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A Study of the Relationships Between Achievement and Intelligence Test Scores for Charleston High School Juniors and Seniors

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A STUDY OF THE RELATIONSHIPS BETWEEN ACHIEVEMENT AND INTELLIGENCE TEST SCORES FOR CHARLESTON HIGH SCHOOL JUNIORS AND SENIORS

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BY

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Preliminary Statement

Tests and measurements of various kinds have played a far more important part in human history than is generally realized. One sociologist attributes the endurance of Chinese civilization to five factors, one of which was its highly organized examination system which began informally in 225 B.C. and was developed into a definite civil service examination by 29 B.C.[1] Testing has continued to be an important tool of many governments since that time because it can be used so easily as a means to conserve and reinforce the values of a society when education is controlled by the state.

In the United States the testing movement has developed rapidly since its beginnings in the early nineteen hundreds, but some of the problems that were apparent at that time continue to be of concern to today's educators. For example, the need to evaluate the relationship between intelligence and achievement has been felt in some degree since the recognition of individual differences among school children and the development of tests to measure both intelligence and achievement. Various schemes and formulas have been offered to give numerical expression to this relationship beginning as early as the nineteen thirties with the presentation of the concept of A. Q. (Accomplishment

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[1] C. C. Ross and Julian C. Stanley, Measurement in Today's Schools (New York: Prentice-Hall, Inc., 1954), pp. 27-28.

Quotient which did not prove to be an adequate measurement[2] for reasons which will be discussed later.

In their efforts to develop the full potential of all youth, concerned educators continue to seek some standard by which they may evaluate achievement in relation to the capacity to achieve. Users of achievement tests frequently wish to make an interpretation of test results for individuals and groups in relation to what has become known as "expectancy."[3] As this term is generally used, the expectancy level of a pupil's achievement is determined by one characteristic only - his level of intelligence. Therefore we have our so-called under-achievers, average achievers, and over-achievers, but we need to know more about background situations that affect test scores if we are to improve our understanding of the ways in which students acquire knowledge.[4]

Today there is increased interest in measurement in our schools. Much of this concern is due to the vast amount of federal funds currently being invested in education. It is only natural that the lawmakers who are being asked to vote ever-increasing appropriations for the improvement of education would eventually want some kind of assurance that the expenditure is producing results. This desire for assurance has provided a large part of the motivation for the development of a program

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[2]Blythe C. Mitchell, "A Comparison of the Achievement - Intelligence Relationship for Pupils With That for School Systems," The Journal of Educational Research, Vol. 57, No. 4 (December, 1963), pp. 172-180.

[3]Ibid.

[4]Ibid.

of national assessment which would set nation-wide standards for evaluating educational progress.[5] Any such program would very likely utilize the time honored intelligence - achievement relationship as a technique of evaluation; therefore, it would seem that an exploration of this relationship would be of particular value at this time.

Purpose of the Study

It is the purpose of this study to investigate the relationship between intelligence test scores and achievement test scores as they may be influenced by differences in sex and in school background in an entire school population - grades eleven and twelve. More specifically it is designed to:

1. Determine whether or not sex differences are reflected in intelligence and achievement test scores;
2. Determine whether or not differences in school background are reflected in intelligence and achievement scores;
3. Determine whether or not the above-mentioned differences or lack of differences are observable in the junior and senior classes studied;
4. Determine the correlation between intelligence test scores and each of ten separate areas of achievement test scores on the basis of grouping according to sex;
5. Determine the correlation between intelligence test scores and each of ten separate areas of achievement test scores on the basis of grouping according to school background;
6. Determine the correlation between intelligence test scores and each of ten separate areas of achievement test scores on the basis of grouping according to school class (junior or senior).

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[5]Ralph W. Tyler, "A Program of National Assessment," The Educational Forum, Vol. 30, No. 4 (May, 1966), pp. 391-396.

Delimitations of the Study

This study involved an entire population in that there was no random sampling. Scores were used for every junior and every senior registered at Charleston High School in 1966 for whom the necessary information was available; therefore, the designation junior class or senior class as used in this study indicates only those groups of eleventh and twelfth grade students for whom scores were available - not each class as a whole.

The designation junior student refers to any eleventh grade student whose scores were included in this study and who was enrolled in Charleston High School in 1966.

The designation senior student refers to any twelfth grade student whose scores were included in this study and who was enrolled in Charleston High School in 1966.

The designation Jefferson School student refers to any student whose scores were included in this study and who entered Charleston High School directly from Jefferson Junior High School. It does not refer to any student currently enrolled in Jefferson Junior High School.

The designation Laboratory School student refers only to a student whose scores were included in the study and who entered Charleston High School directly from the Buzzard Laboratory School of Eastern Illinois University. It does not refer to any student currently enrolled there.

The term intelligence test score as used in this study refers only to the I. Q. score yielded by the California Short Form Test of Mental Maturity.

The designation achievement test score refers only to a score yielded by the Iowa Tests of Educational Development.

Need for the Study

It is apparent that if local schools and school systems do not take steps to develop efficient methods of self-evaluation, private agencies or even the Federal government may develop or support a program of national assessment. The Carnegie Corporation, a private foundation in 1964, appointed an Exploratory Committee on Assessing the Progress of Education which is working on just such a program.[6] In the light of these developments, it is hoped that this study might contribute to the existing need for additional information regarding the effectiveness of the local curriculum as reflected in the scores of various groups which were studied.

Since it is expected that there may be considerable variation in group scores, it is hoped that the results of this study might provide information which would be useful in the development of local norms for more accurate evaluation.

Finally there is a never-ending need for increased understanding of the learning process, more effective teaching methods, better curriculum materials, and more effective testing programs. Since intelligence is a necessary adjunct to achievement, it is hoped that further investigation into this relationship might provide information of value in the above-mentioned areas of need or at the very least indicate areas in which further research is needed.

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[6] Ibid., p. 392.

CHAPTER II

REVIEW OF RELATED LITERATURE

Intelligence Testing

According to the authors of the California Short Form Test of Mental Maturity, the test is an instrument for appraising mental development or mental capacity, and it reveals information that is basic to any interpretation of present functioning and future potential in a relatively specific but critical area of human activities.[7] This information is of particular interest to teachers, counselors, and psychologists whose primary concern is the fullest possible development of the abilities of each student. The test samples mental processes in four areas: spatial relationships, logical reasoning, numerical reasoning, and verbal concepts.[8]

The test manual describes several ways in which the test may be of use to educators. It may be used as a screening device to locate students who have particular needs which could best be met in special classes. Counselors may find the information yielded by this test to be a measure of the level of academic training that students may be expected to achieve; therefore, it would be useful in curriculum planning.[9]

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[7]California Test Bureau, Manual for California Short-Form Test of Mental Maturity (Monterey, California, 1957), p. 2.

[8]Ibid.

[9]Ibid.

The authors also cite the usefulness of this particular test as a research tool. It is suggested that it could profitably be used in longitudinal growth studies, studies of over- and under-achievement and studies of variations in pupil performance caused by other factors with intelligence held constant.[10] It is for this purpose that the test is used in this study.

Achievement Testing

The Manual for School Administrators which describes the Iowa Tests of Educational Development contains some interesting material relative to achievement testing. According to the manual, the Iowa Tests of Educational Development were constructed to measure a number of highly general skills believed to be of lasting importance in adult life. They were not devised to serve as course examinations in various areas of the secondary school curriculum or as a basis for assigning high school grades. The value of the tests from an administrative standpoint is that they provide a fresh evaluation of student performance and an improved basis for a renewed attack on familiar problems.[11]

The problem of providing for individual differences in instruction, for example, is one to which competent administrators have always devoted a large share of their supervisory efforts. The tests provide a definite occasion for reconsideration by a teaching staff of the whole problem of individualization of instruction.

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[10] Ibid.

[11] Science Research Associates, The Iowa Tests of Educational Development Manual for School Administrators (Iowa State University, 1963), p. 19.

[12] Ibid.

One of the major purposes of the entire I.T.E.D. testing program is to assist administrators in the evaluation of the total educational program of individual schools and school systems. A full discussion of the application of test results is contained in the Confidential Summary Report which is prepared for each participating school.[13] To the writer this would seem to be one of the most useful features of any testing program.

It was interesting to note that the writers of the manual did not make extravagant claims regarding the validity of the tests. In fact, they rather surprisingly suggested that the test users are probably the best judges of the content validity and therefore should validate the tests by putting themselves in the student's place to actually take the test. In this way the user himself could decide what skills are demanded of his students and what proficiencies must be developed to obtain high scores. It is further suggested that administrators should compare local evaluations of test content with the judgment of competent, independent authorities so that local norms could be developed.[14]

To this writer's knowledge, no local norms have been developed for Charleston High School. It is possible that results of this study might help to indicate whether or not such norms are needed.

Intelligence and Achievement Test Score Relationships

In a study conducted in 1963 by Blythe C. Mitchell of the Test Department of Harcourt, Brace, and World Publishing Company, some

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[13] Ibid., p. 17.

[14] Ibid., p. 20.

interesting information in the area of intelligence - achievement test score relationships was produced. Three reasons were noted why such proposals as the previously mentioned Accomplishment Quotient have generally failed to meet some basic requirements for accurate evaluation and prediction. The following sources of error are involved:

1. There is often a lack of comparability of the paired achievement and intelligence measures. An educational age derived from age norms of an achievement battery may not be comparable with the mental age taken from an entirely different population.

2. The use of other types of relative measures (percentile ranks and stanine levels) does not afford proper comparison unless the ranks for achievement and for intelligence are based on the same reference population.

3. A requirement often ignored is the need to take account of the varying part that intelligence plays in the specific areas of achievement. Correlations with reading and science, for example, are generally found to be higher than those with spelling and arithmetic computation. The school that expects identical achievement in all subjects for a given level of intelligence is failing to take account of these differentiated relationships. The achievement expected or predicted for a given level of I. Q. must be established separately for each subject test in an achievement battery.[15]

On the basis of forty-eight regression equations which utilized paired intelligence and achievement test scores, Mitchell concluded that the achievement predicted from a given I. Q. is not significantly different for individuals or entire schools. He further suggests that under properly controlled testing conditions, the findings justify considerable confidence that the expectancy tables developed from pairings of pupil scores may quite properly be used for the same type of interpretation or evaluation of the average achievement of a school

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[15] Blythe C. Mitchell, op. cit., p. 179.

system, a school, or a class of students. With I.Q. as the predictive variable, the predicted achievement for individual pupils and for entire school systems was found to be not significantly different.[16]

Mitchell's findings, if verified by other researchers would be of great value to school administrators as they attempt to develop system-wide methods of evaluation because it appears that it would be possible to predict or evaluate educational progress for very large groups of students on the basis of scores obtained under very carefully controlled testing situations from small groups.

Sex Differences

The area of sex differences reflected in testing programs has been of interest to researchers and educators almost from the beginning of the testing movement. In 1927, E. A. Lincoln summarized the position at that time on the influence of sex differences on test scores when he noted that girls excel in arithmetic computation, but boys are better in arithmetic reasoning. Girls are somewhat better in reading rate, spelling and handwriting, but boys are better in history, geography, and definitely better in geometry.[17]

Later, Stroud and Lindquist using the Iowa Every Pupil Test of Basic Skills illustrated significant sex differences in achievement favoring girls in most of the areas studied,[18] but Broderick G. Bonser in a study done at Columbia University found that boys were superior

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[16] Ibid.

[17] Kenneth M. Parsley, Jr., "Are There Really Sex Differences in Achievements?," The Journal of Educational Research, Vol. 57, No. 4 (December, 1963), pp. 210-212.

[18] Ibid.

to girls in both arithmetic reasoning and arithmetic computation, and girls were superior in language ability.[19]

W. C. Olsen in his book, Child Development, published in 1959, cited a variety of sex differences in subject areas with superiority of neither sex clearly illustrated.[20]

More recently, Kenneth Parsley and his colleagues obtained some unusual results in the area of sex differences in testing using the California Reading Achievement Test, the California Arithmetic Test, and the California Test of Mental Maturity as the testing instruments for a population of 2,651 boys and 2,369 girls. These students were in grades two through eight in schools in a suburban community in Ohio, and the results obtained showed no significant differences between the sexes within any grade level for any of the achievement areas studied. The results of the analysis of the I.Q. performances showed no significant differences in intelligence for the two groups. Parsley's conclusion is that if sex differences do not really exist as demonstrated in this study, then the thinking of educators may need substantial revision.[21]

In 1963, Marian Wozencraft found a number of sex differences in test scores obtained from a selected population of third and sixth grade students. For this study, a probable learning rate was established on the basis of scores from the Kuhlmann-Anderson Test and the Cleveland Classification Test. The differences that resulted from these scores

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[19] Ibid.

[20] Ibid.

[21] Ibid.

favored girls rather than boys in all four test traits for both third and sixth graders when grouped separately and for the whole population.[22]

It would seem that in the area of research on sex differences in test performances there is almost no agreement regarding the effect of this factor.

Differences in School Background

Very little has been written regarding the influence of school background on test performances. It appears to be an area in which research is badly needed. Only one such study in this area could be located, and it dealt with the development of some experimental tests by John W. French. He used six experimental tests in different subject areas (science, social studies and humanities) and compared the results with the College Board Scholastic Aptitude Test. Students also were required to complete questionnaires describing their home and school backgrounds. Through a complicated system of weightings an attempt was made to determine the effect of home and school backgrounds on the test scores.[23]

It was concluded that the humanities tests had high correlations with reading and writing activities. The social studies tests were so highly verbal that they measured writing and general reading activity rather than experience specific to social studies. The general inference

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[22]Marian Wozencraft, "Sex Comparisons of Certain Abilities," The Journal of Educational Research, Vol. 57, No. 1 (October, 1963), pp. 211-217.

[23]John W. French, "The Relationship of Home and School Experiences to Scores on Achievement Tests," The Journal of Educational Psychology, Vol. 50, No. 2 (Spring, 1960), pp. 75-82.

drawn from this article is that when a test is to be evaluated in terms of its relationship to multiple experiences, useful information is extremely difficult to obtain.[24]

In reviewing the literature relative to intelligence and achievement testing, it is apparent that there is little or no agreement regarding the influence of sex differences or school background on test scores. Much research remains to be done in this area if we are to develop more meaningful measurement techniques.

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[24] Ibid.

CHAPTER III

PROCEDURES

The original purpose of this study was to investigate the relationship that exists between various descriptive materials found in the cumulative folders of students at Charleston High School, Charleston, Illinois. In an interview with Mr. Gail Borton, Principal, it was determined that these records had not been previously used for such a study, and permission was granted to gather the necessary data.

Upon examining the contents of the cumulative record folders, it was found that even though a number of tests had been administered, only two had been used consistently on a class-wide basis. They were the California Short-Form Test of Mental Maturity and the Iowa Tests of Educational Development; therefore, the study was limited to a consideration of scores from these tests only.

It was also noted that each class of students could be divided into sub-groups for the purpose of comparing test performances. One such division was on the basis of sex differences. Another was on the basis of differences in school background. Charleston High School is somewhat unique in that its students come from at least two distinct sources. The largest group comes from Jefferson Junior High School, Charleston's only junior high school. A second distinct group comes from the Laboratory School of Eastern Illinois University which offers courses only through grade nine. Since Charleston School is a

co-educational high school notations were made indicating the sex as well as the school background of each student whose scores were to be used in the study.

The information described above was gathered for two classes - the senior class of 1966 and the junior class of 1966. These two classes were chosen because both groups had participated in similar testing programs yielding scores which could be readily compared. The data was grouped as follows:

1. Male high school students
2. Female high school students
3. Students from Jefferson Junior High School
4. Students from Eastern Illinois University Laboratory School
5. Students from the junior class of 1966
6. Students from the senior class of 1966

Intelligence test scores used for the junior class are scores obtained when both the Jefferson school students and the Laboratory school students were in the seventh grade. For the senior class, intelligence test scores were obtained when the Laboratory school students were in the sixth grade and the Jefferson school students were in the ninth grade. In every instance the most recent score was used. The test score used in all cases was that yielded by the California Short-Form Test of Mental Maturity which provides a verbal score, a non-verbal score and a combined score. For this study only the combined score was used.

Achievement test scores for both the junior class and the senior class were obtained from individual profiles of the Iowa Tests of

Educational Development given when each class was in the eleventh grade. The Iowa Test profile yields scores in the following order:

1. Understanding of Basic Social Concepts
2. General Background in the Natural Sciences
3. Correctness and Appropriateness of Expression
4. Ability to do Quantitative Thinking
5. Ability to Interpret Reading Materials in Social Studies
6. Ability to Interpret Reading Materials in the Natural Sciences
7. Ability to Interpret Literary Materials
8. General Vocabulary
9. Composite Score
10. Use of Sources of Information

When the data described above had been gathered, it was discovered that the scores of a number of students were not usable either because the students had recently transferred to Charleston High School or because some scores were incomplete.

In the case of transfer students, no scores were used from students who had transferred either to the Laboratory School or to Jefferson School after the fifth grade. The fifth grade was chosen as a dividing point for the study because there were many transfers of students from schools in outlying areas such as Lerna and Loxa and also from some of the city schools to Jefferson School after the completion of the fourth grade. There were few such transfers thereafter largely because several of the above schools have classes only for grades one through four, and their students automatically enter Jefferson school for their fifth grade work.

There were also a number of transfers into the Laboratory School prior to the fifth grade but few after that year; therefore, all scores used were obtained from the records of students who had been enrolled for four continuous years in the same junior high school (either Jefferson School or the Laboratory School) and for four continuous years at Charleston High School.

It was also found that some profiles of the Iowa Test scores were incomplete. These were eliminated from consideration.

The total number of students in the junior class was 250. Of this total 160 scores were used and 90 were eliminated for reasons stated above.

The total number of students in the senior class was 187. Of this total 146 scores were used and 41 were eliminated.

When the information described above had been collected, it was transferred to IBM cards and processed by computer at the Data Processing Center at Eastern Illinois University.

The statistics obtained by computer processing were the Pearson product-moment correlation, a mean score, and the standard deviation according to the groupings as previously noted.

The Pearson product-moment correlation was used even though the I.T.E.D. scores were ranked scores because according to Guilford, "The rank-difference coefficient is practically equivalent to the Pearson product-moment coefficient."[25]

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[25] J. P. Guilford, Fundamental Statistics in Psychology and Education (New York: McGraw-Hill Book Company, 1950), p. 313.

CHAPTER IV

FINDINGS

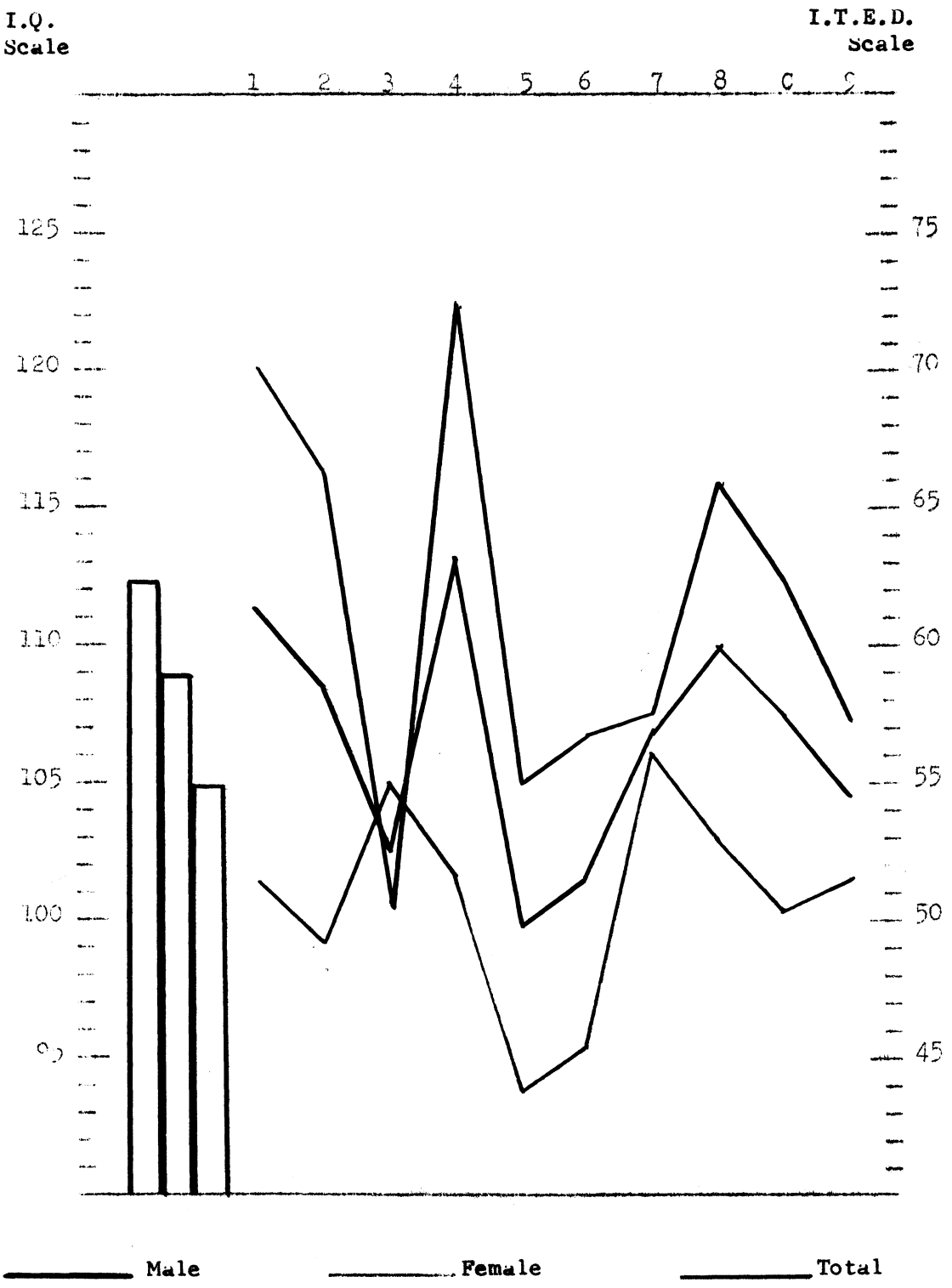
The stated purpose of this study is to investigate the relationships between intelligence test scores and achievement test scores as they may be influenced by differences in sex and in school background in an entire population = grades eleven and twelve.

After the correlation coefficients, mean scores, and standard deviations for the data had been obtained by computer processing, the information was recorded in two tables, appendix pages 51 and 52.

It should be noted that the standard deviation for each distribution of scores was large. The most frequent standard deviation was 25.5 for the achievement scores and 14.5 for the I.Q. scores.

The following graphs illustrate the statistical data which was obtained in the investigation.

Graph 1. A Comparison of Intelligence and Achievement Scores for Male and Female Seniors



Graph 1. A Comparison of Intelligence and Achievement Scores for Male and Female Seniors

There were 146 students in this group. Of this total 79 were male and 67 were female.

The I.Q. scores for senior class males and females fell within a range of seven points - from 104.9 for female students to 112.2 for male students with a class total of 108.9. It can therefore be seen that sex differences in I.Q. scores for this class are apparent though not extremely large. For purposes of comparison, it can be seen that the males ranked higher than both the females and the total class, and the females ranked lower than both the males and the total class.

The males appeared to perform at a higher level than the females in the following tests: Test 1, Understanding of Basic Social Concepts; Test 2, Background in Natural Science; Test 4, Quantitative Thinking; Test 5, Interpretation of Readings in Social Studies, Test 6, Interpretation of Readings in Natural Science; Test 7, Interpretation of Readings in Literature; Test 8, Vocabulary; "C", Composite Score; and, Test 9, Uses of Sources of Information.

Female students appeared to perform at a higher level than males only on Test 3, Correctness of Expression. On all other tests their (the females) scores fell below those of both the males and those of the total class.

When the two groups, males and females, are compared, it can be seen that in general, the males appear to have higher scores than the females in nine of the ten tested areas while the females had higher scores than the males in only one area. The same observation can be made when scores from the two groups are compared with the class total.

It can be seen that levels of the ten test areas for all three groups follow a similar pattern from test to test except in the cases of Test 3, Correctness of Expression, which shows a significant variation, and Test 9, Uses of Sources of Information, where the variation is so slight as to be of small significance.

The spread of scores is relatively widest on Tests: 1, 2, 4, 5, 6, 8, and the Composite Score. The closest association of scores can be observed on Tests: 3, 7, and 9. Therefore, it could be said that the greatest differences in performances (favoring male superiority in every case) appear on Tests:

1. Understanding of Basic Social Concepts
2. Background in Natural Science
4. Quantitative Thinking
5. Interpretation of Readings in Social Studies
6. Interpretation of Readings in Natural Science
8. Vocabulary

"C" Composite Score

The smallest difference in spread of scores can be observed on Tests:

3. Correctness of Expression
7. Readings in Literature
9. Uses of Sources of Information

It appears that male students in the senior class performed at significantly higher levels than did the female students. One possible explanation for this situation lies in the fact that no scores from students enrolled in the Diversified Occupations course are included. Students in this course attend classes at the high school for half of the school day, and they are employed for the other half day. Since a full day is required for administration of the Iowa Tests of Educational Development, these students were able to take only half of the tests; therefore, their scores could not be used because complete scores are required for computer processing. Since a majority of the students in

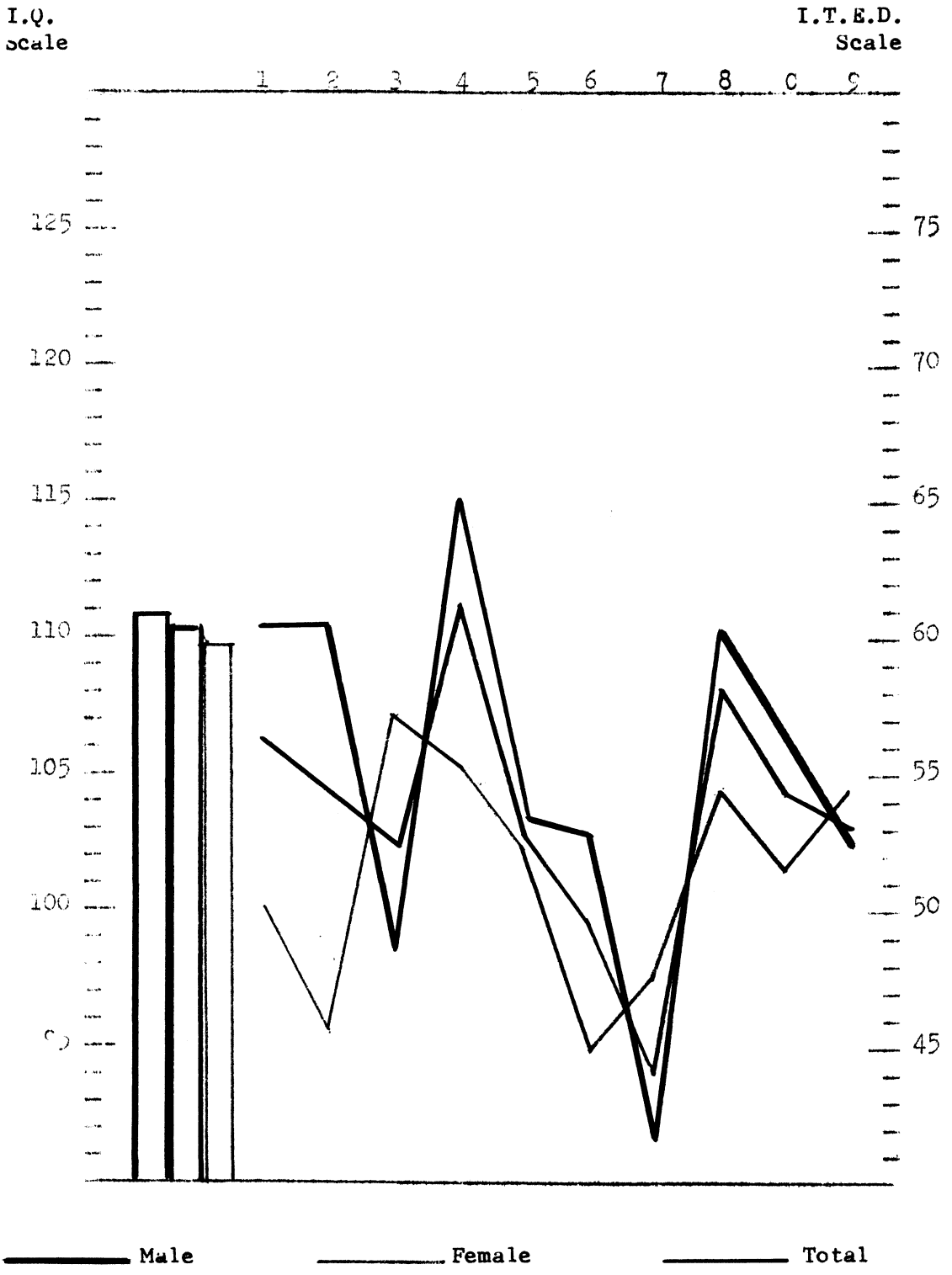
the Diversified Occupations program are males who are not following the college preparatory curriculum, the absence of their scores in the data may have had an inflationary effect upon the scores of the male students.

The observed superiority of male seniors in the area of quantitative thinking supports the observations of earlier researchers as previously noted, but superiority in the areas of basic social concepts and vocabulary may be local phenomena. The same superiorities exist among the junior class male students although the differences between male and female performances are not so large as they are in the senior class.

The observed superiority of female seniors in the area of correctness of expression also supports earlier research; however, the low level of their performance in the area of vocabulary is difficult to understand since it might be assumed that vocabulary would be closely associated with correct expression. Further statistical evaluation would be required to accurately describe or account for factors which produce this kind of unexpected variation.

A similar pattern of performances and sex differences can be observed in the following graph which illustrates data obtained for the junior class.

Graph 2. A Comparison of Intelligence and Achievement Scores for Male and Female Juniors



Graph 2. **A Comparison of Intelligence and Achievement Scores for Male and Female Juniors**

There were 160 students in this group. Of this total 96 were male and 64 were female.

The I.Q. scores for junior class males and females were 110.8 and 109.7, respectively - a difference of 1.1. It can therefore be seen that sex differences in I.Q. scores for this class are negligible.

The males appeared to perform at a higher level than the females in the following tests: Test 1, Understanding of Basic Social Skills; Test 2, Background in Natural Science; Test 4, Quantitative Thinking; Test 6, Interpretation of Readings in Natural Science; Test 8, Vocabulary, and "C", Composite Score.

Female students appeared to perform at a higher level than males on tests: Test 3, Correctness of Expression, and Test 7, Interpretation of Readings in Literature.

Scores for Test 5, Interpretation of Readings in Social Studies, and Test 9, Uses of Sources of Information, were so closely grouped as to make the small sex differences of little significance.

When the two groups, males and females, are compared, it can be seen that in general, male students appear to have higher scores than female students in seven of the ten test areas while female students have higher scores than the males in only three areas. The same observation can be made when scores from the two groups are compared with the class total.

It can be seen that levels of the ten test areas for all three groups follow a similar pattern from test to test except in the case of

Test 3, Correctness of Expression; Test 4, Quantitative Thinking; Test 7, Readings in Literature; and, Test 9, Uses of Sources of Information, where the variation is small.

The spread of scores is relatively widest on Tests: 1, 2, 3, 4, 6, and 8. The closest association of scores can be observed in tests: 5, 7, 9, and the Composite Score. Therefore, it could be said that the greatest differences (favoring male superiority in every case) appear on tests:

1. Understanding of Basic Social Concepts
2. Background in Natural Science
4. Quantitative Thinking
6. Interpretation of Readings in Natural Science
8. Vocabulary

The smallest difference in spread of scores can be observed on tests:

5. Interpretation of Readings in Social Studies
7. Readings in Literature
"C" Composite Score
9. Uses of Sources of Information

It appears that male students in the junior class performed at higher levels than did the female students although they did not surpass female students in as many areas or to as great an extent as did the senior male students. One possible explanation may lie in the fact that scores from students in the Diversified Occupations program did not have to be eliminated from consideration for reasons previously noted. It will be noticed that there are 17 additional scores for junior male students than for senior male students in the study while there are two fewer scores for female junior students than for female seniors. This might also help to account for the closer association of scores for junior class students than can be observed for seniors.

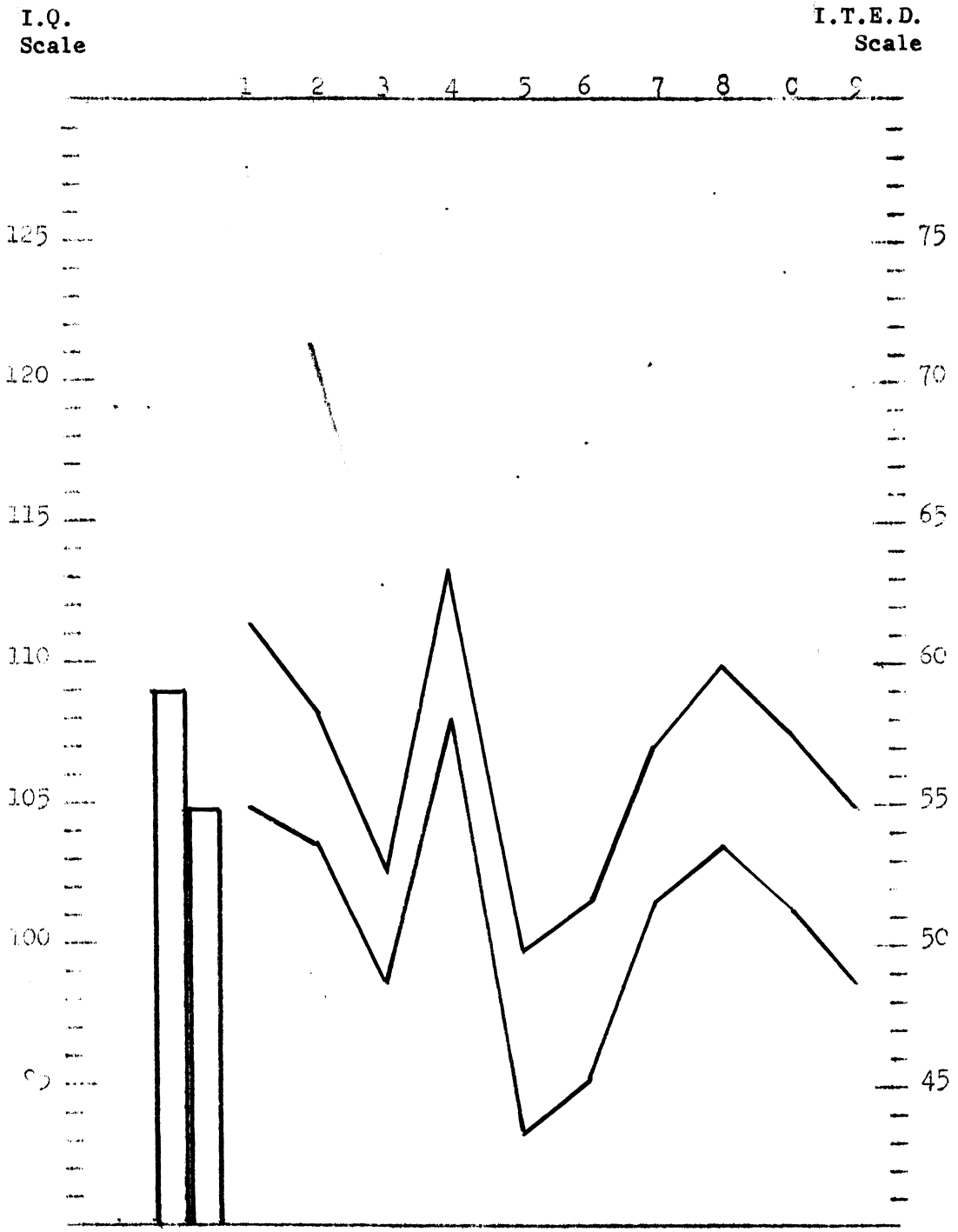
The noticeable superiority of male juniors in the area of quantitative thinking again supports the observations of earlier researchers previously noted, but superiority in the areas of basic social concepts, background in natural science, quantitative thinking, and vocabulary may be local differences. Similar superiorities exist in the senior class and they are more pronounced than in the junior class.

The observed superiority of female seniors in the area of correctness of expression also supports earlier research, and their relatively higher level performance in the area of interpreting readings in literature is not unexpected since we might assume that a relationship exists between skills in the area of correct expression and literary skill; however, it is difficult to understand the lower level of their performance on the vocabulary test. Here again, additional statistical study is needed to help explain the variation.

Two important variations in the pattern of scores for the junior class and the senior class deserve mention. First, the senior class showed a wide range of scores on Test 5, Interpreting Readings in Social Studies. The range was from a high male score of 54.9 to a low female score of 43.7. Junior class scores for the same test were grouped closely with a high male score of 53.1 and a slightly lower female score of 52.1. It would appear that the junior class showed greater strength on this test than did the senior class, but it should be noted that the class totals for the two groups were: 52.7 (juniors) and 49.8 (seniors) - a relatively small difference which places our observations in more accurate perspective.

The second area of variation between the two classes can be observed in the very low performances of both male and female junior students on Test 7, Interpretation of Readings in Literature. A similar low performance is not apparent in the graph of senior student performances, and it cannot be explained by comparing the class totals because the senior class total is 56.8 and the junior class total is 43.9 - still a sizeable difference. Further statistical study would be required to account for this variation.

Graph 3. A Comparison of Intelligence and Achievement Scores for Seniors According to School Background



Graph 3. A Comparison of Intelligence and Achievement Scores for Seniors According to School Background

There were 146 students in this group. Of this total 41 entered Charleston High School from the Laboratory School of Eastern Illinois University and 105 entered Charleston High School from Jefferson Junior High School.

A significant difference in I.Q. scores for the two groups is apparent. The actual I.Q. score for Laboratory School students is 119.2 while the actual I.Q. score for Jefferson School students is 104.8 - a difference of approximately 14 points. One possible explanation for this notable difference in scores (which was nearly the same for junior class students) lies in the fact that a majority of the Laboratory School students are children from Eastern Illinois University faculty families. Therefore, it might be supposed that the academically oriented environment of these children was an influential factor. Although some children from faculty families attend Jefferson School, they are a minority group when compared with the large variety of occupational groups represented by children attending Jefferson School.

It can be seen that the Laboratory School students performed at a significantly higher achievement level than did the Jefferson School students; however, this would be expected as a result of the higher Laboratory School I.Q. level.

It can also be seen that the pattern of achievement score levels is the same for both groups. Neither group showed significant superiority or inferiority in any test area. Both groups showed highest

performance levels on Test 1, Understanding of Basic Social Concepts; Test 4, Quantitative Thinking; and, Test 8, Vocabulary. Lowest levels of performance for both groups can be observed on Test 3, Correctness of Expression; Test 6, Readings in Natural Science; and, Test 9, Uses of Sources of Information.

Graph 4. A Comparison of Intelligence and Achievement Scores for Juniors According to School Background

There were 160 students in this group. Of this total 36 entered Charleston High School from the Laboratory School of Eastern Illinois University, and 124 entered Charleston High School from Jefferson Junior High School.

A significant difference in I.Q. scores for the two groups is apparent. The actual I.Q. score for Laboratory School students is 121.0 while the actual I.Q. score for Jefferson School students is 107.27 - a difference of approximately 14 points. One possible explanation for this notable difference in scores (which was nearly the same for senior class students) lies in the fact that a majority of the Laboratory School students are children from Eastern Illinois University faculty families. Therefore, it might be supposed that the academically oriented environment of these children was an influential factor as previously noted with regard to senior students.

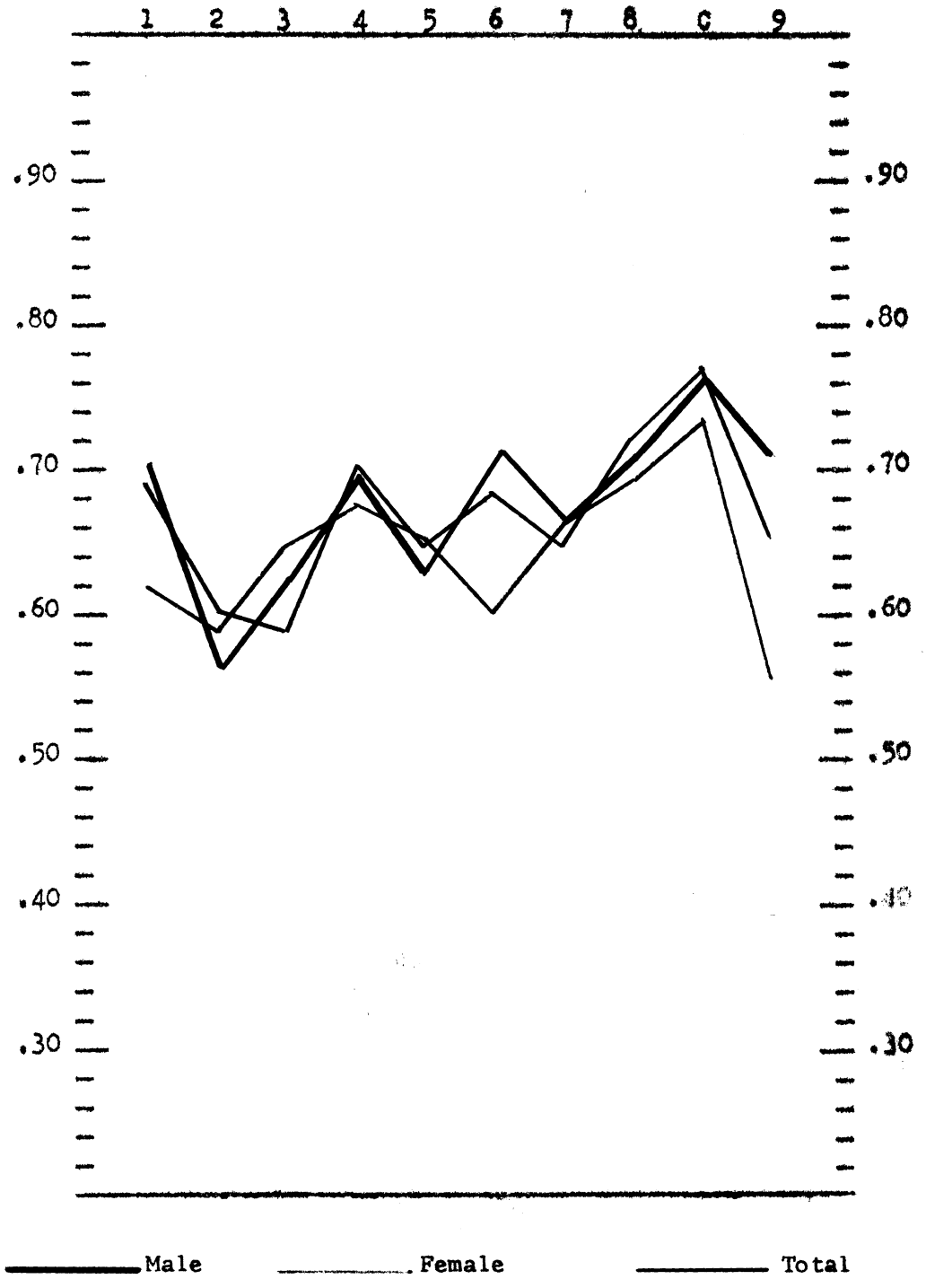
It can be seen that the Laboratory School students again performed at a significantly higher achievement level than did the Jefferson School students; however, this might be expected as a result of the higher Laboratory School I.Q. level.

Both groups had relatively high levels of performance on Test 4, Quantitative Thinking and Test 8, Vocabulary. Lowest performance levels for both groups can be observed for Test 6, Interpretation of Readings in Natural Science and Test 7, Interpretation of Readings in Literature. It should be noted that Test 7 produced the lowest level of performances recorded in any of the test areas. Similar performances on this test are not apparent in the senior class scores.

High performance levels in the areas of quantitative thinking and vocabulary might well be related to the higher number of male students in both the junior and senior classes. There were 12 more males than females in the group of senior class students and 32 more males than females in the group of junior class students.

Variations in levels of test scores may be noted on Test 1, Understanding Basic Social Concepts; Test 2, Background in Natural Science; Test 3, Correctness of Expression; and, Test 9, Uses of Sources of Information. Additional mathematical computation would be necessary for accurate evaluation of the significance of these variations.

Graph 5. Correlation Coefficients for Intelligence and Achievement Scores for Male and Female Seniors



Graph 5. Correlation Coefficients for Intelligence and Achievement Scores for Male and Female Seniors

A strong, positive correlation between intelligence and achievement test scores would normally be expected for any group since the usual assumption is that highly intelligent students have corresondingly high levels of achievement and students who have low intelligence correspondingly have low levels of achievement. This observation seems to be well supported in the data obtained for male and female senior students.

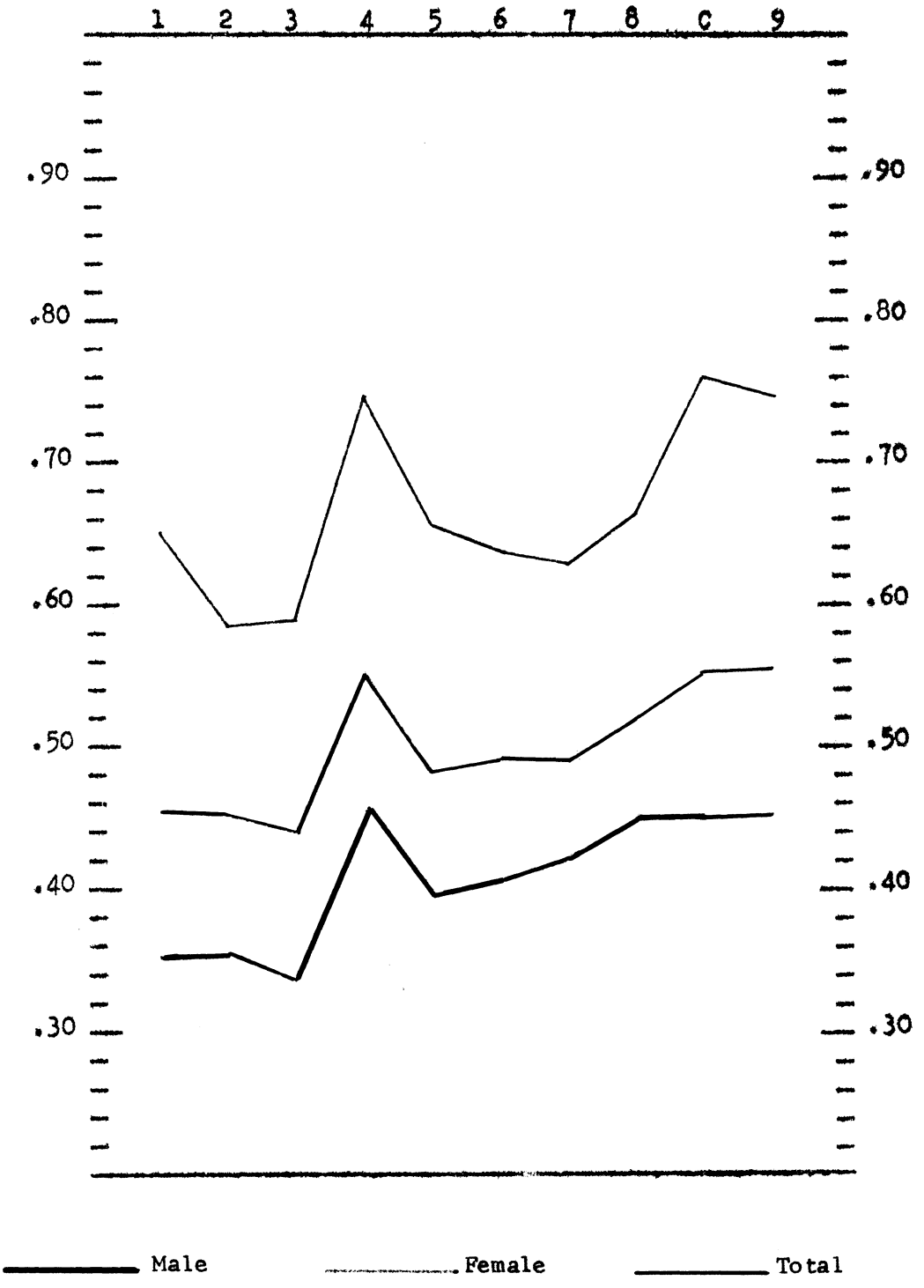
Correlation coefficients for both males and females are closely associated in every test area except Test 6, Interpretation of Readings in Natural Science and Test 9, Uses of Sources of Information. A high, positive correlation between intelligence and achievement in these two test areas is shown for both sexes; however, the correlation appears to be considerably higher for males than for females.

Graph 1 shows that interpretation of readings in natural science is an area in which female seniors had low levels of performance; only Test 5 was lower. It might be assumed that since Test 6 was a low performance area for female seniors and it also showed a lower correlation coefficient than some of the other test areas, some factor other than intelligence has a strong influence on test performance. It could be that fewer girls than boys enroll in natural science courses; therefore, even intelligent female students might lack the background necessary to interpret readings in this field.

In the case of Test 9, Uses of Sources of Information, it might again be assumed that some factor other than intelligence is depressing

the correlation for female students. Since Graph 1 shows a relatively high level of performance for this group on Test 9, it might be that a factor such as familiarity with resource materials has more influence on test performances than does intelligence for this particular test area.

Graph 6. Correlation Coefficients for Intelligence and Achievement Scores for Male and Female Juniors



Graph 6. Correlation Coefficients for Intelligence and Achievement Scores for Male and Female Juniors

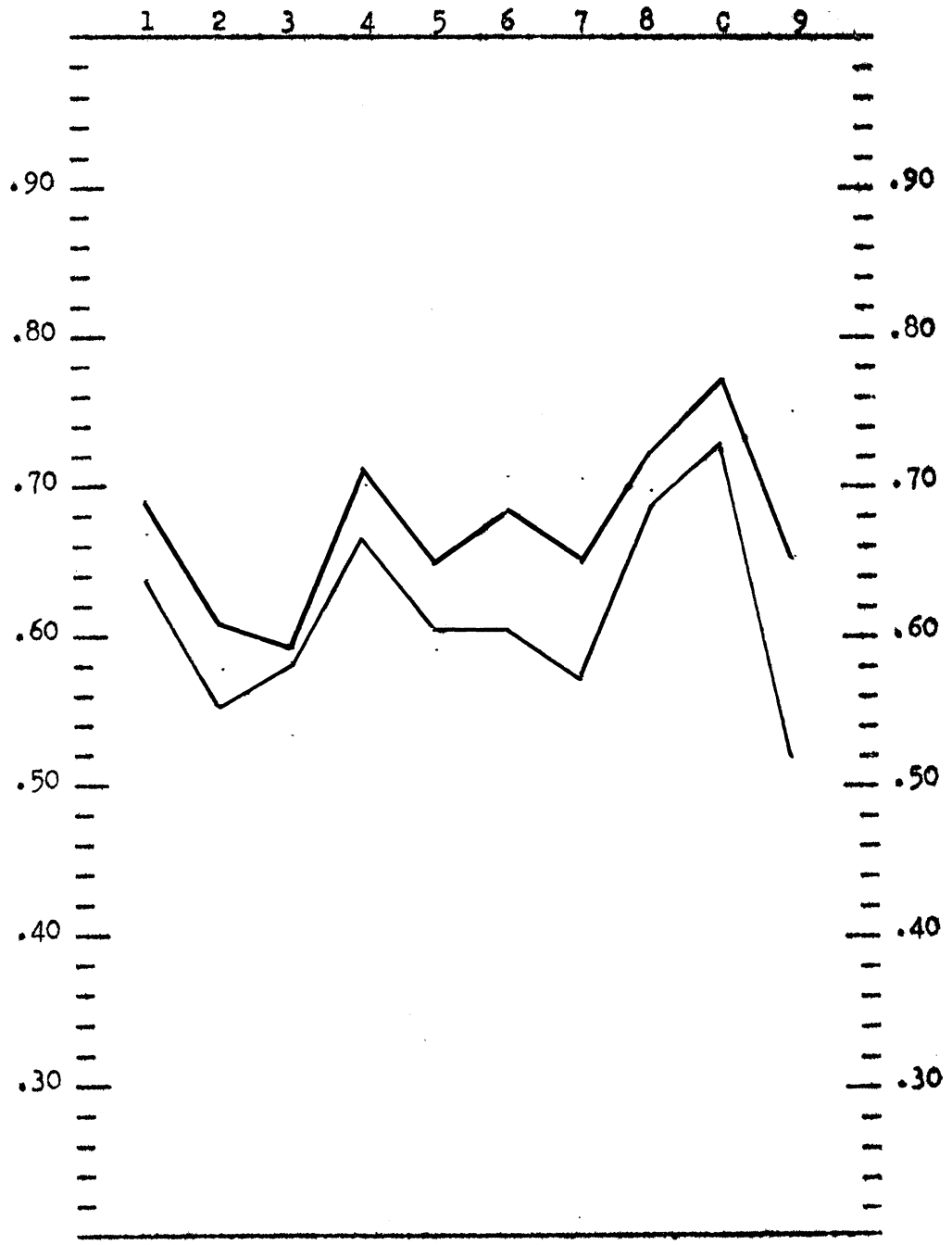
The strong, positive correlation between intelligence and achievement test scores that might normally be expected was not obtained for this distribution of scores. It can be seen that there was a strong, positive correlation obtained for the scores of female students, but a weak, positive correlation was shown for male students.

The range of correlation coefficients is unusually large with the correlations for males falling much lower than would be expected in view of their relatively high level of achievement test performance. The widest range appears in the Composite Score for which the actual range is .32. Such a situation could occur when within a distribution of scores, one large group performs according to expectation - that is, students who have high I.Q. scores also have high achievement scores, and students who have low I.Q. scores also have low achievement scores. When there is also within the distribution a group of similar size in which the students produce scores which are in direct opposition to expectation - that is, students who have high I.Q. scores produce low achievement scores and students who have low I.Q. scores produce high achievement scores, then unusual or very low, positive correlation coefficients may result. This is one possible explanation for the unusual variations shown in this graph.

The pattern of score levels from test to test is similar for both male and female students. Both groups showed highest correlations between intelligence and achievement scores for Test 4, Quantitative Thinking and the Composite Score. This closely approximates the data obtained for the senior class.

It should also be noted that correlation coefficients for female junior students fell within the same general range and followed a pattern similar to that of the female senior students. Only the male junior students fell far below the expected level of correlation. Additional mathematical computation would be needed to account more accurately for this variation.

Graph 7. Correlation Coefficients for Intelligence and Achievement Scores for Seniors According to School Background



Laboratory School _____ Jefferson School _____ Total

Graph 7. Correlation Coefficients for Intelligence and Achievement Scores for Seniors According to School Background

Strong, positive correlations existed between intelligence and achievement test scores for senior students on Test 1, Understanding of Basic Social Concepts; Test 4, Quantitative Thinking; Test 8, Vocabulary; and the Composite Score.

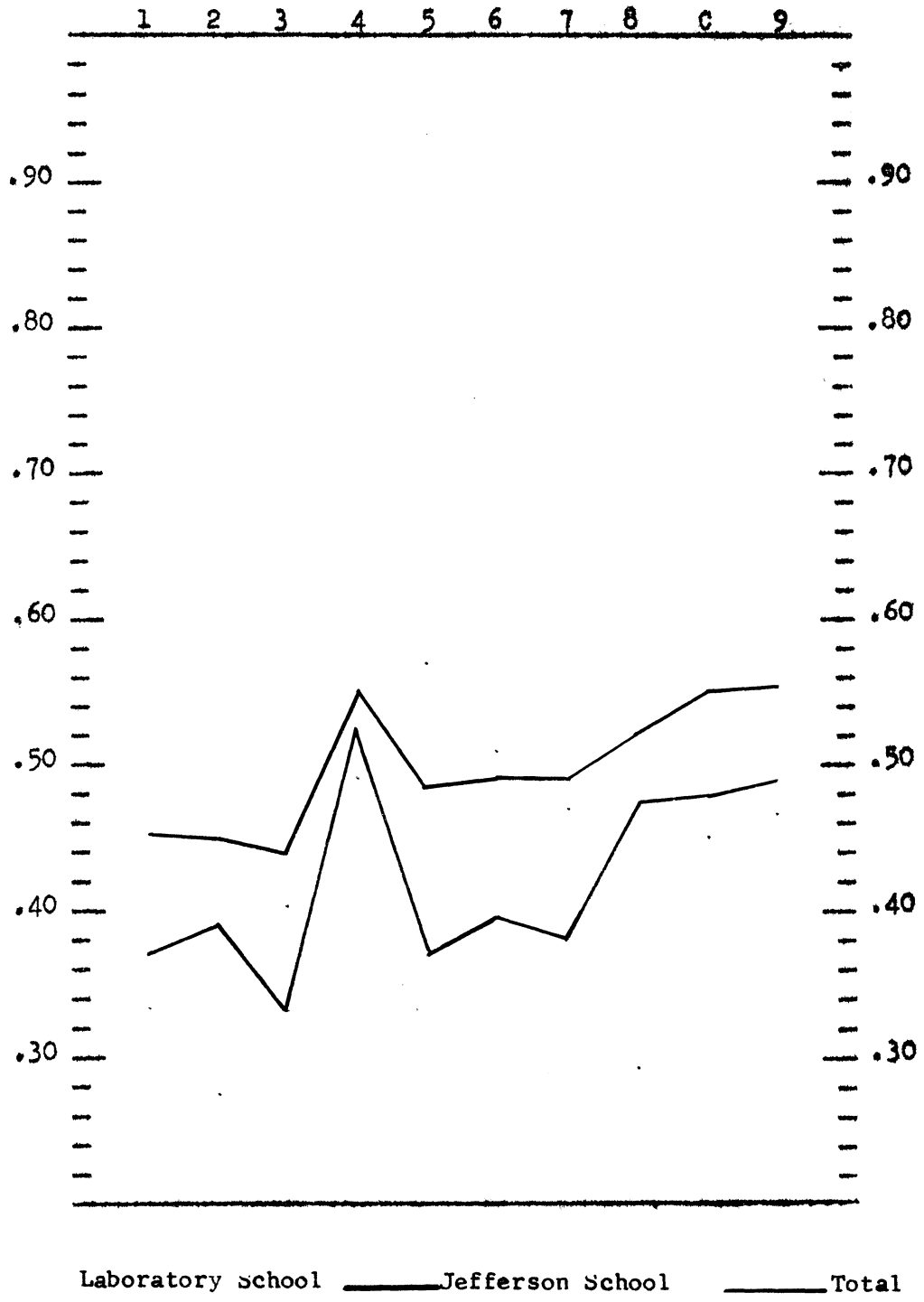
Correlation coefficients for both Laboratory School students and Jefferson School students are closely associated in all test areas except Test 6, Interpretation of Readings in Natural Science; Test 7, Interpretation of Readings in Literature; and, Test 9, Uses of Sources of Information. A similar wide range for correlation coefficients for Test 6 can be seen on Graph 5, which would suggest the possibility that the factor or factors operating to produce the noticeably wide range are associated with sex differences and also with differences in school background. The wide range recorded for Test 7, is not apparent in the graph which illustrates sex differences. This would suggest that the responsible factor or group of factors are primarily associated with differences in school background. The wide range obtained for Test 9, Uses of Sources of Information, closely approximates the range for the same test found on Graph 5, which would again indicate the possibility of influential factors relating both to sex differences and to differences in school background.

The pattern of correlation levels from test to test is similar both for Laboratory School students and Jefferson School students. Both groups showed highest correlations between intelligence and achievement scores for Test 1, Understanding of Basic Social Concepts;

Test 4, Quantitative Thinking; Test 8, Vocabulary; and the Composite Score.

In general, the correlation coefficients shown in this graph for senior class students divided according to school background, fell within a narrower range and occurred at significantly higher, positive levels than did similar scores for junior class students.

Graph 8. Correlation Coefficients for Intelligence and Achievement Scores for Juniors According to School Background



Graph 8. Correlation Coefficients for Intelligence and Achievement Scores for Juniors According to School Background

Correlation coefficients for intelligence and achievement test scores for junior class students were positive in all test areas, but they were much weaker than were similar scores for senior class students. These low correlation coefficients are not entirely unexpected in view of similar low correlations noted for junior class males on Graph 6.

Correlation coefficients for Laboratory School students and Jefferson School students were most closely associated for Test 4, Quantitative Thinking; Test 9, Uses of Sources of Information; and, the Composite Score. The widest range for correlation coefficients is recorded for Test 5, Interpretation of Readings in Social Studies, and a similar wide range can be observed for Test 8, Vocabulary. For both of these tests the correlations recorded for Laboratory School students were among the lowest recorded on any of the graphs. Since we have already observed that Laboratory School students produced significantly higher I.Q. scores than did Jefferson School students, we may assume that some factor or factors related to differences in school background is operating to depress the correlation levels.

Similar wide ranges in correlation levels are not present on Graph 7, which illustrates similar data for the senior class. In fact, some of the wide ranges seen on Graph 8 occur for tests in which the range was quite narrow on Graph 7. For example, the widest range for any test on Graph 8 is recorded for Test 8, Vocabulary. On Graph 7, it can be observed that the coefficients of correlation for Test 8 fall

within a one point range. Therefore, it may be assumed that some factor or factors unique to the junior class are operating to produce this unexpected variation.

It is also interesting to note that there is little similarity in the pattern of correlation levels from test to test for Laboratory School and Jefferson School students.

It is apparent that correlation coefficients produced for junior class students showed unexpected variations when the class was divided according to sex differences and differences in school background. Some possible causes for these variations have been suggested, but further mathematical computation would be needed for accurate isolation and evaluation of the factors involved.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to investigate the relationship between intelligence test scores and achievement test scores as they may be influenced by differences in sex and in school background in an entire school population - grades eleven and twelve. It was specifically designed to:

1. Determine whether or not sex differences are reflected in intelligence and achievement test scores;
2. Determine whether or not differences in school background are reflected in intelligence and achievement test scores;
3. Determine whether or not the above-mentioned differences are observable in junior and senior classes studied;
4. Determine the correlation between intelligence test scores and each of ten separate areas of achievement test scores on the basis of grouping according to sex;
5. Determine the correlation between intelligence test scores and each of ten separate areas of achievement test scores on the basis of grouping according to school background;
6. Determine the correlation between intelligence test scores and each of ten separate areas of achievement test scores on the basis of grouping according to school class (Junior or Senior).

The investigation was conducted with the hope that it might contribute information regarding the effectiveness of the local curriculum, provide information that would be useful in the development of local norms, contribute to an increased understanding of the learning processes

of a particular group of students; provide useful information relative to the high school testing program, and indicate areas in which further research is needed.

Conclusions

For the area of sex differences in the relationship of intelligence to achievement, it was found that male students in both the junior and senior classes had significantly higher scores for Test 1, Understanding of Basic Social Concepts; Test 2, Background in Natural Science; and, Test 4, Quantitative Thinking. Female students in both classes had significantly higher scores than male students only for Test 3, Correctness of Expression.

Differences in school background were observed primarily in the area of I.Q. scores. Laboratory School students had I.Q. scores that were approximately 14 points higher than those of Jefferson School students for both of the classes studied. Therefore, it was not unexpected that Laboratory School students consistently had higher performance levels in every test area for which scores were studied in both the junior and senior classes.

It should also be noted that no significant differences were observed in the pattern of levels of achievement performance for Laboratory School students and Jefferson School students. That is, neither group showed a marked superiority or inferiority in any test area.

Several differences were observed when the performance of an entire class was evaluated. For example, junior class males and females had unusually low performance levels for Test 7, Interpretation of Readings

in Literature. They were unusual in that the levels were considerably below levels for the same test noted in the senior class data, and the senior class showed a much wider range of sex differences in performance levels for each test than did the junior class. Also, senior class students showed lowest performance levels on Test 5, Interpretation of Readings in Social Studies.

Correlation coefficients for male and female senior students were closely grouped except for Test 6, Readings in Natural Science, and Test 9, Uses of Sources of Information. For both of these tests lower correlations between intelligence and achievement are shown for female students.

The correlation coefficients for senior Laboratory School students and Jefferson School students fell within a relatively narrow range for all tests except Test 7, Interpretation of Readings in Literature; and, Test 9, Uses of Sources of Information. For Test 7, the difference is not large enough to be of great significance. For Test 9, the actual difference in correlation coefficients is .23 which would indicate the presence of some unexplained variations which produced a lower correlation between intelligence and achievement for Jefferson School students on this test.

The junior class distribution of correlation coefficients for male and female students contains some unusual variations which could be fully described only with further statistical investigation. In this distribution, it can be seen that the range of correlation coefficients is unusually large with the correlations for male students falling much lower than would normally be expected in view of their relatively high

achievement test performances. The widest range is shown in the Composite Score for which the actual range is .32. For other groups correlation coefficients for the Composite Score have fallen with a rather narrow range.

Unexpected variations can also be observed in the distribution of coefficients of correlation for Laboratory School and Jefferson School students in the junior class. For Test 5, Interpretation of Readings in Social Studies, and Test 8, Vocabulary, the correlations recorded for Laboratory School students are the lowest recorded in any of the correlation distributions.

The appearance of several unexpected variations in the distribution of correlation coefficients for junior class students indicates a need for further statistical study designed to isolate and evaluate the factors involved.

Finally, it is the opinion of the writer that cumulative student records offer endless opportunities for investigations similar to the one here concluded. It is hoped that this study will be a useful contribution to educational knowledge or at least a stimulus to further educational research.

APPENDIX

Table 1

INTELLIGENCE AND ACHIEVEMENT TEST SCORES FOR SENIORS AND JUNIORS OF CHARLESTON HIGH SCHOOL

	SIZE OF GROUP	I.Q. SCORES	I.T.E.D. TESTS 1	2	3	4	5	6	7	8	C*	9
SENIORS												
TOTAL	146	108.89	61.36	58.44	52.66	63.04	49.81	51.48	56.89	59.97	57.52	54.56
MALE	79	112.21	70.01	66.39	50.72	72.60	54.97	56.79	57.67	65.96	63.67	57.13
FEMALE	67	104.98	51.16	49.07	54.95	51.76	43.73	45.22	55.98	52.92	50.26	51.52
JEFFERSON	105	104.85	54.95	53.43	48.67	57.98	43.28	45.12	51.58	53.38	51.10	48.61
LAB. SCHOOL	41	119.24	77.78	71.26	62.87	76.00	66.53	67.78	70.51	76.87	73.95	69.78
JUNIORS												
TOTAL	160	110.36	56.27	54.47	52.51	61.13	52.75	49.66	43.98	58.00	54.42	53.08
MALE	96	110.81	60.40	60.58	48.65	65.05	53.18	52.84	41.53	60.36	56.29	52.13
FEMALE	64	109.70	50.07	45.31	57.56	55.26	52.10	44.98	47.67	54.46	51.62	54.51
JEFFERSON	124	107.27	50.15	50.56	47.01	57.62	47.29	44.62	37.35	51.93	48.53	46.52
LAB. SCHOOL	36	121.02	77.36	67.94	70.13	73.25	71.58	67.00	66.83	78.91	74.72	75.69

*Composite Score

Table 2

CORRELATION COEFFICIENTS OF INTELLIGENCE TEST SCORES AND ACHIEVEMENT TEST SCORES FOR SENIORS AND JUNIORS OF CHARLESTON HIGH SCHOOL

I.T.E.D. TEST NUMBERS	1	2	3	4	5	6	7	8	C*	9
SENIORS										
TOTAL	.691	.602	.592	.708	.655	.686	.650	.720	.768	.649
MALE	.706	.557	.623	.697	.626	.716	.665	.711	.765	.711
FEMALE	.619	.590	.646	.674	.658	.600	.663	.694	.736	.557
JEFFERSON	.637	.555	.582	.665	.603	.604	.569	.683	.734	.517
LAB. SCHOOL	.671	.576	.530	.710	.587	.707	.703	.695	.733	.749
JUNIORS										
TOTAL	.452	.423	.417	.553	.482	.487	.487	.519	.551	.554
MALE	.347	.351	.335	.449	.394	.404	.419	.445	.440	.446
FEMALE	.654	.584	.591	.748	.656	.637	.625	.662	.760	.752
JEFFERSON	.369	.388	.325	.517	.370	.394	.380	.468	.478	.488
LAB. SCHOOL	.366	.269	.402	.492	.570	.510	.468	.287	.450	.465

*Composite Score

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