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Date August 4, 1977

"TERMINAL SCIENCE"?: ENROLLMENT TRENDS OF NINTH GRADE

SCIENCE STUDENTS IN GREAT FALLS PUBLIC SCHOOLS

by

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A professional paper submitted in partial fulfillment
of the requirements for the degree

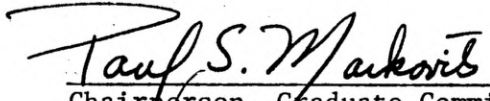
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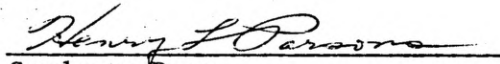
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ABSTRACT

The purpose of this study was to determine if the 1976-1977 ninth grade science students in School District No. 1, Great Falls, Montana, having fulfilled their science requirement for high school graduation, were following the national trends of decreasing high school science course enrollments. The results of these students' preferences toward future science course enrollments were obtained by questionnaire and compared with the high school science enrollment figures spanning a four year period. A secondary goal of the study was to discover if the students' preferences toward future science course enrollments and the factors which may have influenced those preferences changed from the beginning of their ninth grade science course and its completion.

The results of the study indicated that the future science course enrollment preferences showed no significant decrease from the high school enrollment figures of the four year comparison sample. Further, the study did indicate that significant differences occurred in the students' preferences toward future science course enrollments and in the factors which may have influenced those preferences between the beginning of their ninth grade science and the completion of the course.

Recommendations were made that encourage further research in the area of students' preferences toward science enrollments expanding the sample to include preferences over a number of years in an attempt to obtain significant data for the evaluation of existing science programs in the district. The data collected in such a study could be a useful tool in directing desired changes if such are indicated.

Additional research was recommended into the factors which appear to influence student preferences toward future science enrollments. Such a study should place high emphasis upon obtaining first-hand student views rather than student responses to the researcher's perceptions of the possible causes for declining science enrollments.

Chapter 1

DESCRIPTION OF THE STUDY

Introduction

"Science is dead." "The wonder of science is past." "Science has become a lost discipline." Statements such as these have come to dominate the thinking of many students, educators, and citizens in the United States. There have been warnings that the dominant role of science and technology could be diminished. As early as 1958 Dr. James R. Killian, then Special Assistant to the President for Science and Technology, speaking before the Annual Meeting of the American Association for the Advancement of Science and Technology states, "The current emphasis on science, if it is not to cause reactions adverse to science, also requires of the scientific community humility and a sense of proportion." (Killian, 1959:172). Dr. Killian's statement appears to have substance in light of the increasing unrest which has been present in the fields of science and science education since the late 1950's.

During the last decade the fields of science and science education have experienced criticism of their very foundations. The values of science education are being challenged and questioned by students, parents, educators, and the public at large. Demands for validity of teaching techniques and accountability from the education profession, which are taking a more dominant role in today's society, have not been

ignored in the fields of science and science education. Part of the misunderstanding towards the role and goals of science may be related to the science educational background of those individuals expressing concern.

The formal education in science of the man-in-the-street most likely consisted of a rich diet of scientific facts, laws, principles, generalizations, and whatever - all of which unintentionally placed science and scientists on a tall and seemingly impregnable pedestal. (MacMahan, 1971:449).

The pedestal, however, has begun to crumble as evidenced by several factors over the past two decades. These factors are: declining enrollments in science classes at both the high school and college levels, charges that science and technology are the root of many of the problems which are faced by the nation, demands that science solve these same problems, and allegations that science exists as for its own self preservation rather than for the betterment of the society that supports it. As Pella (1976) stated:

To the scientist or potential scientist, science for the sake of science is adequate. During the period of the 60s when the public was convinced of the importance of science in order to remain "respectable" in the world, science for the sake of science was of necessity viewed differently than it seems to be at present. Today, there are more scientists entering the social arena via problems of the environment, such as food production, maintenance of habitats and species, genetics, energy, etc. There are also more scientists being challenged relative to the possible social effects of the application of research results. To be a functioning citizen during the current era demands that one be able to read and interpret technical literature, because his welfare or his decisions should depend upon it.

The citizenry is becoming doubtful of some science and technology expenditures. There is an apparent unwillingness to turn science and technology over completely to the scientists and engineers. (Pella, 1976:98).

Students, the general public, and educators, rather than merely accepting science, seem to be asking: What is the purpose of science?; What should be taught in science?; Who decided what is important in science education?; and What is science doing for us?

Statement of the Problem

Do students in Montana have the same questions in regard to science as do other students throughout the United States? In order to investigate a facet of this question, a research problem was proposed. The problem was to investigate whether ninth grade science students, at the four junior high schools in Great Falls, Montana, were following the national pattern of declining science enrollments. The investigator was involved in sampling the 1976-1977 ninth grade science students with regard to their intentions of enrolling for high school science courses and possible factors which may have had an influence upon pursuit of future science course work. A comparison was also made to determine if students' preferences about future science enrollments changed over a time period extending from the beginning of a ninth grade science and the completion of the course.

Need or Purpose of the Study

One credit of science is required for high school graduation in the State of Montana, and Great Falls conforms to state law in requiring only one credit of science to be completed during the ninth to twelfth grade period. A student who satisfactorily completes ninth grade physical science has met this state and local requirement for graduation and is therefore under no obligation to take further science courses. If in fact these students, ages thirteen to sixteen, are inclined to end their secondary school science studies at this level, then ninth grade physical science is their terminal science course and two serious questions arise. Initially, is the present science approach offering anything of value to the students based upon their preferences? Secondly, (Bray, 1972) are there alternatives which might better prepare science students to meet the needs of their every day lives?

Knowledge of whether or not increasing numbers of students in Great Falls are taking ninth grade science as a terminal course has significance. Only through research can data be obtained for the evaluation of current science education practices, and if necessary, provide guidance for directing desired changes.

Research in the areas of values, enrollments, and alternatives regarding science education should not be delayed. Current research is scanty at best. (Ayers, 1973)

General Questions to be Answered

1. Do the 1976-1977 ninth grade science students in Great Falls exhibit decreasing preferences toward enrolling in high school science courses as compared with science students over a four year period?
2. Do changes occur in student preceptions about future science enrollments between the beginning of the school year and the completion of ninth grade science?
3. Do certain factors prevailing in students' preferences for not enrolling for high school science courses change between the beginning of ninth grade science and the completion of the course?

General Procedure

In this study the researcher investigated enrollment trends and preferences of ninth grade science students as one facet of the over-all problem of decreasing science enrollments. Through this study the investigator attempted to develop a clearer view of whether this group of students in Great Falls, Montana were conforming to the premise that ninth grade science is becoming, for an increasing number of students, a terminal subject.

After obtaining the approval of the School Administration, the Science Department Heads, and the teachers involved at the four junior high schools in the Great Falls Public Schools, the 1976-1977 ninth grade science students were sampled in the following manner. The

students were asked to fill out a short questionnaire during the first week of the 1976 school term on which they indicated their preferences toward enrolling for high school science courses. A list of four choices were provided for those students who indicated that they did not intend to enroll in high school science classes in an attempt to determine the factors which may have influenced those decisions. The same questionnaire was administered to the students during the last two weeks of the 1977 school term, after the completion of tenth grade registration in an effort to determine if the students' exposure to ninth grade science had positively or negatively affected their preferences toward enrolling for high school science courses.

Upon the completion of the sampling, the researcher compiled the data for comparison with science course enrollment figures for a four year period at the two high schools in Great Falls. The material collected provided the statistical data required for analysis.

Limitations of the Study

This study was limited in that the students being researched attended four different junior high schools in the city. These four schools differ somewhat in their approach in teaching ninth grade science (e.e., traditional versus individualized instruction; lab oriented versus lecture oriented), that different teachers are involved with the students, that the ninth grade enrollment is not uniform from

school to school, and that the students do not all attend the same high school.

The nature of the study was to identify, if possible, those students who enrolled for ninth grade science as a terminal science course. Therefore, the sample is restricted to ninth grade science students. Those ninth graders not taking science will be required to earn at least one credit of science in high school, but the study is concerned with the identification of those students who are taking ninth grade science for the sole purpose of meeting high school graduation requirements -- thus becoming potential terminal science students.

Definition of Terms

For the purpose of this study, "terminal science student" will be defined as a student whose science studies terminate at the completion of the science course in which he/she is presently enrolled.

Summary

The value of science and its role in society is the global issue of this paper. The investigation of enrollment trends of ninth grade science students in Great Falls, Montana and various factors involved in enrollment preferences of these students may provide insight into a part of the total problem.

Enrollment trends and attitudes of students about science should indicate to teachers and administration whether definite needs exist for a re-evaluation of present teaching policies.

Chapter 2

REVIEW OF RELATED LITERATURE

Introduction

An understanding of the background of the problem in regard to science enrollments and terminal science courses may best be obtained through a systematic examination of the literature. The review shall emphasize four designated areas. These are as follows; The attitudes and reactions of educators; declining science enrollments in the United States; the apparent apathy of youth towards science; current research and implications for the future.

Educators' Reactions

A re-examination of trends in science seems appropriate presently in light of educational, social and technological changes which have evolved in the past half-decade. (Hounshell, 1976) There is no shortage of literature dealing with science's fall from favor, however, the theme appears to be fairly consistent. There is seemingly overall agreement that dissatisfaction with science and science education exists throughout many segments of American society. "We have been shocked by the realization that our children often detest science, turn away from it, deride it, and in many cases blame it (inaccurately, I think) for many of the nation's ills." (Trowbridge, 1974:15)

Accountability of educational practices in recent years has become a key term in educational circles and other segments of our society. Accountability in regard to the quality of science education as compared to cost expenditures is becoming a demanded right. Science is viewed by the public in two different ways. First as a source of all our ills and at the same time as a medium for solving all of our problems. (Boener, 1973) Can any discipline function from this standpoint of misunderstanding?

"Where do science and technology stand today? We find both on trial." (Hurd, 1974:2) If science is found lacking, both the scientific community and society at large will suffer if the need for evaluation is not heeded.

The summation of the thoughts of educators toward needed research and evaluation in science education and the public's perspective of science is perhaps put best by Browdy:

These are days of judgement, when schools at all levels are called upon to render an accounting. Presumably schools have entered into contracts, explicit or implicit, with a clientele to deliver certain services; presumably also some parts of the clientele believe that the promised services have not been delivered. Hence the demand for an accounting to students, school boards, and taxpayers.

Now a breach of contract is bad enough; but suppose schools are accused -- as it seems at times they are -- of making fraudulent contracts. Suppose schools promise, or allow the client to believe they promise, what, in the nature of the case, they cannot deliver. If the promise

is made in good conscience, then the schools are fools;
if made with deceit, then they are scoundrels. If they
are both, then we are indeed in trouble.

A decade ago the contract to teach science, like
Caesar's wife, was well above suspicion.

(Browdy, 1972:1).

Declining Science Enrollments

Based upon the percentage of high school students enrolled in the following science courses in public schools in the United States (general science, chemistry, and physics) in 1960 as compared to 1973, definite enrollment declines are evident (Herron, 1977). In 1960 22.2 percent of the student population was enrolled in general science which had dropped to 8.1 percent by 1973. In 1960 the enrollment in chemistry was 9.1 percent of the student population and by 1973 had fallen to 7.7 percent. During the same time period physics fell from 4.9 percent to 4.3 percent. The same study noted increases in biology (21.7 to 22.7 percent) and earth science (.09 to 4.2 percent) (Herron, 1977:28). These increases do not offset the declines in the other science subjects over the period.

Another study (Ellis , 1967) pointed out that for the period from 1955-1965 physics enrollments in the United States dropped from 24 percent to 20 percent of the twelfth grade student population. That science enrollments at the secondary and college levels have declined is at the present time well established.

The Apathy of Youth Toward Science

Declining science enrollments in this country indicate that students are turning to other fields to satisfy their educational needs.

The youth of this nation and many other nations appear to be turning science off for a variety of reasons, one of which may be because science is still taught to produce big scientists and little scientists, rather than literate citizens.
(Pella, 1976:98).

Have we as educators contributed to the negative feelings that students have for science by allowing ourselves to think of the scientist and science teacher as having no responsibility of his own? If we are to gain the trust of young people towards science we must admit that science is to blame for some of the mess the world is in today (Bishop, 1976).

Educated young people seem to be aware of the possible roles of science and technology in regard to environmental degradations as well as improvements. However, the results of the study by Sadave (1976), in which the attitudes of college students toward science were sampled, showed that the students had more negative opinions of science and technology than did the general population.

Current Research and Implications for the Future

The investigator in reviewing the literature found that studies dealing with decreasing science enrollments and the factors involved were limited. Furthermore, information dealing with junior high and high

school science in general was very limited. To emphasize this point the researcher refers to a study by Ayers, which analyzes the current literature in science education:

The study was designed to analyze nine journals; "American Journal of Physics," "Chemistry," "Journal of Chemical Education," "Journal of Research in Science Teaching," "Physics Today," "School Science and Mathematics," "Science and Children," "Science Education," and "The Science Teacher," which are devoted to the field of science education.

During the period of 1970-1971, 2093 science articles were reviewed. The articles were categorized on the basis of the level for which they were written (pre-school, elementary, junior high, senior high, college, and others).

It was found that only 11 percent of the articles dealt with science for grades one through twelve, and that only a very limited number of articles were devoted specifically to junior high science. (Ayers, 1973:3,6.)

Assuming that the results of the Ayers study are valid, it becomes apparent that science education research itself is lacking and may have contributed - through neglect - to the problem of declining interest and support for science education.

Although the literature reviewed was generally of a negative nature, some authors expressed a guarded optimism that the path to the recovery of science will be possible when and only when educators admit to themselves that the present approach to science education is not meeting the needs of society. Following are some of their views:

Let's knock the "Great God Science" off its false pedestal and teach our students that science and its

technological extensions cannot hope to solve man's problems unless the majority of men take an active part in determining which problems should receive the greatest priority. (MacMahan, 1971:45).

We must stress the place of science in the curriculum by its contribution to the students' general education or call into question the justification of teaching science in the secondary schools. (Bridgham, 1973:42).

If science is to have a positive impact upon society, it cannot continue along two paths as it has in the past. In that the question of whether instruction in high school science has any impact upon success in college or university science has never been definitely proved or disproved, it might be best for high school science to fully commit itself to "scientific literacy" and leave the pre-professional and vocational training to other institutions. In this day and age it is more important for the public to appreciate and understand the place of science in society than to devote all instruction to the few who will practice it. (Ogden, 1974:354).

The overall trusts of science curriculum design and change in the next few years should be towards restoring confidence in science, bringing back its respectability and relevance as an integral part of everyone's life. (Trowbridge, 1974:15).

Summary

This brief review of literature dealing with the rejection of science tends to show a very negative overall picture of science education in general. The authors dealt with "reactions rather than rationale," "cause rather than solutions," and "speculation rather than research". Those authors who did propose alternatives offered little of a concrete nature. Ruchlis pointed out that the necessity of science educators understanding the validity of the argument of

anti-science is the important issue (Ruchlis, 1971). This premise dominated the tone of the literature reviewed.

Chapter 3

PROCEDURES

Introduction

The problem of this study was to investigate whether there are indications that ninth grade science students in Great Falls are prescribing to the current national trend of science rejection as evidenced by their preferences towards high school science enrollments, as compared with past science students over a four year period. The procedures employed are as follows:

.The sample of students is defined with an explanation as to its selection.

.A segregation of the data into three categories is made: The high school enrollment figures of ninth grade science students over a four year period; Factors which may have influenced the 1976-1977 ninth grade science students in their preferences toward future high school enrollments; Changes in preferences toward science enrollments between the beginning and completion of their ninth grade science course.

.The method of collecting data is explained and the two questionnaires used, defined.

The collection of data being only the initial phase in research,

the investigator then develops the methods used in organizing the data. The statistical hypotheses based upon the researcher's questions are stated. A description of the statistical procedures used in the analysis of data is then presented. The precautions taken to insure accuracy in both the collection of data and analysis are stated. The chapter concludes with the general review of the procedures applied.

Population Description

The sample of the students used in the study was the 1976-1977 ninth grade science students at the four junior high schools in Great Falls who were present to respond to the fall (1976) and the spring (1977) questionnaires. These students, who elected to enroll in ninth grade science are regarded as the sample rather than the total ninth grade enrollment for it was the intent of the researcher to gain insight into the factors which may have influenced these students in their choice of ninth grade science.

Categories of the Investigation

Analysis of the data obtained from the sample is presented in three categories. Initially, the high school enrollment figures on ninth grade science students over a four year period, who attended the two public high schools in Great Falls, were compared with the 1976-1977 ninth grade science students' intentions of enrolling in high school

science courses. Secondly, aspects which may have affected the students preferences on high school science enrollments were determined. Lastly, a comparison of student preferences about enrolling in high school science at the beginning of their ninth grade science class and near the completion of the course.

Methods of Collecting and Presenting Data

A short questionnaire (indicating positive or negative intentions toward future science course enrollments with preference choices available to those students who responded in the negative, attempting to determine the motives which affected that selection - Appendix A) was administered to the ninth grade science students at each of the four junior high schools by their science teachers. The questionnaire, which took about two minutes to complete, was administered during the first week of the 1976 school term. A similar questionnaire (different only in heading - Appendix B) was administered during the last two weeks of the 1977 school year after the students had completed the registration for high school. Copies of both forms of the questionnaires are shown in the Appendix A and B.

The test-retest reliability of the questionnaire was established by the random selection of one of the fifteen ninth grade science classes at East Junior High School. This class was given the questionnaire during the first and third week of the 1976 school year. The

test-retest results are shown in Appendix C.

Content validity was determined for the questionnaire through discussions with Mr. Joel J. LaPray (former instructor of the College of Education, Montana State University) and Mr. John U. Kranick (Assistant Superintendent for Instruction for the Great Falls Public Schools).

Data of the high school science course enrollments for the four year period (1971-1974) was obtained by the researcher's examination of school term end reports indicating enrollment figures at Charles M. Russell and Great Falls High Schools.

Statistical Hypotheses

Three basic questions are addressed in this study. These questions are stated as hypotheses using the null format.

H_{01} : The preferences of the 1976-1977 ninth grade science students toward high school science enrollments will show no proportional decline from the high school science enrollment figures from ninth grade in the four year comparison sample.

H_{02} : There will be no difference in the students' intentions regarding high school science enrollments between the beginning of the school year and the completion of the ninth grade science.

H_{03} : There will be no difference in the factors influencing those students who exhibit negative preferences toward future high school science enrollments when measured at the beginning of ninth grade as

compared with the same factors measured at the completion of ninth grade science.

Analysis of Data

The data obtained from the study is presented in tabular form. The tables show the following information:

Table 1: The number of students enrolled in science courses at the two Great Falls high schools, for the period 1971-1974 is shown.

Table 2: A comparison between the students' responses to questions 1 and 2 on the September, 1976 and June, 1977 questionnaires.

Table 3: A comparison of the projected number of ninth grade science students who will be taking high school science courses (based upon data from the June, 1977 questionnaire) with the results from Table 1.

Table 4: A comparison between the results of the September, 1976 and June, 1977 questionnaire responses on the factors which may have influenced the selection of question 2.

The data contained in the above mentioned tables was used in the testing of the stated hypotheses and the chi-square statistic for testing the accuracy of fit was employed. The three hypotheses were tested at a level of significance of $P < 0.01$. The acceptance of a false null is preferable to making a Type I error which is the chance of rejecting the

true null hypothesis. Because this study deals with existing programs, the consequences to the students involved in these programs justifies a higher level of significance.

Precautions Taken for Accuracy

To eliminate the possibility of computational error, the researcher took the following steps:

1. Enrollment figures for science classes at the two high schools were compiled and rechecked using a calculator.
2. Questionnaire results were recounted and tabulations rechecked.
3. All statistical analyses were rechecked by a second person.

Summary

In this chapter:

- .A re-statement of the problem was given, with a description of the sample to be researched.
- .The categories of the investigation are defined.
- .The methods by which the data was collected and presented are developed.
- .The hypotheses based upon the questions of the study were presented and the method by which the level of significance was obtained is defined.

.The description of data presentation and the chi-square analysis of the data was presented.

.The statement of the accuracy precautions for data collection and analysis concluded the chapter.

Chapter 4

PRESENTATION AND ANALYSIS OF DATA

Introduction

The data obtained by the researcher is presented in Tables 1, 2, 3, and 4. The analyses of the results of the study as presented in these four tables are then used to answer the three questions of the study which are stated in the null hypothesis form.

The organization of the chapter is the presentation of the data which pertains to each of the three hypotheses, the analysis of that data, and the interpretation of the analysis in regards to the acceptance or rejection of the hypothesis.

Data and Analysis

H_{01} : The preferences of the 1976-1977 ninth grade science students toward high school science enrollments will show no proportional decline from the high school enrollment figures from ninth grade students in the four year comparison sample.

A comparison of the high school science enrollments over a four year period (1971-1974) are found in Table 1. The projected number of the 1976-1977 ninth grade science students who will be taking high school science classes (results of June, 1977 questionnaire, Table 2) is shown in the combining of these two tables into Table 3.

Applying the data contained in Table 3 to a chi-square test with

Table 1

A COMPARISON OF SCIENCE ENROLLMENTS
AT THE TWO GREAT FALLS HIGH SCHOOLS
(1971-1974)

School Year	Number of Science Students	Number of Non-Science Students	Total Number of Students	Percentage of Science Students
1971-72	1895	1904	3799	47.0
1972-73	1964	1932	3896	50.4
1973-74	2089	2276	4365	47.9
1974-75	2089	2211	4300	48.6

Table 2

A COMPARISON OF STUDENTS' RESPONSES TO STATEMENTS
ONE AND TWO ON THE FALL, 1976 AND
SPRING, 1977 QUESTIONNAIRES

Questionnaire Statement*	Fall 1976	Percentage of Students	Spring 1977	Percentage of Students
Statement 1	374	38.4	388	46.8
Statement 2	601	61.6	441	53.2
Total Number of Students	975		829	

*Statements 1 and 2 of Questionnaire are found in Appendix A.

A COMPARISON OF INTENTIONS OF 1976-1977 NINTH GRADE
SCIENCE STUDENTS TOWARD ENROLLING FOR
HIGH SCHOOL SCIENCE WITH HIGH
SCHOOL ENROLLMENT FIGURES
OF 1971-1974

School Year	Number of Science Students	Number of Non-Science Students	Total Number of Students	Percentage of Science Students
1971-72	1895	1904	3799	47.0
1972-73	1964	1932	3896	50.4
1973-74	2089	2276	4365	47.9
1974-75	2089	2211	4300	48.6
1976-77*	388	411	829	46.8

*Ninth grade science students' responses to June, 1977 Questionnaire,
Table 2.

four degrees of freedom at a level of significance of $P < 0.01$ (α) yielded a chi-square statistic (χ^2) of 8.33. The maximum χ^2 number as taken from the chi-square table for accepting the null hypothesis at a significance of $P < 0.01$ with four degrees of freedom is 13.28. Based upon this analysis, H_{01} was accepted.

Observation of the data shown in Table 3 therefore, does not, when analyzed statistically seem to indicate decreasing science enrollment preferences by the sample group of ninth grade science students.

H_{02} : There will be no difference in the students' intentions regarding high school science enrollments between the beginning of the school year and the completion of ninth grade science.

The data contained in Table 2 shows the comparison between the students' preferences toward future high school science enrollments at the beginning of the school year (Fall, 1976) and at the completion of their ninth grade science course (Spring, 1977).

The data analyzed using the chi-square test with one degree of freedom at a significance level of $P < 0.01$ produced a result of $\chi^2 =$ 13.21. The maximum chi-square number taken from the chi-square table for accepting the null hypothesis with one degree of freedom at an α level of $P < 0.01$ is 6.64. Based upon this analysis, H_{02} was rejected.

The data obtained in the questionnaire as presented in Table 2, when analyzed, indicated that the students' preferences toward future high school science did change over the time period in which they were enrolled in ninth grade science.

H_{03} : There will be no difference in the factors influencing those students who exhibit negative preferences toward future high school science enrollments when measured at the beginning of ninth grade as compared with the same factors measured at the completion of ninth grade science.

The data contained in Table 4 compares the results of the Fall, 1976 and Spring, 1977 responses to factors which may have influenced the selection of Statement 2 on the questionnaire. Statement 2 reads: Since this course will satisfy my one credit science requirement for high school graduation, at this time I am not planning on taking high school science courses.

The data contained in Table 4 was subjected to a chi-square test with a level of significance of $P < 0.01$ with three degrees of freedom yielding $\chi^2 = 11.89$. Based upon the chi-square table with an α of $P < 0.01$ and three degrees of freedom, the maximum chi-square number for which the null hypothesis can be retained is 11.34. Based upon this analysis, H_{03} was rejected.

The information obtained in this study therefore, does not

A COMPARISON OF FACTORS WHICH INFLUENCED STUDENT SELECTION
OF STATEMENT TWO ON THE FALL, 1976 QUESTIONNAIRE
WITH THE SPRING, 1977 QUESTIONNAIRE

Questionnaire Statement*	Fall 1976	Percentage of Students	Spring 1977	Percentage of Students
Statement A	135	22.5	108	24.5
Statement B	166	27.6	127	28.8
Statement C	219	36.4	125	28.3
Statement D	81	13.5	81	18.4
Total Number of Students	601		441	

*Statements A, B, C and D of Questionnaire are found in the Appendix A.

statistically show that the factors influencing the students' negative preferences toward future science course enrollments remained unchanged between the beginning of their ninth grade science course and its completion.

Discussion of Data

This researcher feels that it would have been well advised to request that students responding to the questionnaire list their reason for selecting the negative preference rather than providing Statement D (A reason other than those listed above.) which the students simply checked. Some students wrote in their reason and though unsolicited, the researcher feels that the presentation of these comments is noteworthy. The following are reasons which were written in by ten students:

.I have to quit school so I can work.

.I don't like biology.

.I thought if I got rid of science now it would leave me more room for other subjects in high school.

.I'm not sure if I want to take more science because I might not go to college.

.I am unsure at this time.

.I need more time for other subjects.

.Science is all right, but I just don't like it.

.All the science classes were full when I got to them.

.I couldn't fit science into my schedule.

.I don't like all of the math in science.

Summary

In this chapter, the data collected in the study was presented in tabular form and the statistical procedures used in analyzing the data were reported. Each of the three hypotheses of the study based upon data from the tables presented was analyzed using the chi-square method with the following results:

H_{01} : The preferences of the 1976-1977 ninth grade science students toward high school science enrollments will show no proportional decline from the high school enrollment figures from ninth grade students in the four year comparison sample.

Based upon the analysis of the data presented in Table 3 (A Comparison of Intentions of 1976-1977 Ninth Grade Science Students Toward Enrolling for High School Science With High School Enrollment Figures in 1971-1974), H_{01} was accepted.

H_{02} : There will be no difference in the students' intentions regarding high school science enrollments between the beginning of the school year and the completion of ninth grade science.

Based upon the analysis of the data presented in Table 2 (A

Comparison of Students' Responses to Statements One and Two on the Fall, 1976 and Spring, 1977 Questionnaires), H_{02} was rejected.

H_{03} : There will be no difference in the factors influencing those students who exhibit negative preferences toward future high school science enrollments when measured at the beginning of ninth grade as compared with the same factors when measured at the completion of ninth grade science.

Based upon the analysis of the data presented in Table 4 (A Comparison of Factors Which Influenced Student Selection of Statement Two on the Fall, 1976 Questionnaire With the Spring, 1977 Questionnaire), H_{03} was rejected.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

In this chapter the results of the study are interpreted based upon the following format. First a general review of the study is presented as a summary. The results of the study as presented in Chapter 4 are then interpreted and presented as conclusions. The chapter concludes with recommendations indicated by the conclusions developed.

Summary

The need for science teachers and administrators to become aware of enrollment trends in their schools is imperative if aspects relating to those trends are to be discovered, analyzed, and treated. The science enrollment trends of ninth grade science students can be an important facet in investigating the entire scope of declining science enrollments.

Overall literature and research studies dealing with declining science enrollments and in particular, junior high and high school science, are limited. Questions dealing with validity and accountability in science education are at the present time very open to study and research. The study's procedures, methods of data collection, data presentation, and statistical analyses of data are not suggested

as a solution for declining science enrollments. Rather, this study investigates one method taken to discover whether a science enrollment problem is indicated in one school district through sampling one group of students.

Conclusions

The conclusions drawn from this study are restricted to the inferences provided by the three hypotheses as analyzed in Chapter 4.

This investigation found that a declining science enrollment trend by the 1976-1977 ninth grade science students in Great Falls, was not statistically significant when the data collected was subjected to analysis in comparison to other years. The projected percentage of the sample group of students who expressed intentions of taking science in high school is lower than the percentages of high school science students (Table 3), but was not significant when analyzed.

This study found that there was a statistically significant difference in the preferences that students exhibited toward future science course enrollments when sampled at the beginning of their ninth grade science course and again at the end of the school year. While the intent of this study was to determine difference, not direction, examination of the percentages provided in Table 3 shows a higher percentage indicating a positive preference towards future science enrollments at the end of the school year.

The investigation indicates that the factors which motivated student responses toward the negative in regard to future science course enrollments are statistically different when comparing data from the beginning of ninth grade science to the data at the completion of the course. There was no direction addressed to this question by the study, only difference. The reader is left to draw his/her own conclusions (Table 4). However, the researcher believes that the decrease in percentage of students responding to Statement C (At this time I don't feel science fits into my future plans.) is encouraging.

Unsolicited student comments (page 30) which were obtained from the questionnaire indicate a variety of factors which, although not dealt with in the study, did influence the results. While all of these comments warrant attention, one has particular significance in addressing the problem of declining science enrollments. This comment follows: "All the science classes were full when I got to them."

Recommendations

While this study has provided insight into future science enrollment preferences of a sample group of ninth grade science students, further research expanding the sample to include student preferences over a longer period of time could be extremely informative. The interpretation of data regarding enrollment trends, when it may affect

existing programs, demands the most meaningful information available.

The study indicated a difference in student preferences toward future science course enrollments between the beginning of ninth grade science and its completion. Further studies could reveal not only positive and negative leanings but could also investigate what factors are involved in the ninth grade science course itself which affect student preferences.

The study showed that statistical differences did exist in the students' preceptions of the reasons for not taking future science course work beyond the ninth grade. A more extensive examination of those factors which influence students to become terminal science students is essential. For such a study strong emphasis should be placed upon the obtainment of student views; in their own words. It is highly unlikely that any researcher can affectively predict all of the factors which motivate a student in his enrollment decisions.

The researcher would recommend an investigation into a problem hinted at in this study by several student comments, in that their reason for not taking science in high school was there was no room left in courses which could meet their schedules. It would be sad indeed if science students are being lost for this reason at the very time that science enrollments are declining.

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APPENDICES

APPENDIX A

QUESTIONNAIRE ADMINISTERED FALL, 1976

Now that you have enrolled in ninth grade science, please check the statement below which applies to you.

____ 1. At this time I am planning on taking science in high school.

____ 2. Since this course will satisfy my one credit science requirement for high school graduation, at this time I am not planning on taking high school science courses.

If you checked number 2 above, please check the statement below which best describes your reason.

____ A. Science is difficult for me.

____ B. I am not interested in science.

____ C. At this time I don't feel that science fits into my future plans.

____ D. A reason other than those listed above.

APPENDIX B

QUESTIONNAIRE ADMINISTERED SPRING, 1977

Now that you have enrolled for tenth grade, please check the statement below which applies to you.

- ☐ 1. At this time I am planning on taking science in high school.
- ☐ 2. Since this course will satisfy my one credit science requirement for high school graduation, at this time I am not planning on taking high school science courses.

If you checked number 2 above, please check the statement below which best describes your reason.

- ☐ A. Science is difficult for me.
- ☐ B. I am not interested in science.
- ☐ C. At this time I don't feel that science fits into my future plans.
- ☐ D. A reason other than those listed above.

APPENDIX C

A COMPARISON OF THE TEST, RE-TEST RESULTS
FOR THE RANDOMLY SELECTED CLASS OF
NINTH GRADE SCIENCE STUDENTS

Questionnaire Statement*	Test Responses	Re-Test Responses
Statement 1	11	11
Statement 2	15	16
Statement A	4	4
Statement B	6	6
Statement C	3	4
Statement D	2	2

*Questionnaire available in Appendix A.