A STUDY CORRELATING HIGH SCHOOL FACTORS AND COLLEGE GRADES OF KANSAS STATE TEACHERS COLLEGE INDUSTRIAL ARTS GRADUATES

A Thesis

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CHAPTER I

INTRODUCTION

As a general rule, it is possible to study the high school record of college applicants and to predict the likelihood of their being able to do college work successfully. It should be remembered, however, that predictions based on group performances would be much more valid than predictions would be for individuals. Criteria on which predictions are made include the high school grades, class ranking, courses taken, entrance examinations, and the size of the high school attended.

On the basis of achievement in certain areas at the secondary level, one may assume that a student is capable of attaining a similar degree of accomplishment in those areas at the college level. Insofar as some fields of study (such as mathematics, chemistry, and physics) are concerned, this assumption may have a certain degree of validity. Another assumption which is frequently made is that the graduates of larger high schools will do better work in college than the graduates of smaller high schools. Can these assumptions be made for students in the field of industrial arts?

I. THE PROBLEM

Statement of the problem. It was the purpose of this study to determine what relationship, if any, exists between (1) the high school record and college achievement and (2) the high school size and college achievement of industrial arts graduates of Kansas State Teachers College.

Answers to the following questions were sought: How did the achievement in industrial arts courses in high school relate to the achievement in industrial arts courses taken in college? How did the overall high school grades correlate with the overall grades for college work? How did students from larger high schools compare with students from smaller high schools in achievement in industrial arts courses taken in college?

The hypotheses tested in this study were: (1) The students, as a group, who attained the highest grades in high school industrial arts courses also attained the highest grades in industrial arts courses taken at the college level. (2) The college industrial arts students who had good overall high school achievement records achieved a good overall college record. (3) Students from larger high schools attained a better record in industrial arts courses taken at the college level than did the students from smaller high schools.

Importance of the study. This study should be useful to high school administrators and counselors when working with students who are considering industrial arts as their major field of study in college. It should also be of benefit in helping them to evaluate the high school curriculum in regard to college preparation for an industrial arts program. College personnel in guidance, officials in the Office of Admissions and Records, and the college student advisors should be able to use the information presented in this study. Teachers and instructors of industrial arts courses should also find the results of this study useful.

Although studies have been made to correlate various aspects of students' high school records with their degree of success in college, little has been done, specifically, to study the high school records of college industrial arts students in an effort to make these correlations. It is felt that all persons interested in industrial arts will benefit from the findings of this study.

II. DEFINITIONS OF TERMS USED

Industrial arts. Industrial arts is defined by Good as:

> . . .that phase of the educational program concerned with orientating individuals through study and experience to the technical-industrial side of society for the purpose of enabling them to deal more

> intelligently with consumers' goods, to be more efficient producers, to use leisure time more effectively and enjoyably, to have a greater appreciation of material culture, and to act more intelligently in regard to matters of health and safety, especially as affected by industry.[1]

Industrial arts majors. For this study, the term "industrial arts majors" shall refer to the students who either prepared for a teaching field in industrial arts with a Bachelor of Science in Education degree or who obtained a Bachelor of Arts degree with the major field of study in industrial arts; who took at least twenty-four hours in industrial arts courses; and who had an advisor in the industrial arts department.

Industrial arts graduate. An industrial arts graduate shall be considered as an industrial arts major who has obtained either a Bachelor of Science in Education degree or a Bachelor of Arts degree from Kansas State Teachers College.

Achievement. This word shall be used to indicate the degree of success in either high school or college and shall be measured in terms of grade point average.

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[1]Carter V. Good (ed.), Dictionary of Education (second edition; New York: McGraw-Hill Book Company, Inc., 1959), p. 41.

Grade point average. The grade point average is determined by assigning numerical values (grade points) to letter grades, totaling these values, and dividing this total by the number of high school units of credits or college semester hours of credit for the courses considered. A letter grade of A shall receive a value of four points per unit or semester hours; a letter grade of B shall be valued at three points per unit or semester hours; two points are assigned to each unit or semester hour of C; one point is given to each unit or semester hour of D; and no points are given for each unit or semester hour of F.

High school size. High school size will refer to the pupil enrollment of the high schools attended at the time of the high school graduation of the students included in this study.

Null hypothesis. A null hypothesis is an assumption that no relationship exists between two sets of variables. It assumes that any relationship is the result of chance and is refuted only when the relationship is proven to be statistically significant.

Coefficient of correlation. The coefficient of correlation is a measure of the degree of relationship between two variables for the same group of individuals. In

this study, the coefficient of correlation used is the Pearson r (also known as the product-moment r).

Chi-square test. The chi-square (χ^2) test is a useful method for comparing observed frequencies with expected frequencies. The chi-square value is normally determined by squaring the difference between each observed and each expected frequency, dividing by the expected frequency, and adding the sums of the quotients together. The null hypothesis is either rejected or accepted by referring to a χ^2 table to determine the significance of the obtained χ^2.

III. PROCEDURE

Subjects selected. The students selected for the study were those who had graduated in the last five years (January, 1960 through August, 1964) from Kansas State Teachers College and who were industrial arts majors. No distinction was made between the students who had transferred from other colleges and those who had taken all their work at Kansas State Teachers College.

The students included in the study were divided into three groups. The three groups were considered both separately and as a unit in comparing the high school and college records. Group I was made up of the students who obtained a Bachelor of Science in Education degree with a

major in industrial arts under an option which required them to have but one teaching field. The students in this group were required to take a larger number of semester hours in industrial arts than those in the other two groups. Present requirements call for a minimum of forty semester hours up to fifty semester hours of industrial arts courses under this option. More than fifty semester hours may be taken in industrial arts but the students are encouraged to meet the requirements of the Kansas State Department of Public Instruction in a second teaching field.

Group II was composed of the students who also obtained a Bachelor of Science in Education degree with a teaching field in industrial arts but who chose the option under which they had to meet the requirements for two teaching fields. To qualify, the two teaching fields had to meet the minimum requirements of the Kansas State Department of Public Instruction for a standard Kansas high school but requiring not more than twenty-eight semester hours each. The industrial arts teaching field required a minimum of twenty-four semester hours. In addition, the students in Group II were required to have an adviser in the industrial arts department before being considered as industrial arts majors to be included in the study.

Students who obtained a Bachelor of Arts degree with a major in industrial arts made up Group III. These students

were required to earn thirty-five semester hours of credit in industrial arts courses but they were not required to meet the requirements of the Kansas State Department of Public Instruction.

Of the one hundred eight students included in the study, sixty-five made up Group I, thirty-three were in Group II, and ten students fell into Group III. In a number of the comparisons made, however, some of these students were not represented either because of insufficient or missing data.

Sources and types of data. The Office of Admissions and Records at Kansas State Teachers College made their records available to the investigator. Since the study involved students who had graduated, however, the original records had been microfilmed and then destroyed. The microfilmed records had been placed on file in the William Allen White library. Much of the required data was taken from the students' individual folders containing transcripts and other records filed in the Industrial Arts Department office. The microfilmed records yielded some data not found in the Industrial Arts Department files. All the needed data concerning the students' college records were obtained from these two sources, but fifty-one high school transcripts were missing. In an effort to obtain these transcripts a

letter was prepared by the writer, endorsed by the Director of Admissions, and mailed to the principals of the high schools still in existence which had been attended by the fifty-one students for whom transcripts were missing. Although some schools had changed names, it was necessary only in two cases to contact the county superintendent for the needed transcripts. A stamped self-addressed envelope was included in the mailing of each letter to encourage a response. After two weeks a reminder was sent to those who had not replied. All but four of the high school transcripts were received so that the data could be used in the study. Of these four, there was no record of one student at the high school he had reported attending and, in another case, the transcript was received too late to be included in the study. Only two schools failed to reply in any way to the request.

Information regarding the size of the high school attended was obtained by noting the high schools attended and then referring to the Kansas Educational Directories to find the population of the schools at the time of graduation for the individual students. The enrollment in the high schools attended in other states was obtained from the student's application for admission in the microfilmed records; however, the size of six high schools in other states could not be determined, as the students had not entered this information on the applications for admission.

Grade point averages were computed from the preceding sources of data. The averages for the college courses were determined by assigning the aforementioned values to the letter grades, totaling these values, and dividing the total by the number of semester hours of credit assigned to these courses. The high school grade point averages were calculated by assigning the same values to the letter grades, totaling the values, and dividing the total by the number of units assigned to the courses to which the grades applied.

Grade point averages were determined for high school industrial arts grades alone, overall high school grades including industrial arts grades, college industrial arts grades alone, and college overall grades. The high school industrial arts grade point average was calculated for only those students who had received at least two units of credit in industrial arts courses. It was felt that grade point averages for less than two units of industrial arts courses would produce less valid results for the study; however, requiring more than two units of industrial arts credit would have resulted in a substantially smaller number of cases to be considered.

In a few instances, the high school grades appeared on the transcripts in terms of per cent. These were converted to letter grades which in turn were assigned a numerical value thereby enabling the grade point average to be determined.

Letter grades were assigned in the following manner: A 94-100 per cent grade became a letter grade of A, 86-93 per cent grades were assigned a B letter grade, 78-85 per cent grades were changed to a C, and 70-77 per cent grades received a letter grade of D.

IV. ORGANIZATION OF THE REMAINDER OF THE THESIS

Chapter II of this report reviews the studies and literature relating to correlations of (1) high school achievement and college achievement and (2) high school size and college achievement. Chapter III is concerned with a discussion of the statistical procedures, formulas, and terminology used in the study. Chapter IV presents the data to show the correlation or lack of correlation between the criteria used for each of the five parts of the study.

The first part of Chapter IV is concerned with correlating the achievement in high school industrial arts courses with achievement in college industrial arts courses. Of the one hundred eight students considered for the study, eighty-three were included in determining the correlation of high school industrial arts grades with college industrial arts grades. The students not included were eliminated either because they had not taken two units of industrial arts in high school or because no high school transcript was available.

In the second part of Chapter IV, the overall high school records are compared to the overall college records. Four of the one hundred eight industrial arts graduates were not included in this study due to their high school transcripts being unavailable.

It was not originally intended to compare high school industrial arts grades to high school overall grades and college industrial arts to college overall grades. However, since the data to make these comparisons had already been compiled and calculated for the first two parts of the study, it was considered desirable to proceed with finding the relationship between these two sets of variables. The third part of Chapter IV was therefore concerned with determining the relationship between high school industrial arts grades and overall high school grades. The number of cases used in this comparison was again eighty-three for the same reasons as those given when relating high school industrial arts grades to college industrial arts grades in the first part of the study. In the fourth part of Chapter IV, the college industrial arts grades are compared with the college overall grades. Only in this comparison were all one hundred eight students included since this was the only part of the study made which did not rely on high school records--some of which were missing. All college records were available for the one hundred eight students.

In the fifth part of the study, when the size of the high schools attended were compared to the achievement in college industrial arts courses, the high school sizes were grouped in two different ways. First, the same size ranges of the high schools used in an earlier study made at Kansas State Teachers College were also used in this study.[2] The seven ranges were (1) 0-50, (2) 51-100, (3) 101-150, (4) 151-250, (5) 251-500, (6) 501-1,000, and (7) over 1,000. These size ranges made it possible to construct a table in which a relationship, if one existed, could be detected by visual examination. Second, the high school sizes were divided into two groups. High schools with an enrollment of 150 or less were placed in one group, while those with an enrollment of 151 or more were placed in the second group. This grouping was used to allow the use of a statistical method, the chi-square test, to determine if a significant relationship existed between the college industrial arts grade point averages and high school sizes.

Finally, in Chapter IV, although it cannot be considered as an entity, a comparison of the mean grade point averages for the various groups is presented.

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[2]Charles W. Lindahl, "A Comparative Study of the Success of Kansas State Teachers College Students According to Size of High School Attended" (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1961), p. 6.

The final chapter, Chapter V, includes a summary of the study, conclusions, and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

A number of studies have been made which have attempted to relate the degree of achievement in college to various high school factors. The studies usually found that a positive relationship existed between the student's standing in his high school class and his degree of success in college--particularly for the students in the upper ranges. Contrary to popular belief, most studies using the size of high schools as a tool for predicting college success found that little, if any, correlation existed between the two criteria.

Several studies were found which had used various criteria to show the degree of relationship between (1) high school achievement and college achievement, both for overall records and for specific courses, and (2) high school size and college achievement. However, no studies have been found which specifically made these comparisons for college industrial arts students.

I. LITERATURE ON HIGH SCHOOL ACHIEVEMENT AND ITS RELATIONSHIP TO COLLEGE SUCCESS

Master's theses and periodical articles were found which related high school achievement to college success.

However, no books were found which provided any information on the relationship between high school factors and college achievement for industrial arts students. Occasionally, a passage would infer a relationship between high school and college courses. Such an inference was found in a statement which suggested that college-bound students should be encouraged to experiment and solve problems through high school industrial arts courses.[1]

Master's theses relating high school records to college success. Three Master's theses were reviewed which related the achievement of college drawing (mechanical or engineering) students to their high school drawing experiences or lack of drawing experiences. A study by Lyday was made on freshmen at the University of Tennessee who had taken engineering drawing and a comparison was made between those who had taken drawing in high school and those who had not.[2] The study was for a ten-year period from 1948 to 1957. Lyday found that the average grade point difference between those who had taken drawing in high school and those who had not was

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[1]Rex Miller and Lee H. Smalley (eds.), Selected Readings for Industrial Arts (Bloomington: McKnight & McKnight, 1963), p. 312.

[2]William A. Lyday, "A Study of Grades in Freshman Engineering Drawing of Students Who Did or Did Not Have Pre-College Drawing Instructions" (unpublished Master's thesis, University of Tennessee, Knoxville, 1963), p. 1.

.34 points.[3] The difference varied little for the ten-year period. It was noted that the average difference was greatest for the first quarter at .56 points; whereas the differences dropped to .27 and .19 for the second and third quarters respectively.[4] The letter grade A was earned in college by 21.5 per cent of those who had drawing in high school, while only 7.9 per cent of those who did not have drawing in high school earned an A in college.[5] Although Lyday's study did not attempt to relate the grade obtained in high school drawing courses to those made in college, one could assume that the better high school drawing students likely obtained the better college grades. Such an assumption appears valid in view of the supporting evidence from other studies.

The objective of a study by Griffith was to determine how valid industrial arts drawing courses taken in high school were in predicting the success in drawing at the University of Wisconsin.[6] He considered, separately, the average high school drawing grades, the number of semesters

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[3] Ibid., p. 93.

[4] Ibid.

[5] Ibid., p. 94.

[6] Fuller O. Griffith, "Industrial Arts Drawing in High School as a Predictor of Grades in College Drawing" (unpublished Master's thesis, Colorado Agricultural and Mechanical College, Fort Collins, 1953), p. 8.

of drawing taken in high school, and the total number of high school honor points in drawing in evaluating their worth as predictors. It was found that, of the three variables, the average grade in high school drawing was the best predictor of success in first semester engineering drawing at Wisconsin.[7] A coefficient of .099 was found when honor points were used as a basis for comparison while the least valid predictor was the number of semesters of high school drawing as the coefficient of correlation was found to be a negative .087.[8]

In a similar study by McCaleb, grade point averages for high school drawing grades were compared to the averages for college drawing grades. He compared the difference in grade point average between those who had taken drawing courses in high school and those who had not. It was found that the average difference in grade point averages for a three-year period was .27 points.[9]

Henry's study of 381 students correlating college and high school mathematics grades, reported a correlation coefficient of .427 when the high school and college mathematics

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[7] Ibid., p. 52. [8] Ibid.

[9] Omar K. McCaleb, "High School Drawing and Certain Other Factors Relating to Student Performance in Engineering Drawing" (unpublished Master's thesis, Oregon State College, Corvallis, 1953), p. 32.

grade point averages were compared.[10] He established at the 1 per cent level of significance that the correlation was significantly different from zero.[11]

Periodical articles pertaining to relationships between high school factors and college success. Three studies found in periodicals supported the relationship between high school grades and college grades. Garrett found that the five factors which had the greatest predictive value were high school scholarship (high school average and rank in graduating class), general achievement test scores, intelligence test scores, general college aptitude test scores, and special aptitude test scores. The respective average coefficients of correlation with college grades were: high school scholarship (high school average and rank in graduating class), .56 and .55; general achievement test scores, .49; intelligence test scores, .47; general college aptitude test scores, .43; and special aptitude test scores, .41.[12] A higher correlation

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[10]Everett F. Henry, "The Correlation Between College Mathematics Grades and High School Mathematics Grades" (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1957), p. 44.

[11]Ibid., p. 45.

[12]Harley F. Garrett, "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teachers Colleges," Journal of Experimental Education, 17:128, December, 1949.

existed between high school scholarship and first year college grades than at any other time. Garrett stated that "although some degree of correlation has been found between high school grades in specific subjects and later college scholarship, no particular subject or group of subjects has exclusive right to this relationship."[13]

A study by Sharp was primarily concerned with investigating the relationship between the number of years a subject was studied in high school, the college placement scores for the subject, and college achievement. However, in summarizing other studies, he stated that they "have indicated statistically significant relationships among the grades students obtained in high school, their test scores, and the grades they earned in college."[14]

Giusti, in his survey of prediction studies, found "the most significant conclusion. . .is the unquestionable superiority and stability of high school grade averages as a single source of data for predicting college success."[15]

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[13]Ibid.

[14]Bert L. Sharp, "College Achievement: Its Relationship to High School Achievement Experiences and Test Scores," The Personnel and Guidance Journal, 41:247, November, 1962.

[15]Joseph Paul Giusti, "High School Average as a Predictor of College Success: A Survey of the Literature," College and University, 39:209, Winter, 1964.

II. LITERATURE ON HIGH SCHOOL SIZE AND ITS RELATIONSHIP TO COLLEGE SUCCESS

One Master's thesis and four periodical studies were reviewed which were concerned with relating high school size to college success.

Thesis relating high school size to college success. Lindahl studied the records of the fall freshmen class of 1956 at Kansas State Teachers College for the purpose of determining the extent of the relationship between the size of the high school attended and the success in college.[16]

> It was found that the size of the high school attended was not significantly related to the cumulative grade point average at the time of leaving college. Concurrently, the size of the high school attended was not related to decile rating on entrance examinations. Only when size of high school attended and length of stay in college were compared did a mildly significant relationship emerge.[17]

Periodical articles relating high school size to college success. Garrett concluded that little or no relationship existed between the size of the high school attended and the degree of college success. However, he did

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[16]Charles W. Lindahl, "A Comparative Study of the Success of Kansas State Teachers College Students According to Size of High School Attended" (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1961), pp. 1, 4.

[17]Ibid., pp. 56-57.

state that some studies showed a tendency for students from smaller high schools to receive somewhat lower college grades.[18]

In Lathrop's study of 1,516 students at Iowa State College, he concluded that the high school size was of little value as a predictive variable when the criterion was the survival-attrition tendency.[19] He also concluded that the achievement in college in terms of grade point averages could not be predicted appreciably on the basis of high school size when the effect of course patterns was eliminated.[20] If the course patterns do influence achievement in colleges, as Lathrop indicates, then one might conclude that the size of the high school does affect college achievement if there is a difference between course patterns offered by large and small high schools.

A study by Altman, made on 144 seniors at Central Michigan College, tested the belief that students from large high schools achieve better grades in college than do students from small high schools. Her conclusion was that the

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[18]Garrett, op. cit., p. 130.

[19]Irvin T. Lathrop, "Scholastic Achievement at Iowa State College Associated with High School Size and Course Pattern," Journal of Experimental Education, 29:37-48, September, 1960.

[20]Ibid.

graduates of the larger high schools did not achieve significantly higher grade point averages than those of the smaller high schools.[21]

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[21]Esther R. Altman, "Effect of Rank in Class and Size of High School on the Academic Achievement of Central Michigan College Senior Class of 1957," Journal of Educational Research, 52:307-309, April, 1959.

CHAPTER III

STATISTICAL PROCEDURES, FORMULAS, AND TERMINOLOGY

It is possible to compile data, present it in the form of tables and illustrations and, after visual inspection, to make reasonably valid conclusions regarding the relationship between two or more sets of variables. However, it is felt that correlations are more meaningful if they are derived by using an accepted statistical procedure and if the level of significance for the correlation has been determined.

The purpose of this chapter is to present a discussion of the statistical procedures, formulas, and terminology used in this study.

I. COEFFICIENT OF CORRELATION

While the relationship between paired variables (two or more sets of data) is referred to as correlation, the measure of the relationship is represented by the coefficient of correlation. Either the Greek letter rho or the symbol r is used to identify the coefficient of correlation. If a perfect positive relationship exists between two variables, the r would be equal to plus 1.00; whereas the r would be negative 1.00 for a perfect negative relationship. A pure chance relationship between two sets of variables would result in a coefficient of correlation equal to zero.

Variables in which human traits are involved seldom produce perfect correlation coefficients.

Best emphasized that a coefficient of correlation does not imply that one variable will have a cause-effect relationship with the other variable. It only "quantifies the relationship which has been previously established."[1] He pointed out that the coefficient represents an averaging of individual relationships of paired variables. It is therefore useful as a general measure in predicting group performance but, because of the many factors influencing an individual's behavior, a high coefficient is less valid in predicting one person's performance.[2]

Although the significance of a coefficient of correlation depends on several considerations, including the number of cases studied, Best presented a general analysis indicating the degree of relationship for values of r:[3] A coefficient of .00 to plus or minus .20 would show a negligible relationship; a r of plus or minus .20 to plus or minus .40 would indicate a low or slight correlation; a moderate relationship would exist when r was plus or minus .40 to plus or minus .60; the relationship would be substantial with an r

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[1]John W. Best, Research in Education (Englewood Cliffs: Prentice-Hall, Inc., 1959), p. 239.

[2]Ibid., p. 240. [3]Ibid.

of from plus or minus .60 to plus or minus .80; and a coefficient of plus or minus .80 to plus or minus 1.00 would show a high to very high correlation.

The raw score method of determining correlation coefficient. The coefficients of correlation in this study were determined by the raw score method. Although there are other methods of determining the coefficients, the raw score method is more appropriate and more accurate when a sufficiently large number of paired scores are involved.[4]

Several formulas which can be used to find the coefficient of correlation have been derived from the Pearson Product-Moment formula. The formula used in this study because of its practicability when using an electric calculator is:

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

In which N = Number of paired variables

ΣX = Sum of X scores

ΣY = Sum of Y scores

ΣX^2 = Sum of X scores squared

ΣY^2 = Sum of Y scores squared

ΣXY = Sum of the product of X and Y scores

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[4] Ibid., p. 235.

The raw scores used for determining the coefficients of correlation in this study were grade point averages. For example, the raw scores used to find the measure of relationship between high school industrial arts grades and college industrial arts grades were the grade point averages for high school industrial arts courses and the grade point averages for college industrial arts courses.

After finding the coefficient of correlation, its level of significance was established by referring to a table which listed the values of r at the 5 per cent and 1 per cent levels of significance at various degrees of freedom.[5] The degrees of freedom are equal to the number of cases less two (N-2). If the coefficient was found to have a level of significance greater than 5 per cent in this study, the variables being compared were considered to have no meaningful correlation.

Using scattergrams to show relationships between variables. A scattergram is a tool used to graphically represent the relationship between two variables. It is made by plotting the two variables against each other on the X and Y axes of a graph.

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[5]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Company, 1958), p. 201.

By visual inspection of a scattergram, it is possible to obtain a general impression of the relationship between two sets of variables. The scattergram shows two aspects of the relationship--the direction of the relationship and the closeness of the relationship.[6] If the plotted values tend to form a line, the two variables would have a close relationship. Conversely, if the points are widely scattered, the variables would have a weak relationship. The coefficients of correlation for variables whose plotted points tend to fall along a line will be high; however, variables whose plotted points are widely scattered will have a low coefficient of correlation. In case of a perfect relationship--one having a coefficient of correlation equal to a plus or minus 1.00--the plotted points would lie along a straight line.

The direction of the relationship as shown by the path formed by the plotted points indicates whether or not the relationship is a positive or a negative one. When the path of the points goes up to the right the relationship is positive. A negative relationship would be indicated if the points formed a path going down to the right.

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[6]John I. Griffin, Statistics Methods and Applications (New York: Holt, Rinehart and Winston, 1962), p. 224.

Scattergrams were used in this study to present each correlation graphically. A total of sixteen different scattergrams were used and in each one the calculated coefficient of correlation is given along with the level of significance.

II. CHI-SQUARE TEST

The chi-square test is a statistical method used to compare the frequency of observed or experimentally obtained results with expected or theoretical frequencies. This test has the advantage that no assumptions need to be made as far as random samples are concerned. The symbol for chi-square is χ^2. The chi-square equation used for testing the agreement between observed and expected results is:[7]

$$\chi^2 = \frac{(f_o - f_e)^2}{f_e}$$

In which f_o = frequency of occurrence of observed or experimentally determined facts

f_e = expected frequency of occurrence

Chi-square is the sum of the quotients determined by squaring the difference between the observed frequencies and the expected frequencies and dividing by the expected frequency. When the expected and observed frequencies are

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[7] Garrett, op. cit., p. 253.

nearly the same the value of chi-square will be small and will support the hypothesis that no significant difference exists. A large value for chi-square would indicate that the differences between the observed and expected frequencies is great enough that accidental occurrence of the differences may be ruled out. Griffin states that the chi-square test is actually a test for "badness" of fit because the results lead to the conclusion that the "fit of a normal distribution to the observed distribution is bad or that the evidence that it is bad is not convincing."[8]

To evaluate chi-square a table can be referred to by using the computed value for chi-square and the number of degrees of freedom (df). The degrees of freedom are determined from the tabulated data by multiplying the number of rows minus one by the number of columns minus one. From the table, the probability (P) that the chi-square value is significant is obtained.

For a four-celled table, chi-square may be determined by the use of a calculator without first computing the expected frequencies. The formula used for this purpose is:

$$\chi^2 = \frac{N(AD-BC)}{(A+B)\ (C+D)\ (A+C)\ (B+D)}$$

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[8]Griffin, op. cit., p. 263.

In which N = The total number of cases

A = Number of cases in the upper left cell

B = Number of cases in the upper right cell

C = Number of cases in the lower left cell

D = Number of cases in the lower right cell

This is the formula which was used in this study to determine the relationship between the sizes of high schools attended and the college industrial arts grade point averages.

III. NULL HYPOTHESIS

A null hypothesis assumes that no relationship exists between two or more variables. It is tested to determine how much a statistic actually reflects a true relationship rather than one resulting from pure chance. To prove that a coefficient of correlation is significant, the null hypothesis would have to be rejected. In this study, the null hypothesis was not rejected unless the level of significance could be demonstrated to be equal to or less than 5 per cent.

Best emphasizes that the rejection of the null hypothesis would not necessarily prove the superiority of an experimental variable.[9] It would only suggest the possibility of superiority.

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[9]Best, op. cit., p. 227.

CHAPTER IV

RESULTS OF THE STUDY

Results of other studies concerning the relationship between grades earned in high school subjects and the grades earned for the same subjects in college have usually shown a very slight to a moderate coefficient of correlation. While this study was not concerned with specific subjects, it did concern itself with a group of subjects (industrial arts). Since Garrett stated that "no particular subject or group of subjects has exclusive right to this relationship," an interesting aspect of this study was in learning whether or not this relationship held true for industrial arts subjects as a whole.[1] From the outset, this was a hypothesis to be tested in this study.

Another purpose was to study the relationship between the overall high school grade point average and college overall grade point average. Of the studies reviewed on the subject, all agreed that high school success was the best indicator for college success. This study correlated the high school and college records of the students under

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[1]Harley F. Garrett, "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teachers Colleges," Journal of Experimental Education, 17:128, December, 1949.

consideration so that it might be determined whether or not high school success could be considered as an indicator of college success for students interested in industrial arts.

Two additional hypotheses were tested which were not originally included in the plans for the study. These had to do with the relationships between industrial arts grades and overall grades for both high school and college. Altogether too often, one hears an expression suggesting industrial arts courses should be taken by the poorer student because he cannot do satisfactory work in other courses. It should not be denied that there is a place in industrial arts for the poor student. However, can it be assumed that a poor student in other subjects will do well in industrial arts? While it was true that the industrial arts grades tended to average higher than the overall grades, it was interesting to learn that a substantial relationship existed between industrial arts grades and overall grades. This would indicate that a student who ranked low in his other school work would also rank low in industrial arts courses. The latter part of the study was made to learn whether or not the students from larger high schools earned better grades in college industrial arts courses than those from smaller high schools. Most studies agree that the size of the high school attended has little relationship to college success.

I. COMPARISON OF HIGH SCHOOL INDUSTRIAL ARTS WITH COLLEGE INDUSTRIAL ARTS GRADE POINT AVERAGES

Perhaps more than any other part of the study, this comparison will be of interest to those directly concerned with industrial arts. It is usually assumed that, if students do well in a subject or a subject field in high school, they will also do well in these subjects in college. Other studies substantiate this belief but, on the whole, the correlations were weak to insignificant. The results of this study do not differ substantially from what was found in similar studies. Table I presents the number of students represented in each of the comparisons in which coefficients of correlation were determined. Complete data for determining these coefficients is presented in Table VI in Appendix A.

Correlation of high school with college industrial arts grades for all students. While correlating the grades for the three separate groups was useful in pointing up the differences between them, it was considered desirable to study the three groups as one. Such a grouping was thought to be just as useful in providing a cross-sectional study of all industrial arts majors.

Of the one hundred eight students, on whom data was gathered, eighty-three were included in this comparison.

TABLE I

STUDENTS REPRESENTED IN DETERMINING COEFFICIENTS OF CORRELATION

	All students	Group I	Group II	Group III
High School Industrial Arts to College Industrial Arts	83	49	27	7
High School Overall to College Overall	104	63	31	10
High School Industrial Arts to High School Overall	83	49	27	7
College Industrial Arts to College Overall	108	65	33	10

Twenty-five students were not included in determining this correlation either because they had taken less than two units of industrial arts courses in high school or because of the unavailability of a high school transcript.

The coefficient of correlation, r, was calculated to be a positive value of .137. This is generally considered by statisticians to be so small as to be negligible. The level of significance was found to be greater than 5 per cent; therefore, the null hypothesis was retained. To be significant at the 5 per cent level, the coefficient would have to have been .216 for a study of eighty-three cases. The calculated r of .137 would have been significant at the 5 per cent level only if the number of cases exceeded two hundred.

The high school industrial arts grade point averages were plotted against the college industrial grade point averages for each of the eighty-three students represented in Figure 1. The widely scattered points indicate a very weak correlation at the best. The calculated value of r verified the negligible positive relationship suggested by the visual inspection of the scattergram.

Correlation of high school with college industrial arts grades for students in Group I. Being made up of those students who had but one teaching field, Group I might be expected to have shown a stronger correlation when this

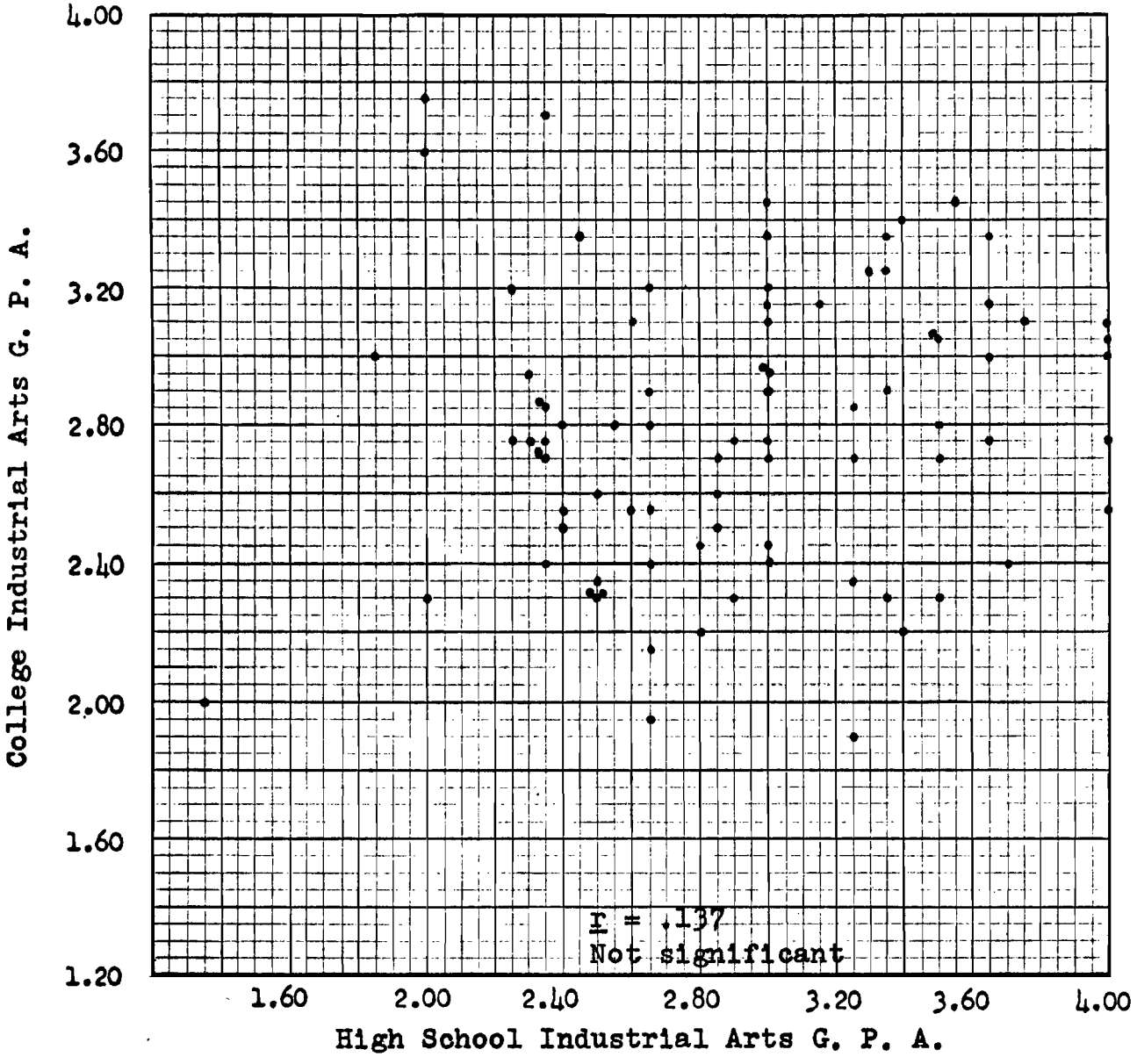

FIGURE 1

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH COLLEGE INDUSTRIAL ARTS GRADES FOR ALL STUDENTS

comparison was made than did the other two groups. This assumption would be difficult to substantiate unless it could be confirmed that those students in Group I were, as a group, more consistent in their performances than those in the other groups. This appears to have been the case as this group of forty-nine had a coefficient of correlation equal to .249. While not large enough to indicate a real relationship, it lacked only .033 points of being significant at the 5 per cent level. The level of significance was not small enough to reject the null hypothesis but r was nevertheless large enough to suggest the possibility of a low relationship between high school and college industrial arts grades for students in Group I. Figure 2 shows a somewhat closer relationship between these grades than did Figure 1. Although scattered, the plotted points are more closely grouped in Figure 2 and appear to slant up to the right thereby suggesting a positive relationship. The calculated r did indicate a closer relationship.

Correlation of high school with college industrial arts grades for students in Group II. It is not possible to conclude from Figure 3, page 40, that any relationship existed between high school and college industrial arts grades for the Group II students. It appears from the scattergram that there were nearly as many grades which had a negative

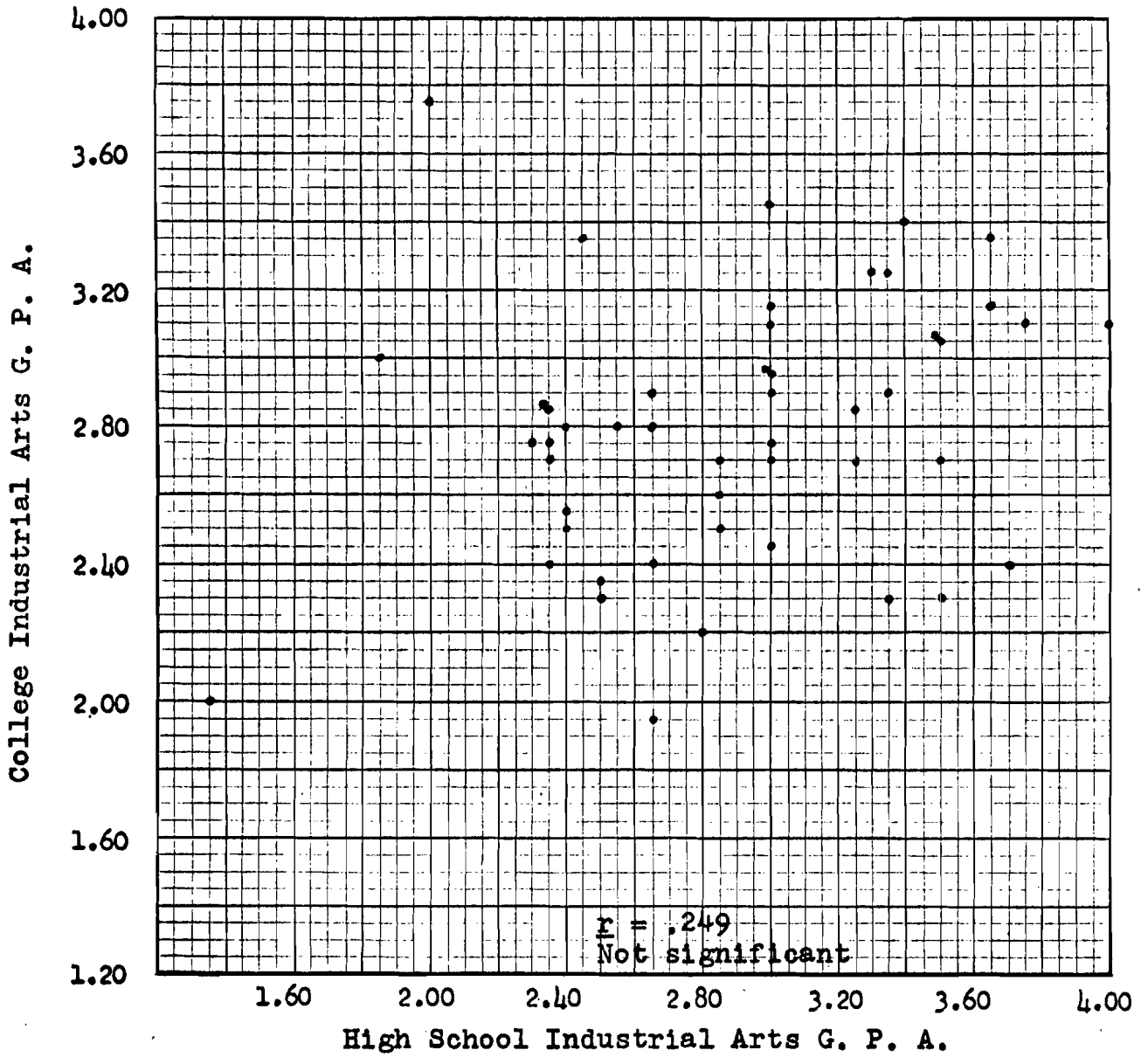

FIGURE 2

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH COLLEGE INDUSTRIAL ARTS GRADES FOR GROUP I

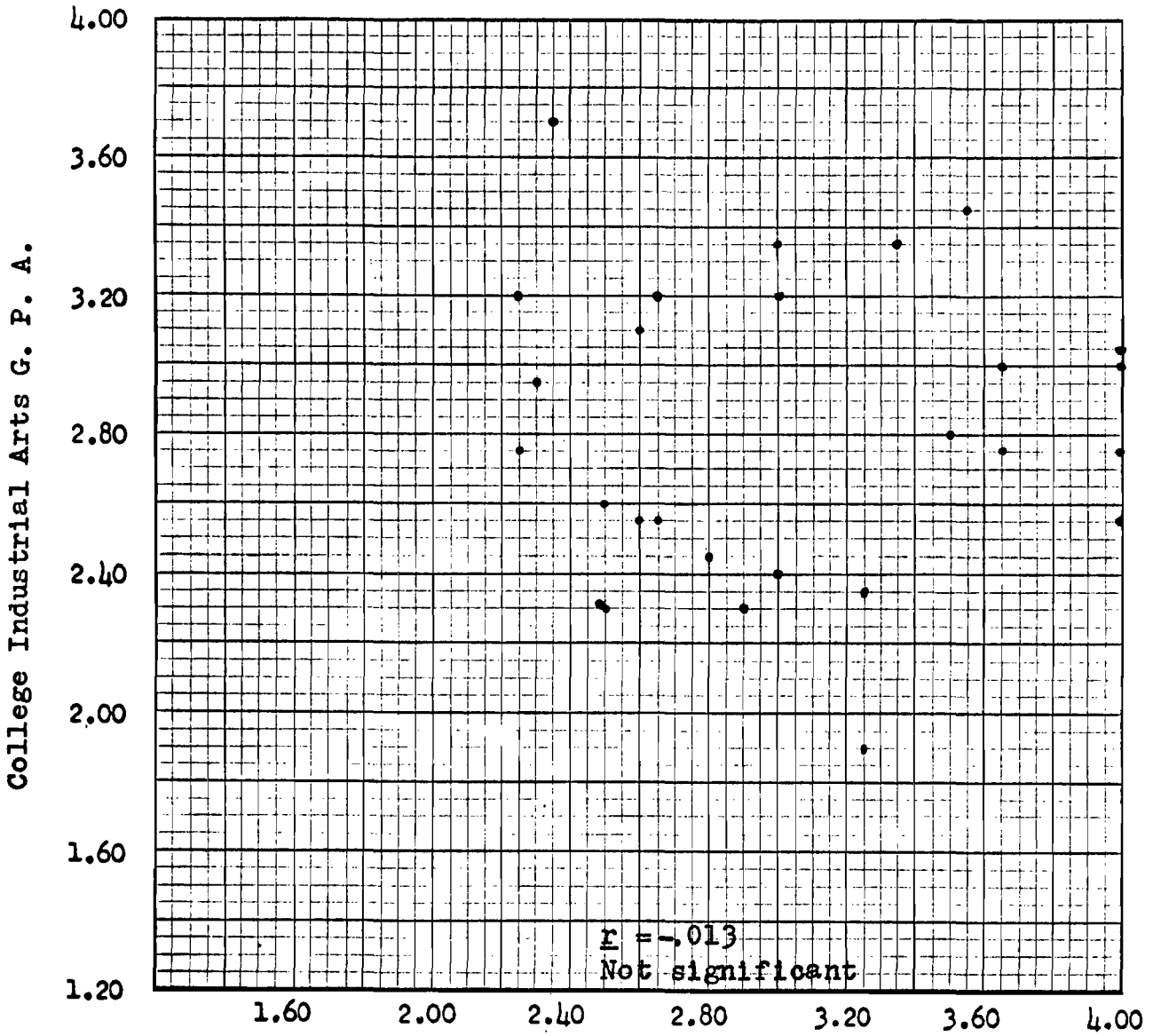

FIGURE 3

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES
WITH COLLEGE INDUSTRIAL ARTS GRADES
FOR GROUP II

relationship as there were which had a positive relationship. This was borne out by the computed coefficient of a negative .013--definitely a negligible relationship. As a group, these students were not at all consistent in the grade average earned for industrial arts courses at the high school and college levels.

Correlation of high school with college industrial arts grades for students in Group III. It was interesting to note, when comparing industrial arts grade point averages, that the coefficients of correlation, though low to negligible, were directly related to the three groups' apparent interest in teaching industrial arts. Group I had a low positive correlation; Group II had a negative relationship so small as to be negligible; and Group III had a low coefficient of minus .278. However, because of the small number of cases in this comparison, this coefficient was not statistically significant. Only seven of the ten Bachelor of Arts graduates had taken two units of high school industrial arts courses. To be significant at the 5 per cent level r would have to have been .754 for a group of seven. The seven plotted points in Figure 4 are skewed down to the right thereby indicating a negative relationship.

It would appear that, of the students who take industrial arts at Kansas State Teachers College, those who

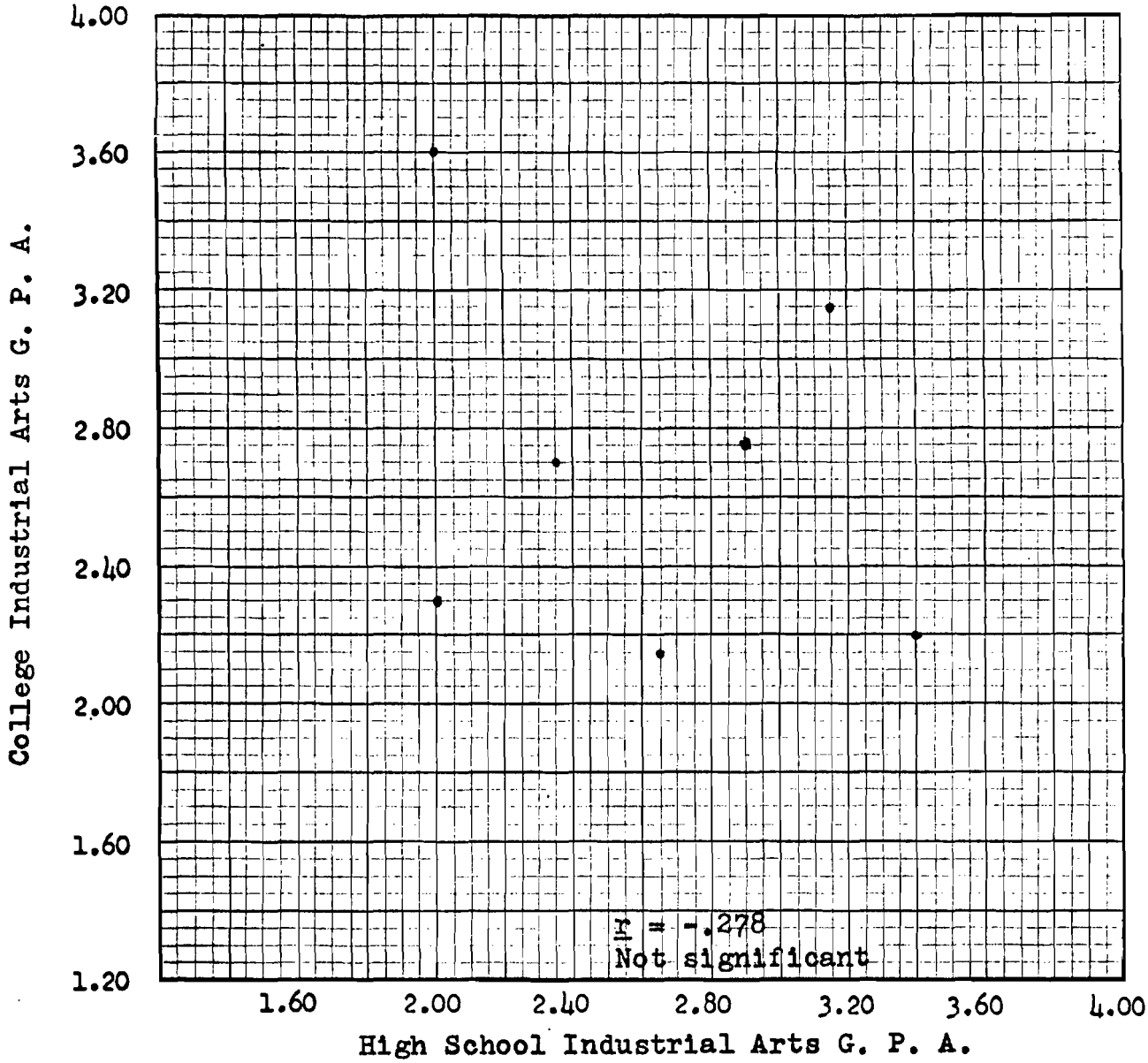

FIGURE 4

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH COLLEGE INDUSTRIAL ARTS GRADES FOR GROUP III

have a primary interest in teaching industrial arts have the highest relationship between their high school and college industrial arts grades.

II. COMPARISON OF HIGH SCHOOL OVERALL WITH COLLEGE OVERALL GRADE POINT AVERAGES

The results of this part of the study largely agree with what had been found in other studies--that high school scholarship is a good indicator of college success. Only for the Bachelor of Arts students did a significant relationship fail to appear.

Correlation of high school overall with college overall grades for all students. Only four of the one hundred eight students were not included in this comparison because of a lack of high school transcripts. It can be seen from Figure 5 that, as a general rule, students tended to obtain the same level of grades in college as they did in high school. Though not tightly grouped, the points in Figure 5 do show a positive relationship between the two variables. There are enough widely scattered points, however, to emphasize the importance of not using the results of this study for predicting accurately for individual cases.

The coefficient of correlation between high school and college overall grade point averages for all students was

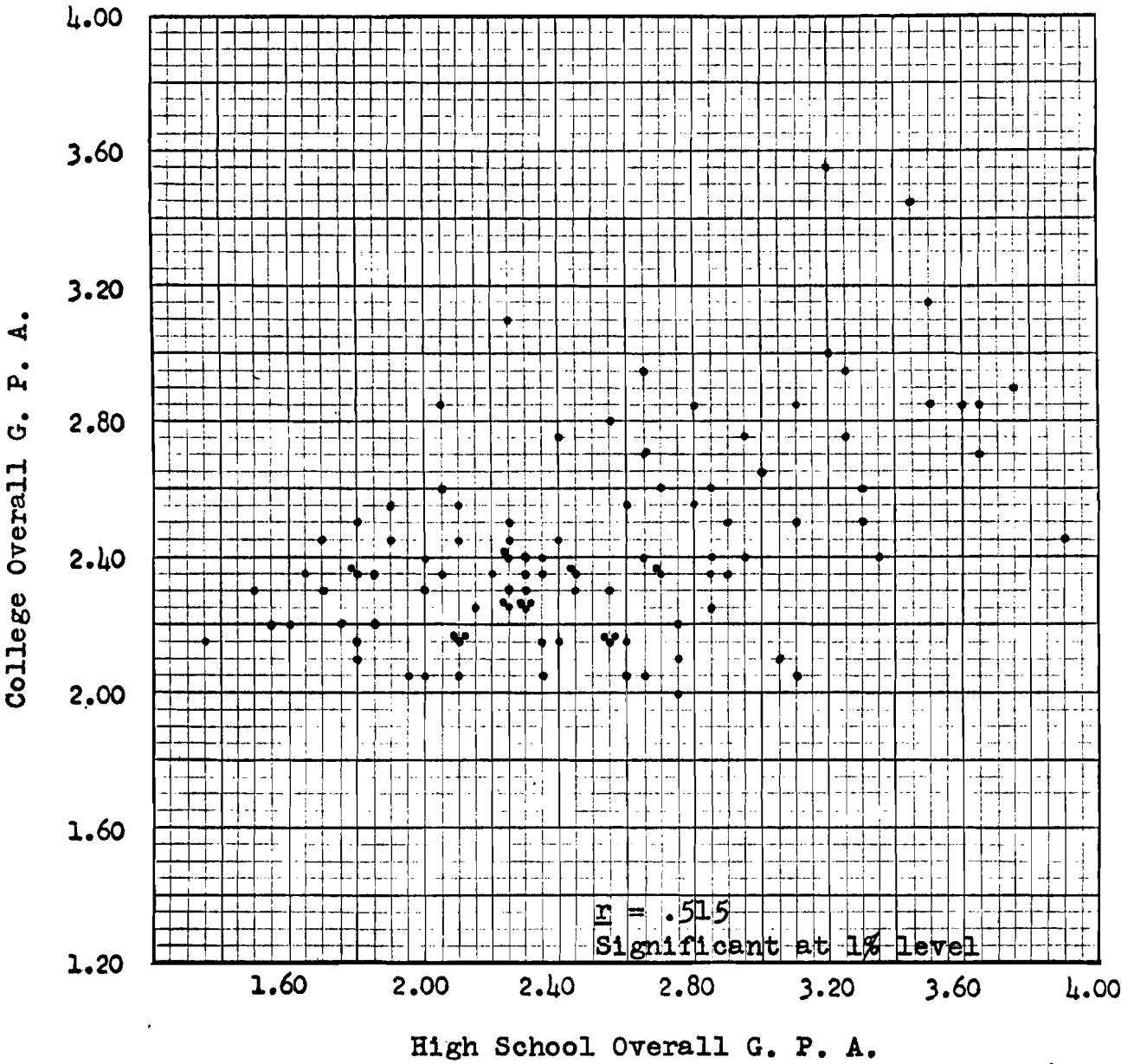

FIGURE 5

RELATIONSHIP OF HIGH SCHOOL OVERALL GRADES
WITH COLLEGE OVERALL GRADES
FOR ALL STUDENTS

found to be a moderate one at .515. This was highly significant at the 1 per cent level, as an r of .252 was all that was needed to be significant at this level.

Correlation of high school overall with college overall grades for students in Group I. The coefficient of correlation was again found to be highly significant for this check. The value for r was determined to be .584--enough to indicate a moderate to substantial relationship. This was the highest coefficient found for each of three separate groups.

Figure 6 presents a pattern quite similar to the one for all students. This naturally is due to the fact that Group I includes a large percentage of all the students. The plotted points slant up to the right indicating a positive relationship and shows a tendency for students with the lower grades in high school to earn lower grades in college.

Correlation of high school overall with college overall grades for students in Group II. The path formed by the points in Figure 7 show the possibility of a lower relationship for the variables for Group II than was found for Group I. While this was proven to be true, the difference was not as great as the distribution of the points might lead one to believe. The value of r for this group was

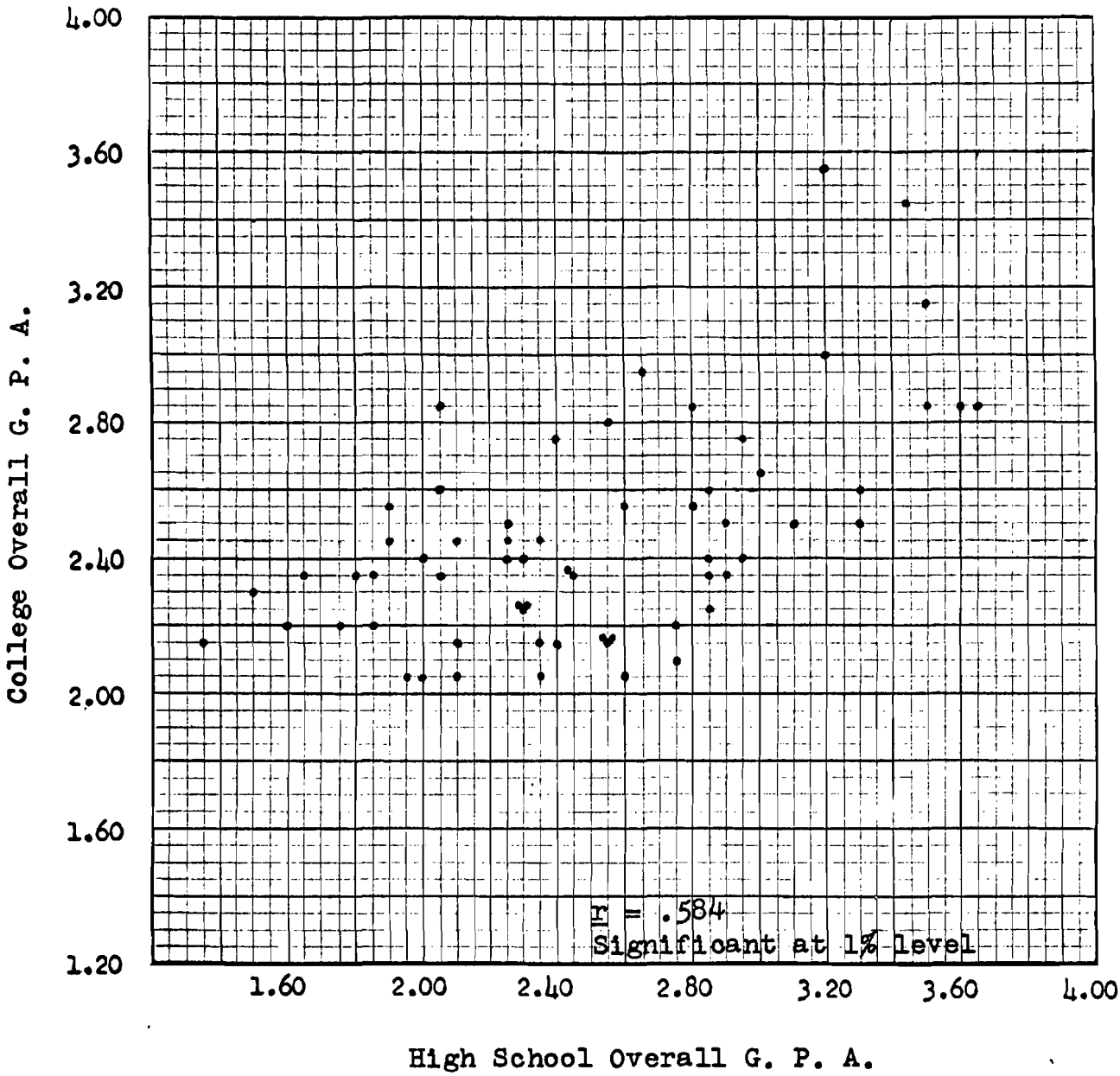

FIGURE 6

RELATIONSHIP OF HIGH SCHOOL OVERALL GRADES
WITH COLLEGE OVERALL GRADES
FOR GROUP I

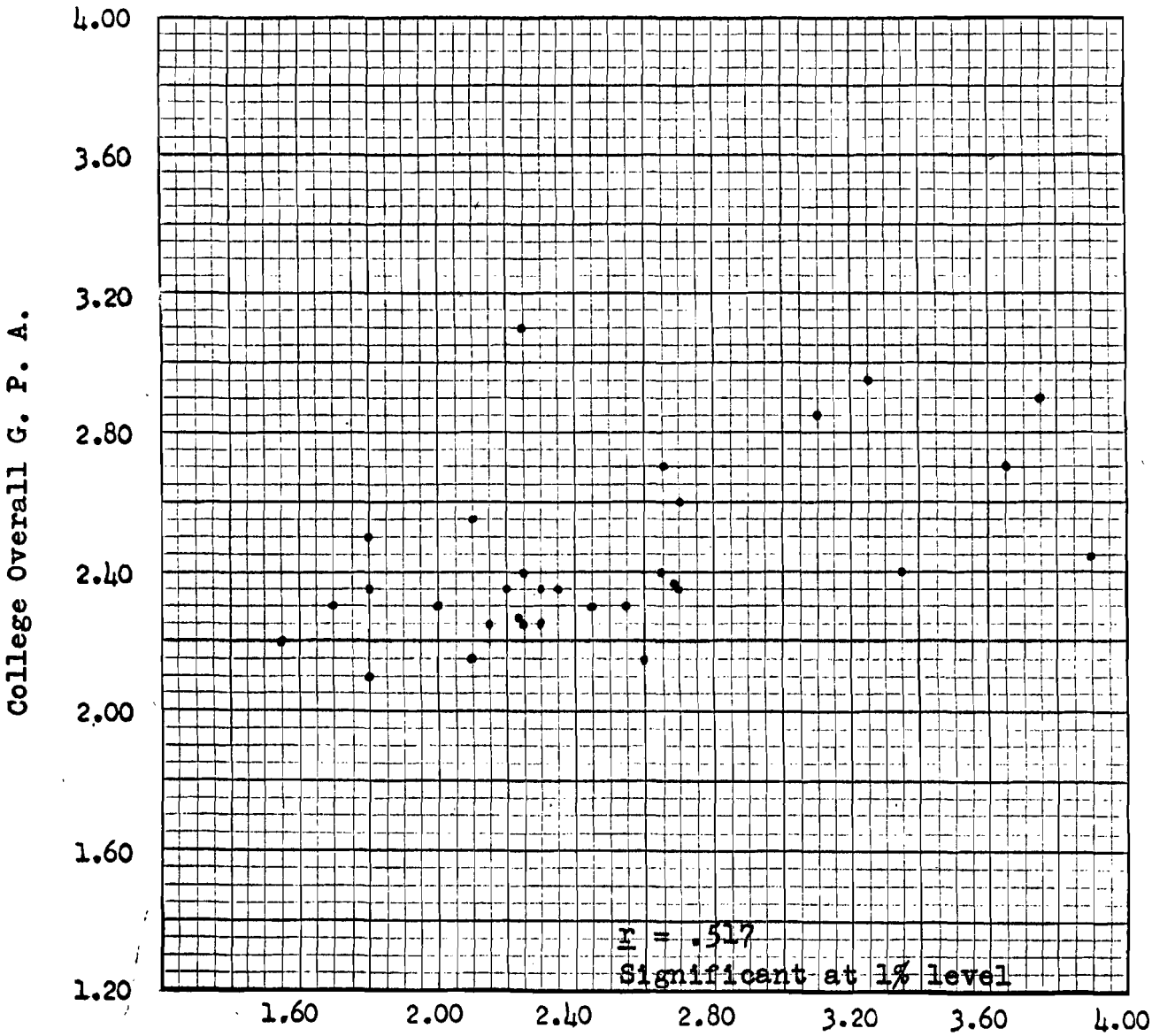

FIGURE 7

RELATIONSHIP OF HIGH SCHOOL OVERALL GRADES
WITH COLLEGE OVERALL GRADES
FOR GROUP II

calculated to be .517, which is significant at the 1 per cent level. Of the thirty-three students classified in Group II, only two were not included in this relationship because their high school transcripts had not been received.

Correlation of high school overall with college overall grades for students in Group III. The pattern formed by the ten plotted points in Figure 8 seem to lie in a path going from the left down to the right, thereby suggesting a negative correlation. If it had not been for the point in the upper right of the pattern, this may have been verified by the calculated r. Since r represents an averaging of the individual relationships, this one point was probably responsible for the fact that r was found to be .015. This is a negligible relationship and is not statistically significant. This value for r is in direct contrast to those found for Groups I and II and is an exception to what one would expect to find since high school success is considered a good indicator for college.

III. COMPARISON OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH HIGH SCHOOL OVERALL GRADE POINT AVERAGES

This represents a part of the study which was not originally included. While it may not be of importance in predicting college success, it was felt that it might be

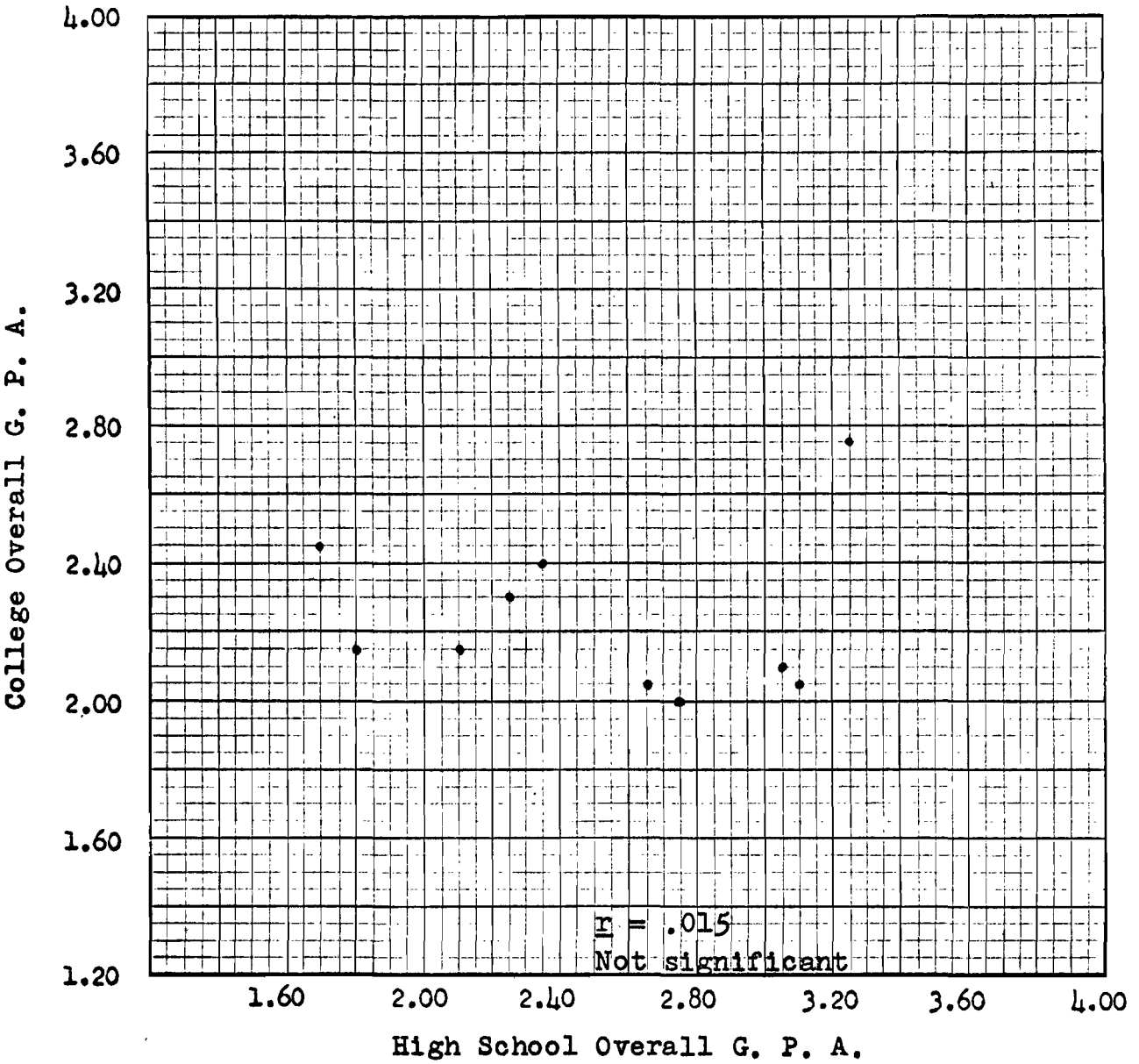

FIGURE 8

RELATIONSHIP OF HIGH SCHOOL OVERALL GRADES
WITH COLLEGE OVERALL GRADES
FOR GROUP III

important in another way. By using the same data obtained for the first two parts of the study, this comparison was accomplished without a great deal of extra effort. One often hears of the poorer students being assigned to shop courses because they cannot handle other school work. This implies that these students can do better work in the shop classes. It is true that industrial arts grades did tend to average approximately .4 of a point higher than did all grades. However, this part of the study resulted in substantial correlations between industrial arts courses and all courses taken in high school. Consequently, the indication is that the poorer students in other high school classes will also be the poorer students in industrial arts classes.

Correlation of industrial arts grades with overall grades in high school for all students. The lack of two units of credit for industrial arts courses in high school for some students and the four missing high school transcripts again reduced to eighty-three the number of students considered for this correlation. The coefficient of correlation for all students was established at .616. This is a substantial and highly significant relationship, as r was required to be only .282 in order to be significant at the 1 per cent level.

The pattern in Figure 9 shows a relatively strong inclination up to the right. The points are scattered but

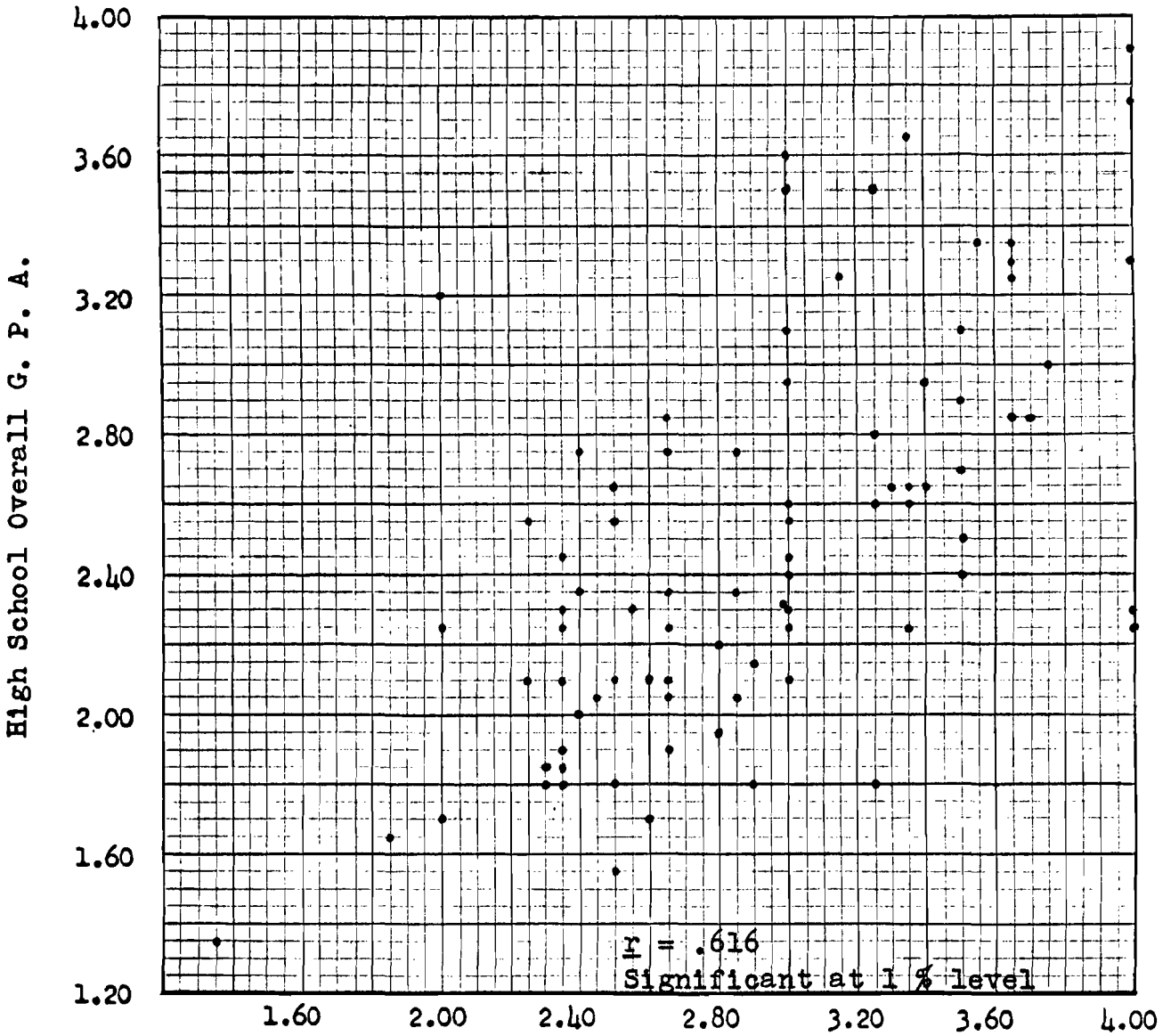

FIGURE 9

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH HIGH SCHOOL OVERALL GRADES FOR ALL STUDENTS

they nevertheless show the positive relationship which was calculated to be .616. This is a stronger relationship than found in the previous two comparisons involving all students.

Correlation of industrial arts grades with overall grades in high school for students in Group I. As might be expected, since Group I made up a large part of all the students studied, the distribution of the points in Figure 10 is similar to the distribution of points for all students. About the same degree of relationship appears to exist between the variables. Proof of the similarity of the relationships was obtained when the coefficient for Group I in this comparison was established at .636. An r of .365 would have made this correlation significant at the 1 per cent level; therefore, it is apparent that this too was a highly significant relationship.

Correlation of industrial arts grades with overall grades in high school for students in Group II. This comparison produced the highest coefficient of all sixteen comparisons made. Only when comparing high school industrial arts grades to high school overall grades did Group II have a larger coefficient than Group I. This fact is not readily apparent when the pattern in Figure 11 is observed; however, the coefficient was calculated to be .774 at the 1 per cent level of significance. A very substantial relationship was

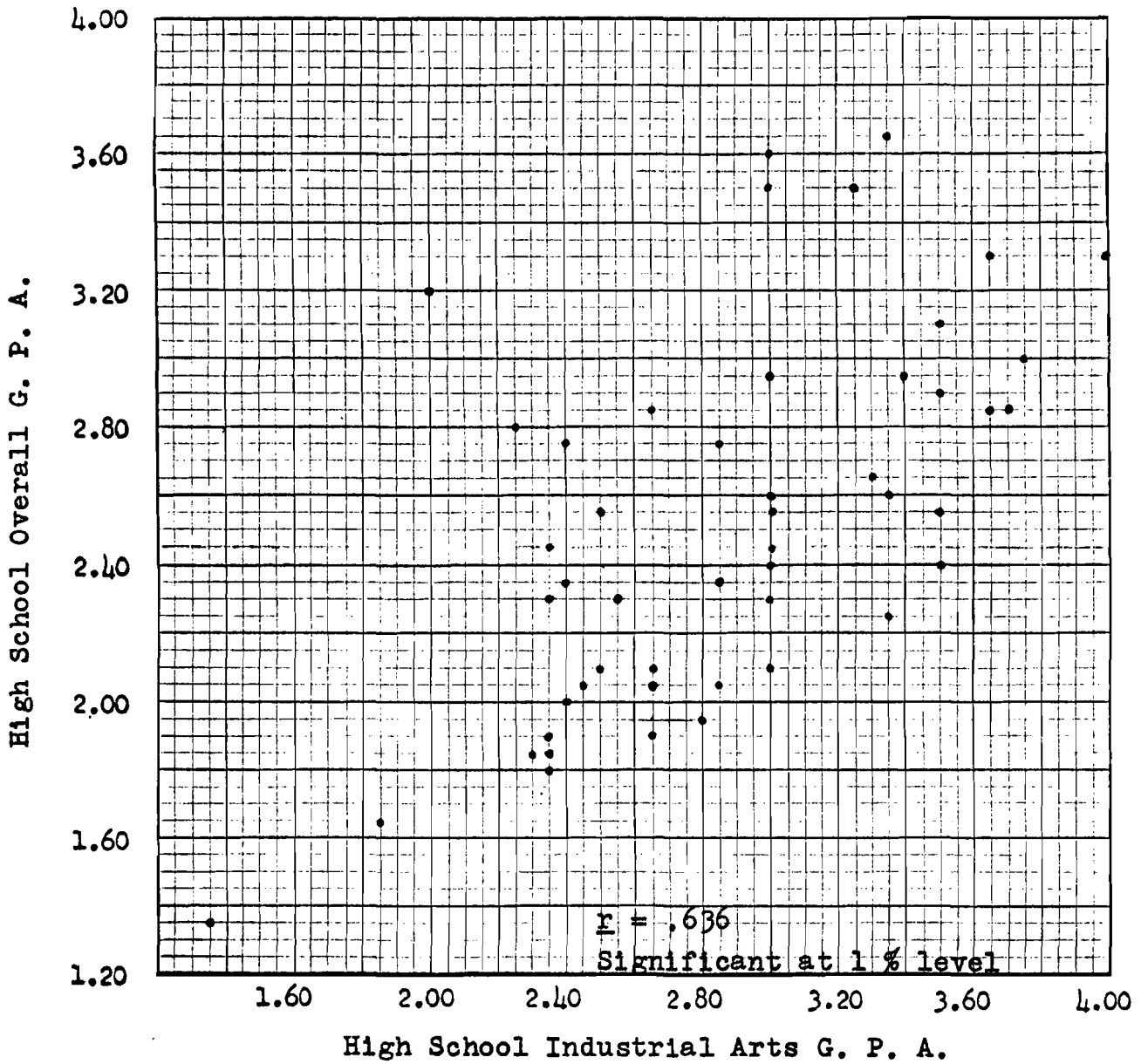

FIGURE 10

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH HIGH SCHOOL OVERALL GRADES FOR GROUP I

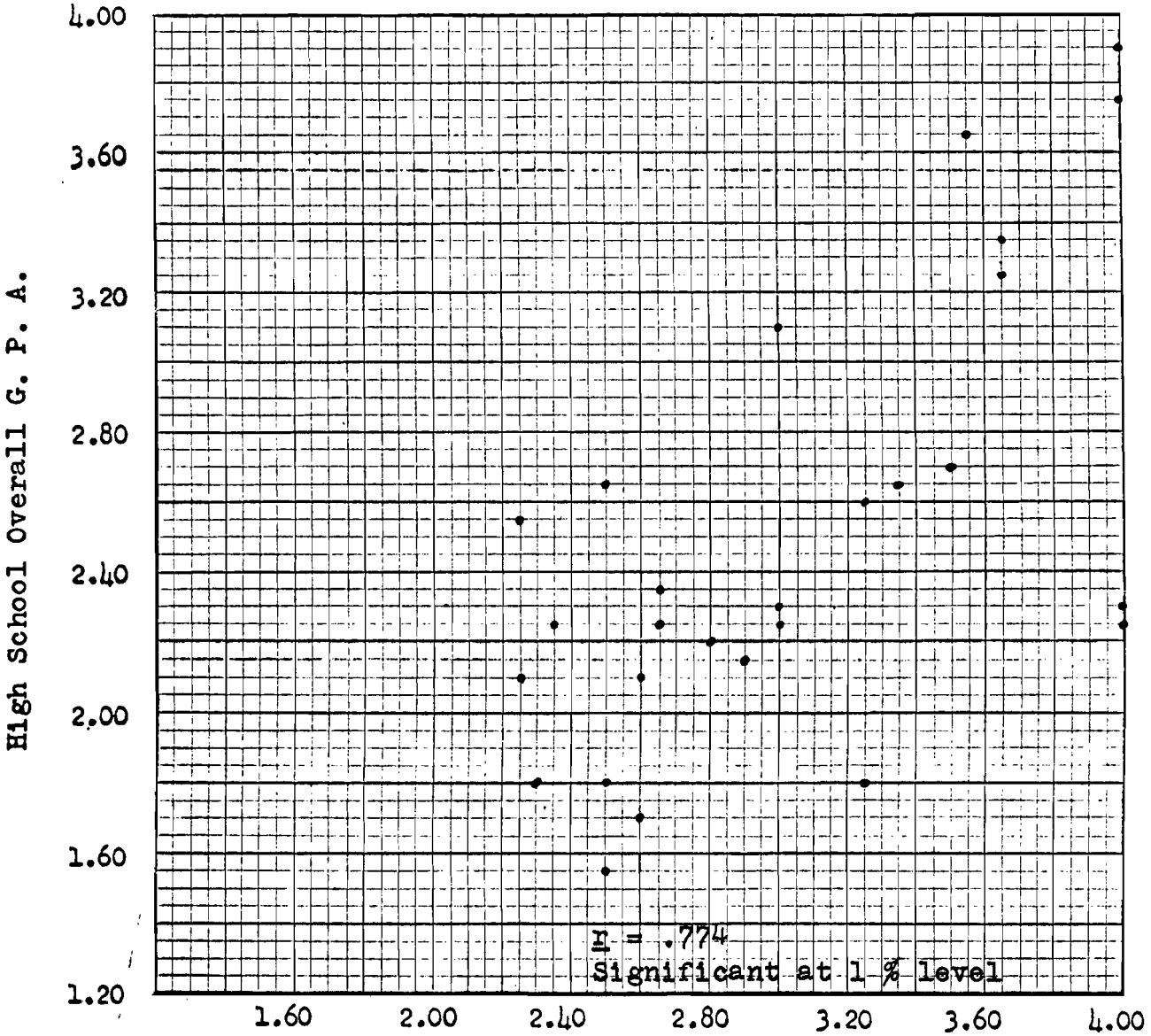

FIGURE 11

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES WITH HIGH SCHOOL OVERALL GRADES FOR GROUP II

indicated by this value. Twenty-seven students were included in this correlation.

Correlation of industrial arts grades with overall grades in high school for students in Group III. Although only seven students were considered in this correlation, the distribution in Figure 12 still shows a substantial positive relationship. Even though the r was found to be .676, which is considered to indicate a substantial relationship, it still was not large enough to be statistically significant for such a small group. To be significant at the 5 per cent level, the value for r would have to be .754 for a group of this size.

IV. COMPARISON OF COLLEGE INDUSTRIAL ARTS GRADES WITH COLLEGE OVERALL GRADE POINT AVERAGES

All of the students for whom data was collected were included in this section of the study. Generally, the same substantial relationships were found to exist between college industrial arts and college overall grades as were found between high school industrial arts and high school overall grades.

This part of the study is also one which was not originally planned for but it has been included for the same reasons as those given for comparing high school industrial arts grades to high school overall grades. The correlations

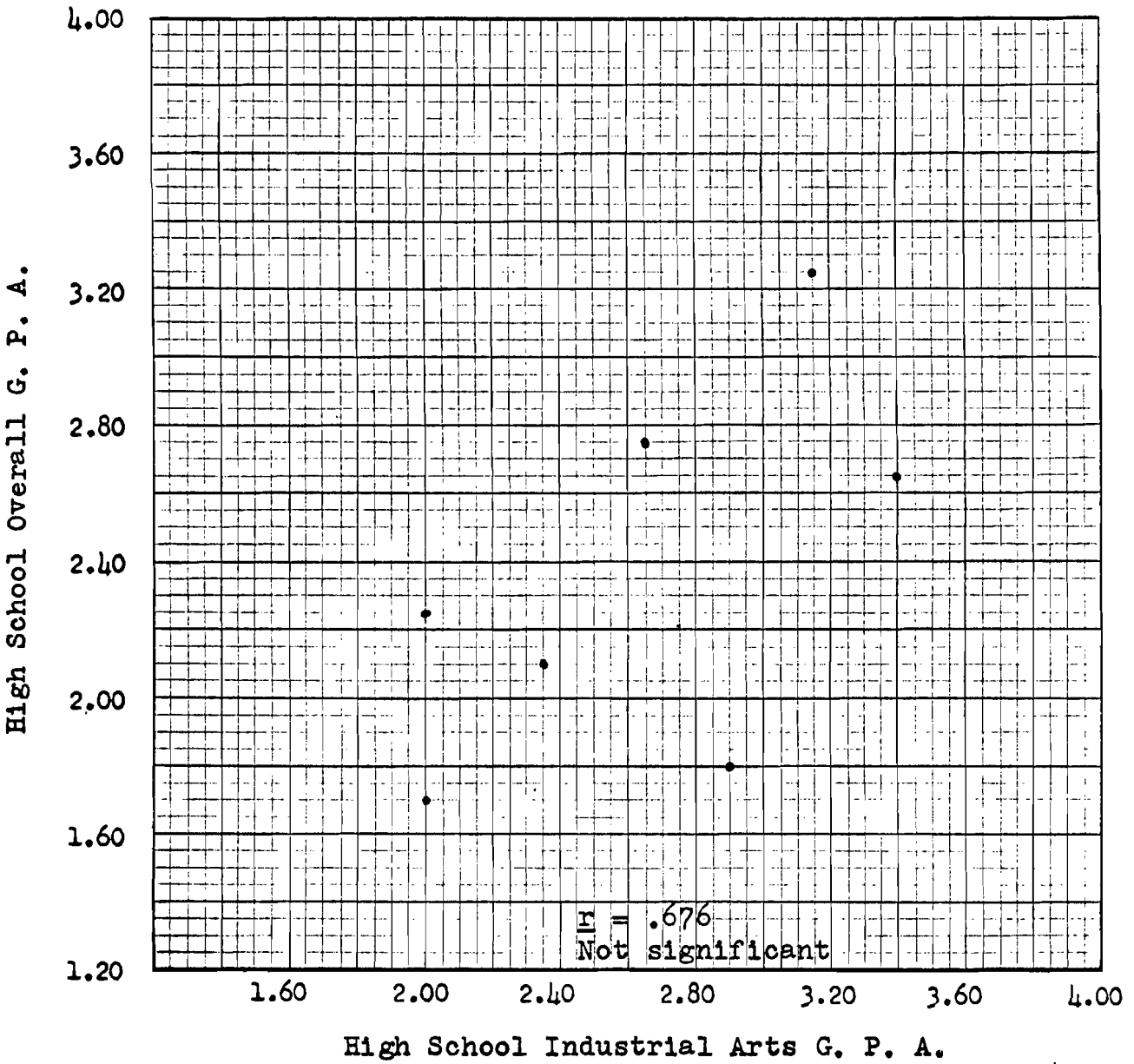

FIGURE 12

RELATIONSHIP OF HIGH SCHOOL INDUSTRIAL ARTS GRADES
WITH HIGH SCHOOL OVERALL GRADES
FOR GROUP III

found at the college level again proved that the poorer students in all subjects tended to be the poorer students in industrial arts courses as well.

Correlation of industrial arts grades with overall grades in college for all students. An interesting observation to be made from Figure 13 is that the distribution is less widely scattered than was the distribution for the same comparison made at the high school level. A closer relationship is suggested for the group as a whole. The pattern in Figure 13 reveals the possibility of a marked positive relationship between college industrial arts and overall grade averages. The calculated r backed up this observation as it was found to be .714. This was a highly significant relationship at the 1 per cent level as the coefficient was nearly three times as large as it would need to be in order to be significant at the 1 per cent level.

Correlation of industrial arts grades with overall grades in college for students in Group I. The correlation coefficient was found to indicate an even more marked relationship for Group I than was indicated for all students. The difference cannot be easily discerned from Figure 14; however, the marked positive relationship is apparent by the distribution of the plotted points.

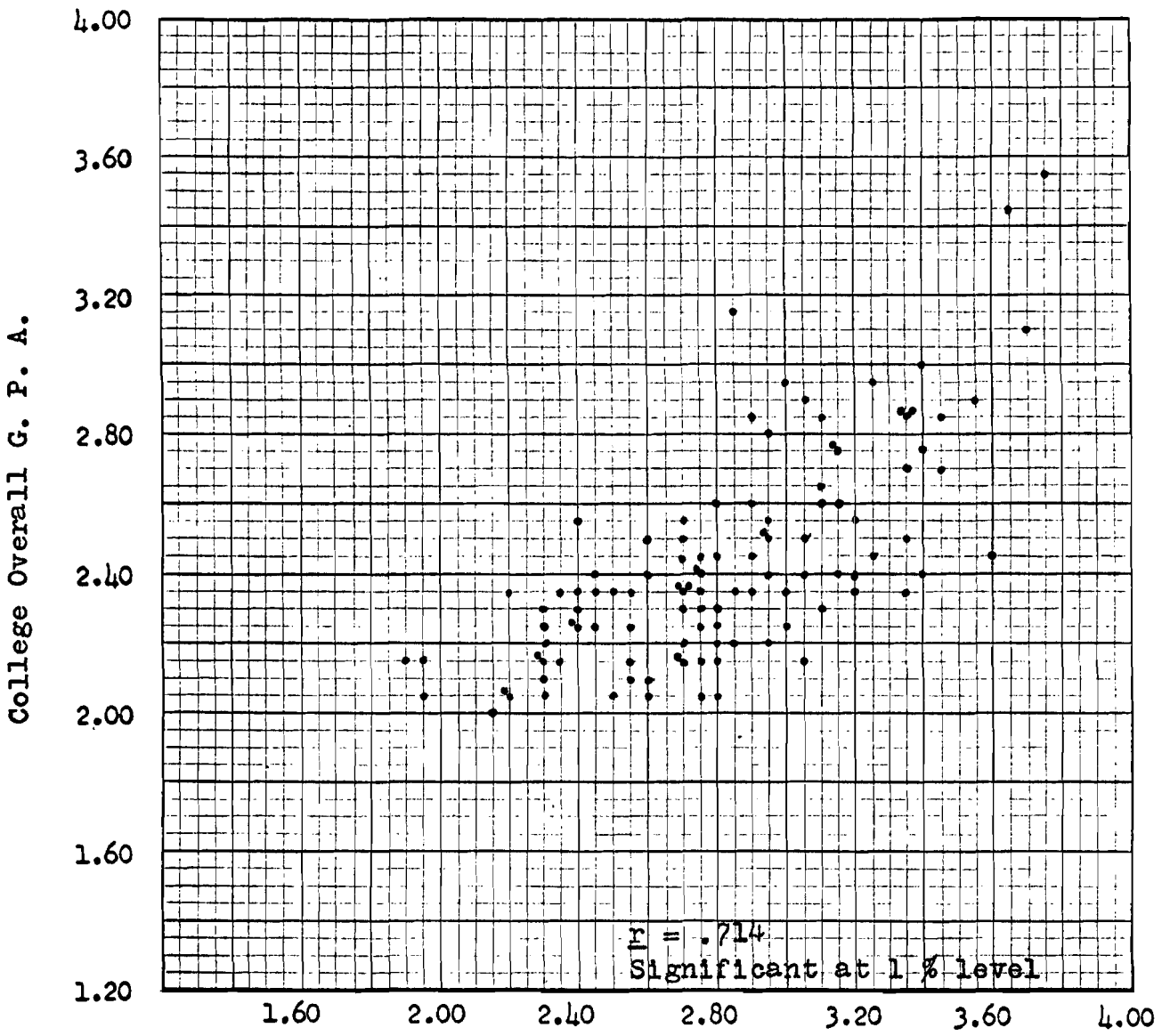

FIGURE 13

RELATIONSHIP OF COLLEGE INDUSTRIAL ARTS GRADES
WITH COLLEGE OVERALL GRADES
FOR ALL STUDENTS

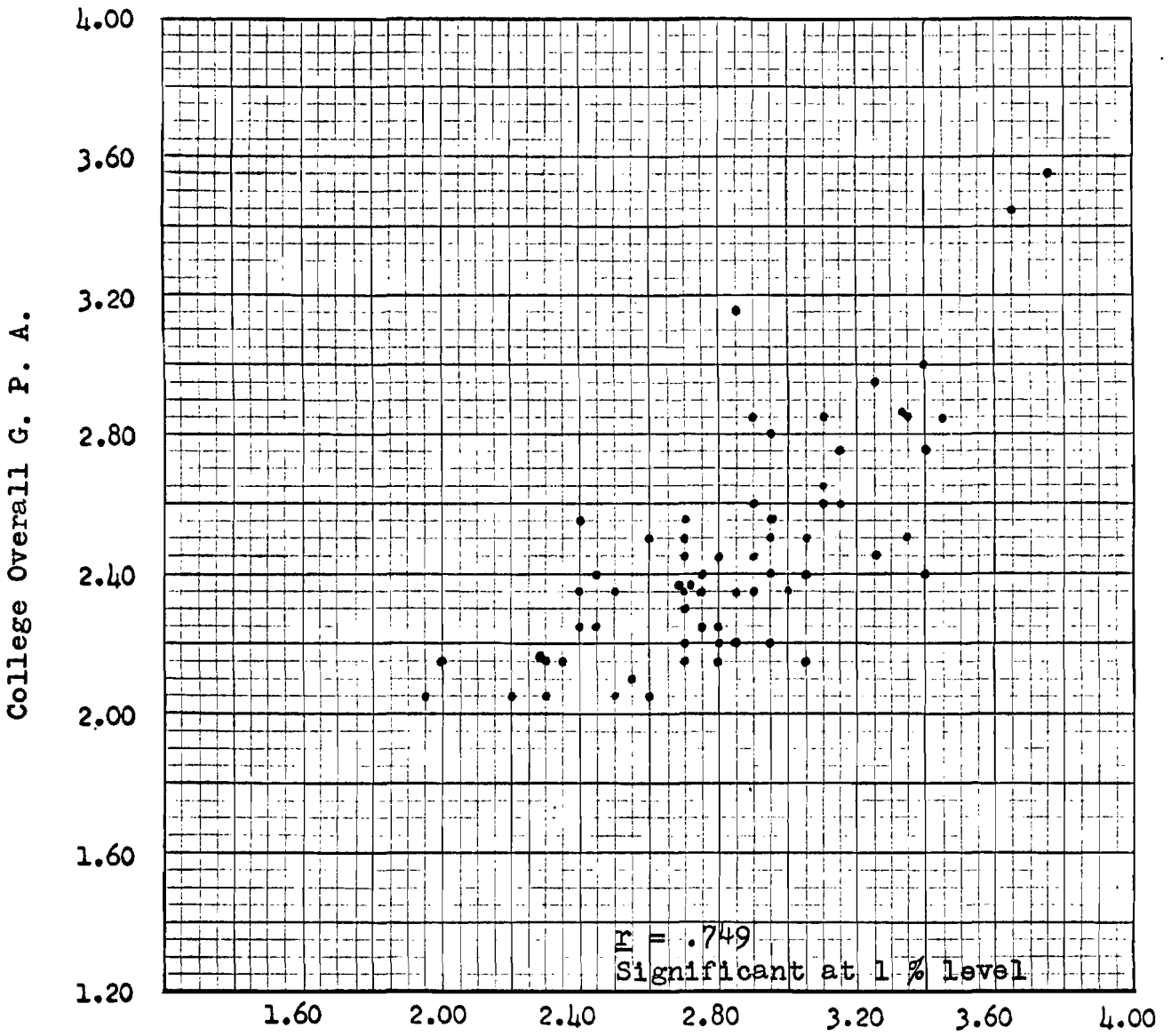

FIGURE 14

RELATIONSHIP OF COLLEGE INDUSTRIAL ARTS GRADES
WITH COLLEGE OVERALL GRADES
FOR GROUP I

The coefficient obtained was .749 which indicated a very significant relationship at the 1 per cent level.

Correlation of industrial arts grades with overall grades in college for students in Group II. As the pattern indicates in Figure 15, the relationship between the variables was also a close, positive, substantial one for Group II. The value for r was, in this case, established as .732. For this group of thirty-three, the level of significance was still at the 1 per cent level.

Correlation of industrial arts grades with overall grades in college for students in Group III. As suggested by Figure 16, the correlation for Group III between college industrial arts and overall grades was still a positive one but apparently not as close or as substantial as the other correlations found using these variables. This was borne out by finding r to be .571. This shows that a moderate relationship existed; however, the relationship was not found to be statistically significant for this group of ten. The null hypothesis therefore was not rejected and the r of .571 cannot be considered an indication of any real correlation in this case.

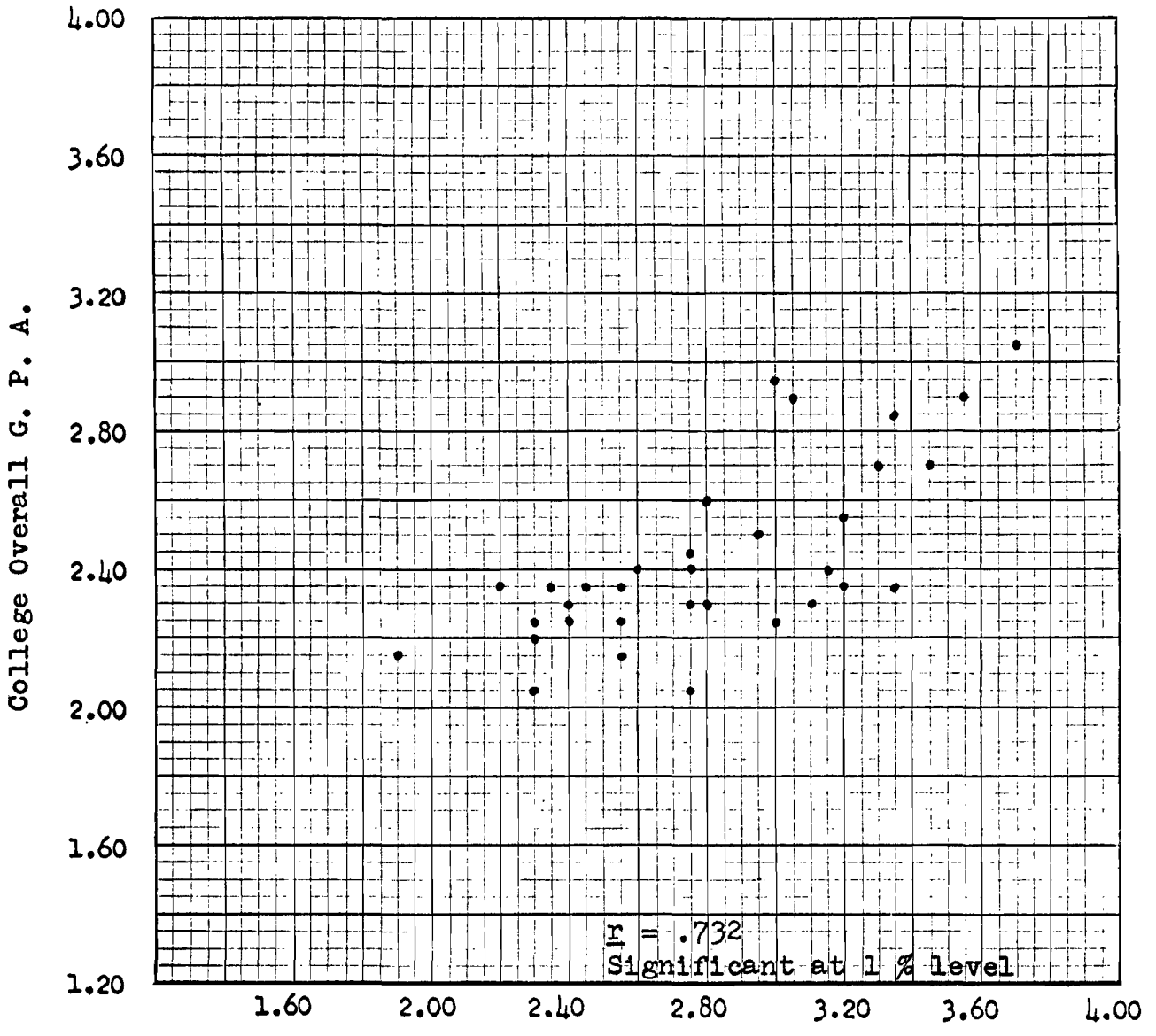

FIGURE 15

RELATIONSHIP OF COLLEGE INDUSTRIAL ARTS GRADES
WITH COLLEGE OVERALL GRADES
FOR GROUP II

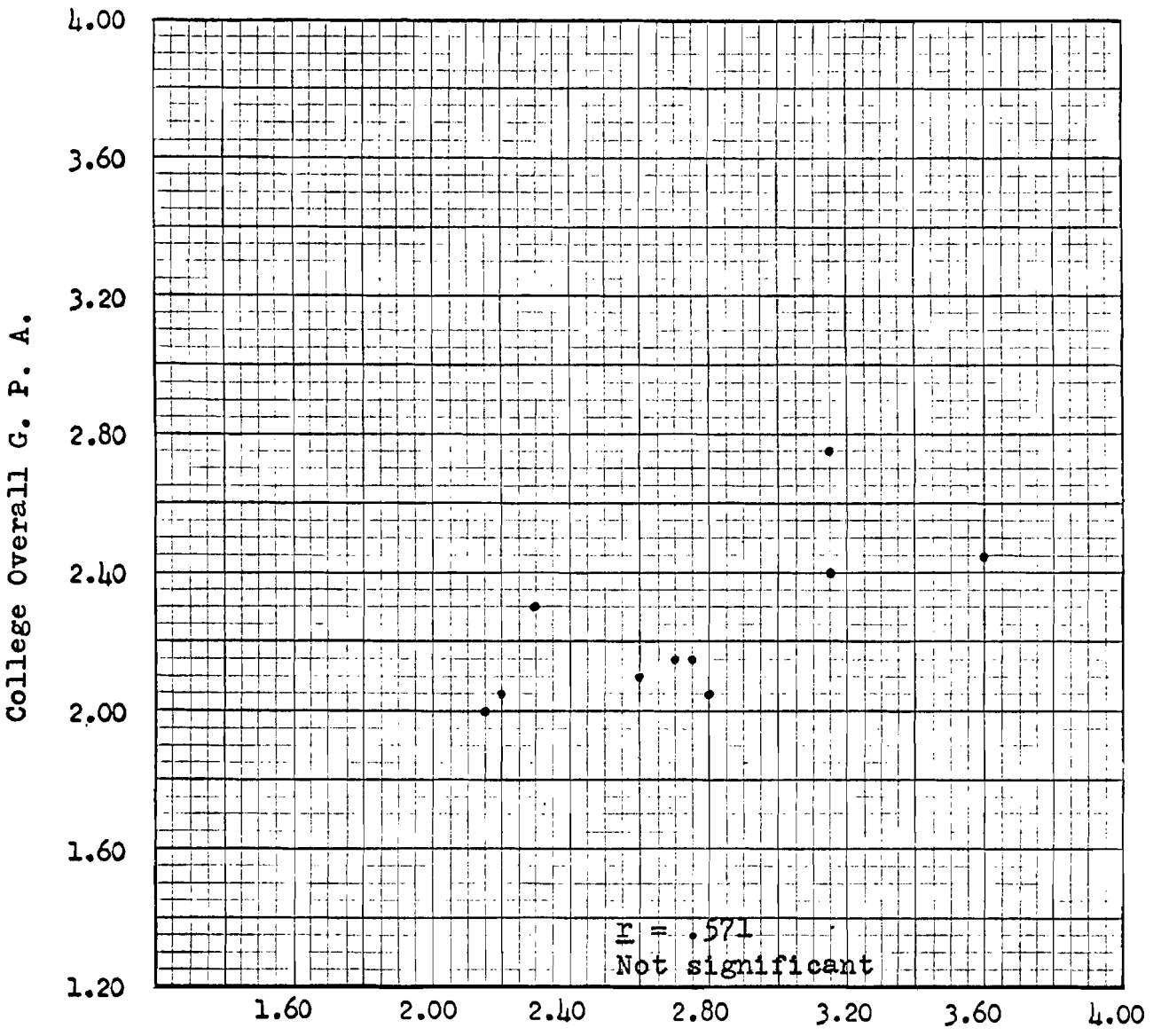

FIGURE 16

RELATIONSHIP OF COLLEGE INDUSTRIAL ARTS GRADES
WITH COLLEGE OVERALL GRADES
FOR GROUP III

V. RELATIONSHIP OF THE SIZE OF HIGH SCHOOLS ATTENDED WITH COLLEGE INDUSTRIAL ARTS GRADE POINT AVERAGES

There is no doubt that large high schools, as a rule, are better equipped to teach industrial arts courses than are smaller high schools. Not only are they better equipped but they generally offer a greater range of industrial arts courses. If any relationship exists between better equipped shops, a wider range of industrial arts courses in high schools, and success in college industrial arts courses, the relationship should show up when comparing high school size to college industrial arts grades.

Many arguments have been heard expounding the advantages of a larger high school over a small one. However, this study and other earlier studies discount the theory that students from larger high schools have significantly greater success in college than students from smaller high schools.

The data for this comparison was presented in two ways, thereby making it possible to use two methods of analyzing the data. In the first method, the data was distributed in a manner allowing conclusions to be drawn by the visual inspection of a table. No statistical analysis was used in the first method. The data in the second method of presentation was grouped to allow the use of a statistical

test known as the chi-square test. Of the one hundred eight students included in the study, the records of one hundred two were used in this comparison as six high school sizes could not be determined.

Comparison of the size of high school attended and college industrial arts grade point averages by visual inspection of data. Seven high school size ranges and nine industrial arts grade point average ranges were used in Table II. The number of students whose college industrial arts grade point averages were in these grade point average ranges are listed under the appropriate high school size range.

If a high positive relationship did exist between the size of high schools attended and grades earned in industrial arts courses in college, a proportionately high percentage of the students would be placed on the table to form a group pattern starting at the upper left corner and slanting down to the right. Such a pattern is not discernible; therefore, a significant relationship apparently did not exist between the size of high school attended and college success in industrial arts courses. As a general rule, approximately the same percentage of students had grade point averages above and below the 2.76 to 3.00 range whether or not they came from large or small high schools.

TABLE II

COLLEGE INDUSTRIAL ARTS GRADE POINT AVERAGES ACCORDING TO SIZE OF HIGH SCHOOL ATTENDED

College I. A. G. P. A.	Size of high school							
	0-50	51-100	101-150	151-250	251-500	501-1000	Over 1000	Totals
1.76-2.00	0 0.00%	1 2.94%	0 0.00%	0 0.00%	1 12.50%	0 0.00%	1 20.00%	3 2.94%
2.01-2.25	0 0.00	1 2.94	0 0.00	1 4.76	0 0.00	1 9.09	0 0.00	3 2.94
2.26-2.50	1 12.50	5 14.71	5 33.33	3 14.28	0 0.00	3 27.27	0 0.00	17 16.67
2.51-2.75	2 25.00	8 23.53	4 26.67	2 9.52	1 12.50	4 36.37	1 20.00	22 21.57
2.76-3.00	2 25.00	6 17.65	3 20.00	11 52.38	0 0.00	2 18.18	0 0.00	24 23.53
3.01-3.25	1 12.50	4 11.76	2 13.33	3 14.29	4 50.00	1 9.09	2 40.00	17 16.67
3.26-3.50	2 25.00	6 17.65	1 6.67	0 0.00	2 25.00	0 0.00	0 0.00	11 10.78
3.51-3.75	0 0.00	2 5.88	0 0.00	1 4.76	0 0.00	0 0.00	1 20.00	4 3.92
3.76-4.00	0 0.00	1 2.94	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 .98
Totals	8 100.00%	34 100.00%	15 100.00%	21 100.00%	8 100.00%	11 100.00%	5 100.00%	102 100.00%

Comparison of the size of high school attended and college industrial arts grade point averages by use of the chi-square test. An analysis of data is more meaningful if a proven statistical procedure is used. The chi-square test is often used to compare the frequency of observed or experimentally obtained results with expected or theoretical frequencies. While it is often necessary to calculate the expected results, they need not be computed if the data to be compared is arranged in a four-celled (two by two fold) table. Two high school sizes (150 and below; 151 and above) and two grade point ranges (2.75 and below; 2.76 and above) were used to allow the construction of a four-celled table. This data was presented in Table III to show the number of students who had industrial arts grade point averages in each of the two grade point ranges under each of the two high school size ranges.

Using the chi-square (χ^2) formula in which the expected frequencies need not be determined and by using a desk calculator the value of chi-square was found to be .5538. Reference to a table and using one degree of freedom (a four-celled table has but one degree of freedom) shows that the value of χ^2 would have to be 3.841 to be significant at the 5 per cent level.[2] The value found for χ^2 shows a level of significance

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[2]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Company, 1947), p. 450.

TABLE III

COLLEGE INDUSTRIAL ARTS GRADE POINT AVERAGES AND SIZE OF HIGH SCHOOL ATTENDED PAIRED FOR THE USE OF THE FOUR-CELLED CHI-SQUARE FORMULA[a]

College I. A. G. P. A.	Size of high school		
	150 & below	151 & above	Total
2.75 & below	27	18	45
2.76 & above	30	27	57
Totals	57	45	102

[a]A desk calculator may be used for a four-celled table without figuring the expected frequencies when this formula is used:

$$\chi^2 = \frac{N\,(AD-BC)^2}{(A+B)\,(C+D)\,(A+C)\,(B+D)}$$

χ^2 = Chi Square
N = The total number of cases (102)
A = Number of cases in upper left cell (27)
B = Number of cases in upper right cell (18)
C = Number of cases in lower left cell (30)
D = Number of cases in lower right cell (27)

at greater than 80 per cent thereby giving very strong support to the null hypothesis that no real difference existed between the smaller an larger high schools insofar as college industrial arts grade point averages were concerned. This conclusion is in line with what other studies found for the relationship between high school size and college grades.

VI. COMPARISON OF MEAN GRADE POINT AVERAGES

Since grade point averages were used in making the correlations for this study, it was considered worthwhile to establish the means for these averages so that the various groups could be compared in this respect. In Table IV, the mean grade point averages for high school industrial arts, high school overall, college industrial arts, and college overall grades are given for each of the three groups studied separately and for all three groups combined. In all cases, whether for high school or for college, the mean industrial arts grade point averages were greater than were the overall grade point average. The least difference was between the high school grade averages for Group III where the difference was .13 points. The greatest difference at the high school level appeared in Group II with a difference of .55 points; whereas, the difference for all students was .52 points. It was interesting to note that the mean high

TABLE IV

MEAN GRADE POINT AVERAGES OF GROUPS STUDIED

Grades	All students	Group I	Group II	Group III
High School Industrial Arts	2.91	2.88	3.04	2.63
High School Overall	2.49	2.50	2.49	2.50
College Industrial Arts	2.82	2.84	2.81	2.73
College Overall	2.43	2.46	2.43	2.24

school overall grade point average for each of the three groups varied no more than .01 points.

At the college level, Group III exhibited the difference of .49 points which was the largest difference. The least difference was still .38 points which showed less variation between the groups at the college than at the high school level. The most significant finding when comparing the mean grade point averages for college grades was that the Group III students had lower grade point averages than did the other two groups. This held true for the high school industrial arts grades also. Also, at the college level, Group I had a very slight grade point advantage over Group II but, in high school, the Group II students had a .16 better industrial arts average than did Group I.

It would be difficult to draw any definite conclusions from this table. However, it does show a tendency for college grades to average slightly lower than high school grades--both industrial arts and overall--and for Bachelor of Arts students to average lower in all but high school overall grades.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

Correlations of high school with college industrial arts grades. The four findings in this comparison were the least consistent of the four comparisons made in which correlation coefficients were determined. The coefficients were .137 for all students, .249 for Group I, minus .013 for Group II, and minus.278 for Group III. None of the values for r were large enough to provide a 5 per cent level of significance; therefore, the null hypothesis was retained.

Correlations of high school with college overall grades. All but one of the relationships between high school and college overall grades were moderate ones. The one for Group III, however, was a negligible .015. In this case the relationship was so insignificant that the null hypothesis was quite valid. The coefficient was .515 for all students, .584 for Group I, and .517 for Group II--all indicating moderate relationships and all highly significant at less than the 1 per cent level.

Correlations of high school industrial arts with overall grades. All of the coefficients for this comparison were found to indicate a substantial relationship and were

all, except for Group III, found to be highly significant at less than the 1 per cent level. The coefficient for Group III, although fairly large, was not large enough for a group of seven to make it significant at the 5 per cent level. Therefore, the null hypothesis was not rejected. The values of r were found to be .616 for all students, .636 for Group I, .774 for Group II, and .676 for Group III.

Correlations of college industrial arts with overall grades. The relationships existing between college industrial arts grades and overall grades were all moderate to substantial. The r value of .571 for Group III again was not significant at the 5 per cent level because of the small number of cases and the null hypothesis could not be rejected. The coefficients of .714 for all students, .749 for Group I, and .732 for Group II were established to be significant at less than the 1 per cent level.

The findings for these and the other comparisons in which coefficients of correlation and their levels of significance were determined are presented in Table V.

High school size compared to college industrial arts grades. Neither the visual inspection of the data presented in Table II, page 65, nor the use of the chi-square test established any appreciable relationship between the sizes of the high schools attended and the average grades earned in

TABLE V

COEFFICIENTS OF CORRELATION AND THEIR LEVELS OF SIGNIFICANCE

Grades compared	All students	Group I	Group II	Group III
High School Industrial Arts to College Industrial Arts	N = 83 r = .137 P > 5%	N = 49 r = .249 P > 5%	N = 27 r = -.013 P > 5%	N = 7 r = -.278 P > 5%
High School Overall to College Overall	N = 104 r = .515 P < 1%	N = 63 r = .584 P < 1%	N = 31 r = .517 P < 1%	N = 10 r = .015 P > 5%
High School Industrial Arts to High School Overall	N = 83 r = .616 P < 1%	N = 49 r = .636 P < 1%	N = 27 r = .774 P < 1%	N = 7 r = .676 P > 5%
College Industrial Arts to College Overall	N = 108 r = .714 P < 1%	N = 65 r = .749 P < 1%	N = 33 r = .732 P < 1%	N = 10 r = .571 P > 5%

NOTE: This table should be read as follows: When comparing the high school industrial arts grades of all students to their college industrial arts grades, the coefficient of correlation (r) was found to be .137 with a level of significance (P) greater than 5 per cent when the number of cases (N) was eighty-three. With a level of significance greater than 5 per cent, the null hypothesis is retained.

college industrial arts courses. The chi-square value was found to be so small that the null hypothesis was very valid.

Mean grade point averages. When the mean grade point averages for the various groups were compared, the industrial arts averages were higher in all cases than the overall averages. For all students, the difference between high school industrial arts and overall grades was .51 grade points. The difference at the college level was .39 grade points. Except for the high school overall averages which were all either 2.50 or 2.49, the Group III students had the lowest mean grade point averages.

II. CONCLUSIONS

The results of this study imply that high school industrial arts grades are not valid indicators of success in industrial arts courses in college. The relationship between these factors for the students at Kansas State Teachers College who elected a program requiring them to prepare for teaching only in industrial arts was a low positive relationship. The relationship was a negligible negative one for those students who elected the program requiring them to prepare in two teaching fields. A low negative relationship was found to exist between these factors for those students who obtained Bachelor of Arts degrees. It would

appear that the correlation was directly related to the students' interest in teaching industrial arts.

Except for Group III, where a negligible relationship was found, the correlations for high school to college overall grades agreed with other studies that high school grades are good indicators of college success.

The highest relationships were found to exist when industrial arts grades were compared to overall grades both for high school and college. While the grades for industrial arts courses did average higher in both high school and college, these relationships show that the student ranking was usually the same in industrial arts courses as for all school work.

A comparison of the size of high school attended and success in college industrial arts courses showed that no significant difference in industrial arts grades existed between the students who attended large high schools and those who attended small high schools.

III. RECOMMENDATIONS

In the course of collecting data for this study, it was discovered that many high school administrators still referred to industrial arts courses by the antiquated titles of manual training and manual arts. It is suggested that all industrial arts personnel do their best to bring the course titles and course content up to date.

A study similar to this one is suggested for a future date. The Office of Admissions and Records is currently doing an excellent job of maintaining records so that a future study of this nature could be made without the need of writing for missing records.

Whereas parts of this study were concerned with comparing industrial arts grades to overall grades in college and in high school, it is suggested that the relationship be determined between industrial arts grades and all grades excepting industrial arts. This would perhaps give a more accurate relationship between industrial arts courses and the other courses, since the industrial arts courses in this study did influence the overall grades.

Finally, a recommendation that a study similar to this one be made for college freshmen rather than college graduates. The results of this study were obviously affected by the fact many students who started as freshmen were not included.

BIBLIOGRAPHY

BIBLIOGRAPHY

Altman, Esther R. "Effect of Rank in Class and Size of High School on the Academic Achievement of Central Michigan College Seniors Class of 1957," Journal of Educational Research, 52:307-309, April, 1959.

Best, John W. Research in Education. Englewood Cliffs: Prentice-Hall, Inc., 1959.

Campbell, William Giles. Form and Style in Thesis Writing. Boston: Houghton Mifflin Company, 1954.

Dwyer, P. S. "Some Suggestions Concerning the Relationship Existing Between Size of High School Attended and Success in College," Journal of Educational Research, 32:271-281, December, 1938.

Garrett, Harley F. "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teachers College," Journal of Experimental Education, 17:91-138, December, 1949.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Company, 1958.

Giusti, Joseph Paul. "High School Average as a Predictor of College Success: A Survey of the Literature," College and University, 39:200-209, Winter, 1964.

Good, Carter V. (ed.). Dictionary of Education. New York: McGraw-Hill Book Company, Inc., 1959.

Griffin, John I. Statistics, Methods and Applications. New York: Holt, Rinehart and Winston, 1962.

Griffith, Fuller O. "Industrial Arts Drawing in High School as a Predictor of Grades in College Drawing." Unpublished Master's thesis, Colorado Agricultural and Mechanical College, Fort Collins, 1953.

Henry, Everett F. "The Correlation Between College Mathematics Grades and High School Mathematics Grades." Unpublished Master's thesis, Kansas State Teachers College, Emporia, 1957.

Lathrop, Irvin T. "Scholastic Achievement at Iowa State College Associated With High School Size and Course Pattern," Journal of Experimental Education, 29:37-48, September, 1960.

Lindahl, Charles W. "A Comparative Study of the Success of Kansas State Teachers College Students According to Size of High School Attended." Unpublished Master's thesis, Kansas State Teachers College, Emporia, 1961.

Lyday, William A. "A Study of Grades in Freshman Engineering Drawing of Students Who Did or Did Not Have Pre-college Drawing Instructions." Unpublished Master's thesis, University of Tennessee, Knoxville, 1963.

McCaleb, Omer K. "High School Drawing and Certain Other Factors Relating to Student Performance in Engineering Drawing." Unpublished Master's thesis, Oregon State University, Corvallis, 1954.

Miller, Rex, and Lee H. Smalley (eds.). Selected Readings for Industrial Arts. Bloomington: McKnight & McKnight Publishing Company, 1963.

Sharp, Bert L. "College Achievement: Its Relationship to High School Achievement Experiences and Test Scores," The Personnel and Guidance Journal, 41:247-250, November, 1962.

Walker, Helen M. Elementary Statistical Methods. New York: Henry Holt and Company, 1943.

Wilber, Gordon Owen. Industrial Arts in General Education. Second edition. Scranton: International Textbook Co., 1954.

APPENDIXES

APPENDIX A

ORIGINAL DATA FOR THE STUDY

Appendix A contains the original data from which all tables, figures, and computations were made for this study. Some data is not shown for certain students because of the reasons indicated by the following letters:

(a) The student had taken less than two units of industrial arts in high school.

(b) No high school transcript was available.

(x) The size of the high school could not be determined.

Student #	Group #	H. S. Size	H. S. I. A.	Grade point averages H. S. Overall	College I. A.	College Overall
1	1	199	3.00	2.53	2.94	2.81
2	1	36	2.43	2.04	3.37	2.86
3	2	52	3.25	2.61	1.91	2.14
4	1	108	2.38	2.00	2.50	2.06
5	2	132	3.67	3.37	2.74	2.41
6	1	334	1.86	1.66	3.01	2.36
7	2	53	3.57	3.36	3.45	2.68
8	2	68	a	2.69	3.37	2.36
9	1	85	3.00	2.09	2.92	2.45
10	2	27	3.00	3.12	3.35	2.83
11	1	121	3.25	2.78	2.68	2.57
12	1	29	4.00	3.29	3.11	2.58

Student #	Group #	H. S. Size	H. S. I. A.	Grade point averages H. S. Overall	College I. A.	College Overall
13	2	Over 1000	2.62	1.71	3.10	2.28
14	1	195	3.66	2.85	3.16	2.62
15	1	146	2.33	1.81	2.71	2.36
16	1	593	2.83	2.06	2.49	2.36
17	1	198	3.75	3.00	3.12	2.67
18	1	252	a	2.82	3.34	2.85
19	1	124	3.00	2.30	2.46	2.24
20	2	406	2.50	2.67	2.58	2.41
21	1	196	3.33	3.63	2.92	2.87
22	1	600	2.29	1.86	2.77	2.36
23	1	250	2.33	1.87	2.84	2.20
24	1	71	a	2.26	2.60	2.48
25	2	x	b	b	2.73	2.05
26	3	882	2.00	2.25	2.31	2.32
27	2	Over 1000	2.60	2.10	2.55	2.13
28	2	x	a	2.02	2.38	2.29
29	1	88	a	2.30	3.06	2.39
30	1	x	a	2.00	3.39	2.39
31	2	90	2.25	2.56	2.77	2.29
32	2	68	2.67	2.24	2.56	2.26
33	1	64	a	3.34	3.65	3.43
34	1	107	a	1.61	2.93	2.21

Student #	Group #	H. S. Size	H. S. I. A.	Grade point averages H. S. Overall	College I. A.	College Overall
35	2	178	2.50	1.81	2.31	2.08
36	1	420	1.33	1.35	2.00	2.14
37	2	97	4.00	3.92	2.73	2.45
38	1	62	3.50	2.53	3.06	2.17
39	2	172	3.67	3.25	3.00	2.93
40	1	59	2.40	2.34	2.79	2.14
41	1	870	3.00	2.41	3.14	2.74
42	1	146	2.67	2.03	2.92	2.58
43	1	46	2.57	2.31	2.78	2.27
44	1	68	2.33	2.43	2.83	2.33
45	2	903	4.00	2.24	3.00	2.25
46	1	68	2.33	2.32	2.75	2.25
47	1	740	2.83	2.34	2.61	2.06
48	3	79	a	3.11	2.81	2.06
49	1	154	a	2.26	2.95	2.42
50	3	206	2.90	1.81	2.73	2.13
51	1	49	2.40	2.74	2.55	2.10
52	2	169	3.00	2.27	3.18	2.41
53	2	68	b	b	3.53	2.91
54	1	62	3.00	3.49	3.46	2.86
55	2	Over 1000	2.33	2.26	3.72	3.09

Student #	Group #	H. S. Size	H. S. I. A.	Grade point averages H. S. Overall	College I. A.	College Overall
56	1	95	a	2.86	2.43	2.38
57	3	361	3.13	3.24	3.14	2.73
58	1	68	2.67	2.85	2.39	2.35
59	1	68	3.00	3.61	3.12	2.84
60	2	x	a	2.71	2.21	2.36
61	1	51	2.50	2.12	2.37	2.16
62	1	126	2.83	2.73	2.72	2.18
63	2	358	4.00	3.73	3.03	2.89
64	1	169	3.33	2.61	2.31	2.04
65	3	630	2.33	2.08	2.68	2.17
66	1	103	a	3.22	3.41	3.02
67	2	69	2.67	2.36	3.21	2.35
68	2	133	2.50	1.53	2.31	2.21
69	1	165	3.50	3.09	2.71	2.52
70	3	187	2.00	1.72	3.58	2.43
71	2	847	4.00	2.31	2.56	2.33
72	2	107	2.25	2.08	3.22	2.55
73	1	52	3.67	3.31	3.37	2.49
74	1	94	3.50	2.42	2.28	2.17
75	1	Over 1000	2.67	2.10	1.97	2.03
76	1	908	3.00	2.45	2.72	2.33
77	1	208	3.00	2.60	2.93	2.55

Student #	Group #	H. S. Size	H. S. I. A.	Grade point averages H. S. Overall	College I. A.	College Overall
78	2	x	3.00	2.28	2.38	2.26
79	1	38	b	b	2.95	2.49
80	1	91	3.25	3.50	2.83	3.16
81	2	108	2.82	2.19	2.45	2.37
82	1	66	a	2.38	2.71	2.45
83	1	600	2.80	1.94	2.19	2.03
84	2	32	3.25	1.78	2.36	2.37
85	1	204	2.67	1.92	2.80	2.44
86	2	174	2.30	1.79	2.96	2.50
87	1	133	3.50	2.91	3.03	2.51
88	1	45	b	b	2.69	2.34
89	1	237	a	1.76	2.81	2.21
90	3	299	a	2.33	3.13	2.42
91	1	73	3.33	2.25	3.27	2.45
92	1	58	2.00	3.21	3.77	3.56
93	1	60	3.00	2.94	2.74	2.38
94	3	59	a	3.03	2.59	2.09
95	1	140	a	2.91	2.91	2.36
96	1	243	3.70	2.85	2.42	2.23
97	3	218	3.40	2.63	2.20	2.04
98	3	91	2.67	2.75	2.14	2.02
99	1	125	2.50	2.53	2.32	2.13

Student #	Group #	H. S. Size	H. S. I. A.	Grade point averages H. S. Overall	College I. A.	College Overall
100	1	68	3.40	2.95	3.38	2.77
101	1	80	a	1.49	2.72	2.29
102	2	194	a	2.44	2.81	2.28
103	2	253	3.33	2.66	3.35	2.68
104	1	608	2.33	1.88	2.41	2.53
105	1	x	a	2.53	2.69	2.16
106	2	165	3.50	2.71	2.79	2.60
107	1	Over 1000	3.30	2.66	3.25	2.94
108	2	69	2.88	2.15	2.28	2.25

TABLE VI

DATA USED IN DETERMINING COEFFICIENTS OF CORRELATION

Grades compared	Data symbol	All students	Group I	Group II	Group III
High School	N =	83	49	27	7
Industrial Arts (X)	ΣX =	241.81	141.25	82.13	18.43
to	ΣY =	231.82	137.19	75.85	18.78
College	ΣX^2 =	773.83	421.65	253.85	50.33
Industrial Arts (Y)	ΣY^2 =	661.22	391.26	217.94	52.07
	ΣXY =	677.98	398.01	230.81	48.96
High School	N =	104	63	31	10
Overall (X)	ΣX =	259.47	157.33	77.22	24.95
to	ΣY =	252.24	154.84	75.29	22.41
College	ΣX^2 =	679.86	411.65	203.32	64.89
Overall (Y)	ΣY^2 =	622.54	387.18	187.67	50.69
	ΣXY =	638.95	393.19	189.83	55.93
High School	N =	83	49	27	7
Industrial Arts (X)	ΣX =	241.81	141.25	82.13	18.43
to	ΣY =	207.16	123.49	67.36	16.48
High School	ΣX^2 =	730.83	421.65	253.85	50.33
Overall (Y)	ΣY^2 =	542.55	325.37	178.71	40.61
	ΣXY =	619.51	365.08	210.00	44.61
College	N =	108	65	33	10
Industrial Arts (X)	ΣX =	304.62	184.43	92.88	27.31
to	ΣY =	262.33	159.67	80.25	22.41
College	ΣX^2 =	876.52	532.45	267.65	76.48
Overall (Y)	ΣY^2 =	644.94	398.86	197.34	50.69
	ΣXY =	749.19	458.88	228.57	61.74

Kansas State Teachers College
Emporia, Kansas

Would you please send me a transcript for
who graduated from High School in , so that I may collect needed data for a study being made for the Industrial Arts Department at Kansas State Teachers College. Data on industrial arts graduates of the last five years is being compiled in order to compare high school industrial arts grades to college industrial arts grades, and overall high school grades to overall college grades.

Your assistance is needed, since approximately 50 per cent of the required high school transcripts are not available on the campus. The study group is a comparatively small one, so it is important that I obtain as many of the transcripts as possible. I assure you that the students whose records make up the study will remain anonymous, and that the transcripts will not be made available to others. The transcript will be returned to you upon request, otherwise it will be destroyed after collection of data. If you are interested in receiving a summary of the study, please write the word "summary" at the bottom of the transcript. Thank you for your cooperation.

Sincerely yours,

Virden L. Turner
Graduate Assistant

I would like to support Mr. Turner's request for transcripts in meeting his research requirements. This research study should provide some significant data for the evaluation of curricular offerings as well as an indication of some interrelating effects of our programs at both the high school and college levels. The use of subjects already graduated or near graduation provides a longitudinal basis for generalization which rarely exists in research related to students.

We will appreciate your extra effort in making the completion of this research study possible.

Respectfully yours,

Arthur F. Miller

Dr. Arthur F. Miller
Director of Admissions

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