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## **Effect of High School Participation in Extracurricular Science Activities on College Matriculation**

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### **INTRODUCTION**

The need to encourage high school students to continue in science and engineering fields has been recognized for a long time. Great emphasis has been placed on these areas by both professional scientists and educators since about 1950. This need has been the result of natural changes in our society toward a more scientifically oriented culture as well as the result of technological advances and conflicting ideologies between the USA and the USSR.

Different approaches have been utilized to increase interest in these fields. Basically the approaches have been to improve the subject matter competencies of the secondary teachers, and to supplement the regular classroom activities with materials and programs not readily available in most secondary schools.

Many private and governmental organizations are active in improving the classroom competencies of science and mathematics teachers. Other methods of encouraging interest in high school science and mathematics courses include career guidance materials, the use of television in science teaching, personal contacts among teachers, students and professional society members, the use of science and mathematics counselors, travelling science exhibits, junior academies of science, science fairs, science clubs, and special science programs.

Within Oklahoma several different approaches have been tried to encourage students to enter scientific fields. These approaches can best be described as being both curricular and extra-curricular. The curricular approaches have attempted improvement of instruction in high school

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science and mathematics. Extra-curricular approaches have developed research programs for students working with scientists in their laboratories, those studying during the summer on a university campus with competent authorities in the fields of mathematics, science, and engineering, and others building projects with the help of their teachers and local scientists. All of these programs have contributed to an interest in science but it is unknown whether one of these programs was more productive in the development of science interest than the others.

The principal activities, at least the most highly publicized ones in Oklahoma, have been The Sir Alexander Fleming Awards, The Oklahoma High School Institutes, and the Oklahoma City Science Fairs Programs. Adequate records exist for identification and location of the participants in these activities for the past several years.

The general question of this study is simply whether or not these special science programs deliver a larger fraction of their participants as scientists than do the elective classes in secondary school science. A control group consisting of high school physics classes was selected for a comparative study because normally this is the most advanced science course offered in most Oklahoma secondary schools.

#### DESIGN OF THE STUDY

A questionnaire was selected as the data-gathering device because of the large numbers involved and the distances of the participants from Oklahoma City, Oklahoma. The participants were asked only objective questions concerning their present statuses as related to their college majors. In order to test the significance of observed differences among the groups, their responses were compared by means of the chi-square method described by Guilford (1956).

A brief description of each special science program and what it purports to do was obtained from the program directors and official brochures released to the students by the director of each program. A description of each program follows.

#### GROUPS STUDIED

*The Sir Alexander Fleming Awards*—The Fleming Awards project was originated by the Volunteer Women's Service Corps of the Oklahoma Medical Research Foundation. All of the details of the competition up to the time of selection are handled by the Frontiers of Science Foundation of Oklahoma.

The purpose of the program is to stimulate interest in science and to provide an opportunity for Oklahoma boys and girls to participate in a research program. Each student selected will work in the laboratories of the Oklahoma Medical Research Foundation under the direct supervision of a member of the Foundation staff.

Applications are accepted from Oklahoma residents who have completed the junior year in high school and two years of mathematics and science. High scholastic standing and aptitude in science are essential qualifications.

*The Oklahoma High School Institutes*—The Oklahoma State University has, for the past nine years, conducted a summer science program for secondary school students.

The purpose of the program is to stimulate interest in science and engineering. The course work covers three principal fields of concentration: concepts in mathematics and their use, concepts in physical sciences and their relation to engineering, and the nature of engineering. The

applicant should have junior standing in high school and display a proficiency in mathematics and English and a very definite interest in the fields of science and/or engineering.

*The Oklahoma City Science Fairs*—The Oklahoma City Science Fair was one of the earliest in the United States. It had its beginning in 1950 under the able direction of the late Mr. Howard E. Brown. The Oklahoma City Science Fair has been jointly sponsored by the Oklahoma City Public Schools, the Oklahoma City Chamber of Commerce, and the Oklahoma Publishing Company.

A science fair is a competitive exhibition of scientific work developed and displayed by students under the direction of teachers and other interested persons. It provides an opportunity for students with imagination and initiative to display their ideas, research, and handiwork in science and mathematics. Essentially a science fair is a collection of exhibits each of which is designed to show a scientific principle, a laboratory procedure, or an industrial development.

Any boy or girl who attends a public, private, or parochial school and who resides in the Oklahoma City School District may enter the science fair. The basic categories of exhibits are biological, physical, and earth sciences. These exhibits are judged by highly qualified individuals who are selected because of their scientific and technical ability. The bases for judging are scientific thought, creative ability, thoroughness, clarity, dramatic value, and technical skills.

*Selected Oklahoma City physics classes*—Any boy or girl who attends a public school in the Oklahoma City School District may take a physics course. A student is usually not permitted to enroll in physics unless he has had at least three years of mathematics, grades 9, 10, and 11. It is also generally recommended that he have biology and chemistry.

#### ANALYSIS OF DATA

The problem was to describe and compare the college careers of students who had participated in the above groups during the years 1956-1962 and to see whether there were significant differences among their choices of college careers.

Participants in each category were asked to complete a copy of the questionnaire. This resulted in returns as shown in Table I.

A significantly greater number of males participated in three of the programs. Only the Sir Alexander Fleming Awards programs had almost equal numbers of males and females.

TABLE I. RELATIONSHIPS, BASED ON QUESTIONNAIRES USED, BETWEEN THE FOUR PROGRAMS AND COLLEGE ATTENDANCE.

Program	% Returns	Male	Female	Total	% Attending College
Fleming	72	54	44	98	99
Institute	73	223	45	268	99
Science Fair	77	90	41	131	95
Physics Classes	55	183	30	213	96

The data shows that there is very little difference in the per cent of respondents for each program who continued to college. Almost all participants in the four programs went to college. It has been estimated that 50-60% of all Oklahoma high school seniors go to college. This fraction is above the national average.

## FINDINGS

1. Little difference exists between the numbers of students in each program who responded to the questionnaire and those who went to college.
2. More males than females from all of the programs continued in science.
3. The Oklahoma High School Institutes Programs and the Sir Alexander Fleming Awards were most successful in delivery of males to science-related careers.
4. The Sir Alexander Fleming Awards Program was the most successful in delivery of females to science-related careers.
5. The males and females of the Sir Alexander Fleming Awards and the Oklahoma High School Institutes Programs had significantly higher grade averages than the males and females of the other two programs.
6. Each group had fewer than 10% who selected professional education as a career and only a part indicated that they planned to become science teachers.
7. There was very little difference, among the groups, in the numbers who later obtained degrees.
8. The programs in engineering which drew the greatest numbers were, first, electrical engineering, and a close second, chemical engineering.
9. The programs in engineering which drew the fewest were geological, petroleum and metallurgical.
10. The most frequent choice of a career field was mathematics, and physics.
11. Geology drew the smallest number of participants.

## CONCLUSIONS AND RECOMMENDATIONS

1. Each of the four programs should be continued. The programs are all delivering potential scientists at markedly different rates and each program seems to have some merit, but the contributions of each program will need to be evaluated more carefully.
2. Careful study of the Sir Alexander Fleming Awards Programs should be made by parties interested in encouraging females to go into science because they continued at a much higher rate than those in other programs.
3. The male students working directly with scientists in the Sir Alexander Fleming Awards Programs did not select science careers at a more significant rate than did those participants in the Oklahoma High School Institutes Programs. This could be extremely important because of the far greater numbers reached by the Institutes Programs.
4. The Oklahoma City Science Fair should be continued but should emphasize values other than encouraging students to enter science careers. Students taking a regular school program in the sciences choose a science career with the same frequency as do the participants in the Fairs. The greatest value of the science fairs at the present time is making the public aware of some of the science activities in the public schools and giving large numbers of students an opportunity to display their work.

## LITERATURE CITED

- Guilford, J. P. 1956. *Fundamental Statistics in Psychology and Education*. McGraw-Hill, New York.