointed out that significantly more of the applicants from areas other than the three western states read educational journals than would be expected.

With respect to the reading of special science journals, the computed chi square (chi square = 8.805, Table XXXVII) with three degrees of freedom indicated that there was a significant difference among applicant groups at the five percent level of confidence.

In the analysis of reading general science journals, the chi

square (Table XXXVII) indicated that there was no significant difference among applicant groups.

Table XXXVII. Reading of professional journals by applicants from Washington, Oregon, California, and other areas.

Applicants	Educational	Special Science	General Science
Washington			
Yes	122	59	131
No	42	105	33
Oregon			
Yes	125	87	150
No	70	108	45
California			
Yes	120	79	152
No	66	107	34
Other Areas			
Yes	659	306	663
No	217	570	213
Chi Square	16.237**	8.805*	3.966

*Computed chi square significant at the five percent level of confidence.

**Computed chi square significant at the one percent level of confidence.

Summary

Characteristics of applicants to the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes at Oregon State University were analyzed by either the analysis of variance or the chi square formula to determine if any signficant differences existed

among applicant groups from Washington, Oregon, California, and all other geographical areas.

The results of these analyses indicated that:

1. At the one percent level of confidence, applicants from Washington and California were significantly older than the applicants from areas other than the three western states.

2. At the one percent level of confidence, applicants from Washington and Oregon had attended significantly fewer summer institutes than had those from California and other areas.

3. With respect to years of teaching experience, there was a significant difference among applicant groups at the five percent level of confidence.

4. At the one percent level of confidence, applicants from California had a significantly greater number of credits in biology than did the applicants of the remaining groups.

5. At the one percent level of confidence, applicants from California had significantly more semester hours of undergraduate science than did the applicants from the remaining groups.

6. At the one percent level of confidence, applicants from California had significantly more hours of preparation in graduate science than did the applicants from the three remaining groups. Also, applicants from Oregon had significantly more graduate science credits than did the applicants from Washington and those from areas

other than the three western states.

7. Applicants from the three western states had a significantly higher undergraduate science grade point average, at the one percent level of confidence, than did the applicants from other areas. With respect to graduate science grade point averages, there was a significant difference among applicant groups at the five percent level of confidence.

8. At the one percent level of confidence, significantly more of the applicants from areas other than the three western states were single than would be expected.

9. With respect to subject matter majors, there was a significant difference among applicant groups at the five percent level of confidence.

10. At the one percent level of confidence, significantly fewer applicants from California belonged to national educational organizations and significantly fewer applicants from areas other than the three western states belonged to state mathematics organizations.

11. At the one percent level of confidence, significantly more of the applicants from areas other than the three western states read educational journals. With respect to special science journals, there was a significant difference among applicant groups at the five percent level of confidence.

Of the 35 characteristics analyzed, ten were found to be

significant at the one percent level of confidence and four at the five percent level of confidence (Appendix C).

Certification Qualifications of Applicants from Washington, Oregon, and California

This portion of the study was concerned with determining the number of applicants from Washington, Oregon, and California that met their respective state certification requirements in respect to subject matter preparation in the areas of science and mathematics normally taught in the junior and senior high schools.

Each applicant's science and mathematics course work was classified, as described in Chapter III of this study, and compared to the certification requirements that were in effect during the years covered by the study.

Washington

Since the State of Washington had no certification requirements in terms of subject matter preparation, all applicants from Washington were certified in this respect. However, the State of Washington did recommend that teachers in the field of science and/or mathematics have a major or at least a minor in their teaching field. In view of this recommendation, 40 of the 164 applicants from Washington did not have a major in science or mathematics. Furthermore,

three applicants did not have a major or minor in science or mathematics.

Oregon

Of the 195 applicants from the State of Oregon, one did not have sufficient subject matter preparation to meet certification requirements in mathematics or in one of the science areas.

In terms of specific subject areas, 114 applicants were qualified to teach mathematics; 117 in biology; 128 in chemistry and physics; 147 in physical science; and 160 in ninth grade science.

California

As presented in Chapter III, the State of California has separate certification requirements for junior and senior high school teachers. All applicants from California met the minimum requirements for certification to teach junior high science or mathematics. At the high school level, 22 of the 186 applicants did not meet the minimum requirements for certification in science or mathematics. However, it should be pointed out that this study was not designed to determine if these applicants were teaching at the high school level.

Subject Matter Preparation of Applicants

The sixth and final portion of this study presents information concerning the nature and amount of subject matter preparation of applicants in fields of science and mathematics.

Applicants were grouped according to their major for purposes of reporting information concerning their subject matter preparation. As outlined in Chapter III of this study, science and mathematics course work was grouped into categories as recommended by the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science (2, p. 1024-1029), hereafter, referred to as AAAS recommendations.

Biology Majors

Of 1421 applicants included in this study, 443 were biology majors. For those applicants, preparation in all types of biology courses ranged from a minimum of 30 semester credits to a maximum of 131, with a mean of 44. 8 (Appendix D).

Many of the biology majors did not have course work in those areas recommended by the AAAS. As shown in Table XXXVIII, 18 of the biology majors had no preparation in the area of plant and animal physiology, anatomy and morphology; 186 lacked course work in ecology and conservation; 133 were void of courses in developmental

anatomy and genetics; and 292 had not received a course in preparation and use of biological materials.

Table XXXVIII. Distribution of biology majors by type and amount of AAAS recommended biology credits.

Course Classification	Semester Credits				
	None	1-3	4-6	7-9	10 or more
Group A (principles of biology)	0	24	0	45	368
Group B (physiol., anat., morph.)	18	34	173	86	126
Group C (ecology & conservation)	186	110	141		
Group D (develop. anat. & genet.)	133	239	65		
Group E (prep. of biol. material)	292	104	41		

With respect to advance course work (Appendix E), as recommended by the AAAS, biology majors had a mean of 4.3 semester credits. It should be noted that 148 biology majors had received no course work that could be placed in the advanced course work category.

In terms of recommended supporting courses, biology majors had respective mean semester credits (Appendix F) in physics, chemistry, earth science and mathematics of 5.9, 10.5, 4.4, and 4.8.

Complete information was not available for six of the biology majors and was therefore not included in this portion of the study.

Chemistry Majors

Mean semester credits (Appendix D) in chemistry for the 117 chemistry majors, irrespective of course type, was 39.4. The range in credits varied from a low of 30 semester hours to a high of 98.0.

In the area of general principles of chemistry, all chemistry majors (Table XXXIX) had received some credit and 106 had eight or more semester credits. One chemistry major had not received credit in organic chemistry, whereas 102 had eight or more hours. Analytical chemistry was void in the backgrounds of four chemistry majors, while 96 had received from four to seven semester credits. Physical chemistry had not been taken by 34 of the chemistry majors, whereas 42 had received eight or more semester credits.

Table XXXIX. Distribution of chemistry majors by type and amount of AAAS recommended chemistry credits.

Course Classification	Semester Credits			
	None	1-3	4-7	8 or more
Group A (general principles)	0	0	9	106
Group B (organic chemistry)	1	0	12	102
Group C (analytical chemistry)	4	15	96	0
Group D (physical chemistry)	34	13	26	42

Chemistry majors had a mean of 5. 5 semester credits of recommended advance course work. However, 29 of the chemistry majors (Appendix E) had not received credit in AAAS recommended areas of advanced course work.

In terms of AAAS recommended supporting courses, (Appendix F) chemistry majors had mean semester credits of 7. 5 in biology, 10. 6 in physics, and 10. 8 in mathematics.

Complete information was not available for two of the chemistry majors and was therefore not included in this portion of the study.

Physics Majors

When considering all types of physics courses, the 30 physics majors (Appendix D) had a mean of 40. 0 semester credits in physics preparation. The range of credits varied from a minimum of 30 semester hours to a maximum of 63. 0.

Of the 30 physics majors (Table XXXX), 25 had ten or more semester credits in introductory physics courses. In terms of intermediate courses, 16 had ten or more semester hours, whereas one physics major had no credit in this area. Modern physics was void in the preparation of six physics majors, while 16 had received from four to six semester units.

Physics majors had a mean of 4. 1 semester credits in advanced

course work (Appendix E). However, 12 of the physics majors had no background at this level.

Table XXXX. Distribution of physics majors by type and amount of AAAS recommended physics credits.

Course Classification	Semester Credits				
	None	1-3	4-6	7-9	10 or more
Group A (Introd. courses)	0	3	1	1	25
Group B (Intermed. courses)	1	2	4	7	16
Group C (modern physics)	6	8	16	-	-

With respect to AAAS recommended supporting courses, physics majors had mean semester credits in chemistry, biology, and mathematics of 10.6, 2.0, and 14.8 respectively (Appendix F). However, it should be noted that 21 of the physics majors had no organic chemistry and 24 had no physical chemistry.

General Science Majors

The 276 general science majors had mean semester credits of 18.7 in biology, 9.8 in physics, 15.0 in chemistry, 6.2 in earth science, and 12.4 in mathematics (Appendix D). When considering those course areas recommended by the AAAS (Table XXXXI), the mean semester credits were 12.8 for biology, 8.3 in physics, 11.7 in chemistry, and 7.3 in mathematics.

Table XXXXI. Distribution of general science majors by type and amount of AAAS recommended semester credits.

Course Classification	Semester Credits				
	None	1-3	4-6	7-9	10 or more
Biology					
Group A (principles of bio.)	4	18	48	60	143
Group B (physiol., anat., morph.)	91	71	82	23	6
Group C (ecology & conservation)	213	24	36	-	-
Group D (devel. anat. & genet.)	168	49	56	-	-
Group E (prep. of biol. material)	248	14	11	-	-
Chemistry					
Group A (general principles)	1	3	39	230	-
Group B (organic chemistry)	127	33	61	52	-
Group C (analytical chemistry)	192	8	73	-	-
Group D (physical chemistry)	259	11	3	-	-
Physics					
Group A (introd. courses)	47	19	38	69	100
Group B (intermed. courses)	208	25	20	14	6
Group C (modern physics)	239	30	14	-	-
Mathematics					
Group A (analysis)	31	20	127	34	61
Group B (algebra, geom., found.)	237	26	9	1	-
Group C (prob. and statistics)	246	27	-	-	-
Group D (applications of math.)	262	11	-	-	-

In terms of advanced work (Appendix E), the general science majors had a mean of 1. 7 semester units. One hundred eighty-seven of the general science majors had no credit at this level.

Complete information was not available for three of the general science majors and was therefore not included in this portion of the study.

Mathematics Majors

With respect to all mathematics courses taken, (Appendix D), the 166 mathematics majors had 38. 4 mean semester credits. Range in preparation varied from a high of 78 semester hours to a low of 30.

All mathematics majors had some work in the area of analysis, with 157 having had at least 12 semester hours. Fifteen of the mathematics majors had taken no courses in the grouping of algebra, geometry, and foundations of mathematics. Probability and statistics were void in the backgrounds of 88 mathematics majors. With respect to courses in mathematical applications, 117 of the mathematics majors had no credit, while 49 had from 1 to 3 semester credits (Table XXXXII).

In terms of supporting courses as recommended by AAAS, (Appendix F), mathematics majors had semester credit means of 4. 6 in biology, 7. 8 in chemistry, 9. 9 in physics, and 3. 4 in earth

science. In the area of advanced study the mean was 1. 3 semester credits (Appendix E).

Table XXXXII. Distribution of mathematics majors by type and amount of AAAS recommended mathematics credits.

Course Classification	Semester Credits				
	None	1-3	4-7	8-11	12 or more
Group A (analysis			3	6	157
Group B (algebra, geom., found.)	15	16	58	29	48
Group C (prob. and statistics)	88	76	2	-	-
Group D (applications of math.)	117	48	1	-	-

Non-science Majors

Mean semester credits for applicants not having a science major were 9. 5 in biology, 7. 9 in chemistry, 6. 9 in physics, 12. 2 in mathematics, and 4. 5 in earth science (Appendix D). Of the 389 non-science majors, 47 had no background in biology, 97 in chemistry, 116 in physics, 54 in mathematics, and 183 in earth science.

Table XXXXIII reveals the classification and amount of science and mathematics courses taken by non-science majors as compared to AAAS recommended categories.

With respect to preparation classified as advance courses by

Table XXXXIII. Distribution of non-science majors by type and amount of AAAS recommended semester credits.

Course Classification	Semester Credits				
	None	1-3	4-6	7-9	10 or more
Biology					
Group A (principles of bio.)	88	67	98	72	54
Group B (physiol., anat., morph.)	243	70	54	9	3
Group C (ecology & conservation)	326	23	30	-	-
Group D (devel. anat. & genet.)	331	20	28	-	-
Group E (prep. of bio. material)	359	13	7	-	-
Chemistry					
Group A (general principles)	97	36	80	166	-
Group B (organic chemistry)	312	25	23	19	-
Group C (analytical chemistry)	328	2	49	-	-
Group D (physical chemistry)	369	6	3	1	-
Physics					
Group A (introd. courses)	138	57	58	64	62
Group B (intermed. courses)	210	33	25	8	3
Group C (modern physics)	333	25	21	-	-
Mathematics					
Group A (analysis)	74	49	119	46	91
Group B (algebra, geom., found.)	310	44	22	3	-
Group C (prob. and statistics)	340	38	-	-	-
Group D (application of math.)	358	21	-	-	-

AAAS (Appendix E), 22 non-science majors had one to five semester hours, nine had six to ten hours, and one had 11 to 15 hours.

Incomplete information resulted in ten non-science majors not being included in this portion of the study.

Summary

In terms of total science and mathematics preparation, chemistry majors had the highest mean, followed in decreasing order by physics, biology, mathematics, and general science majors.

With respect to AAAS recommended supporting courses, chemistry majors again had the highest mean, followed by physics, mathematics, and biology majors.

A greater proportion of the chemistry majors had taken advanced courses, with general science and mathematics majors having had the least.

It would appear that, in terms of AAAS recommendations, chemistry and physics majors were the best prepared and mathematics the poorest.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study was designed to provide information about applicants to Academic Year Institute Programs at Oregon State University.

The investigation involved both acceptees and rejectees for the 1957-58, 1958-59, 1959-60, 1961-62, and 1962-63 Academic Year Institutes. Since information concerning the 1960-61 rejectees was not available, only acceptees for that year were included. The population for the study included all acceptees and a randomly selected one-half of the rejectees. A total of 291 acceptees and 1130 rejectees were included in the study.

Data concerning applicant characteristics was obtained from the official National Science Foundation application form and recorded on IBM cards. An IBM 1410 computer was utilized to process the perforated cards.

In terms of selected applicant characteristics, a statistical comparison was made between or among: (a) acceptees and rejectees for each year, (b) acceptees for each year, (c) rejectees for each year, (d) applicants from Oregon, Washington, California, and all other geographical areas.

Comparisons between or among the aforesaid groups were made on the following characteristics: sex; marital status; teaching residence; subject matter major; membership in state and national educational, mathematics, and science organizations; membership in the National Science Teachers Association; reading of educational, special science, and general science journals; age; number of dependents; number of summer institutes attended; years of teaching experience; periods taught per week in major, in minor, and outside major and minor; semester credits earned in biology, physics, chemistry, mathematics, and earth science; undergraduate and graduate semester credits in science and in mathematics; and undergraduate and graduate grade point averages in science and in mathematics.

Those variables not having a numeric continuum were tested by the chi square formula for significance of difference between or among groups, whereas the analysis of variance was utilized to determine significant differences between or among groups for those variables having a numeric continuum. For purposes of interpretation in this study, computed values at the one percent level of confidence were treated as accepting the hypothesis being tested. Significant differences which fell between the five and one percent level of confidence were noted, but were interpreted as having doubtful significance.

Applicants from Oregon, Washington, and California were

investigated to determine the number that met their respective state certification requirements in terms of subject matter preparation in areas of science and mathematics.

Using recommendations of the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science as a guideline, the academic background of all applicants, grouped according to their major, was analyzed to determine the nature and amount of their science and mathematics academic preparation.

Analyses of the data indicated that, for each of the years studied, there was no significant difference between the acceptees and rejectees on the basis of sex; marital status; subject matter major; membership in state and national mathematics organizations; reading of educational and special science journals; summer institutes attended; periods taught per week in major; credits earned in biology and mathematics; credits earned in graduate science; undergraduate and graduate mathematics; and graduate science grade point average.

At the one percent level of confidence, there was a significant difference between 1957-58 acceptees and rejectees on the basis of periods taught per week in minor. Acceptees and rejectees for 1958-59 were significantly different with respect to teaching residence; membership in the National Science Teachers Association, national science organizations, and state and national education

organizations; credits in undergraduate science; and undergraduate science grade point average. Significant differences were noted between 1959-60 acceptees and rejectees in terms of teaching residence and years since receiving last degree. Acceptees and rejectees for 1961-62 were significantly different in the areas of teaching residence, subject matter major, teaching experience, and credits in undergraduate science. For the 1962-63 acceptees and rejectees, significant differences were noted with respect to membership in state and national science organizations, membership in the National Science Teachers Association, and undergraduate science grade point average.

At the five percent level of confidence, the 1957-58 acceptees and rejectees were significantly different in terms of teaching residence and periods taught per week outside of the major and minor. Acceptees and rejectees for 1958-59 were significantly different with respect to number of dependents and credits in chemistry and earth science. The 1959-60 acceptees and rejectees were significantly different on the basis of reading general science journals and periods taught per week in minor. Significant differences were noted between the 1961-62 acceptees and rejectees in terms of membership in state science organizations and the National Science Teachers Association; credits in physics and chemistry; and undergraduate mathematics grade point average.

Relatively few differences were noted in the characteristics of

acceptees for each of the years included in this study. At the one percent level of confidence, significant differences were noted among acceptee groups with respect to number of summer institutes attended and the reading of general science journals. Significant differences at the five percent level of confidence were indicated in terms of years since receiving last degree and number of periods taught per week in the minor.

Rejectee groups for each of the years included in this study were significantly different at the one percent level of confidence with respect to age; number of summer institutes attended; years since receiving last degree; graduate science credits; membership in national mathematics organizations; and the reading of education and general science journals. At the five percent level of confidence, significant differences were noted in the areas of teaching experience; graduate mathematics credits; teaching residence; and membership in state science organizations.

At the one percent level of confidence, significant differences among applicants from Washington, Oregon, California, and all other geographical areas were indicated on the basis of age; summer institutes attended; credits in biology, undergraduate science, and graduate science; undergraduate grade point average; marital status; membership in national education and state mathematics organizations; and reading of educational journals. Significant differences at

the five percent level of confidence were noted in terms of teaching experience, graduate science grade point average, subject matter major, and reading of special science journals.

All applicants from Washington, Oregon, and California, with the exception of one from Oregon, had sufficient academic preparation to meet their respective state certification requirements for the teaching of science and/or mathematics in the junior or senior high schools. Unfortunately, the average periods taught per week in their science and/or mathematics major was only 9. 7 for applicants from Washington, 9. 5 for Oregon, and 10. 6 for California. Furthermore, the average periods taught per week in science and/or mathematics where applicants did not have a major or minor was 3. 4 for Washington, 2. 6 for Oregon, and 4. 5 for California.

Data concerning the nature and amount of academic preparation in science and mathematics indicated that many of the applicants were lacking both in amount and depth of course work as recommended by AAAS. Insofar as could be determined by the data collected in this study, relatively few of the applicants could have met the recommendations of AAAS. In terms of these AAAS recommendations, chemistry majors appeared to be the best prepared while mathematics majors were the poorest.

Conclusions

On the basis of the findings in this study, certain conclusions have been drawn and summarized as follows:

1. Acceptees and rejectees during 1957-58 were significantly different with respect to periods taught per week in minor. During 1958-59 significant differences were noted between acceptees and rejectees on the basis of teaching residence; undergraduate science grade point average; undergraduate science credits; and membership in the National Science Teachers Association, state educational, national educational, and national science organizations. Significant differences between acceptees and rejectees during 1959-60 were revealed on the basis of teaching residence and years since receiving last degree. Acceptees and rejectees during 1961-62 were significantly different on the basis of teaching residence, experience, subject matter major, and credits in undergraduate science. For 1962-63, acceptees and rejectees were significantly different on the basis of undergraduate science grade point average, membership in state and national science organizations, and membership in the National Science Teachers Association.

2. No specific characteristic discriminated consistently between acceptees and rejectees for each of the years included in this study.

3. With the exception of number of summer institutes attended and the reading of general science journals, there was no significant difference among acceptee groups.

4. Rejectee groups were significantly different on the basis of age; summer institutes attended; years since receiving last degree; credits in graduate science; membership in national mathematics organizations; and reading of general science and educational journals.

5. Applicants from Washington, Oregon, California, and other geographical areas were significantly different on the basis of age; summer institutes attended; credits in biology; undergraduate and graduate science credits; undergraduate science grade point; marital status; membership in national education and state mathematics organizations; and reading of education journals.

6. Applicants from Washington, Oregon, and California met their respective state certification requirements in terms of academic preparation in science and/or mathematics.

7. In terms of AAAS recommendations, many applicants are lacking in depth and breadth of preparation in science and mathematics.

Recommendations

As the result of information obtained in this study it is recommended that:

1. Since many science and mathematics teachers appear to have insufficient and/or inappropriate preparation, responsible personnel should:

   a. Encourage government and private agencies to continue sponsoring programs designed to maintain and enhance the competency of experienced teachers.

   b. Not assign teachers to teach in areas where they have inadequate training.

   c. Establish certification procedures that are concerned with nature of preparation as well as amount.

   d. Guide science and mathematics teachers in obtaining academic preparation such as recommended by the AAAS.

   e. Encourage science and mathematics teachers to broaden their backgrounds by reading related journals and joining their professional organizations.

2. Further study and evaluation be made of the adequacy of AAAS recommendations and that undergraduate and graduate programs be designed to more closely coincide with the results of these studies.

3. A study be conducted to determine the extent to which programs such as the Academic Year Institute improves the academic depth and breadth of the participants.

BIBLIOGRAPHY

1. American Association for the Advancement of Science. Preparation of high school science teachers. Science 131:1024-1029. April, 1960.

2. American Association for the Advancement of Science and the National Association of State Directors of Teacher Education and Certification. Secondary school science and mathematics teachers. Washington, D. C., U. S. Government Printing Office, 1963. 45p. (U. S. National Science Foundation NSF 63-10)

3. Brooks, Merle E. and Weldon N. Baker. A study of academic preparation of the secondary science teachers in Kansas. The Science Teacher 24:277-280. Oct. 1957.

4. Brown, Kenneth E. and Ellsworth S. Obourn. Qualifications and teaching loads of mathematics and science teachers in Maryland, New Jersey, and Virginia. Washington, D. C., 1959. 101p. (U. S. Department of Health, Education, and Welfare. Office of Education. Circular 575)

5. Burger, John M. Academic background of Kansas mathematics teachers. School Science and Mathematics 50:139-142. Feb. 1960.

6. California. State Department of Education. California administrative code, Title 5, education. Sacramento, 1962. 8p.

7. Corporation for Economic and Industrial Research. The professional qualifications of applicants to the 1957 summer and academic year institutes. Washington, D. C., 1958. 145p.

8. Cummins, Ernie L. Science education in public high schools of Oregon. Ed. D. thesis. Corvallis, Oregon State University, 1960. 241 numb. leaves.

9. Deloach, Will S. and Auborn R. Hall. Preparation of high school chemistry teachers in Alabama, 1948-49. Science Education 36:27-28. Feb. 1952.

10. Gardner, Marjorie and John S. Richardson. The teachers of science in Ohio's senior high schools. Educational Research Bulletin 39:65-71. March 1960.

11. Garner, James M., Supervisor of Science Programs State of Washington. Personal communication. Olympia, Washington. Jan. 1963.

12. Greulach, Victor A. Some information about the biology applicants to national science foundation institutes in 1960. The American Biology Teacher 20:300-301. Dec. 1958.

13. Howe, Robert W. The relationship of learning outcomes to selected teacher factors and teaching methods in tenth grade biology classes in Oregon. Ed. D. thesis. Corvallis, Oregon State University, 1964. 263 numb. leaves.

14. Kelly, Harry C. National science foundation support for education in the sciences. Higher Education 16:6-13. Oct. 1959.

15. Koelsche, Charles L. The academic and teaching background of secondary science teachers in the state of Ohio. Science Education 43:134-139. March 1959.

16. Koelsche, Charles L. Characteristics of persons submitting applications in 1962 for participation in NSF institute programs at the University of Georgia, Part I. Athens, University of Georgia, 1962. 67p.

17. Koelsche, Charles L. Characteristics of persons submitting applications in 1962 for participation in NSF institute programs at the University of Georgia, Part II. Athens, University of Georgia, 1962. 55p.

18. National Science Foundation. NSF upgrades teaching of science. The Nation's Schools 65:69-75. Feb. 1960.

19. National Science Foundation. Academic year institutes for science and mathematics teachers 1963-64. Washington, D. C., U. S. Government Printing Office, 1962. 20p.

20. Orr, David B. and Albert T. Young, Jr. Who attends NSF institutes? The Science Teacher 30:39-40. Nov. 1963.

21. Pella, Milton O. The nature of the academic preparation in science of Wisconsin high school teachers of physics, chemistry, biology, and general science. Science Education 42:106-137. March 1958.

22. Romine, Stephen. The subject field preparation of Colorado high school teachers. Boulder, University of Colorado, Bureau of Educational Research and Service, College of Education, 1957. 38p.

23. Science Research Associates. A study of the attributes of applicants to National Science Foundation Institutes in 1960. Washington, D. C., 1961. 282p.

24. Sovick, Dick., Director of Teacher Education and Certification. Personal communication. Salem, Oregon. Jan. 1963.

25. Thaw, Richard F. Teaching load of teachers of science in Oregon. Ed. D. thesis. Corvallis, Oregon State University, 1960. 241 numb. leaves.

26. Timmermann, Dan, Jr. A study of some characteristics of applicants to academic year institutes at the Ohio State University. Master's thesis. Columbus, Ohio State University, 1962. 174 numb. leaves. (Microfilm)

27. Wert, James E., Charles O. Neidt and Stanley J. Ahmann. Statistical methods in educational and psychological research. New York, Appleton - Century - Crofts, 1954. 435p.

APPENDICES

APPENDIX A

CHARACTERISTICS SHOWING SIGNIFICANT DIFFERENCES BETWEEN ACCEPTEES AND REJECTEES

Characteristic	Academic Year				
	57-58	58-59	59-60	61-62	62-63
Teaching residence	.05	.01	.01	.01	
Dependents		.05			
Teaching experience				.01	
Subject matter major				.01	
Read. gen. sci. journals			.05		
Years since last degree			.01		
Periods taught per week					
outside major and minor	.05				
in minor	.01	.05	.05		
Grade point average					
undergraduate math.				.05	
undergraduate science		.01			.01
Organization membership					
state educational		.01			
national educational		.01			
state science				.05	.01
national science		.01			.01
NSTA		.01		.05	.01
Credits earned					
chemistry		.05		.05	
earth science		.05			
physics				.05	
undergraduate science		.01		.01	

APPENDIX B

CHARACTERISTICS SHOWING SIGNIFICANT DIFFERENCES AMONG GROUPS OF ACCEPTEES AND OF REJECTEES

Characteristic	Acceptee Groups	Rejectee Groups
Teaching residence		.05
Teaching experience		.05
Years since last degree	.05	.01
Summer institutes	.01	.01
Age		.01
Graduate math credits		.05
Graduate science credits		.01
Periods taught per week in minor	.05	
Reading general science journals	.01	.01
Reading educational journals		.01
Membership in state science organizations		.05
Membership in national mathematics organizations		.01

APPENDIX C

CHARACTERISTICS SHOWING SIGNIFICANT DIFFERENCES AMONG APPLICANTS FROM WASHINGTON, OREGON, CALIFORNIA, AND OTHER AREAS

Characteristic	Level of confidence
Age	.01
Summer institutes attended	.01
Biology credits	.01
Undergraduate science credits	.01
Graduate science credits	.01
Undergraduate science G. P. A.	.01
Marital status	.01
Membership in nat. ed. organizations	.01
Membership in state math organizations	.01
Reading educational journals	.01
Teaching experience	.05
Subject matter major	.05
Graduate science G. P. A.	.05
Reading special science journals	.05

APPENDIX D

MEAN SCIENCE AND MATHEMATICS SEMESTER CREDITS GROUPED BY MAJOR

Major	Mean Semester Credits				
	Bio.	Phy.	Chem.	Math.	Earth Sci.
Biology	44. 8	6. 6	13. 2	7. 6	4. 4
Chemistry	11. 1	12. 9	39. 4	17. 6	2. 9
Physics	3. 1	40. 0	13. 6	24. 7	2. 2
Gen. Science	18. 7	9. 8	15. 0	12. 4	6. 2
Mathematics	6. 1	12. 2	9. 3	38. 4	3. 4
Non-science	9. 5	6. 9	7. 9	12. 2	4. 5

APPENDIX E

ADVANCED SCIENCE AND MATHEMATICS SEMESTER CREDITS GROUPED BY MAJOR

Major	Semester Credits					
	None	1-5	6-10	11-15	16-20	21-25
Biology	148	126	123	38	2	-
Chemistry	29	35	33	12	5	1
Physics	12	9	4	5	-	-
Gen. Science	187	52	27	7	-	-
Mathematics	113	33	14	4	2	-
Non-science	347	22	9	1	-	-

APPENDIX F

SUPPORTING SCIENCE AND MATHEMATICS MEAN SEMESTER CREDITS GROUPED BY MAJOR

Major	Mean Semester Credits				
	Bio.	Phy.	Chem.	Math.	Earth Sci.
Biology		5.9	10.5	4.8	4.4
Chemistry	7.5	10.6		10.8	2.9
Physics	2.0		10.6	14.8	2.2
Mathematics	4.6	9.9	7.8		3.4