THE RELATIONSHIP BETWEEN DRAFTING SKILLS OF STUDENTS ENROLLED IN MECHANICAL DESIGN TECHNOLOGY AT OKLAHOMA STATE UNIVERSITY AND DRAFTING SKILLS OF RECENT GRADUATES OF OKLAHOMA AREA VOCATIONAL-TECHNICAL SCHOOLS

By

GERALD R. McCLAIN

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Thesis Approved:

Eric W. Dugger
Thesis Adviser

Donald Scott Phillips

Lloyd D. Briggs

N N Durham
Dean of the Graduate College

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CHAPTER I

INTRODUCTION

Engineering technology has a philosophy of its own; training for the development of technical skills similar to those of a tradesman or skilled worker and academic training for skills similar to that of the engineer are required in the design of the engineering technology curriculum. Two academic years of training beyond the high school are usually the minimum required of most engineering technician education programs. Admission requirements for technical programs vary from school to school, but high school completion or the equivalent is the standard requirement. Admission to engineering technology programs which are offered for college credit usually requires graduation from high school, the attainment of a specified composite score on the American College Test (ACT), a specified grade point average (GPA) in high school, or a specified rank in the high school graduating class. The engineering technologist program normally requires two years of additional training beyond the two-year engineering technician program. The combination of these two types of programs is usually referred to as a two plus two engineering technology program. The engineering technician and technologist work as liaisons between the engineer or scientist and the craftsman, but the technologist sometimes works as a project leader in a

position of supervision of a technical area equal to that of the engineer (1). Such a position as a technologist requires additional study in the field of engineering and supervision.

Most students entering college take advanced-placement examinations in mathematics, English, history, and other courses through an ambitious and successful program conducted by the College Entrance Examination Board (2). The Board does not at this time offer tests in technical drafting skills. Students from non-credit area vocational-technical (AVT) schools should have the opportunity to take advanced-placement examinations in order to receive credit for their training. The engineering technology program at Oklahoma State University (OSU) requires most students to take an introductory drafting course. Students are not required to have advanced-placement tests in drafting even though they may have had drafting in high school. Students and schools could save time and money by requiring students who have had drafting in high school to take an advanced-placement examination. If higher education continues to produce the technician with the combination of technical and academic skills, college students should not be required to retake skills developed in high school just to receive college credit. Credit should be given where credit is due regardless of where the skill is learned. Regardless of whether the student learned a skill on a vacation, in a school, or as a hobby, if the skill is such that it can be measured as a part of the curriculum leading to a degree, credit should be given to the student (3).

Statement of the Problem

Education in college or university requires a considerable amount of time and money. When a student repeats courses with content which he has already mastered, frustration and drop-outs often result. Many students enter the engineering technology program at OSU after having completed a draftsman training program at the high school level in an AVT school or in a comprehensive high school. There is not a requirement at OSU requiring the student to take an advanced-placement test if he has had drafting before, consequently many students enroll in the introductory drafting course that have mastered many of the drafting skills required. The drafting skill level of AVT graduates should be determined and compared to the drafting skills of students in Mechanical Design Technology at OSU. A procedure should be developed at OSU which would require a student to take the advanced-placement drafting skills test if he has had drafting before, and if he makes an outstanding score, be allowed to take the advanced-placement test in the advanced drafting course.

Purpose of the Study

The purpose of this study is to present evidence which could be used to evaluate equivalent drafting skill competencies of recent AVT graduates for comparison with those normally expected of students who have completed basic drafting courses in an engineering technology program in order to justify awarding college credit for the former.

Need for the Study

Many students attend a vocational-technical school without realizing that continued education will be required for them after they graduate from high school and pursue a job. Education could be continued through activities such as night courses, on-the-job training, correspondence courses, and advanced training leading to a degree. Advanced training leading to a degree normally requires that the student start over without credit for his previous skill training if he is seeking a regular non-technician-technologist academic degree. The technician-technologist education degree programs offer the vocational-technical school graduate the most for his past skill training. By design, engineering technical education has skill training and academic training blended together to meet job requirements of liaison between skill workers and engineers (1). For several years the University's technician and technologist curriculum have been graduating students who have completed similar fundamental technical skills as a basis for more advanced work. The area vocational-technical schools do not offer college credit; therefore, the University cannot accept by direct transfer course work taken at an area vocational-technical school. The nature of the problem is to provide continued education to the vocational-technical graduate by opening the University to giving credit for skill courses taken at area vocational-technical schools through advanced-placement examinations.

Hypotheses to be Tested

The following null hypotheses are to be tested:

1. There will be no significant difference between the correlations between performance on an advanced-placement drafting skills test for

General Technology (GENT) 1153 Technical Drawing and ACT composite score for Oklahoma State University students and Oklahoma Area Vocational-Technical School graduates.

2. There will be no significant difference between the correlations between performance on an advanced-placement drafting skills test for GENT 1153 and high school GPA for OSU students and Oklahoma AVT graduates.

3. There will be no significant difference between the correlations between performance on an advanced-placement drafting skills test for GENT 1153 and rank in high school graduating class for OSU students and Oklahoma AVT graduates.

4. There will be no significant difference between the correlations between performance on an advanced-placement drafting skills test for Mechanical Design Technology (MECDT) 1214 Machine Drafting and ACT composite score for OSU students and Oklahoma AVT graduates.

5. There will be no significant difference between the correlations between performance on an advanced-placement drafting skills test for MECDT 1214 and high school GPA for OSU students and Oklahoma AVT graduates.

6. There will be no significant difference between the correlations between performance on an advanced-placement drafting skills test for MECDT 1214 and high school rank in class for OSU students and Oklahoma AVT graduates.

Assumptions of the Study

It is assumed that the test given is reliable and valid within an accuracy level suitable to this type of research. It is assumed that

each student taking the test did his best on the test and was in reasonably good health at the time the test was administered. It is assumed the student was able to give a reasonable estimate of his ACT composite score, high school GPA, and rank in high school graduating class. It is further assumed that all those whose scores were 70 percent or higher had achieved a drafting skill level equivalent to that achievable with college credit.

Definition of Terms

An Area Vocational-Technical School is a school which serves students from a geographical area larger than a single community or local school district. Programs offered in the schools are vocational-technical in nature stressing skill-level training for high school students and adults (4).

A Vocational Trade and Industrial Drafting Program is a program offered in an area school which prepares high school students for employment as a draftsman in industry. The student becomes gainfully employed through practical instruction (5).

Engineering Technology is that part of the engineering field which requires the application of scientific and engineering knowledge and methods and which combines such application with technical skills in support of engineering activities; it lies on the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer (1).

An Engineering Technologist Program is a post high school engineering technologist program of four academic years in length that operates within an engineering college. Normally the student meets this

requirement by completing two years beyond the associate degree. The student receives a Bachelor of Science degree upon successful completion of the program. The program aims primarily at training engineering technologist (1).

Technical Drafting Skills are skills required of persons qualified by training and/or experience to draw, read and interpret drawings of which require skill and judgment beyond that of a laborer or beginning apprentice (5). "The ability to use one's knowledge effectively; technical proficiency" (6).

CHAPTER II

REVIEW OF THE LITERATURE

Acceleration as a means of providing for the needs of highly skilled and talented students has not been researched as much as the needs themselves. However, the Advanced Placement Program of the College Entrance Examination Board (CEEB), which has been in operation since 1955, is a unified, well-organized program for the academic student. The rationale for awarding credit for courses in the CEEB Advanced Placement Program is that the advanced student's education is considered to be "commensurate with college work and that achievement, no matter when or where it occurs, should be recognized and rewarded" (7).

The literature and data concerning the able and motivated student has promoted widespread acceptance of advanced-placement for such disciplines as English, history, mathematics and biology. This acceptance proceeds from the hypothesis that enthusiasm and vision can be slowed and years of productivity lost if students must repeat courses they have had in the past. Sidney Pressey correctly observes "That greatest physical vigor and intellectual creativity comes in the earlier adult years. . ." (8); thus unnecessary repetition of course work may cause the student to lose in his first year of college the momentum he gathered in completing high school.

Hedrick (9) in 1960 used a questionnaire to study 301 colleges and universities to ascertain whether or not they granted credit by

examination. The study revealed that 171 institutions granted college credit by examination. The study concluded that the primary reason for granting the credit was "to aid able, highly motivated students." Similarly the institutions recognized that some of the skills and educational experiences which the student realized outside the classroom warranted college credit. Hedrick also concludes that the "examination is another means by which college credit can be given to students transferring from unaccredited institutions."

A great deal of concern is voiced about granting academic college credit for trade and industrial experience. Landa (10) in 1960 surveyed 201 colleges and universities to discover if college credit was given for trade and industrial experiences. His results show that one-fourth of the institutions surveyed grant credit for trade and industrial experiences; others planned to do so. Significantly, he notes that most institutions use a combination of written, oral, and skill test to evaluate competence before granting credit. The New York State University College, Oswego, grants credit when the student demonstrates competency by passing a test. Candidates may take the test only after they have offered proof of the required experience. Unfortunately, Landa does not indicate the specific examinations used, their validity and reliability, nor the method of administrative control.

Erickson and Honke (11) in 1962 conducted a study of freshmen industrial-graphics students at Stout State University. By designing an Advance Placement Qualifying Examination (APQE) to test students for a beginning drafting course and using it on entering freshmen, they were able to allow certain students to accelerate in their technical program in industrial arts. Erickson and Honke determined the statistical

validity of the test by comparing APQE scores with the Minnesota Paper Form Board Test (MPFBT) scores of students who had completed a nine-weeks beginning drafting course. Final grades given in the courses were used as a standard of comparison to find the statistical validity of the tests. Using the Pearson-Product-Moment method to determine the coefficient of correlations, Erickson and Honke obtained an R of 0.6 for the validity coefficient of the MPFBT and an R = .70 was obtained for the validity coefficient of the APQE. Clearly the lower validity coefficient indicates the success of the APQE in predicting possible student success in the beginning drafting course.

Erickson and Honke report that preselected proctors gave the validated APQE to 57 high school graduates in 1962. By scoring above the 67th percentile, 23 students were authorized to enroll directly in the advance drafting course instead of the beginning drawing course.

Using again the Pearson-Product-Moment method, Erickson and Honke found the coefficient of correlation to be R = .47, a finding which indicates that a fair correlation does exist between the high score of the combination of high school rank and number of units of high school drafting and the APQE.

Cohen (12) conducted a study, in 1946, at the Worcester Polytechnic Institute that indicated high school grades were almost as good in predicting success in engineering as the use of a very large battery of tests. The author pointed out that high school grades alone could not be used since a great many high schools had different grading systems. Other studies also indicated that a high school grade point averages are very good predictors of college success. Pierson and Tex (13) researched the use of a Pre-Engineering Inventory and a Cooperative General

Achievement Test as predictors of success in engineering. They showed that mathematics and English scores combined with high school grade point were the most reliable predictors of success in engineering. Although the Pre-Engineering Inventory and the Cooperative Achievement Test were both good predictors of success in engineering, the Pre-Engineering Inventory proved to be the better of the two.

Boyd and Shimberg (14) prepared a Directory of Achievement Tests for Occupational Education in 1971 for the New Jersey Department of Education in cooperation with the United States Office of Education. Tests selected for exclusion or inclusion in the Directory was made on the assumption that the tests should be made available to educators. Some states have well developed occupational competency testing programs for granting academic credit for vocational experiences. However, the tests developed for use in such programs are not available to educators. The following tests are those taken from the Directory.

The Industrial Materials Laboratory of the Ohio State University developed the "Mechanical Drafting, Ohio Trade and Industrial Education Tests." The 250 question test is restricted for university use and is not available to the industrial arts class. The 35-minute timed test contains 50 questions with four multiple choice answers on each question (14).

The "Drawing, Cooperative Industrial Arts Tests" was developed by Educational Testing Services for the 7th, 8th and 9th grade industrial arts class. The 35-minute timed test contains 50 questions with four multiple choice answers on each question (14).

Campbel and Johnson (14) developed "Short Occupational Knowledge Test for Draftsmen" containing 19 questions with five multiple choice

answers per question. A classification system of fail, unclassifiable and pass was used to establish a validity of 92.2% for subjects properly categorized as skilled or unskilled. The test had a reliability $\underline{R}$ = .78 for a population of 79 people.

Blum (13) developed a 140-question, four multiple choice test titled "General Drafting, A Comprehensive Examination." Correlation between course grade and test score was .52 for 3,657 students. Reliability was $\underline{R}$ = .92 out of the same population of students.

The Department of Industrial Education at Eastern Michigan University (13) developed a "Drafting Trade Competency Examination." The test contained 274 questions with four multiple choice answers per question.

The Instructional Objective Exchange has available a list of instructional objectives in "Mechanical Drawing" with examples of measurable items suitable for measuring achievement of each objective. This is not a standardized test, but a list of 85 objectives and related evaluations for grades 7-12 (14).

Garrett (14) in his review of predictive studies for estimating success in college cites several hundred such studies. High school grade point, achievement tests, intelligence measures, aptitude tests, interest, character and personality measures have been the most common variables studied in relation to predicting college achievement. Others (15) have used age, background data, or non-cognitive factors but so far with less success than with the more widely used cognitive factors. The weight of evidence from studies reported in the literature to date, would place high school scholastic achievement or rank at the top of the list in terms of the best single predictor of college scholastic success. Garrett (15) draws the conclusion after reviewing several hundred studies

that the following four factors have the highest predictive values for college achievement:

1. High school grade point, median R of .56.
2. General achievement test scores, median R of .49.
3. Intelligence test scores, median R of .47.
4. General college aptitude test scores, median R of .43.

CHAPTER III

METHODOLOGY AND DESIGN

Introduction

This chapter will be divided into two parts as follows: (1) Methodology and (2) Design. Methodology is concerned with the methods used in the study and design is concerned with the elements that formed the study.

Methodology

Specifically the problem was to determine equivalent drafting skill training between students at OSU and high school graduates of area vocational-technical schools. The objective being to determine the degree of equivalency and if ACT composite scores, high school grade point or rank in high school graduating class could be correlated with drafting courses. All students enrolled in Mechanical Design Technology (MECDT) 1214, Machine Drafting at Oklahoma State University were given the advanced-placement drafting skills test (hereafter referred to as the test) as a final exam in May, 1972. The same test was given to randomly selected students who (1) had made 16 or better on the ACT, (2) had a high school grade point of B or better, or (3) had ranked in

the upper one-half of the high school graduating class and had completed two years of drafting at the area vocational-technical schools in Oklahoma.

Success was based on a student achieving 70 percent or higher on the test. Any student with a percent score of less than 70 percent was considered unsuccessful. The independent variables were ACT composite scores, high school grade point, and rank in high school graduating class. The dependent variable was the percent grade attained on the test. Possible potential intervening variables were conditions of health, emotional stress due to factors other than those encountered in the taking of a test, time interval between subject matter presentation and test, and studying or not studying for the test.

Design

The statistical and descriptive design of this study is presented and analyzed in this section. Test results and student data were obtained by the author from students enrolled in Machine Drafting at Oklahoma State University and students randomly selected from Oklahoma Area Vocational-Technical schools.

All students enrolled at Oklahoma State University in the Spring Semester, 1972, in MECDT 1214 Machine Drafting were tested at the end of the semester to establish validity of the test. Of the 18 students who took the course, 14 had at least 3 hours of basic drafting GENT 1153 Technical Drawing before taking MECDT 1214 and were Mechanical Design majors at Oklahoma State University. The four OSU students not included in this study were enrolled in MECDT 1214 as an elective and were not Mechanical Design Technology majors.

Dr. J. B. Morton, Coordinator of Information Service, Research, Planning, and Evaluation Division of the State Department for Vocational-Technical Education provided a computer printout of the May 1973 graduates of the Vocational Trade and Industrial Drafting programs in Oklahoma's Area Vocational-Technical Schools. The printout contained name, social security number, sex, age and grade level for 146 graduates (see Table I).

Mr. Dale A. Hughey, State Coordinator, Area Vocational-Technical Education, State Department for Vocational-Technical Education gave his permission to obtain the name, telephone number, home address, social security number, sex, race, age, high school attended, ACT composite score, high school GPA, and rank in high school graduating class from the area schools. The author visited each area school to personally inspect records and obtain the needed information. Students were disqualified if they had dropped out of high school or if they were not high school students. Duplication of names were found at several area schools and corrections made as to the total qualified students. The area schools did not have the students ACT composite score, high school GPA, or high school rank in class, but did release the graduates address and telephone number. Dr. Joe Lemley, Principal, Tulsa Area Vocational-Technical School would not release any data until it was approved by the Department of Instructional Research, Tulsa Public Schools. Dr. Paul I. McCloud, director, Department of Instructional Research, required a copy of the requested information and a copy of the thesis proposal all of which were submitted to a three man committee made up of the Superintendent of the Tulsa Public Schools, the Director of Instructional Research, and a disinterested third party. The

TABLE I

DISTRIBUTION OF SELECTED RECENT OKLAHOMA AREA VOCATIONAL-TECHNICAL SCHOOL GRADUATES

AVT School	Initial Report of Graduates*	Qualified Graduates**	Graduates that had taken the ACT	Distribution of Random Sample
A	9	5	1	1
B	3	2	0	0
C	13	8	3	0
D	15	13	1	0
E	8	6	2	0
F	12	10	3	3
G	19	18	9	5
H	5	3	1	0
I	12	10	2	1
J	6	6	2	2
K	44	24	9	2
TOTAL	146	105	33	14

*Graduates reported by the State Department for Vocational-Technical Education, Division of Research, Planning, and Evaluation, Stillwater, Oklahoma, May 25, 1973.

**Graduates were qualified by a personnel review of student records at the Oklahoma Area Vocational-Technical Schools during July, 1973. Students were disqualified if they had dropped out of high school, if they were not high school students, and if the students names were duplicated.

information requested was not released by the committee for one week. The visit to the area schools resulted in 105 graduates being qualified (see Table I). The only means available to the author to get the ACT composite score, high school GPA, and the rank in the high school graduating class was to obtain the written permission of each graduate and submit the request to the graduate's high school. Since all graduates were not required to take the ACT during high school a subpopulation of graduates that took the ACT was developed. A returnable questionnaire and postage paid envelope was mailed out to the 105 recent AVT graduates to obtain ACT composite score, high school GPA, and high school rank in the graduating class. Thirty five did not return the questionnaire, but were contacted by telephone or reached through University records of ACT scores of high school students. Of the 105 qualified students 33 had taken the ACT (see Table I).

A random sample of 14 students was taken from the subpopulation of 33 graduates by using a table of random numbers (16). A cross check of ACT composite scores was made of the 14 graduates with the OSU records. Grade point in high school and rank in high school graduating class was taken from the student when the test was given. A sample of 14 students was used as this matched the total population of students in Mechanical Design Technology that were Mechanical Design Technology majors and enrolled in the course MECDT 1214 at OSU.

The test was then given to the 14 randomly selected graduates who had completed at least two years of drafting skill training at the following Oklahoma Area Vocational-Technical Schools (AVTS): Tulsa AVTS, Tulsa; Oklahoma City AVTS, Oklahoma City; Southern Oklahoma AVTS, Ardmore; Duncan AVTS, Duncan; O. T. Autry AVTS, Enid; Central Oklahoma

AVTS, Drumright; Indian Capital AVTS, Muskogee; Gordon Cooper AVTS, Shawnee; Canadian Valley AVTS (Satellite School), Chickasha; Kiamichi AVTS, McAlester; and Mid-America AVTS, Wayne. A student was considered successful if he obtained a 70 percent achievement on the test.

Overall high school grade point, ACT score and rank in class were obtained from each student at the time of test for correlation with achievement on the drafting skill tests. The student was contacted by telephone and the test date established. The author gave the test to the student in the student's home at the student's convenience. All students were receptive and willing to take the test.

The Test

The test was a standard test designed by the Mechanical Design Technology Department at Oklahoma State University to be given to students desiring credit by advance-standing examination in General Technology (GENT) 1153 Technical Drawing (see appendix A), and Mechanical Design Technology (MECDT) 1214 Machine Drafting (see appendix B). The test contains 100 true and false questions, 120 multiple choice questions and 3 completion problems. The test covered the following areas:

Lettering
Geometrical Construction
Sketching
Multiview Projection
Sectional Views
Auxiliary Views
Dimensioning
Tolerancing
Threads, Fasteners, and Springs
Working Drawings
Pictorial Drawings
Gears and Cams
Welding Drawings.

The questions were structured in such a manner as to be universally accepted and not particular textbook-types of questions.

CHAPTER IV

RESULTS

Of the 14 Oklahoma State University students considered in this research, all were found to be successful on the GENT 1153 part of the test; that is, 14 made a score of 70 percent or higher (see Table II). The average score of the successful students was 84.89 percent, with 6 scores above this average and 8 scores below the average. The equation

$$S_x = \sqrt{\frac{\Sigma X^2 - [(\Sigma X)^2/n]}{n - 1}},$$

was used to calculate the standard deviation. The standard deviation of scores for the 14 OSU students on the GENT 1153 part of the test was 7.49 percent.

Of the 14 AVT graduates considered in this research (see Table III), 8 were found to be successful on the GENT 1153 part of the test and 6 were found to be unsuccessful; that is, 8 scored 70 percent or higher and 6 scored less than 70 percent. The average score of the group was 65.96 percent. The average score of the successful graduates was 74.44 percent with 5 graduates above the average and 3 below the average. The average score of the unsuccessful graduates were 54.58 percent with 4 graduates above this average and 2 below the average. The standard deviation of scores for the 14 AVT graduates on the GENT 1153 part of the test was 11.74 percent.

TABLE II

OKLAHOMA STATE UNIVERSITY STUDENTS ADVANCE PLACEMENT DRAFTING SKILLS TEST SCORES, ACT SCORES, HIGH SCHOOL GRADE POINTS AND HIGH SCHOOL RANK IN CLASS

Student Number	Test GENT 1153 Percent Score	Test MECDT 1214 Percent Score	ACT Score	High School Grade Point	High School Rank in Class (percent)
1	78.5	72.0	22	2.90	60
2	88.0	80.0	23	3.70	86
3	99.0	84.4	21	3.30	85
4	76.5	68.0	19	2.60	59
5	74.5	68.0	17	2.50	63
6	91.5	82.8	22	3.20	66
7	83.5	74.8	18	2.40	30
8	83.0	72.8	16	2.50	28
9	88.0	80.0	17	2.80	69
10	93.0	85.2	27	3.40	92
11	83.5	75.6	20	2.80	72
12	91.5	83.6	26	3.20	84
13	73.5	66.0	18	2.10	73
14	84.5	76.4	21	3.00	79

TABLE III

OKLAHOMA AREA VOCATIONAL-TECHNICAL SCHOOL STUDENTS' ADVANCE PLACEMENT DRAFTING SKILLS TEST SCORES, ACT SCORES, HIGH SCHOOL GRADE POINT, AND HIGH SCHOOL RANK IN CLASS

Student Number	AVT School	Test GENT 1153 Percent Score	Test MECDT 1214 Percent Score	ACT Score	High School Grade Point	High School Rank in Class (percent)
1	I	70.5	62.4	27	3.56	85
2	F	75.5	68.0	22	3.14	81
3	F	81.5	75.6	20	3.5	37
4	K	75.5	70.8	17	2.38	43
5	J	41.5	33.2	18	2.5	26
6	J	62.0	5.12	16	2.30	24
7	G	56.0	46.4	10	2.10	51
8	A	63.0	53.6	18	2.82	79
9	G	75.0	70.0	24	3.43	68
10	G	47.0	40.8	08	3.00	80
11	G	74.5	66.0	22	2.51	51
12	G	58.0	51.2	10	2.52	30
13	F	70.5	57.2	15	2.84	69
14	K	73.0	67.2	17	2.91	75

The difference between the means of the OSU score and the AVT score of 18.83 percent was tested to see if the variation was attributable to a population difference or a random variation from a single population mean. The resultant value to the t Test for significance was 5.07 and as such the difference between the means was attributable to a population difference between the groups at the 5 percent level.

Of the 14 OSU students considered in this research, 11 were found successful on the MECDT 1214 part of the test (see Table II); that is, 11 made a score of 70 percent or higher. The average score of the group was 76.40 percent. The average score of the successful student was 78.87 percent with 6 scoring above this average and 5 below the average. The average score of the unsuccessful student was 67.30 percent with 2 students above this average and one below the average. The standard deviation of scores for the 14 OSU students on the MECDT 1214 part of the test was 6.45 percent.

Of the 14 AVT graduates considered in this research (see Table III), 3 were found to be successful on the MECDT 1214 part of the test and 11 were found to be unsuccessful; that is, 3 scored 70 percent or higher and 11 scored less than 70 percent. The average score of the group was 54.02 percent. The average score for the successful graduate was 72.13 percent with one graduate above the average and 2 below the average. The average score of the unsuccessful graduate was 54.30 percent with 6 graduates above this average and 5 below the average. The standard deviation of scores for the 14 AVT graduates on the MECDT 1214 part of the test was 13.3 percent.

The difference between the means of the OSU score and the AVT score on the MECDT 1214 test of 17.18 percent was tested to see if the variation was attributable to a population difference on a random variation

from a single population mean. The resultant value for the t Test for significance was 4.35 and as such the difference between the means was attributable to a population difference between the groups at the 5 percent level.

The statistical validity of the Advanced Placement Drafting Skills Test was determined by calculating a validity coefficient found by comparing the test results of the students at OSU who took the courses GENT 1153 and MECDT 1214 and the test results of the students from the Area Vocational-Technical Schools. Since the examination was designed and based on the course content of GENT 1153 and MECDT 1214, the final test scores received by students in MECDT 1214 were used as a standard of comparison to determine statistical validity. The result of each test in each group was compared to the approximate ACT composite score, high school grade point and high school class rank.

The Pearson-Product-Moment method of determining the coefficient of correlation was employed.

$$\underline{R} = \frac{n \Sigma X_i Y_i - (\Sigma X_i)(\Sigma Y_i)}{\sqrt{[n \Sigma X_i^2 - (\Sigma X_i)^2][n \Sigma Y_i^2 - (\Sigma Y_i)^2]}}$$

The calculations of the validity coefficients ($\underline{R}$) produced the results appearing in Table IV. The results indicate a near perfect direct relationship .94 between the OSU GENT 1214 test scores and high school grade point. A moderate perfect direct relationship .77 exists between OSU GENT 1153 test scores and high school grade point. A moderate direct relationship exists between OSU GENT 1153 test scores and ACT (.57); AVT GENT 1153 test scores and ACT (.61); OSU GENT 1214 test scores and ACT (.67); OSU GENT 1214 test scores and rank in graduating class (.51); AVT

TABLE IV

RESULTS

Comparison		R Pearson-Product Moment Correlation	Value of Z	Disposition of Null Hypothesis
OSU GENT 1153 Test to	OSU ACT	.57	.14	Not Rejected
AVT GENT 1153 Test to	AVT ACT	.61		
OSU GENT 1153 Test to	OSU High School Grade Point	.77	.75	Not Rejected
AVT GENT 1153 Test to	AVT High School Grade Point	.45		
OSU GENT 1153 Test to	OSU Rank in Graduating Class	.44	.47	Not Rejected
AVT GENT 1153 Test to	AVT Rank in Graduating Class	.24		
OSU MECDT 1214 Test to	OSU ACT	.67	.86	Not Rejected
AVT MECDT 1214 Test to	AVT ACT	.30		
OSU MECDT 1214 Test to	OSU High School Grade Point	.94	2.02	Reject at the 5% Level
AVT MECDT 1214 Test to	AVT High School Grade Point	.08		
OSU MECDT 1214 Test to	OSU Rank in Graduating Class	.51	1.10	Not Rejected
AVT MECDT 1214 Test to	AVT Rank in Graduating Class	.04		

GENT 1153 test results and high school grade point (.45); OSU GENT 1153 test results and rank in graduating class (.44). Little correlation (i.e., near 0 covariation of X and Y) exists between AVT GENT 1153 and rank in graduating class (.24), AVT GENT 1214 test results and ACT (.30), AVT GENT 1214 test results and high school graduating class (.08), AVT GENT 1214 test results and rank in high school graduation class.

Table IV also indicates the disposition of the null hypothesis. Fisher's Z-transformation of $\underline{R}$ (15) are used to test the hypothesis:

$$Z = \frac{Z_{\underline{R}1} - Z_{\underline{R}2}}{\sqrt{\frac{1}{n_1-3} + \frac{1}{n_2-3}}}$$

The null hypothesis was not rejected if the value of Z indicated the statistical probability of the event was greater than five percent. The Z test of significance rejected the null hypothesis for the correlations of MECDT 1214 test scores and high school grade point for OSU and AVT students. The correlation between the test and high school grade point for OSU students was very good--$\underline{R}$ = .94, but the correlation between AVT students and high school grade point was very poor--$\underline{R}$ = .08. The null hypothesis was rejected at the five percent level.

All other hypotheses could not be rejected at the five percent level; therefore, indicating equivalent training in basic drafting skills at OSU and AVT schools for GENT 1153 Technical Drawing but not necessarily for MECDT 1214 Machine Drafting.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to collect evidence that could be used to predict equivalent drafting skill training between students enrolled in a technician-technologist program and drafting skills of recent graduates of Oklahoma's area vocational-technical schools based on measurements of their performance on an advanced-placement drafting skills test. An advanced-placement drafting skills test was given to 14 Mechanical Design Technology students at Oklahoma State University and 14 recent graduates of Oklahoma's Area Vocational Technical schools that had completed two years of drafting. ACT composite score, high school GPA, and rank in high school graduation class were recorded and compared to the results of the advanced-placement drafting skills test.

Conclusions

It was found that the ACT composite score and high school grade point were good predictors of success on the GENT 1153 portion of the drafting skills tests for both OSU students and AVT graduates, with ACT being the better predictor of the two. This would indicate that the AVT graduates received the type of training necessary for him to receive advanced-placement in GENT 1153 Technical Drawing at Oklahoma State University.

The majority of the AVT graduates, 57 percent, succeeded in the GENT 1153 test. Based on the subpopulation of 33 graduates that took the ACT, 18 graduates would have passed the test if they had taken the test. Extending this prediction to the total population of 105 qualified AVT graduates, 60 graduates would have succeeded and earned college credit at Oklahoma State University in GENT 1153 Technical Drawing.

The results also indicated ACT composite score, high school GPA, and rank in high school graduating class as good predictors of success on the MECDT 1214 portion of the drafting skills test for OSU students. AVT graduates did not demonstrate as great a success on the MECDT 1214 portion of the test as they did on the GENT 1153 portion of the test. This would indicate that some of the AVT graduates did not receive the type of training necessary for him to receive advanced-placement in MECDT 1214 Machine Drafting at OSU. Twenty one percent of the AVT graduates were successful on the MECDT 1214 part of the test. Based on the subpopulation of 33 graduates that took the ACT, 7 graduates would have passed the test. Extending this prediction to the total population of 105 qualified graduates, 22 graduates would have succeeded and earned college credit at OSU in MECDT 1214. The AVT graduates that made 75 percent or greater on the GENT 1153 test also passed the MECDT 1214 test.

Factors other than those being measured may have influenced the success or failure of a student. Not all graduates received identical instruction in the area vocational-technical schools. Many students received broader training in architectural drafting rather than in-depth training in machine drafting. Some students were more motivated than

others to take the tests. Hopefully these factors did not outweigh any of the variables being tested. Social, economic and emotional factors should not be overlooked as possible influential factors in success or failure, but these are areas for additional studies and are not covered in this study.

Recommendations

Based upon this study the following recommendations are made.

1. The Mechanical Design Technology Department at Oklahoma State University should give advanced-placement examinations in the courses GENT 1153 Technical Drawing and MECDT 1214 Machine Drafting to Oklahoma Area Vocational-Technical school graduates that have had two years of drafting in a vocational trade and industrial program.

2. Oklahoma State University should give college credit to those students who pass the advanced-placement examinations (70 percent or higher) and subsequently enroll at OSU.

3. All entering freshmen engineering technology students at OSU that have had at least 2 years in drafting in high school and are required to take GENT 1153 should be required to take an advanced-placement examination in GENT 1153 Technical Drawing. All students that make 70 percent or higher should be given college credit in GENT 1153.

4. All entering freshmen Mechanical Design Technology students at OSU that make 75 percent or higher on the GENT 1153 examination should be required to take the advanced-placement examination in MECDT 1214 Machine Drafting.

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APPENDIX A

COURSE OUTLINE: GENT 1153 TECHNICAL DRAWING

COURSE OUTLINE: GENT 1153 Technical Drawing

Time Period: 1 hour of theory and 6 hours of laboratory per week

Textbook: Technical Drawing, Giesecke, Mitchell, Spencer, and Hill NacMillan Company, 5th Edition, 1967.

Meeting	Subject	Textbook
1	Preview of Course, Materials, Equipment, & Use, Geom. Const.	1-57 & 88-124
2	Lettering	62-85
3	Technical Sketching	129-154
4	Multiview Projection	138-149, 160-177
5	Multiview Projection	117-192
6	TEST I	Preceding Refs.
7	Sectional Views	211-229
8	Sectional Views	211-229, 429-430
9	Auxiliary Views & Shop Processes	238-250, 278-307
10	Dimensioning	308-344
11	Tolerancing	347-367
12	TEST II	Since Test I
13	Threads and Fasteners	368-407
14	Working Drawings	410-434
15	Pictorial Drawings	505-525, 540-551
16	SUMMARY	All References
17	FINAL EXAM	All References

APPENDIX B

COURSE OUTLINE: MECDT 1214 MACHINE DRAFTING

COURSE OUTLINE: MECDT 1214 Machine Drafting

Time Period: 2 hours of theory and 6 hours of laboratory per week

Testbook: Technical Drawing, Giesecke, Mitchell, Spencer, and Hill, MacMillan Company, 5th Edition, 1967.

Meeting	Subject	Textbook Reference
1	Course Introduction	
2	Review: Principles of Multiview & Line Technique	11-57, 138-148 160-192
3	Review: Lettering & Techniques of Freehand	62-85, 129-154
4	Engineering Geometry: Special Problems	88-123
5	Engineering Geometry: Special Problems	88-123
6	Technical Terms & Standard Abbreviations	819-824, 826-829
7	Shop Processes	278-307
8	Summary	Preceding References
9	TEST I	All References Class Notes
10	Sectional Views: Interpretations and Application	211-229, 429-431
11	Sectional Views: Interpretations and Application	211-229, 429-431
12	Auxiliaries and Partial Views	169, 238-256
13	General Dimensioning Practices	308-344
14	General Dimensioning Practices	308-344
15	Tolerancing	347-367, 830-836
16	Tolerancing	347-367, 830-836

COURSE OUTLINE: MECDT 1214 Machine Drafting
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Meeting	Subject	Textbook Reference
17	Summary	Sessions 10-15
18	TEST II	Since Test I
19	Threads & Mechanical Fasteners	368-407
20	Threads & Mechanical Fasteners	368-407
21	Design & Working Drawings	410-434
22	Design & Working Drawings	410-434
23	Welding Terminology and Representation	698-711
24	Gears: Terminology & Conventional Representation	609-619
25	Summary	Sessions 19-24
26	TEST III	Since Test II
27	Cams: Terminology and Displacement Diagrams	619-624
28	Cams: Plotting cam Profile	619-624
29	Reproduction & Control of Drawings	496-504
30	General Summary	All References
31	FINAL EXAMINATION	All References & Class Notes

VITA

Gerald R. McClain

Candidate for the Degree of

Master of Science

Thesis: THE RELATIONSHIP BETWEEN DRAFTING SKILLS OF STUDENTS ENROLLED IN MECHANICAL DESIGN TECHNOLOGY AT OKLAHOMA STATE UNIVERSITY AND DRAFTING SKILLS OF RECENT GRADUATES OF OKLAHOMA AREA VOCATIONAL-TECHNICAL SCHOOLS

Major Field: Technical Education

Biographical:

Personal Data: Born December 27, 1941, in Chickasha, Oklahoma, the son of Mr. and Mrs. J. R. McClain.

Education: Graduated from Chickasha High School, Chickasha, Oklahoma, in May, 1959; received Associate of Science degree in Drafting and Design Technology in May, 1961; received Associate of Science degree in Metallurgical Technology in January, 1963; received Bachelor of Science degree in Technical Education in May, 1964; completed the requirements for the Master of Science degree at Oklahoma State University in December, 1973.

Professional Experience: Secondary Industrial Arts, Drafting teacher, Northwest Classen High School, Oklahoma City, Oklahoma, 1965-66; Secondary Technical Drafting and Design teacher, Capitol Hill High School, Oklahoma City, Oklahoma, 1966-68; Instructor, Mechanical Design Technology, Oklahoma State University, Stillwater, Oklahoma, 1968-70; Assistant Professor, Mechanical Design Technology, Oklahoma State University, Stillwater, Oklahoma, 1970-73.

Professional and Honor Societies:
American Society for Engineering Education, member.
Oklahoma Technical Society, member.
Tau Iota Epsilon, member.
American Institute for Design and Drafting, Oklahoma Chapter, member and vice president.
American Institute for Design and Drafting, National Chairman, student chapters.
Oklahoma Inventors Congress, member.