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THE RELATIONSHIP BETWEEN ENROLLMENT IN NINTH GRADE
GENERAL SCIENCE AND SUCCESS IN SUBSEQUENT SCIENCE COURSES

by

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Chapter 1

INTRODUCTION OF THE PROBLEM

Need

All youth are vitally affected by science in a world dominated by technological advances. Our society has almost demanded that all young people study science even though this demanding society has not been able to agree what the outcomes of scientific study should be. Science educators have given this much thought and have made recommendations for certain objectives to be pursued in the science curriculum. One of the purposes of general science in the curriculum was to offer a general course built around the life problems of people and casting aside some of the more traditional units of scientific subject matter.

Each year students enrolling in the ninth grade of Belleville High School in Belleville, Kansas have a choice to enroll in general science or wait until the following year and enroll in one of the other science courses offered. Many students and parents wonder if general science is a necessary course during the freshman year or can this time be spent in another subject that would give the student more useful knowledge for future years. It is the purpose of this study to determine whether students taking general science are more successful in subsequent science courses than those who do not take it.

Background

Belleville High School is located in a midwest town of about 3,500 population with a rural environment surrounding it. This is the

main high school attendance center in Unified District #427. There has been an enrollment the past few years of 300 to 350 students, grades 9-12, each year. This school enrollment places the high school in a classification of 3-A in the state of Kansas. The classification of schools in Kansas is based on school enrollment and consists of five classes: 1-A, 2-A, 3-A, 4-A, 5-A with 1-A schools the smallest and 5-A schools the largest.

The following science courses have been offered for the past five years. General science, biology, chemistry, and physics and are generally taken in that order during the 9, 10, 11, and 12 grades respectively. All of the science courses are considered by the Kansas State Department of Education as laboratory courses and are conducted in fifty-five minute periods each day, five days a week.

The students entering Belleville High School have had a similar background in science. During the period 1965 to 1970, the Holt series of science books was used at the seventh and eighth grade level. The amount of student turnover is very small in this school district. Most of the students entering the 7th grade usually end up in the Belleville High School graduating class six years later. During the last six week period of the eighth grade, the students are given the Differential Aptitude Test (1963 edition) produced by the Psychological Corporation, New York. The general scholastic ability of the students may be determined by the scores obtained on the verbal reasoning plus the score on the numerical ability. According to the individual report form for the test, the score obtained is the equivalent in meaning of "mental ability"

scores on most traditional group tests of intelligence.¹ These scores are converted to a percentile scale and made available to each teacher. These scores give the counselor and teacher an idea of the relative ability of the students who are enrolling in the ninth grade for the first time.

The students enrolling in general science use the third of a series of science textbooks by Holt.² The series has been used to provide a well rounded introduction into the different areas of science. The areas covered during the ninth grade science course include geology, chemistry, biology, physics, meteorology, and space science. The course included laboratory exercises and additional exercises added by the instructor. The students obtain instruction on how to use and handle general laboratory equipment and understand basic science terminology.

If students elect not to enroll in general science, they enroll in biology during their sophomore year. A traditional biology has been used with laboratory work based on the text "Modern Biology" by Otto and Towle.³ The Chem-study program was introduced into the science curriculum in 1969. The text is titled "Chemistry An Investigation Approach" by Cotton and Lynch.⁴ The P.S.S.C. physics was introduced in 1965 with the text titled "Physics" by the Physical Science Study Committee.⁵

¹G. K. Bennett and others, Differential Aptitude Tests, (New York: The Psychological Corporation, 1963), Individual Report Forms L and M.

²Ira C. Davis and others, Science 3, Discovery and Progress, (New York: Holt, Rinehart and Winston, 1965).

³James H. Otto and Albert Towle, Modern Biology, (New York: Holt, Rinehart and Winston, 1965).

⁴Robert E. Cotton and Francis Lynch, Chemistry an Investigation Approach, (New York: McGraw-Hill, 1969).

⁵Physical Science Study Committee, Physics, (Boston: Heath, 1965).

In a personal interview with the science teachers of Belleville High School, the importance of a ninth grade science course was discussed. The teachers felt the students make a better start in biology and chemistry with the introduction the students obtain in these areas in the general science course. They felt that the classwork was delayed at times in order to explain to students without any previous science, items other students already knew. If general science were not offered, several students would probably graduate from high school with little or no physical science. It was generally agreed that this would be a step in the wrong direction since several students complete only general science and biology. Several alternatives to general science were suggested, but no agreement could be reached. This led the researcher of this report to make a study of the value of general science to later academic science courses.

With the rapid changes in science curriculums taking place and the great variety of courses offered to high school students, the question in the minds of many students, parents, and counselors is how to make the best decision for the incoming students. An attempt will be made to answer part of these questions especially for the future students of Belleville High School.

Hypotheses

The following null hypotheses were therefore proposed:

1. Students enrolled in general science during their ninth grade at Belleville High School show no difference in academic achievement in biology over students who do not enroll in general science.

2. Students from Belleville High School who have completed only general science and biology show no difference in academic achievement in science over students who have completed only biology and no other science course.
3. Students from Belleville High School who have completed only general science, biology, and chemistry show no difference in academic achievement in science over students who have completed only biology and chemistry.
4. Students from Belleville High School who have completed general science, biology, chemistry, and physics show no difference in academic achievement in science over students who have completed only biology, chemistry and physics.

Chapter 2

REVIEW OF THE LITERATURE

Previous Literature

General science was started during the early 1900's; and by 1923, 53.1 percent of the schools in the United States had included it.⁶ Of the courses established prior to general science, only physics and chemistry are still taught today. The rationale for establishing general science was the belief that studies like general science would help the student in their later science courses.⁷ An upward trend in required sciences continued so that by 1956 most schools required one year of science for graduation. There still were 15.4 percent of the high schools that had no science courses offered in their programs.⁸ Today the majority of all schools require or encourage a science course be completed before the issuance of a graduation certificate.

October 4, 1957, launched a new awakening in science education with the well-know Sputnik. This event brought about a new era in science education in the schools of the United States. The well-known American scientist, educator, and diplomat, James B. Conant, stated in his report on American High Schools Today that all students be required

⁶U.S. Department of Health, Education, and Welfare, Office of Education, Pamphlet No. 120, (Washington, D.C.: U.S. Govt. Printing Office, 1956).

⁷Francis D. Curtis, Ph D., Investigations in The Teaching of Science, (Philadelphia: P. Blakiston Son and Co., 1926) p. 310.

⁸U.S. Pamphlet No. 120, loc. cit.

to study "at least one year of science in the ninth or tenth grade, which might be biology or general physical science."⁹ Brown and Obourn recommended in 1960 that a general science sequence for grades 7, 8, and 9 be offered to students. This sequence consisted of a minimum science requirement and a maximum science offering. They recommended that courses in biology and physical science be mandatory.¹⁰

There had been several suggestions for study and changes in the science curriculum. Robinson reports in the literature that one of the main changes in science instruction has been from a descriptive to an experimental science.¹¹

As a result of the "new look" at science curriculums, several programs have developed in biology, chemistry, physics, and earth science. The Biological Science Curriculum Study (BSCS) was developed in biology. With this new approach to biology teaching, science educators believed that an adequate background in physical science principles should be covered before taking the biology.¹² Following the development of BSCS, the CHEM-study and CBA were introduced for high school chemistry. A physics program by the Physical Science Study Committee (PSSC) was developed as a new approach to physics. The Earth Science Curriculum (ESCP)

⁹James B. Conant, The American High School Today, (New York: McGraw-Hill Book Company, 1959), p. 47.

¹⁰K. E. Brown and E. S. Obourn, "Offering and Enrollments in Science and Mathematics in Public High Schools," Policies for Science Education, ed. F. L. Fitzpatrick (New York: Bureau of Publications, Teachers College, Columbia University, 1960) p. 205.

¹¹James T. Robinson, "Developing a Science Sequence," School Science and Mathematics, December 1960, p. 690.

¹²Robert C. Gray and others, "Student Achievement in High School Biology," School Science and Mathematics, November 1969, p. 708.

was added to the above mentioned four to help round out the science curriculum in the '60's.

After introduction of the new curriculum approaches in biology, chemistry, and physics, scientists found that a great deal of the important content in their disciplines had been omitted. It was suggested that a junior high science course be developed which would be correlated with the high school sciences. Also, other important areas in science that believed they had been neglected could be included in the science curriculum. Among the areas neglected were the astronomers, geologists, meteorologists, psychologists, and oceanographers. Arguments for the ninth grade science course also included that it would serve as a prerequisite for students to gain sufficient maturity and mathematical facility to handle the quantitative ideas in following science courses.¹³

As one reads through the literature, he has the feeling that elementary science programs also needed to be reviewed and revised to prepare students more adequately for high school science programs. New science curriculums have revealed that children are able to understand more sophisticated subject matter than was previously thought possible.

Recent Developments in Science Curriculum

Today there are several new approaches to teaching science at the junior high level to fulfill the needs of students. The Educational Research Council of America has a course titled Life Science Course for

¹³J. Stanley Marshall and Ernest Burkman, Current Trends in Science Education, (New York: The Center for Applied Research in Education, 1966) p. 67.

the seventh grade. Dr. Sherwood Githerns, Jr. has designed a course called Quantitative Physical Science for the ninth grade. Introductory Physical Science (IPS) is a program developed by Educational Services Incorporated for junior high school pupils. This has been followed by Physical Science II, (PS II). The contents of IPS and PS II together match neither a year of chemistry nor a year of physics but does try to give a good physical background for non-science students.¹⁴ An instructional research project called Intermediate Science Curriculum Study (ISCS) is aimed at upgrading junior high, grades 7, 8, and 9, science education in line with modernized science curricula. The project has been funded since 1965 by both the Office of Education and the National Science Foundation. The program allows each student to learn at his own pace and to deal with content adjusted to his background, interests, and ability.¹⁵ Another approach is Ideas and Investigations in Science, (IIS), which produces science materials specifically designed for use with low-achieving and uninvolved students in grades 9 through 12.

There are also other programs being used and planned in different areas of the United States. An example of the different titles of science courses being taught in the state of Kansas for the 1970-71 school year is given in a letter received from Warren J. Bell, Director, Curriculum Section, Kansas State Department of Education. A total of thirty-four different titles for grades 6 through 12 are listed by the Department.¹⁶

¹⁴Elisabeth Lincoln, "College Admissions and PS II", Physical Science II Progress Report, p. 28.

¹⁵Ernest Burkman, "ISCS: An Individualized Approach to Science Instruction," The Science Teacher, Vol. 37, No. 9, December 1970, p. 27.

¹⁶Based on personal correspondence between Warren J. Bell, Director, Curriculum Section, Kansas State Department of Education, and the writer.

An examination of Table 1 will show the diversity of the science subjects offered and the differences in the enrollment of each.

Specifically Related Studies

A study was made by Grey and others to relate student achievement in high school biology to prior physical science coursework. Their work consisted mainly of comparing the effect of a physical science course during the 9th grade year on student achievement in biology. They divided the groups into high ability, middle ability, and low ability and those that did or did not have ninth grade physical science. Grey and others found that students with high, middle, or low ability are not at a disadvantage if they have not taken the physical science course during the ninth grade. They recommended that teachers and counselors refrain from advising eighth grade students to take ninth grade physical science course on an assumption that it will help them in biology or other sciences. This research also showed that the mental ability level of students should not be a basis for determining which students should by-pass ninth grade physical science. Grey and others questioned the importance of ninth grade physical science to the other science courses such as chemistry, physics, and earth science.¹⁷

Williams has made an evaluation of IPS as a preparatory course for BSCS Green version biology in the West Geauga, Ohio schools. Some of the problem solving skills that are used in IPS are similar to some of the problem solving skills in the BSCS. The usual random selections were made and a testing program followed on the control groups and experimental groups. His conclusions showed that IPS students do not

¹⁷Gray and others, op. cit., pp. 711-712.

Table 1
Students Enrolled in Science in
the Public Schools of Kansas

SUBJECTS	PUPILS
Chemistry	9,659
Biology	34,380
Chemistry II	267
Biology II	1,687
Other Chemistry	125
Physics	3,913
Physical Science	4,870
General Science	4,407
Physiology	980
Anatomy	397
Anatomy - Physiology	108
Lab Science	1,244
Health	469
Advanced Science	108
Practical Science	793
Electricity	138
Life Science - JHS	8,958
Science 7-8	26,900
Science and Health 7-8	1,603
Aerospace	625
Other aerospace	78
Science 6	217
Science and Health 6	623
Zoology	293
Astronomy	157
Earth Science	10,261
Conservation	113
Physical Science - JHS & Physics II	8,509
Other JHS Science	1,644
Other Earth-Space Sciences	95
Other Survey Science	205
Botony	107
Geology	217
Meteorology	11

perform better academically or demonstrate higher qualities of cooperation, leadership, initiative, helpfulness, and self-reliance than do non-IPS students. The tests given showed no advantage in problem-solving skills. The results further suggest that no improvement in problem-solving skills results from exposure to the BSCS Green Version. Williams' conclusion is that IPS course does not give an advantage to a student about to enter a BSCS biology program.¹⁸

Summary

Since many science programs are based on a 7, 8, 9 grade sequence to coordinate the materials to be covered, one has the feeling that a student would be at a disadvantage not to include all three parts of the program. In a survey of the recent literature, two articles showed an evaluation of their ninth grade science program on the following science courses, biology. Both results showed no disadvantage to students not taking the ninth grade science courses offered.

The new approach in junior high science is to develop concepts by way of students inquiring and investigating. The effect of these courses on subsequent years of science achievement have not been evaluated to a great extent.

¹⁸Byron P. Williams, "IPS as Preparation for BSCS Biology", The American Biology Teacher, Vol. 13, No. 8, November 1971, p. 494.

Chapter 3

METHODS AND PROCEDURES

Description of Sample

Approximately 70 to 75 students graduate from Belleville High School each year. In the three years selected for this study, 1969, 1970, and 1971, a total of 229 students completed four years of high school at Belleville. About one-half of these students had enrolled in general science during their ninth grade. Other ninth grade students elected non-science courses. Almost 100 percent of the students enrolled in biology during their sophomore year. Approximately 60 percent of the students followed biology with chemistry during their eleventh grade, and about 20 percent of all the students selected physics in their twelfth year. The curriculum, texts, and instructors for the science courses had remained quite stable for these three years, making the instructional background for the students fairly uniform.

During the first part of the student's senior year, several students take the American College Testing Program tests (ACT). The reliability of this test can be attested by its wide use in the United States and by comparative studies such as that made by Munday that predict the student's college ability.¹⁹ One of the scores on the test is a score for the natural sciences. This score will be one of the criteria

¹⁹Leo Munday, Comparative Predictive Validities of American College Tests and Two Other Scholastic Aptitude Tests, Iowa City: American College Testing Program, 1965.

used to measure the student's achievement in science. Of the 229 students that graduated from Belleville High School, 129 had participated in the ACT testing program. It is this group of students that was used to make a study of the value of general science during the ninth grade toward their academic achievement in science.

The students were divided into two groups, those that had taken general science and those who had not. A total of 72 students were found to have had general science and will be referred to as Group A in this study. The remaining 57 students that did not elect to take general science will be referred to as Group B.

Limits of the Study

Since students selected for this study did not include all the students that graduated from Belleville High School, there are certain limitations to the result. Only those students who had completed four years of high school and who had taken the ACT test were included.

Any senior student that had an interest in obtaining more education after high school was encouraged by the counselor to take the ACT test. The results of the test may help the student determine what type of post high school education to undertake. Therefore, the results of this study will not apply to all students of Belleville High School but to those that plan to obtain more education.

Description of Measures

Permission from the school administration was obtained to use the information from the permanent record file. All grades on the permanent records use the alphabetic system. The letters A, B, C, D, and F with the addition of (+) and (-) are used. These letter grades are used to

determine grade point averages (G.P.A.) for honor rolls, class ranking, and some scholarships awarded at graduation. There are three grades recorded for each subject completed: a first semester grade, a second semester grade, and a final grade. Only the final grade was used in this study.

The following numerical value for the letter grades was used in this report:

A+	=	12	B+	=	9	C+	=	6	D+	=	3	F	=	0
A	=	11	B	=	8	C	=	5	D	=	2			
A-	=	10	B-	=	7	C-	=	4	D-	=	1			

The Differential Aptitude Test (D.A.T.) scores, the G.P.A. for biology, and the natural science score from the ACT were recorded for each of the 129 students. The G.P.A. in chemistry and physics were recorded for the students that had completed those science courses. Several comparisons were made in an attempt to determine the contribution of general science at the ninth grade level. The arithmetic mean of the students' D.A.T.'s was used to determine whether for each comparison made, the two groups differ significantly with respect to their general aptitude. Further comparisons were made between their scholastic achievements in science.

The first comparison made between Group A and Group B used their G.P.A. in biology and natural science score from ACT tests. This comparison indicated if students from Group A, who had general science, were significantly different from students of Group B, who had no general science, in G.P.A. in biology or in natural science scores from ACT tests. Biology was completed at the end of the 10th year. The effect of general

science on science accomplishment in high school was measured by the natural science scores on ACT tests taken during the senior year.

The second study made was between students from the two groups, who enrolled in no more science, after completing biology at the end of their sophomore year. The students from Group A had completed general science and biology while the students from Group B had completed only biology.

At the end of the junior year, there were students in both groups that had completed chemistry. The students from Group A had completed general science, biology, and chemistry. The students from Group B had completed biology and chemistry. The mean values for D.A.T., G.P.A. in chemistry, and natural science scores on the ACT were recorded and a comparison made between the two groups.

The fourth study concerned students from Group A and Group B, who did not enroll in any more science after completing chemistry. Nineteen students from Group A were compared to twenty-five students from Group B. the mean values for D.A.T., G.P.A. in chemistry, and score in natural science were used to determine if any advantage of having general science at the ninth grade level was evident.

The last comparison between students from Group A and students from Group B involved those that had completed physics. The students from Group A had completed general science, biology, chemistry, and physics. Students from Group B had completed only biology, chemistry, and physics. A comparison of their mean values of D.A.T., G.P.A. in physics and natural science scores on ACT was made to test for any significant differences.

The t-test for two independent samples was used to determine whether there was a significant difference in the mean value of D.A.T., G.P.A. in subject, and natural science score on ACT. The .05 level of confidence was chosen. To determine the value of (t) for two independent samples the following formula was used:

$$t = \frac{M_a - M_b}{S_{M_a - M_b}}$$

$$\text{Where } S_{M_a - M_b} = \sqrt{\frac{SS_a + SS_b}{n_a + n_b - 2} \left(\frac{1}{n_a} + \frac{1}{n_b} \right)}$$

The calculated value for (t) is compared to a tabled value at the desired level of significance and with degrees of freedom equal to $n_a + n_b - 2$. The tabled value for (t) are from Fundamental Research Statistics for the Behavioral Sciences, by John T. Roscoe.²⁰ If the calculated statistic equals or exceeds the table value, the null hypothesis was rejected. If the calculated value is smaller than the tabled value, the null hypothesis was retained as no significant difference between the means had been established. No attempt was made to try and correlate the different values for (t) obtained.

Statistical Hypotheses

Null Hypotheses:

1. Students enrolled in general science during their ninth grade at Belleville High School show no difference in academic achievement in biology over students who do not enroll in general science

²⁰John T. Roscoe, Fundamental Research Statistics for the Behavioral Sciences, (New York: Holt, Rinehart, and Winston, 1969)

2. Students from Belleville High School who have completed only general science and biology show no difference in academic achievement in science over students who have completed only biology and no other science course.
3. Students from Belleville High School who have completed only general science, biology, and chemistry show no difference in academic achievement in science over students who have completed only biology and chemistry.
4. Students from Belleville High School who have completed general science, biology, chemistry, and physics show no difference in academic achievement in science over students who have completed only biology, chemistry, and physics.

Chapter 4

RESULTS AND CONCLUSIONS

The purpose of this study was to determine the relationship between ninth grade general science and later academic achievements in science. Three years data on 129 students that had graduated in 1969, 1970, and 1971 was obtained. All of the students had the following scores in common: D.A.T., biology, and ACT. Group A consisted of 72 students that had general science, and Group B consisted of 57 students that had no general science.

A comparison of the mean D.A.T., G.P.A. in biology, and natural science scores of Group A to Group B is made in Table 2. Group A had a slightly lower mean D.A.T. than Group B, but the calculated value of (t) shows this is not a significant difference. The mean G.P.A. in biology and natural science scores on ACT for Group A were slightly higher than for Group B, but the calculated (t) value shows this is not a significant difference between the two groups. The null hypothesis must be retained.

Table 3 presents a comparison between students from Group A and students from Group B that had not enrolled in more science after completing biology. The 33 students from Group A showed a slightly lower mean D.A.T. than the 20 students from Group B but was found to be of no significant difference. The difference in the mean G.P.A. in biology and natural science scores were found not to be significant. It is interesting to note that although the D.A.T. for Group A was lower, their natural science scores were higher. Since the calculated values for (t)

Table 2

Comparison of all Students in the Study on G.P.A.
in Biology and ACT Natural Science Scores

	No.	D.A.T.	Biology G.P.A.	ACT Nat. Science
Group A	72	51.7	7.2	22.2
Group B	57	52.9	7.0	21.4
Calc. t-value		-.483	.419	.792
Table value for (t) with df = 127 (1.658)				

Table 3

Comparison of Students That Take No More
Science after Finishing Biology

	No.	D.A.T.	Biology G.P.A.	ACT Nat. Science
From Group A	33	42.5	5.5	18.1
From Group B	20	45.2	5.6	16.8
Calc. t-value		-.752	-.194	.972
Table value for (t) with df = t1 (1.684)				

were less than the established level of significance, the null hypothesis was retained.

There were 39 students from Group A and 37 students from Group B who had completed chemistry. The comparison of these students is found in Table 4. The calculated t-value of the mean D.A.T. shows that these two groups were significantly different in their mental ability. Since the two groups selected in this comparison had different mental abilities, the other values obtained were not used to accept or reject the hypotheses. It is interesting to note that these two groups showed no significant difference in their natural science scores from the ACT.

Table 4
Comparison of Students in the Study
Who Have Completed Chemistry

	No.	D.A.T.	Chemistry G.P.A.	ACT Nat. Science
From Group A	39	59.6	8.4	25.7
From Group B	37	54.4	7.8	23.6
Calc. t-value		2.002	3.821	1.542
Table value for (t) with df = 74 (1.671)				

Table 5 is a comparison made between 19 students from Group A with 25 students from Group B. These are students from the two groups who enrolled in no more science courses after chemistry. Students from Group A had now completed general science, biology, and chemistry while students from Group B had completed only biology and chemistry. The

mean D.A.T. values show the two groups were not significantly different in mental ability. The mean G.P.A. in chemistry and natural science scores were found also to be of no significant difference. No evidence was obtained from these groups to reject the null hypothesis.

Table 5
Comparison of Students Who Have Completed No
More Science after Finishing Chemistry

	No.	D.A.T.	Chemistry G.P.A.	ACT Nat. Science
From Group A	19	55.7	7.5	23.4
From Group B	25	56.8	7.6	23.0
Calc. t-value		-.306	-.147	.265
Table value for (t) with df = 42 (1.684)				

The last comparison made was between the students from Group A and Group B that had completed physics. Table 6 compares the students' mean values of D.A.T., G.P.A. in physics, and natural science scores from the ACT. The calculated t-value showed no significant difference between the mental ability of the two groups. This made the two groups uniform enough to make a comparison of their academic achievement in physics and on their natural science scores. It was found that there was no significant difference between the two groups tested. The null hypothesis was retained.

Table 6
Comparison of Students Who
Have Completed Physics

	No.	D.A.T.	Physics G.P.A.	ACT Nat. Science
From Group A	20	63.2	9.4	27.8
From Group B	12	57.7	9.2	26.0
Calc. t-value		1.488	.391	1.097
Table value for (t) with df = (1.697)				

Summary

The groups compared in Tables 2, 3, 5, and 6 were not significantly different in their mental ability according to the t-test. A further comparison between G.P.A. of science subjects and natural science scores from the ACT test by using the t-test showed no significant difference between groups of students from Group A and Group B that had completed similar levels of science. Therefore, the null hypotheses were retained.

Chapter 5

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine whether students taking general science at Belleville High School are more successful in subsequent science courses than those who do not take it. The upgrading of science curriculums in the various fields of science had precipitated questions about the necessary background students should have for courses in biology, chemistry, and physics. A survey of literature had revealed that several leading educators advocate science at the ninth grade level be required. Some recent studies have shown little or no advantage of ninth grade science to other science courses and question its value. Instructors of science at Belleville voiced their opinion that students completing a course in general science will succeed better when enrolling in other science courses over students that have not completed general science.

General science at Belleville High School is taught to about one-half of the ninth grade students each year. Students not enrolling in general science have had several electives from which to select. These alternatives include Spanish I, French I, Latin I, Industrial Arts, Vocational Agriculture, Art I, Business Arithmetic, Freshmen Band, Freshmen Choir, and World History.

The students chosen for this study were graduates of Belleville High School 1969, 1970, and 1971 who had taken the ACT tests. The

natural science score on the ACT test was used as a basis for total science achievement during high school.

The selected students were divided into two groups: those that had enrolled in general science were in Group A, and those that had not enrolled in general science were in Group B. This mean G.P.A. in science subjects was used to determine if a significant difference could be detected between students from these two groups upon their completion of different science courses.

At the end of the sophomore year when the students had completed biology, no significant difference was found in the mean G.P.A. in biology between Group A and Group B. Their achievement in science through their senior year, indicated by the mean natural science scores on ACT, was also found not to be significantly different. There was no positive evidence to show that students who had taken general science in the ninth grade had a better grade point average in biology over the students who had not taken it.

In comparing students that do not take more science courses after biology from Group A to students from Group B, it was found that the mean natural science scores were not significantly different. The students from Group A did show slightly lower mean D.A.T. values than Group B but produced higher mean natural science scores. The students that had completed general science and biology from Group A showed no significant advantage over students from Group B that had taken only biology and no other science.

When comparing all the students from Group A and Group B that had completed chemistry, it was found that the mean D.A.T.'s of these two groups were significantly different. The data from this comparison were

not used to test the hypotheses. It was interesting to note that although one group showed a mean higher mental ability than the other group, there was no significant difference found in the mean natural science scores of the two groups.

Students from Group A and Group B that enrolled in no more science after completing chemistry were found to have no significant difference in mean G.P.A. in chemistry or mean natural science scores on ACT. There was no evidence to support that students completing general science showed a higher grade point average in chemistry over students that had not completed general science.

In comparing students from Group A with students from Group B that had completed physics, no significant difference was found in mean G.P.A. in physics or mean natural science scores. These data tend to support that enrollment in general science at the ninth grade level for students from Group A showed no grade point average advantage in physics over students from Group B who had not enrolled.

As a result of finding no significant differences in the comparisons made between students from Group A and students from Group B, the null hypotheses were retained. Students who enroll in general science showed no academic advantage in subsequent science courses at Belleville High School over students who did not enroll in general science.

A lack of significantly greater achievement on the part of students with a background in ninth grade science does not indicate that ninth grade students should by-pass the general science course. It may stimulate a student's interest in science resulting in the student enrolling in more science subjects than he normally would.

Belleville students with above average D.A.T. scores need not feel that by-passing the general science course at the ninth grade will

be a great disadvantage at the present time in other science courses. These students have shown by this study to have done as well academically as students who had enrolled in general science.

Students interested in science should be encouraged by providing a science program that is stimulating and progressive. To obtain this type of program, a committee of elementary and high school science teachers at Belleville should be set up to review the present science program in Unified District #427 and determine what steps might be taken to improve their present program.

More study is needed about the value of ninth grade science for the student that does not plan to go on to college. This student usually does not participate in the ACT testing program. This study has not completely determined the value of ninth grade science at Belleville High School.

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THE RELATIONSHIP BETWEEN ENROLLMENT IN NINTH GRADE
GENERAL SCIENCE AND SUCCESS IN SUBSEQUENT SCIENCE COURSES

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AN ABSTRACT OF A MASTER'S REPORT

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ABSTRACT

The purpose of this study was to determine whether students taking general science at Belleville High School are more successful in subsequent science courses than students who do not take it. Information for this study was obtained from the permanent files at Belleville High School with permission from the administration. All of the graduates from 1969, 1970, and 1971 classes that had participated in the ACT testing program were selected for this study. The students were divided into two groups, those that had enrolled in general science and those that had not.

A survey of previous literature revealed that several leading educators advocated science at the ninth grade level be required. Some related studies showed little or no advantage of ninth grade science to other science courses and questioned its value.

Students from the two groups were compared after they had completed biology, chemistry, physics and the ACT tests. The natural science scores on the ACT test were used as a measure of achievement in science in high school. Grade point averages were used for subject matter. The (t) test for two independent samples was used to determine if a significant difference could be found between the two groups. The study showed no significant differences were found. The students that had completed general science at the ninth grade level showed a higher mean natural science score in all the comparisons but none were found to be significant in this study.

Based on the results of this study, students at Belleville High School should not feel that by-passing ninth grade science will affect their ability in other science courses.

More study is recommended concerning the value of ninth grade science to students that have lower differential aptitude test scores and do not participate in the ACT testing program.