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THE RELATIONSHIP OF PROGRAM AND STUDENT VARIABLES TO STUDENT ACHIEVEMENT IN SELECTED VOCATIONAL TRADE AND INDUSTRIAL EDUCATION PROGRAMS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By
George Carl Kosbab, B.S. in Educ., M.A.

* * * * *

The Ohio State University
1977

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Sincere appreciation is expressed to Dr. Robert M. Reese for his continual support and guidance throughout this study.

The deepest of gratitude is expressed to my wife, Shirley, and my sons, Steven and Kenneth, for their love and understanding during these years of study.
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PUBLICATIONS


"Local Educational Agency Planning," EPDA Project #72052, The Ohio State University, 1972.

"Development of and Training in the Use of Local Educational Agency Planning by State Staff," EPDA Project #74012, The Ohio State University, 1974.
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CHAPTER I
INTRODUCTION

When the National Defense Education Act of 1958 was passed by Congress, considerable emphasis and interest was focused upon guidance and testing services. During the same year, the Ohio Trade and Industrial Education Services of the State Department of Education, Division of Vocational Education, became interested in achievement testing for purposes of program improvement. In 1958, local supervisors of trade and industrial education programs made demands for instruments to measure student achievement in the vocational program.

The demands were directed to Dr. Byrl R. Shoemaker, then the State Supervisor of Trade and Industrial Education, who appointed Mr. William Berndt and Mr. William K. Dunton to develop an achievement test for Machine Trades. These two individuals organized a test development committee, and with the assistance of personnel located at The Ohio State University, developed a machine trades achievement test in 1958 which was administered to 508 machine trades seniors in Ohio secondary vocational programs. Since 1958, tests have been developed for eleven additional occupational programs; and in 1969, 179 schools in eleven states administered the tests to 13,661
students of which 8,202 were in Ohio. The following nine occupational tests were used in this study:

1. Ohio Auto Body Achievement Test
2. Ohio Automotive Mechanics Achievement Test
3. Ohio Basic Electricity Achievement Test
4. Ohio Basic Electronics Achievement Test
5. Ohio Cosmetology Achievement Test
6. Ohio Machine Trades Achievement Test
7. Ohio Mechanical Drafting Achievement Test
8. Ohio Printing Achievement Test
9. Ohio Welding Achievement Test

This writer was privileged to serve as Consultant, Testing and Research, for the Trade and Industrial Education Service from March 1964 through August 1970. As a result of working with the development of five achievement tests plus a major revision of the Ohio Automotive Mechanics Achievement Test in 1969, a keen interest has been maintained in the testing program and its implications for research and program improvement.

Throughout the growth of the Achievement Test Program, there was continual focus on the objectives of the testing program. The Ohio Trade and Industrial Education Services (1970) asked Mr. Harry F. Davis, Assistant Director of Vocational Education, Trade and Industrial Education Service, to identify the goals of the Achievement Test Program. He stated:

The Trade and Industrial Education Achievement Test Program has proven to be a most effective tool for improving instruction. It is a
unique and valuable tool for school administrators, supervisors, teachers, and guidance counselors working in a vocational program of instruction.

The purpose of the Achievement Test Program is outlined by the following eight goals:

1. to help determine if the objectives of instruction have been achieved
2. to provide motivation for students and teachers
3. to provide a basis for reviewing the curriculum and improving instruction
4. to identify facility and equipment deficiencies
5. to assist in the process of supervision
6. to help identify strengths and weaknesses of the student
7. to help identify strengths and weaknesses of the instructor
8. to help evaluate reference materials.

These objectives have focused upon the values of achievement testing for local directors and supervisors of vocational education since the primary function of supervision is to improve instruction. One of the most significant uses of the achievement test results and the data which have been generated by the test scores was the implementation of statewide research studies. Such studies should assist state directors and supervisors, teacher educators, and local school administrators and supervisors in the improvement, development, and expansion of vocational education.
The Problem

The primary purpose of this study was to investigate program variables and student variables which may have a relationship to student achievement. More specifically, the program variables investigated were the length of instructional time and the type of school districts which offer vocational trade and industrial education programs. Student variables such as mental ability, arithmetic achievement, and chronological age were incorporated into the study.

In 1970, statewide normative data were generated for the use of all types of programs and school districts which led this researcher to study the relationships program variables have with the achievement level of the students served. Although norms have been published for both junior and senior grade levels, no attempt has been made through the Achievement Test Program offered by the Ohio Trade and Industrial Education Service to examine the maturity of the students being tested by considering the chronological age of students.

This study was to accomplish the following goals which were deemed essential for sound decisions affecting program improvement, development, and expansion.

1. To compare the achievement levels of students in the various district types as measured by the occupational achievement tests.

2. To compare the achievement level of students enrolled in the various program types as measured by the occupational achievement tests.
3. To compare the achievement levels of students by age groups.

Incorporated into each of these comparisons was the mental maturity and arithmetic test scores as collected through the Ohio Trade and Industrial Education Achievement Test Program.

**Limitations of the Study**

This study was limited to the vocational programs of Ohio schools which used the test battery of the Ohio Trade and Industrial Education Achievement Test Program in March, 1970. Specifically, other limitations were as follows:

1. No individual school or student was identified in the study. Confidentiality of individual school data was to be maintained.

2. Only schools with approved vocational trade and industrial education programs were included in the study.

3. Each occupational area was examined independently of the others with the achievement test battery provided through the Achievement Test Program.

4. Individual schools were not contacted since only grouped data were explored as collected through the Achievement Test Program.

5. Another limitation of the study was the inability of the Ohio Trade and Industrial Education Service to pair a student's test score on the occupational
test with the California Survey of Mental Maturity, Advanced Form 1 and/or the Stanford Arithmetic Achievement Test, Form JM. The mean scores of one group of students on the various tests were compared with the mean score of other student groups who were in the same occupational program and had completed the same tests.

6. Included in the study were all the students in Ohio who completed the appropriate test battery for their occupational area in 1970. Table 1 illustrates the number of schools and students included in the sample.

**TABLE 1**

NUMBER OF SCHOOLS AND STUDENTS IN OHIO USING THE TRADE AND INDUSTRIAL EDUCATION ACHIEVEMENT TEST PROGRAM IN 1970 FOR NINE OCCUPATIONAL AREAS

<table>
<thead>
<tr>
<th>Occupational Area</th>
<th>Number of Schools</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive Body and Fender Repair</td>
<td>21</td>
<td>232</td>
</tr>
<tr>
<td>Automotive Mechanics</td>
<td>61</td>
<td>764</td>
</tr>
<tr>
<td>Cosmetology</td>
<td>35</td>
<td>580</td>
</tr>
<tr>
<td>Industrial Electrician</td>
<td>6</td>
<td>90</td>
</tr>
<tr>
<td>Industrial Electronics</td>
<td>25</td>
<td>234</td>
</tr>
<tr>
<td>Machine Trades</td>
<td>64</td>
<td>727</td>
</tr>
<tr>
<td>Mechanical Drafting</td>
<td>51</td>
<td>485</td>
</tr>
<tr>
<td>Printing</td>
<td>15</td>
<td>140</td>
</tr>
<tr>
<td>Welding</td>
<td>22</td>
<td>172</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>123</strong></td>
<td><strong>3,424</strong></td>
</tr>
</tbody>
</table>
Terminology

Throughout this study certain terminology will be utilized which needs to be defined. For the purpose of clarity and accurate communication, these terms are defined as follows:

**Vocational Education** -- "vocational or technical training or retraining which is given in schools or classes...under public supervision and control or under contract with a state board or local educational agency, and is conducted as part of a program designed to fit individuals for gainful employment as semi-skilled or skilled workers or technicians in recognized occupations..." (American Vocational Association, 1964).

**Trade and Industrial Education** -- "instruction which is planned to develop basic manipulative skills, safety judgment, technical knowledge, and related occupational information for the purpose of fitting persons for initial employment in industrial occupations and upgrading or retraining workers employed in industry" (American Vocational Association, 1964).

**Achievement Test Program** -- a battery of tests offered through the Ohio Trade and Industrial Education Service for several occupational areas which are designed to assist school personnel in the improvement of local trade and industrial education programs.

**Validity** -- the extent to which the test serves its purpose with respect to the group for which it is intended (Wood, 1960).

**Reliability** -- the consistency of measurement (Noll, 1965).
Methodology

At the time the data were collected, this researcher was directly involved with the supervision and administration of the Achievement Test Program. The scoring and reporting of all test results, as well as the development of the occupational tests, were the direct responsibility of this researcher.

The same students who took the occupational test also took the California Survey of Mental Maturity, Advanced Form I, and the Stanford Arithmetic Achievement Test, Form JM. Scores on the occupational test served as the dependent variables. The students completing an occupational test were also compared with the mental maturity and arithmetic tests which were considered to be indirect control variables. The independent variables were: 1) program type, 2) type of school district, and 3) the chronological age of the student. These same variables served as control variables when one of the three was the independent variable.

The Design of the Study

The design of the study utilized the test results of students enrolled in Ohio schools participating in the Ohio Trade and Industrial Education Achievement Test Program during March, 1970. Additional data and information were obtained from the files and previous studies conducted by the Ohio Trade and Industrial Education Achievement Test Program.

The following procedures were followed:

1. School districts using the trade and industrial education achievement test were identified as
either city school districts, joint vocational school districts, exempted village school districts, or local school districts.

2. Instructional programs were classified by the amount of instructional hours per week provided for both manipulative experience and related instruction. The state has three basic program types which were considered in this study: (1) program type 00 consists of 15 hours per week for laboratory activities with an additional 7.50 hours of related instruction, (2) program type 01 consists of 15 hours per week of laboratory activities with an additional 3.75 hours of related instruction, and (3) program type 02 consists of only 15 hours of laboratory instruction per week. Table 2 identifies the program types and criteria.

TABLE 2
PROGRAM TYPES AND CRITERIA

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Class Hours/Week</th>
<th>Laboratory Time Per Week</th>
<th>Related Class Hours of Instruction Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>22.50</td>
<td>15</td>
<td>7.50</td>
</tr>
<tr>
<td>01</td>
<td>18.75</td>
<td>15</td>
<td>3.75</td>
</tr>
<tr>
<td>02</td>
<td>15.00</td>
<td>15</td>
<td>----</td>
</tr>
</tbody>
</table>

3. Instructional programs to be studied were identified and the occupational achievement test which was used with each program is listed below.
<table>
<thead>
<tr>
<th>Instructional Program</th>
<th>Ohio Trade Achievement Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive Body and Fender Repair</td>
<td>Ohio Auto Body Achievement Test</td>
</tr>
<tr>
<td>Automotive Mechanics</td>
<td>Ohio Automotive Mechanics Achievement Test</td>
</tr>
<tr>
<td>Cosmetology</td>
<td>Ohio Cosmetology Achievement Test</td>
</tr>
<tr>
<td>Industrial Electrician</td>
<td>Ohio Basic Electricity Achievement Test</td>
</tr>
<tr>
<td>Industrial Electronics</td>
<td>Ohio Basic Electronics Achievement Test</td>
</tr>
<tr>
<td>Machine Trades</td>
<td>Ohio Machine Trades Achievement Test</td>
</tr>
<tr>
<td>Mechanical Drafting</td>
<td>Ohio Mechanical Drafting Achievement Test</td>
</tr>
<tr>
<td>Printing</td>
<td>Ohio Printing Achievement Test</td>
</tr>
<tr>
<td>Welding</td>
<td>Ohio Welding Achievement Test</td>
</tr>
</tbody>
</table>

4. The student's chronological age as recorded on the answer documents was used in combination with the two program variables for each instructional program.

Test Selection and Description—Control Variables

A description of the two tests which served as control variables follows.

California Survey of Mental Maturity, Advanced Form I. This test was composed of two sections, non-language and language. The non-language section had 40 items measuring (1) spatial relationships, (2) pictorial analogies (opposites and similarities), and (3) the number series type. The language section includes 40 items examining (1) vocabulary, (2) quantitative reasoning, and (3) syllogistic reasoning. This was a timed test requiring 30 minutes for administration.

The items in the Survey of Mental Maturity, "Advanced," were selected from the "California Test of Mental Maturity." Validity of
the Survey of Mental Maturity, Advanced, was established by item analysis procedures in comparison with other tests and equivalent forms. The authors of the test had used a sample of 659 students, over the age of 16, to establish their norming information. The reliability coefficient for the test as a whole, based on the Kuder-Richardson Formula 21, proved to be .93 with the standard error of measurement of 4.3. (Ohio State and Industrial Education Service, 1970)

Stanford-Advanced Arithmetic Test, Form JM. This test was composed of two sections, arithmetic reasoning, and arithmetic computation. In 1970, only the arithmetic computation section was administered along with the occupational achievement tests. The Ohio Trade and Industrial Education Service (1970) reports that "The primary reason for not giving the 'Arithmetic Reasoning' section is that most of the trade achievement tests have an applied math section which explores arithmetic reasoning capabilities within the trade area. To give the 'Arithmetic Reasoning' section would, therefore, be a duplication of effort and time."

The "computational" section measures addition, subtraction, division, and multiplication of decimals, fractions, and mixed numbers. It also requires the calculation of percent, areas, and interest, and utilizes graphs and charts for statistical interpretation.

The arithmetic test contained 44 items and was a timed test requiring 35 minutes. The authors of the test used a sample of 298 ninth graders to obtain a split-half reliability coefficient of .87 utilizing the Spearman-Brown formula. It was decided that this test
would, therefore, serve as a balance to determine academic achievement in the mathematical field. This was done to see if high achievement, as measured by this test, proved to be a contributing factor to student success in the trade achievement test. This test also gave a breakdown of grade level achievement from raw scores.

(The Ohio Trade and Industrial Education Service, 1970)

Test Selection and Description—Dependent Variables

The dependent variables are scores on the occupational achievement tests which have been developed by the Ohio Trade and Industrial Education Services at The Ohio State University. The following discussion reviews the development of the occupational tests, their validity, reliability, and a brief description of each test.

Occupational Test Development. The Ohio Trade and Industrial Education Service (1970) outlined the following procedures for developing an achievement test.

A committee is appointed by the Assistant Director, Trade and Industrial Education, to develop a course outline. This committee is comprised of a representative of the state supervisory staff, a teacher-educator, a local supervisor of Trade and Industrial Education, selected teachers of the course, and a representative of the Ohio Trade and Industrial Education Services, Instructional Materials Laboratory. The development phases are as follows:

1. A comprehensive course outline is developed which lists the basic instructional units which the committee determines should be offered in the course.

2. The committee develops and reviews test questions based on the course outline.
3. The Ohio Trade and Industrial Education Services, Instructional Materials Laboratory, compiles, publishes, and distributes the test. They also provide the scoring, the reporting, and the evaluation of test results.

4. After the first year of use, a test is revised by the committee using an extensive item analysis. Each question is reviewed on the basis of types of responses made by students. If the analysis indicates a question is faulty, the item is either replaced, rewritten or eliminated.

Occupational Test Validity. Also reported by the Ohio Trade and Industrial Education Service (1970) was the validity of the occupational tests.

The items selected for use in the Ohio T & I Achievement Tests have been selected from a general pool of items. Item analysis data, which yield discrimination values and difficulty level, have been produced for each item. Based on this information, final forms of each test have been developed. These items are constantly under surveillance and new analyses are run each year.

Test validity studies have been developed in various ways. First, content validity of items was established by test developers, then construct validity was determined by test battery inter-correlation. Predictive validity was established by correlating test scores and teacher's grades.

The concurrent (predictive as reported) validity was accomplished in 1961 for Machine Trades and Auto Mechanics which yielded a .35 and .39 correlation respectively with teacher's grades. These are the only two occupational tests for which concurrent validity is reported. Of keen interest was the content validity which each test has, due to the practicing teachers determining what should be taught, and then writing test items for inclusion into the occupational achievement test. This
process of test revision increases the validity of the test since questionable test items are reviewed by the test committee in reference to the course outline. The course outline, therefore, serves as the criterion reference for content validity.

Occupational Test Reliability. Reliability coefficients for 1971 were reported for the nine occupational areas and are reflected in Table 3. The Kuder-Richardson Formula-20 reliability coefficients ranged from .85 for the Ohio Basic Electricity Achievement Test to .96 for the Ohio Welding Achievement Test. The Kuder-Richardson Formula-21 had a low of .84 and a high of .95 for the same two tests respectively.

TABLE 3
MEANS, STANDARD DEVIATIONS AND RELIABILITY COEFFICIENTS FOR THE OHIO TRADE AND INDUSTRIAL EDUCATION ACHIEVEMENT TESTS -- 1971

<table>
<thead>
<tr>
<th>Occupational Test</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Reliability K-20</th>
<th>Coefficients K-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Body</td>
<td>312</td>
<td>155.79</td>
<td>31.09</td>
<td>.95</td>
<td>.94</td>
</tr>
<tr>
<td>Auto Mechanics</td>
<td>998</td>
<td>190.69</td>
<td>43.90</td>
<td>.93</td>
<td>.91</td>
</tr>
<tr>
<td>Basic Electricity</td>
<td>458</td>
<td>115.63</td>
<td>26.83</td>
<td>.85</td>
<td>.84</td>
</tr>
<tr>
<td>Basic Electronics</td>
<td>646</td>
<td>49.33</td>
<td>13.80</td>
<td>.89</td>
<td>.87</td>
</tr>
<tr>
<td>Cosmetology</td>
<td>840</td>
<td>176.73</td>
<td>27.29</td>
<td>.92</td>
<td>.90</td>
</tr>
<tr>
<td>Machine Trades</td>
<td>876</td>
<td>149.91</td>
<td>32.35</td>
<td>.94</td>
<td>.93</td>
</tr>
<tr>
<td>Mechanical Drafting</td>
<td>552</td>
<td>128.56</td>
<td>38.41</td>
<td>.93</td>
<td>.92</td>
</tr>
<tr>
<td>Printing</td>
<td>203</td>
<td>157.31</td>
<td>41.04</td>
<td>.95</td>
<td>.94</td>
</tr>
<tr>
<td>Welding</td>
<td>381</td>
<td>175.34</td>
<td>43.99</td>
<td>.96</td>
<td>.95</td>
</tr>
</tbody>
</table>

SOURCE: Ohio Trade and Industrial Service, 1972

aCorrected for publisher's error.
The dependent variables in this study were scores on the occupational trade tests which were described as follows by the Ohio Trade and Industrial Education Service (1970).

**Ohio Auto Body Achievement Test.** The auto body test, developed in 1970, has two parts. Students were allowed three hours of testing time to take each part. The first part, composed of 150 items, had six sections: (1) welding, (2) metal forming, (3) body filler, (4) refinishing, (5) trim and hardware, and (6) parts replacement. Part two had nine sections: (1) alignment, (2) glass replacement, (3) fiber glass repair, (4) frame and unit body, (5) electrical systems, (6) cooling and air conditioning, (7) shop management, (8) applied science, and (9) applied math.

**Ohio Automotive Mechanics Achievement Test.** The auto mechanics test was divided into two parts. Part one contained 195 items and part two had 184 items. Each part was to have three hours of testing time for completion. This test was developed in 1970.

Part one contained six sections and were: (1) applied math, (2) basic operations, (3) general science, (4) engines, (5) cooling systems, and (6) electrical system. Part two of this test contained eight sections: (1) applied science, (2) fuel system, (3) emission system, (4) power train, (5) suspension system, (6) steering system, (7) brakes, and (8) ventilation system.

**Ohio Cosmetology Achievement Test.** The cosmetology test was developed in 1969 and was divided into two parts. The first part contained 193 items, and the second part contained 155 items. Students were allowed three hours to take each part.
Part one had seven sub-tests: (1) scalp, (2) hands and feet, (3) hair, (4) hair tint and bleach, (5) face information, (6) facial, and (7) makeup. Part two had six sections: (1) sanitation-sterilization-bacteriology, (2) applied science, (3) anatomy-physiology, (4) shop management, (5) trade mathematics, and (6) legal guidance.

**Ohio Basic Electricity Achievement Test.** The electricity test was developed in 1962. This test was developed around nine areas, containing 244 items with testing time to be three hours.

The test was divided into nine areas: (1) direct current electricity, (2) laws of magnetism, (3) alternating current electricity, (4) measurement, (5) construction wiring, (6) diagnosis and maintenance, (7) circuit tracing, (8) applied mathematics, and (9) applied science.

**Ohio Basic Electronics Achievement Test.** The electronics test developed in 1962 consisted of 100 items which the students had one and one-half hours to complete. It was divided into eight sections as follows: (1) tuning circuits, (2) vacuum tubes, (3) semiconductor characteristics, (4) power supplies, (5) amplifiers, (6) detector circuits, (7) test equipment, and (8) oscillator circuits.

**Ohio Machine Trades Achievement Test.** The machine trades test was developed in 1960 and consisted of two parts. Part one contained 99 items, and part two contained 172 items. Students were allowed three hours to do each part of the Ohio Machine Trades Achievement Test. Part one consisted of eight sections designed to measure the
students' achievement in (1) applied machine trades mathematics, (2) layout, (3) hand tools, (4) measuring, (5) power sawing, (6) drilling, (7) shaping, and (8) heat treating. Part two was made of nine sections which were: (1) machine trades science, (2) machining-lathe, (3) milling, (4) blueprint reading, (5) grinding-bench, (6) grinding-surface, (7) grinding-tool and cutter, (8) grinding-cylindrical, and (9) grinding-internal.

Ohio Mechanical Drafting Achievement Test. The mechanical drafting test was developed in 1963. It was divided into two parts with a total of 250 items. The students were allowed three hours to complete each part of this test.

Part one had ten sections: (1) drafting materials and equipment, (2) dimensioning, (3) auxiliary views, (4) threads and fasteners, (5) production or working drawing, (6) machine elements, (7) auxiliary information, (8) industrial processes, (9) materials of industry, and (10) applied science.

Part two of the test was divided into eight sections: (1) orthographic projection, (2) sectional views, (3) pictorial drawing, (4) intersections and development, (5) geometric drawings, (6) lettering, (7) reproduction of drawings, and (8) functions of mathematics.

Ohio Printing Achievement Test. The printing test, developed in 1963, was divided into two parts. Part one of 150 items had ten sections: (1) orientation, (2) printing planning, (3) hand composition, (4) machine composition, (5) photo composition, (6) camera operation,
(7) film processing, (8) letterpress platemaking, (9) letterpress presswork, and (10) applied science.

Part two was divided into six sections with 143 items: (1) lithographic stripping and platemaking, (2) lithographic presswork, (3) binding work, (4) paper technology, (5) ink technology, and (6) applied mathematics. Students were allowed two and one-half hours to complete part one, and one and one-half hours to complete part two.

Ohio Welding Achievement Test. The welding test was developed in 1970. It was divided into two parts. Students were allowed three hours for part one, and two and one-half hours to complete part two. Part one had five sections: (1) blueprint reading, (2) flame cutting, (3) oxy-acetylene, (4) arc welding, and (5) resistance welding. The six sections of part two were (1) TIG, (2) MIG, (3) equipment, (4) labor and management, (5) applied math, and (6) applied science. There were 193 items in part one and 142 questions in part two.

Clearance and Approval

The results of the Ohio Trade and Industrial Education Achievement Test Program were confined to Ohio to specific research studies conducted by the State Department of Education, Division of Vocational Education, Trade and Industrial Education Services. Since this study was to utilize the achievement test results for 1970 and the data were to be used for a dissertation for the first time, it was necessary to consult with Mr. Harry F. Davis, Assistant Director, Trade and Industrial Education, Division of Vocational Education, State Department of Education, and Mr. W. F. Stover (deceased), State Supervisor,
In structural Materials Laboratory, The Ohio State University. After several discussions, they decided to grant permission to use the 1970 test results provided two conditions were met: (1) All data regarding an individual school or school district would be held confidential, and (2) no individual school or school district would be identified in the study or compared with another.

With appropriate verbal assurances given, this writer was granted permission to proceed with the necessary steps as required by The Ohio State University. A reading committee with Dr. Robert M. Reese as Chairman was selected and met in formal session on June 9, 1970, and approved the dissertation prospectus. However, considerable time elapsed from the time of original approval, and a new committee was formed in 1976. The new committee was composed of Dr. Robert M. Reese, Chairman, with Dr. A. J. Miller and Dr. J. Robert Warmbrod agreeing to serve and granting reapproval of the proposal.

Analysis of Data

Group size had to be considered to protect the conditions under which the data were given by the Ohio Trade and Industrial Education Service. To stay within the limits of the study, it was decided to use no group size of less than thirty students. The rationale for this decision was that any group of thirty students would involve at least two classes of students since the minimum enrollment was fifteen students per class with a maximum of twenty-five students per class.

Upon studying the number and type of school districts in which the Achievement Test Program was used, it was necessary to combine
exempted villages and local school districts into one category to allow for an adequate sample size for comparison purposes. Therefore, in the analysis of data, exempted village school districts and local school districts were handled as a group, and the city school districts and joint vocational school districts were handled as separate groups in their own category. Student age was utilized only in combination with district type and program type.

For each of the groups tested, four reliability coefficients were calculated. The four reliability coefficients used were the Kuder-Richardson Formula-20, the Kuder-Richardson Formula-21, and the Spearman-Brown Formula applied to both a split-half and odd-even correlation.

The data were put into numerous tables for analysis and comparison. Once the data were on worksheets, these were transferred to the Columbus Technical Institute which proceeded to do the necessary keypunching to match a special computer program which was developed by the Office of Evaluation at The Ohio State University. The Ohio State University, at that time, did not have in its files a computer program to work with the already established data as opposed to data processing programs that only worked with initial raw data. The test scores for each group of students included in the comparisons were subjected to a t-test of significant difference between means.

The special program written by the Office of Evaluation on The Ohio State University campus specifically for this project followed the formula discussed by Hays (1963) regarding large sample confidence limits for a difference. Hays asserts that "sometimes it is not
possible to obtain an equal number in each group. Then one way out of this problem is by use of a correction in the value for degrees of freedom. This is useful when one cannot assume equal population variances and samples are of different size. This need not result in a whole value for variance, in which case the use of the nearest whole value for variance is sufficiently accurate for most purposes." The test of variance took into consideration the standard deviation of each group and applying the appropriate degrees of freedom, and referring to the t distribution table, a level of significance was accepted or rejected. This was at the advice and direction of the university testing center. The reader is referred to the appendices for the tables showing the comparisons and their "t" values along with the N's, means, and standard deviations for each group. Reliability coefficients for each group taking the occupational tests are also reported in the appendices.

Organization of the Dissertation

The organization of this dissertation follows the sequence of activities within this basic research study. Chapter I presents the problem, limitations of the study, terminology, and methodology.

Chapter II presents the review of literature which serves to define the concepts and rationale for the study, the program and student variables, and research in the field of trade and industrial education.

Chapter III presents the findings of the study for each of the selected occupational areas in Trade and Industrial Education.
Chapter IV presents the summary, conclusions and recommendations related to school districts, organizational variables, program variables, and the chronological age in combination with program and school district variables.

Nine appendices are included which present the complete listing of comparisons for the tests used with each of the occupational areas and the respective reliability coefficients for each group.

The bibliography presents a selected list of entries which have been reviewed and/or referenced in relation to this project.
A review of the related literature was conducted in order to identify research studies or published materials which contain relevant information for this study. The literature reviewed was grouped into the following two categories:

1. Publications concerning educational measurement, testing, and research which relates to the theoretical aspects of this study.

2. Studies or other publications which directly relate to the dependent, independent, and control variables used in this study.

The basic procedures of reviewing the literature were to utilize library resources, professional journals, and information on an ERIC search. The files of the Ohio Trade and Industrial Education Achievement Test Program at The Ohio State University were also searched. But, rather than reproducing the studies in total, only parts which were relevant to this study will be discussed.

Publications Concerning Educational Measurement, Testing, and Research Which Relate to the Theoretical Concepts of this Study

The theoretical concepts of this study focus on the relationship of program and student variables to occupational achievement. The
assumption was that the achievement levels of vocational students as measured by standardized tests can produce results which are of value to vocational education leaders for decision making.

Dr. Ralph W. Tyler (Lindquist, 1951) asserted that achievement testing can serve to improve instruction. Since the improvement of instruction is the primary focus of the Ohio Trade and Industrial Education Achievement Test Program, the occupational tests are most appropriate for examining program and student variables. The test results, therefore, are of value in selecting and clarifying educational objectives and stimulating the faculty to formulate appropriate behavioral objectives.

Tyler also stated, "the results of achievement tests given at the close of the preceding grade or course or at the beginning of the current one provide a basis for judging the various levels at which students are ready to proceed toward the attainment of each major objective, and therefore the several levels of content and the kinds of instructional materials and procedures likely to be effective."

Benjamin S. Bloom (Gage, 1963), like Tyler, also believes that achievement testing can be of value to the process of improving instruction. Bloom stated, "Research on teaching must, in most cases, make use of measures of cognitive achievement to determine whether the teaching methods, instructional procedure, or the teacher produces changes in the learners. Research on teaching makes use of tests of cognitive ability (and achievement) to identify the samples of students being studied and to determine whether there are differential effects of the teaching on the various sub-groups."
Bloom made the following statement regarding the nature and use of test evidence (Gage, 1963).

The systematic nature of testing makes it possible to use test evidence for a variety of comparative purposes. If uniformity of testing procedures and conditions is assured, it is possible to summarize the responses with those numbers of other individuals. The test scores of several individuals can yield an average which may be compared with the distribution of similar scores for an appropriate population of individuals. Normative data make it possible to determine where individuals stand with respect to other individuals who presumably were tested with the same instrument under similar conditions. Such comparisons may make use of so called raw scores which are relatively simple summations of the original responses, derived scores which transmit the raw scores into positions on a scale (standard scores, percentile scores, mental age, etc.), or judgmental categories which relate the raw or derived score to a qualitative decision (normal-subnormal, passing-failing, good-poor, etc.).

Bloom's discussion provided considerable implications for developing normative data which should be used to interpret individual scores as well as making judgments regarding the comparisons of grouped data.

Dr. Robert L. Thorndike and Elizabeth Hagen (1961) stated, "A testing program can serve the school administrator as a type of educational quality control. Summary tabulations for the separate schools and classes in a system, reviewed in the light of the aptitude and the background characteristics of each group, can serve to point out strengths and weaknesses of particular schools and classes."

Micheels and Karnes (1950) concluded in their text "that evaluation is based on reflective judgment, using all the pertinent data that can be gathered. Tests and testing are only a means to an
end. They will be useful only insofar as they bring about better teaching and thus better growth." They were concerned with the use of test results and that relative information must be examined to effectively and appropriately interpret test results.

Donald E. Super has completed considerable work on career development theory (1953) in which grade levels have been examined for the appropriate time for career decisions to be made by students. Super and Overstreet (1960) suggest that vocational maturity is not present in the ninth grade. Then again, another study by Gribbons and Lohnes (1965, 1968) found that some students are vocationally mature by the time they are in the ninth grade. Super (1960) refers to vocational maturity as vocational age, similar to mental age in early adolescence, but changing from late adolescence to early adulthood because of the ability to make distinctions. Such changes in vocational maturity may also have some relationship to achievement. Providing vocational maturity is directly associated with age, the age of students tested may also identify differences in achievement. However, Hoagland (1959) found no relationship between age and student success in a shop type subject.

Lawrence S. Wright (1966) in an article discussed the value of standardized testing for drafting. He stated:

Teachers could determine how their students compare with the norm group. They could use the test to aid in evaluating their drafting instruction. In schools sufficiently large it might be used to group drafting classes by ability levels. Such tests could suggest where remedial work is needed. To the extent that a good standardized test might contribute to better instruction and higher standards, we might improve our image and attract better students.
In 1966, Dr. H. H. London, Dr. William J. Micheels, Dr. Charles B. Porter, Dr. Ralph C. Bohn and Dr. Robert M. Reese (1966) responded to a series of questions on "Standardization in Tests and Measurements: What are the trends? Problems? Needs?"

London: If I were attempting to standardize one or more tests in some area of industrial or technical education, I would first want to make a rather detailed study of the content in that area, and check it carefully with authorities such as employers, textbook writers, outstanding teachers, and the like. With this done, I would then want to prepare preliminary objective-type questions covering the essential features of the body of knowledge peculiar to that area. Then I would administer the test on a trial basis, eliminating ambiguous questions, questions that did not differentiate, and the like. This process should be continued until the test is relatively free of "bugs." ...the test should be validated by specialists in the area, and its coefficient of reliability determined. Finally, ... (it) should be administered widely in different parts of the country to establish norms. For obvious reasons, it would be well to have several equivalent forms.

Micheels: This is a broad question...not easy to answer. I would generalize by saying that many researchers will be necessary. The broad area of desirable competencies to be learned can stand much research. Research on the theoretical structure(s) of industrial education is another area. Once we have a sound idea of what it is we are trying to measure, then the research would shift to the best ways of doing the measuring. In too many instances we have concentrated on this last approach with too little attention given to the first.

Porter: I really cannot see that the problem of developing standardized tests for vocational-technical education differs significantly from that of industrial arts. With our store of scientific and technical knowledge expanding at an exponential rate, in a society where change is a way of life, in these times when occupations are emerging almost daily, it seems incumbent
upon us to eliminate our preoccupation with specific trade training and turn our attention to identifying and dealing with those concepts and broad understandings that cut across families of occupations and are, as a result, less sensitive to the passage of time. The necessary research therefore is that which will identify this kind of content.

Bohn: Much of the research needed in vocational-technical education lies in the area of curriculum rather than testing and measurement. The new federal laws and the continual demand for imaginative approaches to vocational-technical curriculum means that research must be planned to identify what educational background future employees actually need, and how and what levels the needed instruction is to be provided.

In addition, research studies should attempt to identify future needs and directions so that a planned revision schedule can be incorporated within the standardized testing program. After this research is well underway, the unique problems of evaluation leading to standardized tests should be undertaken.

Reese: Two factors would need to be identified prior to any such standardizations. First, a clearly identified occupation or occupational family for which persons are to be prepared and second, determination of the minimum acceptable curriculum that must be basic to each of these identifiable vocations.

These two elements have been implemented in our achievement testing program which covers some seven vocational preparatory programs and participated in by five states to date.

To accomplish these things, vocational educators must work closely with experienced workers in the occupation as well as with employers. Our experience also indicates that experienced highly competent, vocational teachers can be of considerable help in developing such a testing program.

Mehrens and Lehmann (1969) in discussing future trends in testing identified the development of measures of curricular assessment as becoming a more challenging task since test results will be
used to make decisions about groups rather than individuals.

Summary

Upon reviewing these theoretical concepts, it was evident that Tyler and Bloom agreed that testing was a means to improving instruction. Bloom along with Mehrens and Lehmann considered the need to use test results for comparative purposes with normative data, but it was Thorndike and Hagen who pointed out the need to examine background characteristics of groups.

One student characteristic which may need to be considered is referred to by Super as vocational maturity or age. Since vocational maturity is a factor for consideration in career development, it may also be an important factor for relationship to student achievement.

In the area of vocational education, Wright, London, Micheels, Porter, Bohn, and Reese all agree that standardized achievement testing of vocations is valuable and should present no problem for continuing vocational education research.

Studies or Other Publications Which Relate to the Dependent, Independent, and Indirect Control Variables Used in this Study

This section of the review of literature provides information from previous studies which reflect upon the dependent, independent, and control variables utilized within this study.

One aspect of this study was to show the relationship of chronological age to student achievement. Of the numerous studies reviewed, several reflected relationship by grade levels, but no
research for secondary vocational students considering any age spread within a grade level was discovered.

References to Independent Variables

Unfortunately, no studies were revealed that examined various types of school districts and the relationship to student achievement. One of the probable causes for this lack of research is the fact that the first jointure became operational in Ohio during the 1965-66 school year and it is generally accepted among educators that educational achievement is a direct outcome of instruction, not school district organization.

In 1974, however, Jerome T. Kapes and Vladimir Pawlowski studied the characteristics of teachers from three school districts and their relationship to student shop achievement. A total of thirty-one teachers were involved in the study. Kapes and Pawlowski urge vocational educators to be cautious in interpreting the results of their study on characteristics of vocational-technical instruction. They suggest that additional studies using larger samples and examining a wider variety of characteristics are necessary before their conclusions can be transferred to other school districts. This expressed caution by Kapes and Pawlowski suggests that there are quite possibly some unique factors which may be inherent in school district organizations.

Dr. Paul H. Steagall (1968) completed a study which analyzed student achievement level with standardized tests. Students from a block-of-time program were compared to students in conventional
business and office education programs. Using over 200 students for each group and applying an analysis of co-variance to adjust for difference in I.Q. scores, Steagall found no significant difference in student achievement, but concluded that the block-of-time programs: (1) provided time for in-depth instruction and for intensive training, (2) the teacher was able to become better acquainted with the needs, interests, and abilities of students and to plan learning experiences to meet student needs, and (3) the teacher was better able to vary instruction to meet individual needs.

McQuay (1974) cautions administrators against making generalizations regarding the two-year and three-year programs which he studied since there is considerable variances from one occupational area to another. A total of 82 students were included in the study for four occupational areas. McQuay pooled students from different occupational areas by means of standard scores and found that the three years of instruction provided a very insignificant change in student achievement in comparison with two years of instruction.

In another study, the Ohio Trade and Industrial Education Service (1964) compared program type 00 in Ohio with program type 02 in four other states. By using matched pairs of students, using the California Survey of Mental Maturity, Advanced Form 1, they concluded that the students in program type 00 were achieving at a significantly higher level than the students enrolled in program type 02 from the other four states.
In summary, McQuay found little difference in student achievement for the increased amount of instruction time but he fails to identify the hours of instruction for each year of the vocational program. Whereas, Ohio in 1964, showed significant differences in achievement with an intensive program over students from four other states. Steagall, however, could not identify greater achievement of business and office education students over the conventional subject approach to teaching business education. This research has not yielded a consistent pattern for instruction based upon hours of class time per year.

Reference to Control Variables

In 1959, Donald P. Hoagland conducted a study to ascertain the relationship of success of students as measured by shop grades in a manipulative-type shop subject with: (1) intelligence, (2) basic arithmetic ability, and (3) chronological age. The findings were consistent and showed that neither intelligence, arithmetic ability, nor age had any relationship to success in a shop-type class.

Florence Rambo (1964) examined the nature and needs of gifted and talented students in Georgia and the nature of an instructional program best suited to meet these needs. The study consisted of gifted and talented academic and fine arts students. Rambo, in conclusion to her study, basically made the following generalization: gifted secondary school students functioned at a level relative to the upper half of college freshmen and sophomore classes in terms of intelligence, academic achievement, and some motivational
characteristics; and yet these students were similar to secondary school pupils in terms of chronological age, sex discrimination, grade placement, and selected family characteristics, and the gifted were more often enrolled in the larger Georgia high schools. Rambo's study directly relates intelligence, not age, to academic achievement.

John G. Miller (1966) examined several variables to identify vocationally talented students and used two comprehensive achievement tests in machine trades and electricity for criterion measures. An analysis of school records and teacher marks indicated that a majority of students who scored above the mean on the achievement test was scholastically in the upper one-third of their vocational group and had intelligence quotients above 100. This finding indicated a direct relationship of intelligence with student achievement.

Dr. Gerald N. Rau (1971) reported also that a student's native intelligence more than any other single factor included in his study was the vital element in predicting student achievement. His findings were determined through a regression equation which considered teacher characteristics in relation to machine shop achievement.

Student ability, as reported by Paul L. McQuay (1974) must be considered as a factor when evaluating educational programs. He suggested that maturity, interests, and values also play a significant role in achievement. In his study first year students, 10th graders, were compared to second year students and third year students. Students with two years of instruction did better than those with only one year but very little difference appeared between students of three years of instruction and those with only two years.
Dr. Robert W. Ullman and Dr. Ralph W. Ingersoll (1964) used the Trade and Industrial Education Achievement Tests as a criterion for assessing education quality. One conclusion identified student intelligence as a factor in occupational achievement and teachers' industrial experience as a significant positive factor to student achievement. Included in this study were 330 trade and industrial education teachers throughout Ohio and some 2200 students.

The studies of Rambo, Miller, Rau, McQuay, and Ullman identify the need to consider mental ability for assessing educational programs through standardized achievement tests. The Ohio Trade and Industrial Education Service (1964) controlled (matched pairs) for mental ability. They also examined the relationships of the Stanford Advanced Arithmetic Test, Form JM, to the applied math and applied science section in several of the occupational areas studied and did not find arithmetic to be a contributing factor to student achievement. Hoagland (1959) found no relationship between arithmetic and intelligence or age for success in shop classes.

References to Dependent Variables

Dennis McFadden (1967) completed a validation study of the Ohio Printing Achievement Test which included 795 students from 29 states and the District of Columbia. This study concluded that the printing test had reliability and predictive validity based upon employer rating. The study also indicated that vocational graduates who entered printing occupations had a significantly greater mean level of achievement than the norm group. To determine the predictive validity,
student achievement test scores were correlated with employer ratings of the vocational graduates as well as the Ohio Printing Performance Test.

Thomas S. Baldwin (1967a), while at North Carolina, issued five progress reports on the development of achievement measures for trade and technical education. Although these reports dealt with test development and validation, they provide evidence of the interest which was being generated for vocational test development. Frank L. Schmidt and others (1974) in their study of performance testing of machinists, were unsuccessful in their attempt to locate the Baldwin Machinist Achievement Test. This was despite the help of the U. S. Office of Education. Without the Baldwin Test they employed the Ohio Machine Trades Achievement Test. Schmidt reported that this was his best alternative and it was judged to have adequate content validity by the machinist consultant on that project.

Finch and Bjorkquist (1970) reported success and promise for the use of the Ohio occupational achievement test but pointed out they may measure the academic component of achievement rather than performance in the laboratory.

A study by Jerome T. Kapes and Thomas E. Long (1971) analyzed seven occupational areas and conducted a correlation between the occupational achievement test scores and shop grades for 195 students in 1969 and expanded the study in 1970 to include 197 students in nine occupational areas. The nine occupational areas were: auto body, auto mechanics, basic electricity, basic electronics, mechanical
drafting, machine trades, printing, sheet metal and welding. Two of the conclusions which were drawn from the study are:

1. That T & I Achievement Tests may validly measure those aspects of achievement which can be easily reflected in a paper and pencil knowledge test, but measures only a small portion of whatever it is that shop instructors base grades on.

2. The T & I Achievement Test may be useful as an evaluation tool when that evaluation is concerned with the course content.

Thomas E. Enderlein (1972) studied 118 students, seventy in grade eleven and forty-eight in grade twelve, and found the Ohio achievement tests for auto body, auto mechanics, carpentry, cosmetology, electricity, electronics, machine trades, mechanical drafting, printing, and welding to be more objective measures of achievement than teacher grades. There is, Enderlein found, a significant correlation between occupational achievement test scores and end-of-course shop grades.

Although the validity of the Ohio Trade and Industrial Education Achievement Tests was discussed in the first chapter, a review of the literature identified additional studies which reflect the value of these tests for use in research activities. McFadden conducted an extensive validity study with the Ohio Printing Achievement Test. Schmidt identified the machine trades test as being valid. Kapes and Long qualified their validity review as well as Finch and Bjorkquist. Enderlein indicated the Ohio occupational achievement tests to be a sound objective measure, more so than teacher grades.
Summary

1. There is theoretical support and need for developing and using standardized occupational achievement tests for program improvement and group comparisons (Tyler, 1951; Bloom, 1963; Thorndike and Hagen, 1961; Micheels and Karnes, 1950; Wright, 1966; and London, et al, 1966).

2. Age, which is directly associated with vocational maturity, may need to be considered when examining standardized test results (Super, 1953; Super and Overstreet, 1960; and Gribbon and Nohnes, 1965, 1968).

3. Little research was identifiable which examine the age spread within a grade level for vocational education as a factor associated with achievement (Hoagland, 1959).

4. No research identified comparisons between school district types but caution has been urged if comparisons are drawn between school districts (Kapes and Pawlowski, 1974).

5. No consistent pattern of student instructional time has been determined as contributing to student achievement (Steagall, 1968; McQuay, 1974; and Ohio Trade and Industrial Education Service, 1964).

6. Student achievement is directly related to intelligence (Rambo, 1964; Miller, 1966; Rau, 1971; McQuay, 1974; Ullman, 1964).

CHAPTER III  
FINDINGS  

The findings have been categorized by the three principal questions raised in this study: (1) comparison of school district types, (2) comparison of program types, and (3) comparison of student age.

The types of school districts compared were City School Districts (City), Joint Vocational School Districts (JV), and Exempted Village and Local School Districts (EV&L). The types of programs compared were type 00 with 22.5 hours of instruction per week (00), type 01 with 18.75 hours of instruction per week (01), and type 02 with 15 hours of instruction per week (02). Three age groups compared consisted of those students age 17, 18, and 19 at the time the tests were taken.

Comparison of School District Types for Nine Occupational Areas

Auto Body

The senior students in auto body programs from city districts were compared with students from joint vocational districts. Table 4 identifies three comparisons for which there were no significant differences between the two types of districts for occupational achievement in auto body. For the same groups of students there
<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement(^a)</th>
<th>Mental Maturity(^b)</th>
<th>Arithmetic Achievement(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>City vs. JV</td>
<td>City vs. JV</td>
<td>City vs. JV</td>
</tr>
<tr>
<td>None</td>
<td>City = JV</td>
<td>City = JV</td>
<td>City = JV</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>City = JV</td>
<td>City = JV</td>
<td>City = JV</td>
</tr>
<tr>
<td>Program Type 00 and Age 17</td>
<td>NC(^d)</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00 and Age 18</td>
<td>City = JV</td>
<td>City = JV</td>
<td>City = JV</td>
</tr>
<tr>
<td>Program Type 00 and Age 19</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>

\(^a\)Source: Appendix A, Table 25  
\(^b\)Source: Appendix A, Table 26  
\(^c\)Source: Appendix A, Table 27  
\(^d\)NC = No Comparisons  
\(^e\)City = City School Districts  
\(^f\)JV = Joint Vocational School Districts  
\(^g\)EV&L = Exempted Village and Local School Districts
were no significant differences on the mental maturity test and the arithmetic achievement test. The comparison for city districts with joint vocational districts indicates that both types of school districts produce students with comparable occupational achievement levels in auto body.

Automotive Mechanics

Table 5 identifies five comparisons of city districts with joint vocational districts in the occupational area of automotive mechanics. Two of the five comparisons show no significant differences while in three comparisons senior students in joint vocational districts achieved significantly higher than students in city districts. For each of the three comparisons where students in joint vocational districts scored significantly higher than students in city districts, the two groups of students did not differ significantly on mental maturity or arithmetic achievement.

There were three comparisons of students in joint vocational districts with students in exempted and local districts. In two of these comparisons, students in joint vocational districts achieved significantly higher scores. There were no significant differences on mental maturity when students in joint vocational districts and exempted and local districts were compared. In each of the two comparisons where students in joint vocational districts scored significantly higher on automotive mechanics, the students in the joint vocational districts also scored significantly higher on arithmetic achievement.
### TABLE 5

**Comparisons of Automotive Mechanics Programs for Type of School District by Occupational Achievement, Mental Maturity, and Arithmetic Achievement**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>City&lt;sup&gt;e&lt;/sup&gt; vs. JV&lt;sup&gt;f&lt;/sup&gt;</td>
<td>vs. JV&lt;sup&gt;g&lt;/sup&gt; vs. EV&amp;L</td>
<td>City vs. JV &lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>None</td>
<td>City &lt; JV</td>
<td>JV &gt; EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>City &lt; JV</td>
<td>JV &gt; EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>City = JV</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>and Age 17</td>
<td>City &lt; JV</td>
<td>JV = EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>City &lt; JV</td>
<td>JV = EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>and Age 18</td>
<td>City = JV</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>City = JV</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>and Age 19</td>
<td>City = JV</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
<td>NC &lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Source: Appendix B, Table 29

<sup>b</sup>Source: Appendix B, Table 30

<sup>c</sup>Source: Appendix B, Table 31

<sup>d</sup>N.C. = No Comparisons

<sup>e</sup>City = City School Districts

<sup>f</sup>JV = Joint Vocational School Districts

<sup>g</sup>EV&L = Exempted Village and Local School Districts
There were no significant differences on automotive mechanics achievement or mental maturity in the three comparisons of students in city districts with students in exempted village and local districts. However, in two of the three comparisons, students in city districts had significantly higher arithmetic achievement than students in exempted village and local districts.

In five of the eight comparisons of joint vocational districts with other types of school districts, students in the joint vocational districts scored significantly higher on automotive mechanics than students in the other type of districts. Similar comparisons between school districts for students' mental maturity and arithmetic achievement indicate that the differences in automotive mechanics achievement based on type of district are probably not accounted for by differences in the mental maturity or arithmetic achievement of students in the types of districts compared.

**Cosmetology**

Table 6 identifies three comparisons of city districts with joint vocational districts in the occupational area of cosmetology. One of the three comparisons shows no significant difference, while in two comparisons senior students in city districts achieved significantly higher scores than students in joint vocational districts. For each of the two comparisons where students in city districts scored significantly higher than students in joint vocational districts, the two groups of students did not differ significantly in mental maturity or arithmetic achievement.
### TABLE 6

**Comparisons of Cosmetology Programs for Type of School District by Occupational Achievement, Mental Maturity, and Arithmetic Achievement**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>City&lt;sup&gt;f&lt;/sup&gt; vs. JV&lt;sup&gt;g&lt;/sup&gt;</td>
<td>JV vs. EV&amp;L&lt;sup&gt;h&lt;/sup&gt;</td>
<td>City vs. EV&amp;L</td>
</tr>
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<td>NC</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>City &gt; JV</td>
<td>JV &lt; EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00 and Age 17</td>
<td>City &gt; JV</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00 and Age 18</td>
<td>City = JV</td>
<td>JV = EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00 and Age 19</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>

<sup>a</sup>Source: Appendix C, Table 33
<sup>b</sup>Source: Appendix C, Table 34
<sup>c</sup>Source: Appendix C, Table 35
<sup>d</sup>All cosmetology programs were Type 00
<sup>e</sup>NC = No comparisons
<sup>f</sup>City = City School Districts
<sup>g</sup>JV = Joint Vocational School Districts
<sup>h</sup>EV&L = Exempted Village and Local School Districts
There were two comparisons of students in joint vocational districts with students in exempted village and local districts. In one of these comparisons, students in exempted village and local districts achieved significantly higher scores. For the comparison where the students in exempted village and local districts scored significantly higher than students in joint vocational districts, the group of students did not differ significantly on mental maturity or arithmetic achievement.

There were no significant differences on cosmetology achievement, mental maturity and arithmetic achievement in the two comparisons of students in city districts with students in exempted village and local districts.

In two of the five comparisons of city districts with other types of school districts, students in the city districts scored significantly higher on cosmetology than students in other types of districts. Similar comparisons between school districts for students' mental maturity and arithmetic achievement indicate that the difference in cosmetology achievement between types of districts are probably not accounted for by differences in the mental maturity or arithmetic achievement of students in the types of districts compared.

**Industrial Electrician**

The senior students in industrial electrician programs from city districts were compared with students from joint vocational districts using the Ohio Basic Electricity Achievement Test. Table 7 identifies one comparison of city districts and joint vocational
### TABLE 7

**COMPARISONS OF INDUSTRIAL ELECTRICIAN PROGRAMS FOR TYPE OF SCHOOL DISTRICT BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT FOR STUDENTS WHO USED THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement(^a)</th>
<th>Mental Maturity(^b)</th>
<th>Arithmetic Achievement(^c)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>City vs. JV(^f)</td>
<td>JV vs. EV&amp;L(^g)</td>
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<td>NC</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>NC(^d)</td>
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<td>NC</td>
</tr>
<tr>
<td>and Age 17</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00</td>
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<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>and Age 18</td>
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<td>NC</td>
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</tr>
<tr>
<td>Program Type 00</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>and Age 19</td>
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</tr>
</tbody>
</table>

\(^a\)Source: Appendix D, Table 37  
\(^b\)Source: Appendix D, Table 38  
\(^c\)Source: Appendix D, Table 39  
\(^d\)NC = No Comparisons  
\(^e\)City = City School Districts  
\(^f\)JV = Joint Vocational School Districts  
\(^g\)EV&L = Exempted Village and Local School Districts
districts where the students from the city districts scored significantly higher on the occupational achievement and mental maturity tests. There were no significant differences on the arithmetic achievement between students from city districts and joint vocational districts.

In the one comparison of city districts with joint vocational districts in which the city district students had the higher occupational achievement on the basic electricity test, a similar comparison between mental maturity and arithmetic achievement indicates that the difference in basic electricity achievement may be related to the significant difference in mental maturity but probably not affected by the arithmetic achievement.

The senior students in industrial electrician programs from city districts were also compared with students from joint vocational districts using the Ohio Basic Electronics Achievement Test. Table 8 shows one comparison of students from city districts with students from joint vocational districts. No significant differences were identified with either the basic electronics, mental maturity or arithmetic achievement test. This comparison, using the basic electronics test for city districts with joint vocational districts, indicates that both types of school districts produce students with comparable occupational achievement levels in industrial electrician programs.
# TABLE 8

**COMPARISONS OF INDUSTRIAL ELECTRICIAN PROGRAMS FOR TYPE OF SCHOOL DISTRICT BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT FOR STUDENTS WHO USED THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>City vs. JV vs. EV&amp;L</td>
<td>City vs. JV vs. EV&amp;L</td>
<td>City vs. EV&amp;L</td>
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<td>City = JV</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Age 17</td>
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<tr>
<td>Program Type 00</td>
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<td></td>
<td></td>
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<tr>
<td>and Age 18</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Program Type 00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>and Age 19</td>
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<td></td>
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</tr>
</tbody>
</table>

<sup>a</sup>Source: Appendix D, Table 40  
<sup>b</sup>Source: Appendix D, Table 41  
<sup>c</sup>Source: Appendix D, Table 42  
<sup>d</sup>NC = No Comparisons  
<sup>e</sup>City = City School Districts  
<sup>f</sup>JV = Joint Vocational School Districts  
<sup>g</sup>EV&L = Exempted Village and Local School Districts
Industrial Electronics

Table 9 identifies three comparisons of students in city districts with students from joint vocational districts in the occupational area of industrial electronics who used the Ohio Basic Electronics Achievement Test. There were no significant differences on basic electronic achievement or mental maturity in the three comparisons. However, in all three comparisons, students in city districts had significantly higher arithmetic achievement than students in joint vocational districts.

The comparison for city school districts with joint vocational districts indicate that both types of school districts produce students with comparable achievement levels in industrial electronics. Similar comparisons between school districts for students' mental maturity and arithmetic achievement indicate that the difference in industrial electronics achievement between types of districts are probably not accounted for by difference in the mental maturity but may possibly be explained by the arithmetic achievement of students in the types of districts compared.

Machine Trades

Table 10 identifies three comparisons of senior students from city districts with joint vocational districts in the occupational area of machine trades. There were no significant differences on machine trades achievement, mental maturity, and arithmetic in these three comparisons.
TABLE 9
COMPARISONS OF INDUSTRIAL ELECTRONICS PROGRAMS FOR TYPE OF SCHOOL DISTRICT BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT FOR STUDENTS WHO USED THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement(^a)</th>
<th>Mental Maturity(^b)</th>
<th>Arithmetic Achievement(^c)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>City(^e) vs. JV(^f)</td>
<td>JV vs. EV&amp;L(^g)</td>
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<tr>
<td>Program Type 00</td>
<td>City = JV</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00 and Age 17</td>
<td>NC(^d)</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00 and Age 18</td>
<td>City = JV</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Program Type 00 and Age 19</td>
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<td>NC</td>
<td>NC</td>
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</tbody>
</table>

\(^a\)Source: Appendix E, Table 48
\(^b\)Source: Appendix E, Table 49
\(^c\)Source: Appendix E, Table 50
\(^d\)NC = No Comparisons
\(^e\)City = City School Districts
\(^f\)JV = Joint Vocational School Districts
\(^g\)EV&L = Exempted Village and Local School Districts
TABLE 10
COMPARISONS OF MACHINE TRADES PROGRAMS FOR TYPE OF SCHOOL DISTRICT BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>JV vs. EV&amp;L&lt;sup&gt;g&lt;/sup&gt;</td>
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<td>JV = EV&amp;L</td>
<td>City = JV</td>
</tr>
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<td>City = JV</td>
<td>JV = EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>NC</td>
</tr>
<tr>
<td>and Age 17</td>
<td>City = JV</td>
<td>JV &gt; EV&amp;L</td>
<td>City &gt; EV&amp;L</td>
</tr>
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<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>and Age 18</td>
<td>City = JV</td>
<td>JV = EV&amp;L</td>
<td>City = EV&amp;L</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>NC</td>
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<td>NC</td>
</tr>
<tr>
<td>and Age 19</td>
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<td>JV = EV&amp;L</td>
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</table>

<sup>a</sup>Source: Appendix F, Table 53
<sup>b</sup>Source: Appendix F, Table 54
<sup>c</sup>Source: Appendix F, Table 55
<sup>d</sup>NC = No Comparisons
<sup>e</sup>City = City School Districts
<sup>f</sup>JV = Joint Vocational School Districts
<sup>g</sup>EV&amp;L = Exempted Village and Local School Districts
There were three comparisons of students in joint vocational districts with students in exempted village and local districts. There were no significant differences on machine trades achievement or arithmetic achievement in these three comparisons. However, in one of the three comparisons, students in joint vocational districts scored significantly higher on the mental maturity test.

There were no significant differences on machine trades achievement or arithmetic achievement in the three comparisons of students in city districts with students in exempted village and local districts. However, in one of the three comparisons, students in city districts had significantly higher mental maturity than students in exempted village and local districts.

In the nine comparisons of school district types, no significant differences were identified on the machine trades achievement test. Similar comparisons between school districts for students' mental maturity and arithmetic achievement identified one comparison in which the students from the joint vocational districts had a significantly higher mental maturity than students from the exempted village and local districts. The city district students also had a significantly higher mental maturity on all comparisons than the exempted village and local district students in machine trades.

The comparisons of the three school district types indicate that all types of school districts produce students with comparable occupational achievement levels in machine trades.
Mechanical Drafting

Table 11 identifies three comparisons of city districts with joint vocational districts in the occupational area of mechanical drafting. In all three comparisons the senior students from joint vocational districts scored significantly higher than the students from city districts. For each of the three comparisons, the students from city districts had a significantly higher mental maturity compared to the students from joint vocational districts. No significant differences were found between the city district students and the joint vocational students for the three comparisons.

There were two comparisons of students in joint vocational districts with students in exempted village and local districts. In both comparisons the joint vocational students achieved significantly higher grades. There were no significant differences on mental maturity when students in joint vocational districts and exempted village and local districts were compared. In one comparison where students in joint vocational districts scored significantly higher on mechanical drafting, those same students also scored significantly higher on arithmetic achievement.

There were two comparisons of students in city districts with students in exempted village and local districts. In both comparisons, the city districts' students achieved significantly higher scores. There were no significant differences on mental maturity when students in city districts were compared with the exempted village and local districts. However, in both comparisons, students in city districts
### TABLE 11

**COMPARISONS OF MECHANICAL DRAFTING PROGRAMS FOR TYPE OF SCHOOL DISTRICT BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
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<td>City vs. EV&amp;L</td>
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<td>JV &gt; EV&amp;L</td>
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<td>Program Type 00</td>
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<td>JV &gt; EV&amp;L</td>
<td>City &gt; EV&amp;L</td>
</tr>
<tr>
<td>and Age 17</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>NC</td>
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<tr>
<td>Program Type 00</td>
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<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>and Age 18</td>
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<tr>
<td>and Age 19</td>
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<sup>a</sup>Source: Appendix G, Table 57  
<sup>b</sup>Source: Appendix G, Table 58  
<sup>c</sup>Source: Appendix G, Table 59  
<sup>d</sup>NC = No Comparisons  
<sup>e</sup>City = City School Districts  
<sup>f</sup>JV = Joint Vocational School Districts  
<sup>g</sup>EV&L = Exempted Village and Local School Districts
had significantly higher arithmetic achievement than students in exempted village and local districts.

In all five comparisons of joint vocational districts with other types of school districts, students in the joint vocational districts scored significantly higher on mechanical drafting than students in the other type of districts. Similar comparisons between school districts for students' mental maturity showed the city district students with the higher mental maturity in three comparisons and no significant difference in the other two comparisons. One of the five comparisons for these same districts found the students from joint vocational districts with arithmetic achievement significantly higher. Since the students from joint vocational districts had the higher achievement without the advantage of the higher mental maturity, the difference in mechanical drafting achievement between type of districts is probably not related to difference in the mental maturity or arithmetic achievement of students in the types of districts compared.

**Printing**

Table 12 identifies two comparisons of city districts with joint vocational districts in the occupational area of printing. In both comparisons the senior students from city districts achieved significantly higher than students in joint vocational districts. Significant differences were identified for the same two comparisons with the mental maturity and arithmetic achievement tests. The comparison of city districts with joint vocational districts indicates that city districts produce students with higher achievement levels
<table>
<thead>
<tr>
<th>Control Variable(s)</th>
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<td>Program Type 00</td>
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<td>NC</td>
</tr>
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<td>Program Type 00 and Age 17</td>
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<td>NC</td>
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<tr>
<td>Program Type 00 and Age 18</td>
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<sup>a</sup>Source: Appendix H, Table 61
<br><sup>b</sup>Source: Appendix H, Table 62
<br><sup>c</sup>Source: Appendix H, Table 63
<br><sup>d</sup>NC = No Comparisons
<br><sup>e</sup>City = City School Districts
<br><sup>f</sup>JV = Joint Vocational School Districts
<br><sup>g</sup>EV&L = Exempted Village and Local School Districts
than joint vocational districts. However, similar comparisons between school districts for students' mental maturity and arithmetic achievement indicate that the differences in printing achievement between types of districts may be related to the significant difference in the mental maturity and arithmetic achievement of students in the types of districts compared.

**Welding**

Table 13 identifies two comparisons of city districts with joint vocational districts in the occupational area of welding. There were no significant differences on welding achievement or arithmetic achievement in the two comparisons of students in city districts with students in joint vocational districts. However, in both comparisons, the students in city districts had significantly higher mental maturity than students in joint vocational districts.

The comparison for city districts with joint vocational districts indicates that both types of school districts produce students with comparable occupational achievement levels in welding. However, similar comparisons between school districts for students' mental maturity and arithmetic achievement indicate that the difference in welding achievement between types of districts are probably not accounted for by differences in arithmetic achievement but mental maturity may have an effect on welding achievement of students in the types of districts compared.
### TABLE 13
COMPARISONS OF WELDING PROGRAMS FOR TYPE OF SCHOOL DISTRICT BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
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</thead>
<tbody>
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<td>NC</td>
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</tr>
<tr>
<td>Program Type 00 and Age 17</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td>Program Type 00 and Age 18</td>
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<td>Program Type 00 and Age 19</td>
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<sup>a</sup>Source: Appendix I, Table 65
<sup>b</sup>Source: Appendix I, Table 66
<sup>c</sup>Source: Appendix I, Table 67
<sup>d</sup>NC = No Comparisons
<sup>e</sup>City = City School Districts
<sup>f</sup>JV = Joint Vocational School Districts
<sup>g</sup>EV&L = Exempted Village and Local School Districts
Summary

Joint vocational districts were identified as having students achieve significantly higher than other school district types in the occupational areas of automotive mechanics and mechanical drafting.

City districts were identified as having students achieve significantly higher than joint vocational districts in the occupational areas of cosmetology, industrial electrician and printing. However, similar comparison of students from city districts with students from joint vocational districts would indicate that the difference in industrial electrician and printing achievement may have been affected by the significant difference in the mental maturity of the students in the districts compared. In the occupational area of printing, the significant difference in printing achievement scores for the districts compared may also have been affected by the significant difference in arithmetic achievement scores for the city districts compared with the joint vocational districts.

Exempted village and local districts were identified as having students achieve significantly higher scores than joint vocational districts in the occupational area of cosmetology. Similar comparisons between these two school district types for mental maturity and arithmetic achievement indicates that the difference in cosmetology achievement between these districts are probably not related to differences in the mental maturity or arithmetic achievement of these students.
Comparison of Program Types for Six Occupational Areas

Automotive Mechanics

The senior automotive mechanics students in program type 00 were compared with students in program type 01. Table 14 identifies five comparisons where there were no significant differences between the two types of programs for occupational achievement in automotive mechanics. There were no significant differences on the mental maturity test and the arithmetic achievement test for the same groups of students. The comparison for program type 00 with program type 01 indicates that both types of programs produce students with comparable occupational achievement levels in automotive mechanics.

Industrial Electrician

The senior industrial electrician students in program type 00 were compared with students in program type 02. Table 15 identifies the one comparison for which there was no significant difference between the two types of programs for occupational achievement in industrial electrician. There were no significant differences on the mental maturity test and the arithmetic achievement test for the same groups of students. The comparison for program type 00 with program type 02 indicates that both types of programs produce students with comparable occupational achievement levels in industrial electrician.
TABLE 14

COMPARISONS OF AUTOMOTIVE MECHANICS PROGRAMS FOR TYPE OF PROGRAM BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
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<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
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<sup>a</sup>Source: Appendix B, Table 29
<sup>b</sup>Source: Appendix B, Table 30
<sup>c</sup>Source: Appendix B, Table 31
<sup>d</sup>NC = No Comparisons
### TABLE 15

**Comparisons of Industrial Electrician Programs for Type of Program by Occupational Achievement, Mental Maturity, and Arithmetic Achievement for Students Who Used the Ohio Basic Electricity Achievement Test**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
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<td>City District and Age 19</td>
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<sup>a</sup>Source: Appendix D, Table 37

<sup>b</sup>Source: Appendix D, Table 38

<sup>c</sup>Source: Appendix D, Table 39

<sup>d</sup>NC = No Comparisons
Industrial Electronics

Table 16 identifies two comparisons of program type 00 with program type 01 in the occupational area of industrial electronics for those students who used the Ohio Basic Electricity Achievement Test. One of the two comparisons shows no significant difference while the other one shows senior students in program type 00 achieving significantly higher scores than students in program type 01. There were no significant differences on the mental maturity and the arithmetic achievement test for the same groups of students. Similar comparisons between program types for students' mental maturity and arithmetic achievement indicate that the differences in industrial electronics achievement between types of programs, as measured by the basic electricity test, are probably not accounted for by differences in the mental maturity or arithmetic achievement of students in the types of programs compared.

Table 17 identifies three comparisons of program type 00 with program type 01 in the occupational area of industrial electronics for those students who used the Ohio Basic Electronics Achievement Test. There were no significant differences in the basic electronics achievement or mental maturity in the three comparisons of students in program type 00 with students in program type 01. In one of the three comparisons, students in program type 01 had significantly higher arithmetic achievement than students in program type 00. The comparisons for program type 00 with program type 01 indicate that both types of programs produce students with comparable occupational
TABLE 16
COMPARISONS OF INDUSTRIAL ELECTRONICS PROGRAMS FOR TYPE OF PROGRAM BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT FOR STUDENTS WHO USED THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST

<table>
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<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
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<sup>a</sup>Source: Appendix E, Table 45
<sup>b</sup>Source: Appendix E, Table 46
<sup>c</sup>Source: Appendix E, Table 47
<sup>d</sup>NC = No Comparisons
**TABLE 17**

COMPARISONS OF INDUSTRIAL ELECTRONICS PROGRAMS FOR TYPE OF PROGRAM BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT FOR STUDENTS WHO USED THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST

<table>
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<th>Control Variable(s)</th>
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<td>City District and Age 17</td>
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</table>

\(^a\)Source: Appendix E, Table 48  
\(^b\)Source: Appendix E, Table 49  
\(^c\)Source: Appendix E, Table 50  
\(^d\)NC = No Comparisons
achievement levels in industrial electronics as measured by the Ohio Basic Electronics Achievement Test. However, arithmetic achievement may be affecting basic electronics achievement in the occupational area of industrial electronics.

Machine Trades

Table 18 identifies three comparisons of program type 00 with program type 01 in the occupational area of machine trades. There were no significant differences on machine trades achievement or arithmetic achievement in the three comparisons of students in program type 00 with students in program type 01. However, in one of the three comparisons, students in program type 01 had significantly higher mental maturity scores than students in program type 00. The comparisons for program type 00 with program type 01 indicate that both types of programs produce students with comparable occupational achievement levels in machine trades. However, mental maturity may account for achievement in the occupational area of machine trades.

Mechanical Drafting

Table 19 identifies three comparisons of program type 00 with program type 01 in the occupational area of mechanical drafting. There were no significant differences between student scores on mechanical drafting achievement, mental maturity, or arithmetic achievement in the three comparisons of program type 00 with program type 01.

Also shown in Table 19 are three comparisons of program type 00 with program type 02 in the occupational area of mechanical drafting.
<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement(^a)</th>
<th>Mental Maturity(^b)</th>
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<td>00 vs. 01 00 vs. 02 01 vs. 02</td>
</tr>
<tr>
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<td>00 = 01 NC(^d) NC</td>
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<td>City Districts</td>
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<td>00 = 01 NC NC</td>
<td>00 = 01 NC NC</td>
</tr>
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<td>NC NC NC</td>
<td>NC NC NC</td>
<td>NC NC NC</td>
</tr>
<tr>
<td>City District and Age 18</td>
<td>00 = 01 NC NC</td>
<td>00 = 01 NC NC</td>
<td>00 = 01 NC NC</td>
</tr>
<tr>
<td>City District and Age 19</td>
<td>NC NC NC</td>
<td>NC NC NC</td>
<td>NC NC NC</td>
</tr>
</tbody>
</table>

\(^a\)Source: Appendix F, Table 53

\(^b\)Source: Appendix F, Table 54

\(^c\)Source: Appendix F, Table 55

\(^d\)NC = No Comparisons
TABLE 19

COMPARISONS OF MECHANICAL DRAFTING PROGRAMS FOR TYPE OF PROGRAM BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
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<td>00 vs. 02</td>
<td>01 vs. 02</td>
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<td>00 = 01</td>
<td>00 = 02</td>
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<tr>
<td>City Districts</td>
<td>00 = 01</td>
<td>00 = 02</td>
<td>01 = 02</td>
</tr>
<tr>
<td>City District and Age 17</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>City District and Age 18</td>
<td>00 = 01</td>
<td>00 = 02</td>
<td>01 = 02</td>
</tr>
<tr>
<td>City District and Age 19</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>

<sup>a</sup>Source: Appendix G, Table 57
<sup>b</sup>Source: Appendix G, Table 58
<sup>c</sup>Source: Appendix G, Table 59
<sup>d</sup>NC = No Comparisons
There were no significant differences between student scores on mechanical drafting achievement, mental maturity, or arithmetic achievement in the three comparisons of program type 00 with program type 02.

Displayed in Table 19 are three comparisons of program type 01 with program type 02 in the occupational area of mechanical drafting. There were no significant differences between student scores on mechanical drafting achievement, mental maturity, or arithmetic achievement in the three comparisons of program type 01 and program type 02.

The comparisons of program types indicate that all three types of programs produce students with comparable occupational achievement levels in mechanical drafting.

**Printing**

Table 20 identifies one comparison of program type 00 with program type 01 in the occupational area of printing. The students in program type 01 scored significantly higher than the students in program type 00 in the printing achievement. There was no significant difference for these same groups of students on the mental maturity or arithmetic achievement.

There were two comparisons of students in program type 00 with students in program type 02. In one of these two comparisons, students in program type 00 scored significantly higher on the printing achievement and the mental maturity than the students in program type 02. There were no significant differences in arithmetic achievement when students in program type 00 and program type 02 were compared.
### TABLE 20

COMPARISONS OF PRINTING PROGRAMS FOR TYPE OF PROGRAM BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement (^{a})</th>
<th>Mental Maturity (^{b})</th>
<th>Arithmetic Achievement (^{c})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00 vs. 01</td>
<td>00 vs. 02</td>
<td>01 vs. 02</td>
</tr>
<tr>
<td>None</td>
<td>00 &lt; 01</td>
<td>00 = 02</td>
<td>01 &gt; 02</td>
</tr>
<tr>
<td>City Districts</td>
<td>NC (^{d})</td>
<td>00 &gt; 02</td>
<td>NC</td>
</tr>
<tr>
<td>City District and Age 17</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>City District and Age 18</td>
<td>NC</td>
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<td>NC</td>
</tr>
<tr>
<td>City District and Age 19</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>

\(^{a}\)Source: Appendix H, Table 61  
\(^{b}\)Source: Appendix H, Table 62  
\(^{c}\)Source: Appendix H, Table 63  
\(^{d}\)NC = No Comparisons
There was one comparison of students in program type 01 with students in program type 02, in which the students in program type 01 scored significantly higher than the students in program type 02 in the occupational area of printing. There was no significant difference on mental maturity and arithmetic achievement when the students in program type 01 and program type 02 were compared.

The comparisons of program types indicate that program type 01 produces students with higher achievement than the other program types. Similar comparisons between program types of students' mental maturity and arithmetic achievement indicate that the differences in printing achievement between program types are probably not caused by the differences in the mental maturity or arithmetic achievement of students in the program types compared. However, the mental maturity level of students in program type 00 may have affected the achievement level in one comparison of program type 00 compared with program type 02 for which there was a significant difference in printing achievement.

Summary
Five of the six occupational areas examined indicated that the occupational achievement level of students is comparable regardless of the program type. In the occupational area of printing, significant difference in occupational achievement was identified for program type 01 compared with the other two program types. This study does not provide substantial evidence to indicate that one type of program is producing greater student achievement than any other. This finding is in direct conflict with the study by the Ohio Trade and Industrial
Education Service (1964) in which program types with indepth instruction proved to be consistently superior by using matched pairs of students' mental maturity scores.

Comparison of Student Age Groups for Four Occupational Areas

Automotive Mechanics

Table 21 identifies three comparisons of students age 17 with students age 19 in the occupational area of automotive mechanics. One of the three comparisons shows no significant differences in occupational achievement, while in two comparisons senior students age 17 scored significantly higher than students age 19. The students age 17 also had a significantly higher mental maturity level than the students age 19. Of the three comparisons of students age 17 with students age 19, the students age 17 had a significantly higher arithmetic achievement level for two of the three comparisons.

There were three comparisons of students age 17 with students age 18. In one of these comparisons, students age 17 achieved significantly higher on the automotive mechanics test. There were no significant differences on mental maturity or arithmetic achievement levels between the students age 17 and the students age 18.

There were three comparisons of students age 18 with students age 19. The students age 18 achieved significantly higher on the automotive mechanics test than the students age 19 in one of the three comparisons. The students age 18 which scored significantly
TABLE 21
COMPARISONS OF AUTOMOTIVE MECHANICS PROGRAM BY AGE BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17 vs. 19</td>
<td>17 vs. 18</td>
<td>18 vs. 19</td>
</tr>
<tr>
<td>City District and Program Type 00</td>
<td>17 &gt; 19</td>
<td>17 = 18</td>
<td>18 = 19</td>
</tr>
<tr>
<td>City District and Program Type 01</td>
<td>17 &gt; 19</td>
<td>17 &gt; 19</td>
<td>18 &gt; 19</td>
</tr>
<tr>
<td>J.V.S.D.</td>
<td>17 = 19</td>
<td>17 = 18</td>
<td>18 = 19</td>
</tr>
</tbody>
</table>

<sup>a</sup>Source: Appendix B, Table 29
<sup>b</sup>Source: Appendix B, Table 30
<sup>c</sup>Source: Appendix B, Table 31
higher than the students age 19 did not have a significant difference for mental maturity. However, the students age 18 scored significantly higher than the students age 19 on the arithmetic achievement test. Although two of the three comparisons of students age 18 with students age 19 were found not to have significant differences for occupational achievement, there was a significant difference on mental maturity for both comparisons with one of the two comparisons also having a significant difference on arithmetic achievement for the groups compared.

In three of the six comparisons of students age 17 with other age groups, the students age 17 scored significantly higher on automotive mechanics than students in other age groups. Similar comparisons between age groups for students' mental maturity and arithmetic indicates that the difference in automotive mechanics achievement between age groups may be explained by differences in the mental maturity or arithmetic achievement of students in the age groups compared.

**Cosmetology**

The senior students age 17 in cosmetology programs were compared with students age 18. Table 22 identifies two comparisons with one comparison having a significant difference in occupational achievement. The student age 17 which did significantly better than the students age 18 on the cosmetology test also had a significantly higher mean score on the mental maturity and arithmetic achievement when compared with the same students age 18. Similar comparisons between age groups
TABLE 22
COMPARISONS OF COSMETOLOGY PROGRAM BY AGE BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mental Maturity&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Arithmetic Achievement&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
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<td>18 vs. 19</td>
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<tr>
<td>City District and Program Type 00</td>
<td>NC&lt;sup&gt;d&lt;/sup&gt;</td>
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</tr>
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<td>City District and Program Type 01</td>
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<td>NC</td>
<td>NC</td>
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<td>J.V.S.D.</td>
<td>NC</td>
<td>17 = 18</td>
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</table>

<sup>a</sup>Source: Appendix C, Table 33
<sup>b</sup>Source: Appendix C, Table 34
<sup>c</sup>Source: Appendix C, Table 35
<sup>d</sup>NC = No Comparisons
for students' mental maturity and arithmetic achievement indicate that the differences in cosmetology achievement between age groups may be accounted for by difference in the mental maturity or arithmetic achievement of students in the age groups compared.

**Machine Trades**

Table 23 identifies one comparison of students age 17 with students age 19 in the occupational area of machine trades. The students age 17 achieved significantly higher than the students age 19. The students age 17 who achieved significantly higher on the occupational achievement over the students age 19 also had a significantly higher mental maturity and arithmetic achievement level.

In one comparison of students age 18 with students age 19, the students age 18 had a significantly higher occupational achievement, mental maturity, and arithmetic achievement level than the students age 19. Similar comparisons between age groups for students' mental maturity and arithmetic achievement indicate that the differences in machine trades achievement between age groups may be related to the difference in the mental maturity and arithmetic achievement of students in the age groups compared.

**Mechanical Drafting**

The senior students age 17 in the mechanical drafting were compared with students age 18. Table 24 identifies one comparison for which there was no significant difference between the two age
# TABLE 23

**COMPARISONS OF MACHINE TRADES PROGRAM BY AGE BY OCCUPATIONAL ACHIEVEMENT, MENTAL MATURITY, AND ARITHMETIC ACHIEVEMENT**

<table>
<thead>
<tr>
<th>Control Variable(s)</th>
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<th>Mental Maturity(^b)</th>
<th>Arithmetic Achievement(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17 vs. 19 17 vs. 18 18 vs. 19</td>
<td>17 vs. 19 17 vs. 18 18 vs. 19</td>
<td>17 vs. 19 17 vs. 18 18 vs. 19</td>
</tr>
<tr>
<td>City District and Program Type 00</td>
<td>17 &gt; 19 17 = 18 18 &gt; 19</td>
<td>17 &gt; 19 17 = 18 18 &gt; 19</td>
<td>17 &gt; 19 17 = 18 18 &gt; 19</td>
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<td>City District and Program Type 01</td>
<td>NC (^d) NC NC</td>
<td>NC NC NC</td>
<td>NC NC NC</td>
</tr>
<tr>
<td>J.V.S.D.</td>
<td>NC NC NC</td>
<td>NC NC NC</td>
<td>NC NC NC</td>
</tr>
</tbody>
</table>

\(^a\)Source: Appendix F, Table 53  
\(^b\)Source: Appendix F, Table 54  
\(^c\)Source: Appendix F, Table 55  
\(^d\)NC = No Comparisons
<table>
<thead>
<tr>
<th>Control Variable(s)</th>
<th>Occupational Achievement(^a)</th>
<th>Mental Maturity(^b)</th>
<th>Arithmetic Achievement(^c)</th>
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</thead>
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<tr>
<td></td>
<td>17 vs. 19</td>
<td>17 vs. 18</td>
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<tr>
<td></td>
<td>18 vs. 19</td>
<td>17 vs. 19</td>
<td>18 vs. 19</td>
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<tr>
<td></td>
<td>17 vs. 19</td>
<td>17 vs. 18</td>
<td>18 vs. 19</td>
</tr>
<tr>
<td>City District and Program Type 00</td>
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<td>17 = 18</td>
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<tr>
<td>City District and Program Type 01</td>
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<tr>
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<td>NC</td>
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<tr>
<td>J.V.S.D.</td>
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<tr>
<td></td>
<td>NC</td>
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</tr>
</tbody>
</table>

\(^a\)Source: Appendix G, Table 57  
\(^b\)Source: Appendix G, Table 58  
\(^c\)Source: Appendix G, Table 59  
\(^d\)NC = No Comparisons
groups for occupational achievement, mental maturity, or arithmetic achievement. The comparison of students age 17 with students age 18 indicates that student age probably is not affecting student occupational achievement in mechanical drafting for the age groups compared.

Summary

In three of the four occupational areas compared, whenever a significant difference was found between student age groups, the younger group of students always had the significantly higher mean score on either the occupational achievement, mental maturity, or arithmetic achievement test. In the occupational areas of machine trades and mechanical drafting no significant differences were identified between the students age 17 and 18.
CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter will provide a summary of this study, conclusions based on the findings, and recommendations for further research.

Summary

The Ohio Trade and Industrial Education local supervisors made initial demands in the mid-fifties for the development of achievement measures for vocational education. In 1958, 508 students enrolled in machine trades programs were initially tested. The Ohio Trade and Industrial Education Achievement Test Program grew to serve over 13,000 students in 1969 with twelve different occupational achievement tests. The achievement test program has provided considerable data and information to school administrators, counselors, and teachers for student assessment and program improvement.

The achievement test program has been utilized for numerous research studies. Many of the studies reviewed in the related literature pointed to the validity and reliability of the occupational tests. Studies have been directed at assisting state and local supervisors, teacher educators, and school administrators with decisions for the improvement of instruction in vocational education.
Statement of Problem

The primary purpose of this study was to determine program and student variables which may have a relationship to student achievement. Specifically: (1) to compare the achievement levels of students in the various school district types as measured by occupational achievement tests, (2) to compare the achievement level of students enrolled in the various program types as measured by the occupational achievement tests, and (3) to compare the achievement level of students by age groups. Incorporated into each of these comparisons were the mental maturity and arithmetic test scores as collected through the Ohio Trade and Industrial Education Achievement Test Program.

Procedures

The procedures for this study involved all the students who participated in the Ohio Trade and Industrial Education Achievement Test Program in selected occupational areas during the school year 1969-70. The occupational achievement test scores were the dependent variables. The occupational areas considered were: (1) Automotive Body and Fender Repair, (2) Automotive Mechanics, (3) Cosmetology, (4) Industrial Electrician, (5) Industrial Electronics, (6) Machine Trades, (7) Mechanical Drafting, (8) Printing, and (9) Welding. Four reliability coefficients were generated for each group included in the comparisons.

The independent variables were: (1) type of school district, (2) program type, and (3) the chronological age of students. The
California Survey of Mental Maturity, Advanced Form 1, and the Stanford Arithmetic Achievement Test, Form JM, were used as control variables within the study.

Within each group, the data from the tests were subjected to a t-test for significant difference between means. By applying the appropriate degrees of freedom and referring to the t distribution table, a level of significance was either accepted or rejected.

Findings

The goals of this study, as identified in Chapter I, are the interpretations of three data comparisons. These findings are as follows:

Comparison 1 -- Comparison of the achievement levels of students in the various district types as measured by the occupational achievement test.

Findings -- Joint vocational districts were identified as having students achieve significantly higher than other school district types in the occupational areas of automotive mechanics and mechanical drafting.

City districts were identified as having students achieve significantly higher than joint vocational districts in the occupational areas of cosmetology, industrial electrician, and printing. However, similar comparison of students from city districts with students from joint vocational districts would indicate that the difference in industrial electrician and printing achievement may have been accounted for by the significant difference in mental maturity of the students in
districts compared. In the occupational area of printing, the significant difference in printing achievement for the students in the districts compared may also have been explained by the significant difference in arithmetic achievement for the city district students compared with the joint vocational district students.

Exempted village and local districts were identified as having students achieve significantly higher than students in joint vocational districts in the occupational area of cosmetology. Similar comparisons between these two school district types for mental maturity and arithmetic achievement indicates that the difference in cosmetology achievement between students from these two types of districts is probably not accounted for by differences in the mental maturity or arithmetic achievement.

Comparison 2 -- Comparison of the achievement levels of students enrolled in the various program types as measured by the occupational achievement test.

Findings -- Five of the six occupational areas examined indicated that the occupational achievement level of students is comparable regardless of the program type. In the occupational area of printing, significant difference in occupational achievement was identified for program type 01 compared with the other two program types. This study does not provide substantial evidence to indicate that one type of program is producing greater student achievement than any other. This finding is in direct conflict with the study by the Ohio Trade and Industrial Education Service (1964) in which students from program
type 00 with indepth instruction proved to be consistently superior than students in program type 01. This 1964 study used matched pairs of students' mental maturity scores.

Comparison 3 -- Comparison of the achievement levels of students by age groups.

Findings -- In three of the four occupational areas compared, whenever a significant difference was found between student age groups the younger group of students always had the significantly higher mean score on either the occupational achievement, mental maturity, or arithmetic achievement test. In the occupational areas of machine trades and mechanical drafting no significant differences were identified between the students age 17 and 18.

Conclusions

Upon examining the findings of the numerous occupational areas in reference to the three basic questions of the study, the following are the three major conclusions.

(1) School district type does not consistently account for differences in students' occupational achievement for the nine occupational areas studied. However, students from joint vocational districts had higher levels of achievement in automotive mechanics and mechanical drafting; and city district students had a higher level of achievement in cosmetology, industrial electrician, and printing.

(2) Program type does not consistently account for differences in students' occupational achievement for the six occupational areas
studied. However, students from city districts in program type 00 scored significantly higher than city students in program type 01 in the occupational area of industrial electrician; and printing students in program type 01 achieved higher than students in other types of programs.

(3) When there is a significant relationship between performance and student age, highest performance is consistently made by the youngest age group. This may be accounted for by many student, teacher and other program factors not measured in this study. However, this phenomenon merits further examination.

**Recommendations for Further Research**

This study has raised several questions which cannot be answered by this research due to the limitations of the study. The following seven recommendations for further study may identify specific factors relating to the program and student variables which may be contributing to student achievement.

(1) It is recommended that this study be replicated utilizing current testing information and an analysis of covariance. Such a study should investigate the relationship between mental maturity and academic achievement of students and the occupational achievement of students in trade and industrial education classes.

(2) It is recommended that future studies involving the trade and industrial education achievement test program utilize occupational performance tests and rating scales to examine student occupational competence and job success as determined by employers of program
graduates. The findings of these studies may provide additional and current validity of the achievement tests and a broader base to study total occupational competence and educational achievement.

(3) It is recommended that further studies be undertaken to examine the curricular program and the relationship of the instructional time to the curricular outline as set forth in the criterion of the occupational achievement test. Studies of this nature will provide correlated data of actual occupational instruction compared to the standardized measures of occupational achievement.

(4) It is recommended that future studies comparing occupational achievement between various program variables include relationships with instructional facilities and equipment, occupational experience of instructors, degree of professional competence, and years of teaching experience of the teachers in the occupational program. Factors such as these will need to be analyzed through a process such as multiple regression analysis to determine how each factor is contributing to student achievement.

(5) It is recommended that student characteristics such as reading level of students and the reading level of the pencil and paper achievement test be considered in future studies. A correlation of reading level with student age may further explain the one consistent pattern of younger students achieving at a higher level than older students.

(6) It is recommended that further studies be conducted to explore the chronological age of students and the relationship of that age to other standardized measures of student achievement and aptitude.
Such a study may require a controlled longitudinal study to determine if age in combination with other student characteristics accounts for high achievement.

(7) It is recommended that future studies examine the possibility of social and economic benefits derived from the extended block of instructional time. For example, the programs with greater periods of time may be providing educational experiences which may have a positive effect on student job success and job satisfaction.
APPENDIX A

AUTOMOTIVE BODY AND FENDER REPAIR
**TABLE 25**

AUTO BODY PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO AUTO BODY ACHIEVEMENT TEST

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. City Districts</td>
<td>97</td>
<td>158.61</td>
<td>33.53</td>
<td>.262</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>106</td>
<td>159.86</td>
<td>34.13</td>
<td></td>
</tr>
<tr>
<td>2. City Districts with Program Type 00</td>
<td>62</td>
<td>165.83</td>
<td>31.67</td>
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</tr>
<tr>
<td>Joint Vocational Districts with Program Type 00</td>
<td>106</td>
<td>159.86</td>
<td>34.13</td>
<td></td>
</tr>
<tr>
<td>3. City Districts with Program Type 00 and Age Group 18</td>
<td>31</td>
<td>165.38</td>
<td>33.78</td>
<td>.042</td>
</tr>
<tr>
<td>Joint Vocational Districts with Program Type 00 and Age Group 18</td>
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<td>165.08</td>
<td>28.46</td>
<td></td>
</tr>
<tr>
<td>Groups Compared</td>
<td>N</td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>t Value</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----</td>
<td>------</td>
<td>--------------------</td>
<td>---------</td>
</tr>
<tr>
<td>1. City Districts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>97</td>
<td>39.12</td>
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<td>1.459</td>
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<tr>
<td>2. City Districts with Program Type 00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
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<td>41.34</td>
<td>10.91</td>
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<td>Joint Vocational Districts with Program Type 00</td>
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<td></td>
<td>62</td>
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<td></td>
<td>106</td>
<td>41.34</td>
<td>10.91</td>
<td>.036</td>
</tr>
<tr>
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### TABLE 27

**AUTO BODY PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE STANFORD ARITHMETIC ACHIEVEMENT TEST**

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TABLE 28

RELIABILITY COEFFICIENTS FOR THE OHIO AUTO BODY
ACHIEVEMENT TEST - 1970

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<td>.91</td>
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### TABLE 29
AUTOMOTIVE MECHANICS PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO AUTOMOTIVE MECHANICS ACHIEVEMENT TEST

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^Significant at the .001 level.

 Significant at the .01 level.

 Significant at the .02 level.

 Significant at the .05 level.
TABLE 30

AUTOMOTIVE MECHANICS PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY, ADVANCED FORM 1

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*Significant at the .05 level.

bSignificant at the .01 level.

cSignificant at the .001 level.
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AUTOMOTIVE MECHANICS PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE STANFORD ARITHMETIC ACHIEVEMENT TEST

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*Significant at the .05 level.
^Significant at the .02 level.
&Significant at the .01 level.
TABLE 32

RELIABILITY COEFFICIENTS FOR THE OHIO AUTOMOTIVE MECHANICS
ACHIEVEMENT TEST - 1970

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APPENDIX C

COSMETOLOGY
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\(^a\)Significant at the .05 level.
\(^b\)Significant at the .01 level.
## TABLE 34

COSMETOLOGY PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY, ADVANCED FORM 1

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
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<td>1. City Districts</td>
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<td>9.81</td>
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<td>9.81</td>
<td>.597</td>
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<tr>
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<td></td>
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<td></td>
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<td>6. Joint Vocational Districts</td>
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<td>8.89</td>
<td>1.353</td>
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TABLE 34—continued

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<tr>
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<th>t Value</th>
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*aSignificant at the .02 level.
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<td>6.76</td>
<td>.169</td>
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<td>7.61</td>
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<td>City Districts</td>
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<td>6.64</td>
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<td>Age Group 18</td>
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</tbody>
</table>
TABLE 35--continued

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<tr>
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<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
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<td>6.42</td>
<td>1.312</td>
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*Significant at the .01 level.*
TABLE 36
RELIABILITY COEFFICIENTS FOR THE OHIO COSMETOLOGY
ACHIEVEMENT TEST - 1970

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<th>Groups</th>
<th>N</th>
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<td></td>
<td>20</td>
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<td>Joint Vocational Districts</td>
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<td>.97</td>
</tr>
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<td>Exempted Village/Local Districts</td>
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<td>.98</td>
</tr>
<tr>
<td>City Districts with Program Type 00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age Group 17</td>
<td>92</td>
<td>.94</td>
</tr>
<tr>
<td>City Districts with Program Type 00</td>
<td></td>
<td></td>
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<tr>
<td>Age Group 18</td>
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<td>.93</td>
</tr>
<tr>
<td>Joint Vocational Districts with</td>
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<td></td>
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<tr>
<td>Program Type 00 Age Group 17</td>
<td>53</td>
<td>.91</td>
</tr>
<tr>
<td>Joint Vocational Districts with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Type 00 Age Group 18</td>
<td>140</td>
<td>.94</td>
</tr>
<tr>
<td>Exempted Village/Local Districts</td>
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<td></td>
</tr>
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<td>with Program Type 00 Age Group 18</td>
<td>58</td>
<td>.96</td>
</tr>
</tbody>
</table>
APPENDIX D

INDUSTRIAL ELECTRICIAN
### TABLE 37

**INDUSTRIAL ELECTRICIAN PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
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<td>1. City Districts</td>
<td>55</td>
<td>123.01</td>
<td>28.34</td>
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<tr>
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<td>107.68</td>
<td>23.43</td>
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<td>33</td>
<td>116.12</td>
<td>27.25</td>
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</table>

^aSignificant at the .01 level.

### TABLE 38

**INDUSTRIAL ELECTRICIAN PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY, ADVANCED FORM 1, FOR STUDENTS WHO ALSO USED THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
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<td>2.669^a</td>
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<td>8.41</td>
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<td>1.872</td>
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<td>34.54</td>
<td>6.01</td>
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</table>

^aSignificant at the .02 level.
### TABLE 39

INDUSTRIAL ELECTRICIAN PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE STANFORD ARITHMETIC ACHIEVEMENT TEST FOR STUDENTS WHO ALSO USED THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
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<tbody>
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<td>51.47</td>
<td>11.51</td>
<td>.443</td>
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<td>50.34</td>
<td>11.76</td>
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### TABLE 40

INDUSTRIAL ELECTRICIAN PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
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<td>10.42</td>
<td>.858</td>
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<td>41.60</td>
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### TABLE 41

**INDUSTRIAL ELECTRICIAN PROGRAM COMPARISONS WITH \( t \) VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL Maturity, Advanced Form 1, FOR STUDENTS WHO ALSO USED THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>( t ) Value</th>
</tr>
</thead>
<tbody>
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<td>1. City Districts</td>
<td>36</td>
<td>50.50</td>
<td>11.65</td>
<td>.139</td>
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<td>50.90</td>
<td>11.54</td>
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### TABLE 42

**INDUSTRIAL ELECTRICIAN PROGRAM COMPARISONS WITH \( t \) VALUES FOR SIGNIFICANCE USING THE STANFORD ARITHMETIC ACHIEVEMENT TEST FOR STUDENTS WHO ALSO USED THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>( t ) Value</th>
</tr>
</thead>
<tbody>
<tr>
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<td>31</td>
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TABLE 43
RELIABILITY COEFFICIENTS FOR THE OHIO BASIC ELECTRICITY
ACHIEVEMENT TEST BY GROUPS ENROLLED IN INDUSTRIAL
ELECTRICIAN PROGRAMS - 1970

<table>
<thead>
<tr>
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<th>N</th>
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<th>Spearman Brown</th>
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<td>20</td>
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</tr>
<tr>
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<td>.94</td>
<td>.92</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>35</td>
<td>.92</td>
<td>.89</td>
</tr>
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<td>Program Type 00</td>
<td>47</td>
<td>.94</td>
<td>.92</td>
</tr>
<tr>
<td>Program Type 02</td>
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<td>.94</td>
<td>.92</td>
</tr>
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</table>

TABLE 44
RELIABILITY COEFFICIENTS OF THE OHIO BASIC ELECTRONICS
ACHIEVEMENT TEST BY GROUPS ENROLLED IN INDUSTRIAL
ELECTRICIAN PROGRAMS - 1970

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Kuder Richardson</th>
<th>Spearman Brown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>City Districts</td>
<td>36</td>
<td>.81</td>
<td>.78</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>31</td>
<td>.92</td>
<td>.91</td>
</tr>
</tbody>
</table>
APPENDIX E

INDUSTRIAL ELECTRONICS
### TABLE 45
INDUSTRIAL ELECTRONICS PROGRAM COMPARISONS WITH \( t \) VALUES FOR SIGNIFICANCE USING THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST

<table>
<thead>
<tr>
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<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>( t ) Value</th>
</tr>
</thead>
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<td>22.02</td>
<td>1.178</td>
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<td>Program Type 01</td>
<td>49</td>
<td>109.81</td>
<td>23.84</td>
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</tr>
<tr>
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<td>67</td>
<td>115.07</td>
<td>22.12</td>
<td>2.038(^a)</td>
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<td>34</td>
<td>104.73</td>
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\(^a\)Significant at the .05 level of confidence.

### TABLE 46
INDUSTRIAL ELECTRONICS PROGRAM COMPARISONS WITH \( t \) VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY, ADVANCED FORM 1, FOR STUDENTS WHO ALSO USED THE OHIO BASIC ELECTRICITY ACHIEVEMENT TEST

<table>
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<tr>
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<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>( t ) Value</th>
</tr>
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<td>Program Type 01</td>
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<tr>
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<td>Mean</td>
<td>Standard Deviation</td>
<td>t Value</td>
</tr>
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### TABLE 48

**INDUSTRIAL ELECTRONICS PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST**

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**TABLE 49**

**INDUSTRIAL ELECTRONICS PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY, ADVANCED FORM 1, FOR STUDENTS WHO ALSO USED THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST**

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*aSignificant at the .05 level.
*bSignificant at the .02 level.
*cSignificant at the .01 level.
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TABLE 52

RELIABILITY COEFFICIENTS FOR THE OHIO BASIC ELECTRONICS ACHIEVEMENT TEST BY GROUPS ENROLLED IN INDUSTRIAL ELECTRONICS PROGRAMS - 1970

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<td>.86</td>
<td>.77</td>
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APPENDIX F

MACHINE TRADES
TABLE 53

MACHINE TRADES PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE
USING THE OHIO MACHINE TRADES ACHIEVEMENT TEST

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<th>t Value</th>
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<td>28.24</td>
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<td>Standard Deviation</td>
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*aSignificant at the .01 level.
# TABLE 54

MACHINE TRADES PROGRAM COMPARISONS WITH \( t \) VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY-ADVANCED FORM 1

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<th>( t ) Value</th>
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\[a\] Significant at the .05 level.
\[b\] Significant at the .01 level.
\[c\] Significant at the .001 level.
TABLE 55
MACHINE TRADES PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE STANFORD ARITHMETIC ACHIEVEMENT TEST

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*aSignificant at the .05 level.

bSignificant at the .001 level.
**TABLE 56**

RELIABILITY COEFFICIENTS FOR THE OHIO MACHINE TRADES ACHIEVEMENT TEST - 1970

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APPENDIX G

MECHANICAL DRAFTING
### TABLE 57

MECHANICAL DRAFTING PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO MECHANICAL DRAFTING ACHIEVEMENT TEST

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*aSignificant at the .05 level of confidence.

bSignificant at the .02 level of confidence.

cSignificant at the .001 level of confidence.
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\(^a\)Significant at the .05 level.
\(^b\)Significant at the .02 level.
TABLE 60
RELIABILITY COEFFICIENTS FOR THE OHIO MECHANICAL DRAFTING ACHIEVEMENT TEST - 1970

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APPENDIX H

PRINTING
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PRINTING PROGRAM COMPARISONS WITH $t$ VALUES FOR SIGNIFICANCE USING THE OHIO PRINTING ACHIEVEMENT TEST

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</tbody>
</table>

^aSignificant at the .001 level.
# TABLE 64

RELIABILITY COEFFICIENTS FOR THE OHIO PRINTING ACHIEVEMENT TEST - 1970

<table>
<thead>
<tr>
<th>Groups</th>
<th>Reliability Coefficient</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Kuder</td>
<td>Spearman</td>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Richardson</td>
<td>Split-</td>
<td>Odd-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>Half</td>
<td>21</td>
<td>Even</td>
</tr>
<tr>
<td>City Districts</td>
<td>100</td>
<td>.97</td>
<td>.94</td>
<td>.94</td>
<td>.97</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>34</td>
<td>.97</td>
<td>.93</td>
<td>.90</td>
<td>.95</td>
</tr>
<tr>
<td>Program Type 00</td>
<td>69</td>
<td>.98</td>
<td>.96</td>
<td>.94</td>
<td>.97</td>
</tr>
<tr>
<td>Program Type 01</td>
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<td>.94</td>
<td>.96</td>
<td>.98</td>
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<tr>
<td>Program Type 02</td>
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<td>.92</td>
<td>.92</td>
<td>.96</td>
</tr>
<tr>
<td>City Districts with Program Type 00</td>
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<td>.97</td>
<td>.94</td>
<td>.92</td>
<td>.96</td>
</tr>
<tr>
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<td>.92</td>
<td>.92</td>
<td>.96</td>
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<tr>
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<td>.97</td>
<td>.93</td>
<td>.90</td>
<td>.95</td>
</tr>
<tr>
<td>Program Type 00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I

WELDING
## TABLE 65

WELDING PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE OHIO WELDING ACHIEVEMENT TEST

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. City Districts</td>
<td>95</td>
<td>176.13</td>
<td>43.14</td>
<td>.369</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>51</td>
<td>178.81</td>
<td>40.34</td>
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</tr>
<tr>
<td>2. City Districts with Program Type 00</td>
<td>91</td>
<td>178.16</td>
<td>42.82</td>
<td>.088</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>51</td>
<td>178.80</td>
<td>40.34</td>
<td></td>
</tr>
</tbody>
</table>

## TABLE 66

WELDING PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE CALIFORNIA SURVEY OF MENTAL MATURITY, ADVANCED FORM 1

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. City Districts</td>
<td>95</td>
<td>41.77</td>
<td>10.24</td>
<td>2.045a</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>51</td>
<td>38.17</td>
<td>9.96</td>
<td></td>
</tr>
<tr>
<td>2. City Districts with Program Type 00</td>
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<td>41.78</td>
<td>10.27</td>
<td>2.032a</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>51</td>
<td>38.17</td>
<td>9.96</td>
<td></td>
</tr>
</tbody>
</table>

aSignificant at the .05 level of confidence.
### TABLE 67

**WELDING PROGRAM COMPARISONS WITH t VALUES FOR SIGNIFICANCE USING THE STANFORD ARITHMETIC ACHIEVEMENT TEST**

<table>
<thead>
<tr>
<th>Groups Compared</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. City Districts</td>
<td>95</td>
<td>27.17</td>
<td>8.99</td>
<td>.886</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
<td>51</td>
<td>25.74</td>
<td>9.34</td>
<td></td>
</tr>
<tr>
<td>2. City Districts with Program Type 00</td>
<td>91</td>
<td>27.35</td>
<td>8.94</td>
<td>.992</td>
</tr>
<tr>
<td>Joint Vocational Districts with Program Type 00</td>
<td>51</td>
<td>25.74</td>
<td>9.34</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 68

**RELIABILITY COEFFICIENTS FOR THE OHIO WELDING ACHIEVEMENT TEST - 1970**

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Reliability Coefficient</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Kuder</td>
<td>Spearman Brown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Richardson</td>
<td>Split-Half</td>
</tr>
<tr>
<td>City Districts</td>
<td>95</td>
<td>.98</td>
<td>.95</td>
</tr>
<tr>
<td>Joint Vocational Districts</td>
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<td>.95</td>
</tr>
<tr>
<td>City Districts with Program Type 00</td>
<td>91</td>
<td>.98</td>
<td>.95</td>
</tr>
<tr>
<td>Joint Vocational Districts with Program Type 00</td>
<td>51</td>
<td>.97</td>
<td>.95</td>
</tr>
</tbody>
</table>


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