A STUDY TO DETERMINE THE RELATIONSHIP OF GRADES EARNED IN INDUSTRIAL ARTS TO THE GRADES EARNED IN CERTAIN OTHER SUBJECTS IN SENIOR HIGH SCHOOL

A Thesis

Presented to

the Faculty of the Department of Industrial Arts

and the Graduate Council of the Kansas

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In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

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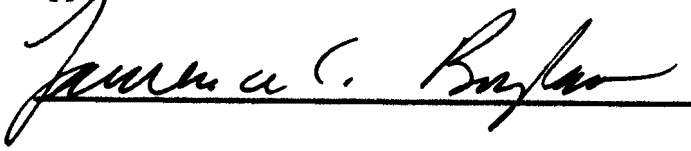

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Students in secondary schools are placed or guided into the school curriculum according to the results of various aptitude, achievement, and intelligence tests, and their success or failure in previous courses. Often times students who can not comprehend the subject matter or adjust themselves to other classroom activities are sent to the industrial arts laboratory. Because of the technological advances in industry, students who can not comprehend the material in English, mathematics, and science may not have the ability to succeed in technical courses. Informational content of these courses is presented in a manner that requires students to understand written instructions and directions. The student needs to know how to use various mathematical formulas and have a basic understanding of scientific information.

I. THE PROBLEM

Statement of the problem. The purposes of this study were (1) to ascertain whether students who make satisfactory grades in industrial arts also make satisfactory grades in certain other subjects and if students who do unsatisfactory work in industrial arts do unsatisfactory work in certain other subjects; (2) to show the relationship between Differential Aptitude Test (DAT) scores and achievement in industrial arts; (3) to determine whether students who enroll in industrial arts subjects also enroll in other elective subjects.

Importance of the study. Society in the United States of today is indeed dominated by technology. Man has been living in and adjusting to an ever-changing environment for centuries, but the full force of the ever increasing technology has developed since the turn of the twentieth century. The everyday activities of a person, both at home and at work, requires vastly increased technical understanding and specialization of skill. The need for a broad knowledge of the principles and processes of industry is stated by Bennett.

> Every man who would intelligently use the modern conveniences of his own home, or the labor saving devices and conveniences of business life, must know something of the materials and principles of industry; and if he is to have any adequate appreciation of the product . . . and judge the quality of the things he purchases or uses, he must know something of the process that produced it. In fact, industry development has been so rapid and so varied in our country . . . it has affected every man's life to an extent that if he is to retain sufficient mastery of his environment to make it serve his needs, he is forced to acquire considerable practical knowledge of the materials, principles and process of industry.[1]

The technical advancement has changed the demands upon our educational system "from the earlier dual concept which would educate some as 'thinkers' and others as 'doers'".[2] Now the trend seems to be toward combining the thinking and doing in an effort to make a more effective program of education.[3] Advancement in technology is causing changes in

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[1] Charles A. Bennett, The Manual Arts (Peoria, Illinois: The Manual Arts Press, 1919), p. 15.

[2] Walter C. Brown, "What's Good About Industrial Arts in our School," The Teachers College Journal, 36:36, October, 1964.

[3] Ibid.

the nature of and requirements for entry into many occupations and professions. It is necessary for students to participate in a bread spectrum of subjects. Industrial arts is part of general education and a process of relating general education to technology of industry. It is then necessary to provide each student with an opportunity to acquire knowledge and skills in practical ways so that the student will experience a bread background of learning.

The primary purpose of industrial arts is to provide a bread background of exploratory experiences for the development of an intelligent understanding of modern industrial civilization.[4] The exploratory experiences will include an understanding of industrial technology, processes and materials, development in the basic use of tools, respect for and habit of safety practices, creative thinking techniques, problem solving abilities, and an understanding of good design.

There seems to be a trend toward sending the unsuccessful student, socially and academically, to the industrial arts laboratory and placing the successful student in strictly college preparatory courses.[5] This is an injustice to the successful student. For example, some major colleges in the United States are omitting various industrial arts courses from the students' curriculum. Presumably, this is being done on the assumption that this knowledge was obtained in high school. Every student,

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[4] S. L. Coover, "Industrial Arts and General Education," Industrial Arts and Vocational Education, 49:28, May, 1960.

[5] Lawrence S. Wright, "Space-Age Industrial Arts," Industrial Arts and Vocational Education, 48:223, October, 1959.

successful or unsuccessful, should be given the opportunity for the development of leisure time activities. The ability to know the qualities of good materials and workmanship and to select, care for, and use industrial products wisely should be developed in every student. If high schools channel the college bound student into strictly college preparatory subjects, omitting the industrial arts, where is the student expected to acquire this knowledge? While the writer agrees that the unsuccessful student should have an opportunity in industrial arts to develop a prevocational background, this does not mean that the industrial arts laboratory should be a dumping ground for students of low general ability only.

Limitations of the study. The data for this study were taken from the group of students who attended Shawnee Mission West High School during the 1964-1965 school year. This group is made up of 104 students who were enrolled in Metalworking I. The other subjects that were used in the comparison for this study are: English, mathematics, and laboratory science. Only those students who were enrolled in the various courses for the entire year were included in this study. The topic for this thesis was developed after the various courses were near completion.

II. DEFINITIONS OF TERMS USED

Differential Aptitude Tests. These are a battery of eight tests designed to appraise fundamental intellectual abilities with the placing of as little emphasis as possible on particular school subjects. Even

though the Numerical Ability and Language tests are basically dependent on school subjects, the aim has been to use information learned in elementary schools. The battery of eight tests is made up of the following tests: Verbal Reasoning, Numerical Ability, Abstract Reasoning, Space Relations, Mechanical Reasoning, Clerical Speed and Accuracy, and Language Usage. The Language Usage test is made up of two sections, one on spelling and one on sentences. The Verbal Reasoning and Numerical Ability will give a sampling of the general mental ability of intelligence.[6]

Verbal Reasoning. Verbal Reasoning is a measure of the ability to grasp an idea explained in words. The purpose of the test is to evaluate the students' ability to generalize relationships inherent in knowledge and to think abstractly. The questions are multiple choice with sixteen options from which the correct answer is chosen. This test has high correlation with academic success. Because some vocational jobs have a positive relationship with the ability to understand complex verbal phrases the results of this test also deserve some consideration.[7]

Numerical Ability. This test was designed to test the understanding of numerical relationships and the ability to handle numerical concepts. It involves arithmetic computation rather than arithmetic reasoning. The Numerical Ability test is also important in the predicting of

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[6]George K. Bennett, Harold G. Seashore, and Alexander G. Wesman, Manual for the Differential Aptitude Tests (New York: The Psychological Corporation, 1959), p. 5.

[7]Ibid., p. 6.

academic success. Due to the fact that many occupations require numerical ability, the results of this test require some consideration.[8]

Correlation coefficient. It is a summary of the magnitude and direction of the relationship between two sets of measurements.[9] The method employed for computing the correlation coefficient is the Pearson product-moment. In this study the correlation coefficient will be represented by the letter r.

Level of significance. "The level of significance refers to the degree of improbability which is deemed necessary to cast sufficient doubt upon the truth of the hypothesis to warrant its rejection."[10] If it is stated that the results are significant at the 5 per cent level, it is meant that the event may not be expected to occur more than 5 times in 100 by pure chance error in sampling; and likewise, if an event is significant at the 1 per cent level, it is implied that the event may be expected to happen not more than 1 time in 100 by pure chance error in sampling. This also means that the probability of a pure chance error is less than 1 per cent. A study that has a probability of 1 per cent is more meaningful and has greater significance than if it had a probability of 5 per cent. The 1 per cent level and 5 per cent levels are often times

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[8] Ibid.

[9] C. C. Ross, and Julian C. Stanley, Measurements in Today's Schools (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1960), p. 86.

[10] Paul Bloomers, and E. F. Linquist, Elementary Statistical Methods in Psychology and Education (Boston: Houghton Mifflin Co., 1960), p. 267.

indicated as .01 or .05. The level of significance is indicated by the Greek letter alpha (α).

Industrial arts. Industrial arts is that phase of general education which gives the student a basic understanding of industry using various materials, machines, tools, and equipment in preparation for future education or employment.[11]

Elective courses. Elective courses are necessary for the total accumulation of units of credits but are not specifically required by the State Department of Education for the completion of a high school education.

Successful student. For the purpose of this study, successful students are those students who achieve grades A, B, or C.

Unsuccessful student. For the purpose of this study, unsuccessful students are those students who achieve grades of D or F.

Satisfactory grades. For the purpose of this study, satisfactory grades are those grades achieved which are A, B, or C.

Unsatisfactory grades. For the purpose of this study, unsatisfactory grades are those grades achieved which are D or F.

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[11] Gordon O. Wilber, Industrial Arts in General Education (Scranton, Pennsylvania: International Textbook Co., 1948), p. 2.

III. METHOD OF PROCEDURE

Students enrolled in Metalworking I in the Shawnee Mission West High School during the 1964-1965 school year were selected for this study. Those students were selected because the writer had worked with them throughout the school year. A total of 104 students were included in this study. Of the total number of students enrolled in Metalworking I, eighty-eight students or 84.6 per cent were sophomores; thirteen students or 12.5 per cent were juniors; and three students or 2.9 per cent were seniors. There were twenty students enrolled in two or more industrial arts courses.

A mean of the grades earned in industrial arts courses was used for the comparison with the grades earned in the other subjects. The average of the industrial arts courses could be any combination of the following courses: automechanics, drawing, metalworking, or woodworking.

The other subjects chosen for the comparison were English, mathematics which consisted of algebra or geometry, and laboratory science which included biology or applied science.

After the courses had been selected, the permanent records were used to obtain scores for the Verbal Reasoning and Numerical Ability tests of the Differential Aptitude Test, the industrial arts grades, and the grades in the other subjects. A special tabulation sheet was prepared to record this information (Appendix A, page 44). The industrial arts grades were averaged and compared with the sum of the Verbal Reasoning and Numerical Ability test scores to determine their relationship.

The Pearson product-moment correlation coefficient was used for the calculation of the correlation between the Differential Aptitude Test scores and the grade in industrial arts. A comparison of the grade achieved in industrial arts was also made with the grade achieved in each of the following subjects: English, mathematics, and laboratory science. There were sixteen students who were enrolled in slow or remedial courses in English, mathematics, and laboratory science. Interviews with instructors of these various slow or remedial courses indicated that grades earned tended to be one grade higher than grades earned in regular courses. The grades earned in these classes were therefore lowered one grade point to correspond with grades in regular courses. To determine the correlation coefficient each letter grade was assigned an arbitrary value of A = 4, B = 3, C = 2, D = 1, F = 0. Here again, the Pearson product-moment was used to calculate the correlation coefficient between the industrial arts grade and the English, mathematics, and science grades. A scatter diagram was then made to aid in interpreting the results.

At this time an analysis was made to ascertain whether the students who enrolled in industrial arts also enrolled in other elective subjects. This information was taken from the special tabulation sheet prepared for the recording of the DAT scores and grades of the various subjects. A listing of the various electives taken and the percentage of the total number was given (Figure 7, page 35).

Procedure used in calculating the correlation coefficient. The course grades for the various subjects were gathered and arranged in

tabular form (Tables I to III, pages 18, 22, and 27). The industrial arts grades and the raw scores from the Differential Aptitude Tests were gathered and arranged in Table IV, page 31.

The data were arranged in tabular form for calculating the correlation coefficient between the industrial arts grades and the grades earned in each subject: English, mathematics, and laboratory science. The correlation coefficient between the industrial arts grades and the combined raw scores of the Verbal Reasoning test and Numerical Ability test was also calculated.

The following formula was used:

[12]

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

N - number of frequency

Σ - sum of

X - industrial arts grade

Y - English, mathematics, laboratory science grade or raw score of the Verbal Reasoning and Numerical Ability tests.

All calculations were carried out two places and rounded off to the nearest number.

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[12] Henry E. Garrett, and R. S. Woodworth, Statistics in Psychology and Education (New York: Longmans, Green and Co., 1959), p. 143.

CHAPTER II

REVIEW OF THE LITERATURE

From the literature reviewed, it was found that there had been only one study made regarding the relationship of Verbal Reasoning and Numerical Ability of the Differential Aptitude Test and industrial arts.

From the information in Tables 2, 4, 6, and 13 in the manual for the Differential Aptitude Test, the correlation between grades achieved in industrial arts and the Verbal Reasoning and Numerical Ability scores is relatively low.[1] The mean r between Verbal Reasoning and English is .44; in mathematics, .35; and in science, .49 in comparison to the mean r between industrial arts and Verbal Reasoning which is .24. The mean r for the Numerical Ability and English is .40; mathematics .47; and science, .45 in comparison to the mean r between industrial arts and Numerical Ability which is .24. These scores were earned by a group of students consisting mainly of eighth and ninth grade level with some tenth grade students, while the present study included students who were mainly at the tenth grade level, with some eleventh and twelfth grade students.

A study was conducted by Larsen comparing the relationship of intelligence quotient with grades earned in industrial arts and with

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[1] Bennett, op. cit., pp. 40-50.

grades earned in English and mathematics.[2] From the study it was found that in general, "a student with a lower mean and median [sic] intelligence quotient received a higher final grade in industrial arts than in either English or mathematics."[3] There was one exception to this in the seventh grade. It was found that the mean and median intelligence quotient for students earning the letter grade A was higher in industrial arts than for students earning the letter grade A in either English or mathematics.

From Larsen's study it was found that a greater percentage of students received higher grades in industrial arts courses than in the other courses, and at the same time a smaller percentage received lower or failing grades in industrial arts courses than in English and mathematics. The correlation of intelligence quotient and final grades was lower in industrial arts than other subjects. In the ninth grade the r was .51 for English and .38 for industrial arts for group one and the r was .31 for algebra and .28 for industrial arts in group two. The correlation for eighth grade students was .59 in English, .52 in mathematics, compared to the r of .40 in industrial arts; while the correlation coefficient for the seventh grade students was .51 in English, .41 in mathematics, and .26 in industrial arts. Although these correlation coefficients are significant at the one per cent level, it should be

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[2]Elrid S. Larsen, "The Relationship Between I. Q. and Grades Received by Students at the Logan Junior High School in Industrial Arts as Compared With Other Subjects" (unpublished Master's thesis, Utah State University, Logan, Utah, 1959), pp. 23-41.

[3]Ibid., p. 23.

noted that the correlation in industrial arts was lower than other subjects. There were no studies found on the senior high school level comparing the grades earned in industrial arts with grades earned in English and mathematics. It must be remembered that junior high school students may not have had the opportunity to work with as complicated machines and equipment as is the case with senior high school students.

According to the manual for Differential Aptitude Tests the combined score of the Verbal Reasoning and Numerical Ability test may be used in place of intelligence or mental ability tests.[4] The correlation between the Verbal Reasoning and Numerical Ability test scores of the Differential Aptitude Tests and various intelligence quotient scores was given. The r ranged from .59 to .86 for the Verbal Reasoning test and from .35 to .75 for the Numerical Ability test.[5]

In a study, "What High School Pupils Study", the Office of Education reported that 32 per cent of the lower 25 per cent ability group were enrolled in the industrial arts and home economics curriculums.[6] The upper group consisted of the top 25 per cent of the total number of students in the study. The middle group was the middle 50 per cent and the lower group was the bottom 25 per cent of the total number of

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[4]Bennett, op. cit., p. 5.

[5]Ibid., p. 72.

[6]United States Department of Health, Education, and Welfare, Office of Education, What High School Pupils Study (Washington: United States Government Printing Office, 1962), pp. 25-67.

students. Most of the students who enrolled in industrial arts were from the average or below average ability group, although there were 15 per cent of the upper ability students who enrolled in industrial arts courses. From this same study it was found that of the lower ability group, 24 per cent of the students completed two or more industrial arts courses and 15 per cent of this same group completed three or more industrial arts courses. Sixteen per cent of the middle ability group completed two or more industrial arts courses, while 8 per cent of this group completed three or more industrial arts courses. In the upper ability group there were 6 per cent of the students who completed two or more industrial arts courses. Only 3 per cent of the upper ability group completed three industrial arts courses. Only 3 per cent of the total credits earned by all high school students were earned in industrial arts.

A study comparing the grades earned in automechanics and electricity with the grades earned in English, mathematics, and science was conducted by Scheuhing.[7] The correlation between grades in automechanics and English for 141 students was $\underline{r} = .34$, while the correlation between electricity and English for eighty-nine students was $\underline{r} = .32$. The correlation for the combined group was $\underline{r} = .25$. The median English grade for the students of this group was a D. An interesting point is that

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[7]Mary A. Scheuhing, "An Analysis of the Predictive Efficiency of Certain Test Scores and Grades in the Selection of High School Students for the Industrial Auto and Electric Shop Courses" (unpublished Master's thesis, Temple University, Philadelphia, Pennsylvania, 1948), pp. 37-45.

of the eighteen students failing in industrial arts, only four of these failed English.

The correlation between the grades earned in automechanics and mathematics for 133 students was $r = .34$, and the correlation between the grades earned in electricity and mathematics was $r = .30$. The correlation for the entire group was $r = .33$. The median mathematics grade for all students studied was a C. Of the thirty-eight students earning the letter grade of an A or B in industrial arts, only one failed in mathematics. The mathematics course offered was called shop mathematics. It was designed to relate mathematics with the work in the industrial arts shop. This may be a reason for the greater relationship of the grades in these two subjects.

The correlation of grades earned in science and automechanics was $r = .31$, while the correlation between science and electricity was $r = .60$. The combined group had a correlation of $r = .37$. This high correlation may be explained by the fact that science, which consisted of applied chemistry and applied physics, is rather closely related to the electricity course.

CHAPTER III

ANALYSIS OF THE DATA

The purpose of this study was to ascertain the relationship between the grades earned in industrial arts and the grades earned in English, mathematics, and laboratory science in the Shawnee Mission West High School. It was desired to determine the relationship of grades earned in industrial arts courses to the scores of the Verbal Reasoning and Numerical Ability test of the Differential Aptitude Test. Another purpose was to determine what elective courses other than industrial arts the students had taken.

Data were gathered and analysed from the grades earned in industrial arts and the grades earned in various other subjects. This information is presented in a scatter diagram (Tables I, II, and III, pages 18, 22, and 27). These tables show the general trend between the two sets of grades and what grades the students earned in industrial arts compared to the grades earned in the various other subjects. The correlation coefficient and level of significance are also given on these tables.

Tables I, II, and III should be read in the following manner. Table I will be used as an example. Industrial arts grades are read from top to bottom. The English, mathematics, or laboratory science grades are read from left to right. The grades are given in numerical values. Relatively speaking, 3.5 - 4.0 is an A grade, 2.5 - 3.49 is a B grade, 1.5 - 2.49 is a C grade, .5 - 1.49 is a D grade, and .0 - .49 is an F grade. The vertical columns show the number of students earning each

industrial arts grade, while the horisontal columns show the grade earned in English by the same student. Of the two students earning the letter grade A in industrial arts, one student earned an A in English while the other received a C in English. The distribution of the English grades for the twenty-nine students earning the letter grade B in industrial arts is as follows: ten earned a B, ten earned a C, and nine earned a D. In the horisontal column, of the forty-three students earning the letter grade D in English, nine students earned a B, twenty earned a C, and fourteen earned a D in industrial arts. The remaining portion of the table is read in the same manner.

I. CORRELATION OF INDUSTRIAL ARTS TO CERTAIN OTHER SUBJECTS

Correlation of industrial arts to English. The data for this comparison were obtained by an analysis of the grades earned by 104 students. The correlation of these grades should be noted in the scatter diagram (Table I, page 18). The correlation coefficient of grades earned in industrial arts to the grades earned in English was $r = .56$. This correlation is significant at the 1 per cent level. Nine students were enrolled in a remedial English class. The grades earned by those students were lowered one grade point to correspond with the regular English course grades for the reason stated in Chapter I.

The distribution of industrial arts grades and English grades is also presented in Table I. Of the two students earning the letter grade A in industrial arts, one student earned an A and the other earned a C in English. Twenty-nine students earned the letter grade B in industrial

TABLE I

SCATTER DIAGRAM SHOWING ENGLISH AND INDUSTRIAL ARTS GRADES RECEIVED AT THE END OF THE SCHOOL YEAR FOR 104 STUDENTS

English Grades in Numerical Values	.0- .49	.5- .99	1.0-1.49	1.5-1.99	2.0-2.49	2.5-2.99	3.0-3.49	3.5-4.0	TOTAL
3.5-4.0								1	1
3.0-3.49						II	II		4
2.5-2.99			I			II	IIII		7
2.0-2.49			III	III	IIII	IIII I	I	I	20
1.5-1.99			I	IIII	IIII IIII	II	I		18
1.0-1.49		IIII	IIII I	IIII I	IIII IIII I	IIII I	II		35
.5- .99		I	III	II	I	I			8
.0- .49	I	IIII	II	III	I				11
TOTAL	1	9	16	19	28	19	10	2	104

Industrial Arts Grades in Numerical Values

$r = .56$

α = 1 per cent level

arts and of these, ten received a B, ten received a C, and nine received a D in English. The distribution of English grades for the forty-seven students earning the letter grade C in industrial arts was: twenty-three C grades, twenty D grades, and four F grades. Twenty-five students earned the letter grade D in industrial arts while the English grades were as follows: one B grade, four C grades, fourteen D grades, and six F grades. There was only one industrial arts student that earned the letter grade F compared to eleven English students who received the letter grade F. The mean grade for industrial arts was 1.8 and the mean grade for English was 1.3.

The percentage of the final grades received in industrial arts and the final grade received in English is as follows: 1.9 per cent letter grade A, 27.9 per cent letter grade B, 45.2 per cent letter grade C, 24 per cent letter grade D, and 1 per cent letter grade F in industrial arts compared to 1 per cent letter grade A, 10.6 per cent letter grade B, 36.5 per cent letter grade C, 41.3 per cent letter grade D, and 10.6 per cent letter grade F in English (Figures 1 and 2, pages 20 and 21).

Correlation of industrial arts to mathematics. The correlation of grades earned in industrial arts to the grades earned in mathematics was calculated for sixty-three students. There were fewer students in this comparison because some of the students had not taken any mathematics courses. The correlation of the grades is presented in a scatter diagram (Table II, page 22). The correlation coefficient between industrial arts grades and mathematics grades was $r = .49$. This correlation is significant at the 1 per cent level. One student was enrolled in a

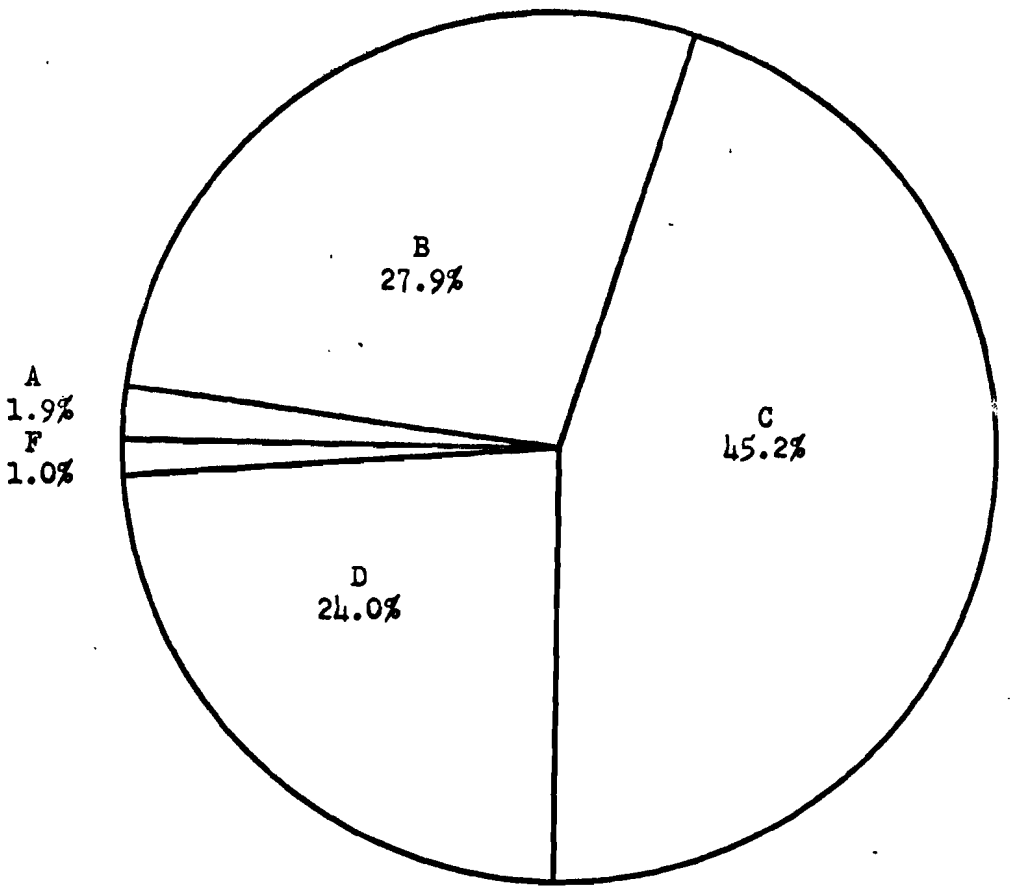

FIGURE 1

DISTRIBUTION OF FINAL GRADES IN INDUSTRIAL ARTS
FOR 104 STUDENTS

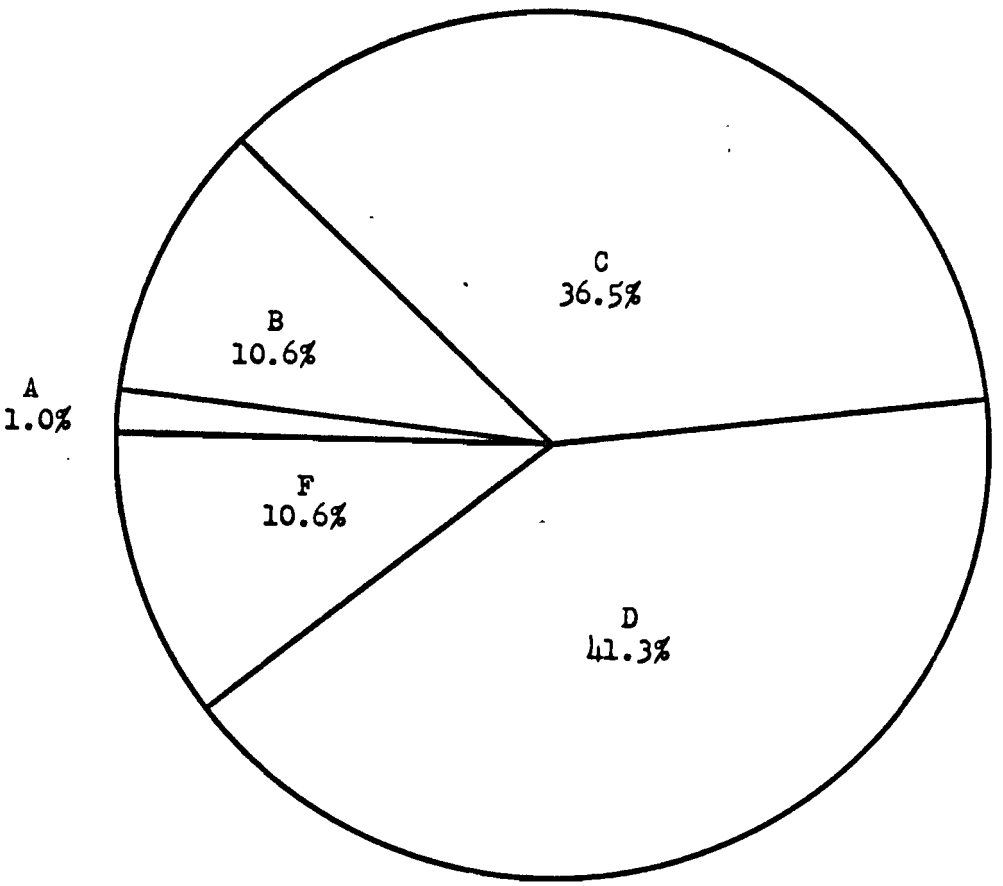

FIGURE 2

DISTRIBUTION OF FINAL GRADES IN ENGLISH FOR 104 STUDENTS

TABLE II

SCATTER DIAGRAM SHOWING MATHEMATICS AND INDUSTRIAL ARTS GRADES RECEIVED AT THE END OF THE SCHOOL YEAR FOR 63 STUDENTS

Mathematics Grades in Numerical Values	.0- .49	.5- .99	1.0-1.49	1.5-1.99	2.0-2.49	2.5-2.99	3.0-3.49	3.5-4.0	TOTAL
3.5-4.0						I			1
3.0-3.49					II	II		I	5
2.5-2.99					I		I		2
2.0-2.49				I	III		I		5
1.5-1.99			I	II	IIII	IIII	III		16
1.0-1.49		I		II	IIII	IIII	III	I	16
.5- .99			II	IIII	I				7
.0- .49		II	III	IIII	II				11
TOTAL		3	6	13	18	13	8	2	63

Industrial Arts Grades in Numerical Value

$r = .49$

α = 1 per cent level

remedial mathematics course. This grade was lowered one grade point to correspond with the regular mathematics course grades.

Table II also shows the industrial arts and mathematics grade distribution. There were two students who earned the letter grade of A in industrial arts compared to only one A in mathematics. One of the two students earning the letter grade A in industrial arts earned a B in mathematics and the other student earned a D. Of the twenty-one students receiving a B in industrial arts, one student earned an A in mathematics, three students earned a B, nine students earned a C, and eight students earned a D. The distribution of the mathematics grades for the thirty-one students earning the letter grade C in industrial arts was: three B grades, eleven C grades, eleven D grades, and six F grades. There were nine students earning the letter grade D in industrial arts. One student received a C in mathematics, three a D, and five an F. There were no failing grades earned in industrial arts compared to eleven failing grades earned in mathematics. The mean grade was 2.0 for industrial arts and 1.2 for mathematics.

The percentage of the final grades in industrial arts compared to the final grades in mathematics is shown in Figures 3 and 4, pages 24 and 25. In industrial arts 3.2 per cent received the letter grade A, 33.3 per cent the letter grade B, 49.2 per cent the letter grade C, and 14.3 per cent the letter grade D compared to 1.6 per cent receiving a letter grade of A, 11.1 per cent a letter grade of B, 33.3 per cent a letter grade of C, 36.5 per cent a letter grade of D, and 17.5 per cent a letter grade of F in mathematics.

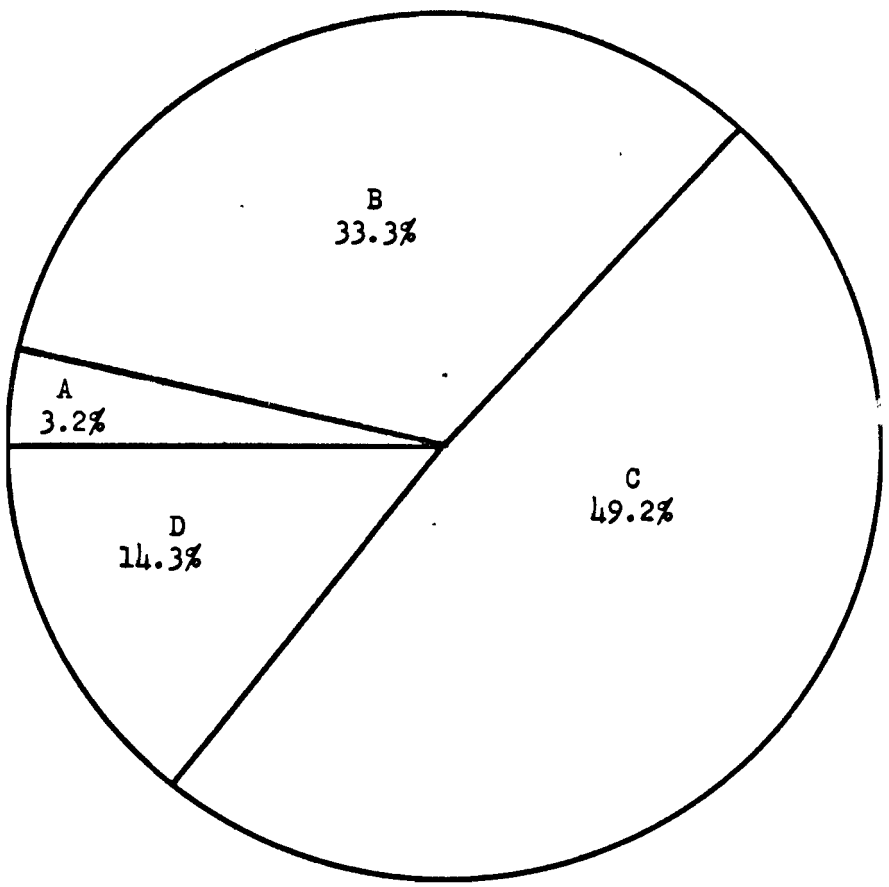

FIGURE 3

DISTRIBUTION OF FINAL GRADES IN INDUSTRIAL ARTS
FOR SIXTY-THREE STUDENTS

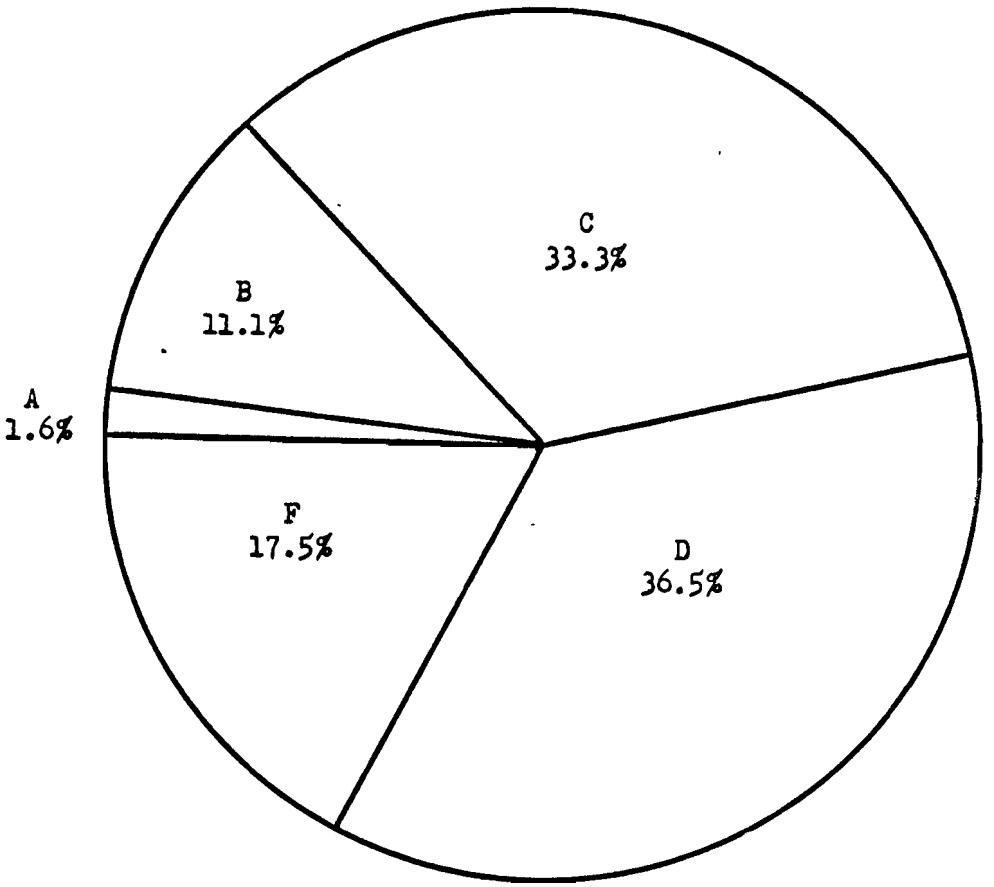

FIGURE 4

DISTRIBUTION OF FINAL GRADES IN MATHEMATICS FOR SIXTY-THREE STUDENTS

Correlation of industrial arts to laboratory science. Ninety-one students were used in this comparison of industrial arts grades to laboratory science grades. A scatter diagram was used to aid in illustrating the comparison of the grades earned in industrial arts to the grades earned in laboratory science (Table III, page 27). The correlation coefficient between industrial arts and laboratory science was $r = .55$. This correlation coefficient is significant at the 1 per cent level. Six students were enrolled in a remedial laboratory science class. These grades were lowered one grade point to correspond with the regular laboratory science grades.

Table III also shows the distribution of the industrial arts grades and laboratory science grades. Two students earned the letter grade A in laboratory science compared to one A in industrial arts. Five students in laboratory science earned an F compared to two students in industrial arts. The only student receiving an A in industrial arts also received an A in laboratory science. Of the twenty-five industrial arts students earning the letter grade B, one received an A, eight received a B, eleven received a C, four received a D, and one received an F in laboratory science. The forty-two industrial arts students earning the letter grade C earned the following grades in laboratory science: two earned a B, nineteen earned a C, nineteen earned a D, and two earned an F. The distribution of the laboratory science grades for the twenty-one students receiving the letter grade D in industrial arts was: one B grade, four C grades, fifteen D grades, and one F grade. One of the two students earning the letter grade F in industrial arts also earned an F

TABLE III

SCATTER DIAGRAM SHOWING LABORATORY SCIENCE AND INDUSTRIAL ARTS GRADES RECEIVED AT THE END OF THE SCHOOL YEAR FOR 91 STUDENTS

Laboratory Science Grades in Numerical Values	.0- .49	.5- .99	1.0-1.49	1.5-1.99	2.0-2.49	2.5-2.99	3.0-3.49	3.5-4.0	TOTAL
3.5-4.0						1		1	2
3.0-3.49				1		1	1		3
2.5-2.99			1	1		4	2		8
2.0-2.49				3	9	6	2		21
1.5-1.99		1	3	1	4	1	2		13
1.0-1.49		2	5	8	8	1	2		26
.5- .99	1	4	4	2	1	1			13
.0- .49	1		1	1	1	1			5
TOTAL	2	7	14	17	25	16	9	1	91

Industrial Arts Grades in Numerical Values

$r = .55$

α = 1 per cent level

in laboratory science. The other student earned a D in laboratory science. The ninety-one students in this comparison of industrial arts and laboratory science had a mean grade of 1.8 and 1.4 respectively.

Figures 5 and 6, pages 29 and 30, illustrate the percentage of final grades in industrial arts and laboratory science. In industrial arts 1.1 per cent earned a letter grade of A, 27.5 per cent earned a letter grade of B, 46.2 per cent earned a letter grade of C, 23.0 per cent earned a letter grade of D, and 2.2 per cent earned a letter grade of an F compared to 2.2 per cent earning the letter grade A, 12.1 per cent earning the letter grade B, 37.4 per cent earning the letter grade C, 42.8 per cent earning the letter grade D, and 5.5 per cent earning the letter grade F in laboratory science.

II. CORRELATION OF INDUSTRIAL ARTS TO VERBAL REASONING AND NUMERICAL ABILITY TEST SCORES OF THE DIFFERENTIAL APTITUDE TEST

The data were gathered and analyzed for the comparison of industrial arts grades to the combined score of the Verbal Reasoning and Numerical Ability test. This information is presented in Table IV, page 31. Seven students were omitted from the study because no Verbal Reasoning and Numerical Ability test score could be found for them. The correlation of the grades earned in industrial arts with the combined score of the Verbal Reasoning and Numerical Ability test was $r = .41$. This correlation is significant at the 1 per cent level.

Table IV should be read in the following manner. The industrial arts grades are read from top to bottom, with the totals at the bottom

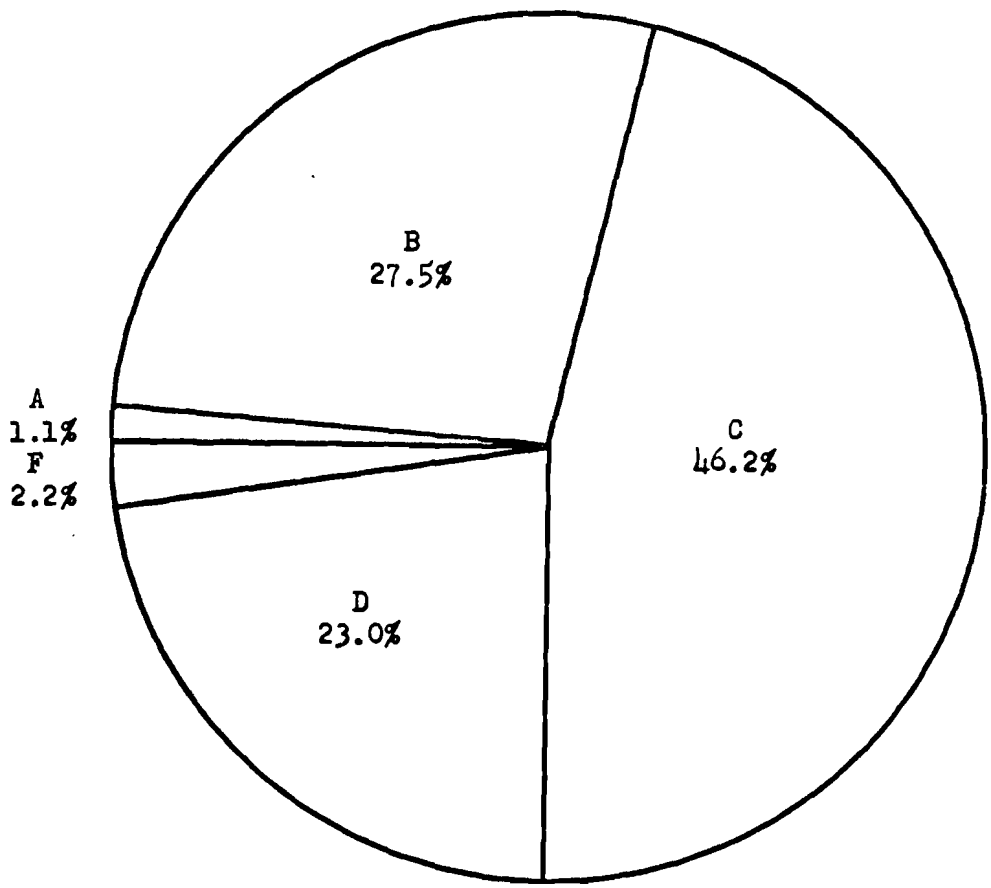

FIGURE 5

DISTRIBUTION OF FINAL GRADES IN INDUSTRIAL ARTS
FOR NINETY-ONE STUDENTS

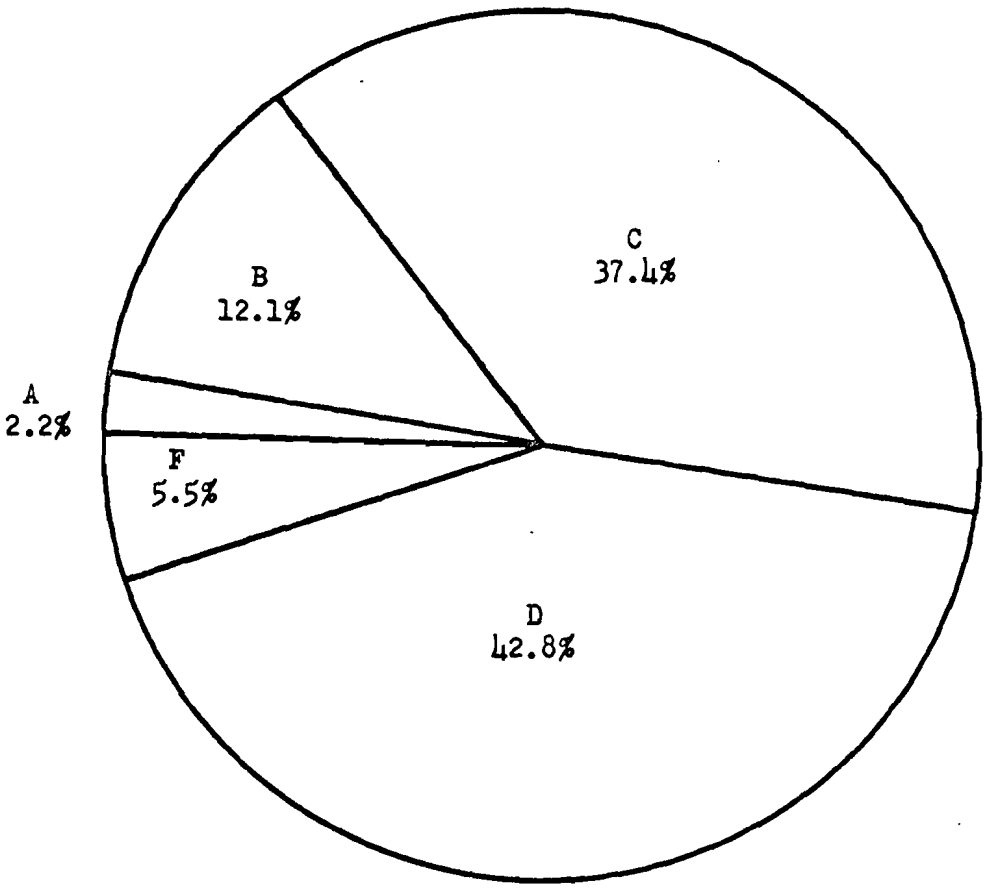

FIGURE 6

DISTRIBUTION OF FINAL GRADES IN LABORATORY SCIENCE
FOR NINETY-ONE STUDENTS

TABLE IV

SCATTER DIAGRAM OF THE COMBINED SCORES OF THE VERBAL REASONING AND NUMERICAL ABILITY TEST AND MEAN INDUSTRIAL ARTS GRADES FOR 97 STUDENTS

Verbal Reasoning and Numerical Ability Raw Scores	.0- .49	.5- .99	1.0-1.49	1.5-1.99	2.0-2.49	2.5-2.99	3.0-3.49	3.5-4.0	TOTAL
80 - 90									
70 - 79						1			1
60 - 69						1		1	2
50 - 59		1	11	1	1111	11	11		12
40 - 49		11	1	1111 11	1111 11	11	1111	1	25
30 - 39		11	1111	1111 1	1111 111	1111 1111	1		30
20 - 29		1	1111	1111	1111	11	1		18
10 - 19		1	11		1	1			5
0 - 09	1	11	1						4
TOTAL	1	9	15	18	25	18	9	2	97

Industrial Arts Grades in Numerical Values

r = .41

α = 1 per cent level

of the table. The raw scores of the Verbal Reasoning and Numerical Ability test are read from left to right, with the total at the right side of the table. The grades are given in numerical values. The raw scores are given in a ten interval range. The vertical columns show the number of students earning each industrial arts grade, while the horizontal column shows the range in which each student was located.

The information presented in Table IV shows that no student scored in the 80 - 90 range and only one student received a score in the 70 - 79 range on the combined score of the Differential Aptitude Test. This student earned the letter grade B in industrial arts. Of the four students who scored in the 0 - 9 range, one earned an F and three earned a D in industrial arts. Fifty-five of the ninety-seven students studied, or 56.7 per cent, were in the range from 30 - 49 on the Differential Aptitude Test. Of these, only one student earned the letter grade A and no student earned an F in industrial arts. Only two students, of the ninety-seven students studied, received a mean grade of A and only one student received a mean grade of F in industrial arts.

III. SUMMARY OF THE CORRELATION BETWEEN INDUSTRIAL ARTS AND OTHER COURSES AND THE CORRELATION BETWEEN INDUSTRIAL ARTS AND THE DIFFERENTIAL APTITUDE TEST

The comparisons of the various correlation coefficients and the significant r values are presented in Table V, page 33. The right hand column lists the r values of the comparison of grades earned in industrial arts to the grades earned in English, mathematics, and laboratory science.

TABLE V

THE VALUES OF r FOR THE COMPARISON OF INDUSTRIAL ARTS TO ENGLISH, MATHEMATICS, OR LABORATORY SCIENCE AND TO THE SCORES OF A GENERAL ABILITY TEST WITH THE REQUIRED VALUES OF r

Course	Required Value of r 1%*	Obtained Value of r**
English	.254	.56
Mathematics	.325	.49
Laboratory Science	.267	.55
Verbal Reasoning and Numerical Ability Tests of the DAT	.267	.41

*The required value of r in Table V is taken from Fisher: Statistical Methods for Research Workers, Oliver & Boyd Ltd., by permission of author and publishers.

**The value of r shows the correlation between the grades in industrial arts and the grades in English, mathematics, laboratory science and the combined scores of the Verbal Reasoning and Numerical Ability tests.

[1]Allen L. Edwards, Experimental Design in Psychological Research (New York: Rhinehart and Company, Incorporated), p. 408.

The correlation coefficient between grades earned in industrial arts and the scores achieved on the Verbal Reasoning and Numerical Ability test of the Differential Aptitude Test is also given. The middle column gives the required values of r that are significant at the 1 per cent level. These values were included to show how much greater the value of r was than the 1 per cent level.

IV. ELECTIVE COURSES ENROLLED IN OTHER THAN INDUSTRIAL ARTS COURSES

An indication of the most popular elective courses is presented in Figure 7, page 35. The combined total of all elective courses other than industrial arts enrolled in by the 104 students studied was 134. This shows that each student completed 1.3 elective courses other than industrial arts. Driver education was enrolled in by more students than any other. Sixty students, or 44.8 per cent of the students in this study, enrolled in driver education. Twenty students enrolled in arts and crafts, while nineteen students enrolled in various business courses. Bookkeeping was the most popular business course. Speech, music and foreign language are the other courses, in respective order, in which students were enrolled.

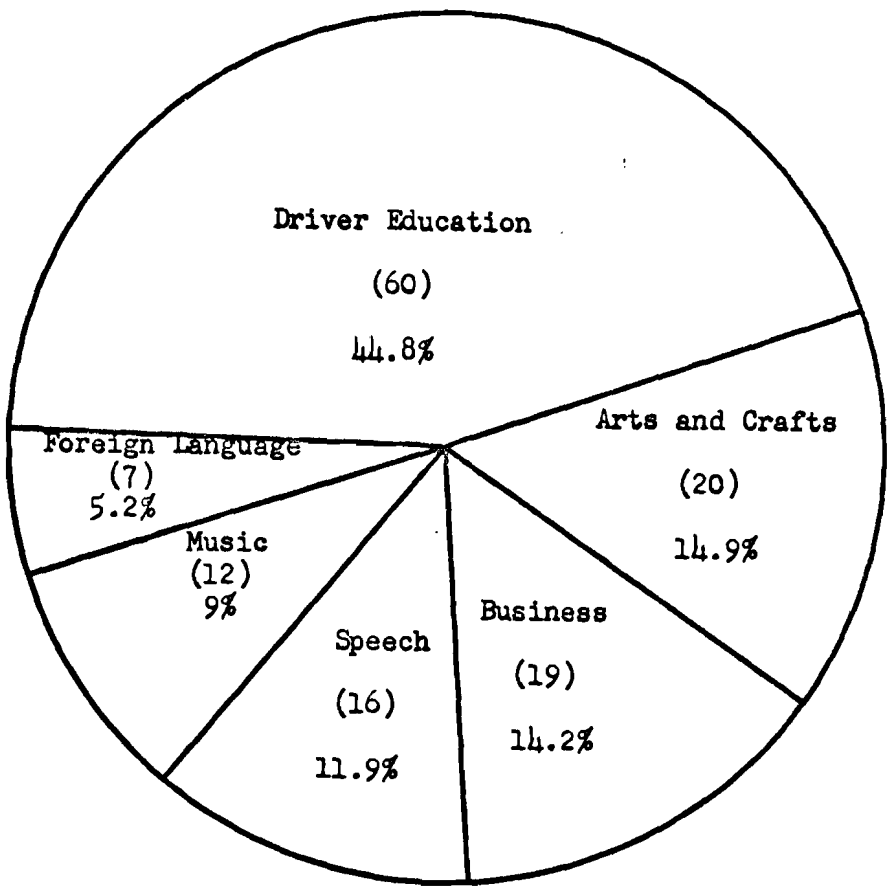

FIGURE 7

NUMBER AND PER CENT OF ELECTIVE COURSES ENROLLED IN OTHER THAN INDUSTRIAL ARTS COURSES BY 104 STUDENTS

CHAPTER IV

SUMMARY AND CONCLUSION

A limited amount of information is available on the correlation between the grades earned in industrial arts and the grades earned in English, mathematics, and laboratory science. The available information indicated that the correlation coefficient between grades in industrial arts and in English, mathematics, and science was rather low. There is also only a limited amount of information available on the correlation between the grades earned in industrial arts and the scores achieved on the Verbal Reasoning and Numerical Ability test of the Differential Aptitude Test. The correlation coefficient between industrial arts grades and the Differential Aptitude Test scores was relatively low.

The purposes of this study were (1) to determine whether there is a positive relationship between the grades earned in industrial arts and those grades earned in English, mathematics, and laboratory science; (2) to determine the relationship of grades earned in industrial arts and the scores achieved on the Verbal Reasoning and Numerical Ability test of the Differential Aptitude Test; and (3) to determine whether other elective courses are taken by students enrolled in industrial arts courses.

This study included 104 students enrolled in Shawnee Mission West High School during the 1964-1965 school year. These students who had been enrolled in Metalworking I were used for the basis of this study.

The courses to be compared with industrial arts were English, mathematics, and laboratory science. The Verbal Reasoning and Numerical Ability test of the Differential Aptitude Test was also compared to industrial arts.

ANALYSIS OF THE DATA

After the individuals and courses had been selected, the required information was obtained from their permanent files. The information was arranged in tabular form to facilitate the comparison. The Pearson product-moment correlation coefficient was used for the calculation of the correlation between the grades earned in industrial arts and the grades earned in English, mathematics, and laboratory science. This same method was employed to obtain the correlation between grades earned in industrial arts and the scores achieved on the Differential Aptitude Test. The industrial arts grade was a mean grade of the industrial arts courses taken. It could have been any combination of the following: automechanics, drawing, metalworking, and woodworking. The correlation coefficient was checked against a table of values of r to determine whether the correlation was significant at the 1 per cent level.[1]

The findings of this study indicate that there is a significant correlation between the grades earned in industrial arts and the grades earned in English, mathematics, and laboratory science at the Shawnee Mission West High School. This study also indicates that there is some

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[1] Ibid.

predictive value in the Verbal Reasoning and Numerical Ability test for achievement in industrial arts courses. All correlation coefficients of the various comparisons are significant at the 1 per cent level. From the information obtained in the study it was found that students who enroll in industrial arts courses also enroll in other elective courses.

CONCLUSIONS

On the basis of this study the following statements can be made about the 1964-1965 Metalworking I students at the Shawnee Mission West High School:

1. There was a significant correlation between the grades in industrial arts, English, mathematics, and laboratory science as the courses were conducted at Shawnee Mission West High School.
2. There was a higher relationship between the grades in industrial arts, English, and laboratory science than between the grades in industrial arts and mathematics as the courses were taught in the Shawnee Mission West High School.
3. The mean grade for industrial arts was higher than the mean grade for English, mathematics, or laboratory science.
4. The Verbal Reasoning and Numerical Ability tests of the Differential Aptitude Test have some predictive value for success or failure in industrial arts.

5. The Verbal Reasoning and Numerical Ability tests have a predictive value for success or failure in industrial arts because the industrial arts courses are designed and taught with emphasis on verbal reasoning and numerical ability as well as manipulative skills in the Shawnee Mission West High School.
6. Students who were enrolled in industrial arts also were enrolled in other elective courses.

RECOMMENDATIONS

From the results of this study the following recommendations can be made:

1. The counselors at the Shawnee Mission West High School should be made aware of the results of this study so that industrial arts courses will be included in the over-all general education program of a greater number of students.
2. Similar studies should be made in other schools to determine whether the results are the same.

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APPENDIX

												NAME
												N A / V R
											English	
											Mathematics	
											Lab. Science	
											Social Science	
											Metalworking I	
											Woodworking	
											Automechanics	
											Drawing	
											Phys. Educ.	
											Arts-Crafts	
											Music	
											Speech-Debate	
											Foreign Lang.	
											Business	
											Drivers Educ.	