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ABSTRACT
        The purpose of this study was to compare the shop
achievement of secondary vocational-technical students who received
one year versus two years of Area Vocational/Technical School (AVTS)
instruction. One group attended the AVTS for both the 10th and 11th
grade, while the other attended only for the 11th grade year. The
criterion variable used to make the comparison was the Ohio Trade and
Industrial Education Achievement Test. When ability was not taken
into consideration, the one year group did at least as well as the
two year group in terms of shop achievement. When differences in
ability were taken into account the finding suggests that those
students who received twice as much instruction did somewhat better
on the shop achievement test as a total group. Beginning AVTS
instruction in 10th grade appears to result in greater shop
achievement at the end of 11th grade than taking shop only in 11th
grade; however, the amount of increase in achievement appears to be
small and may not be of practical importance. Differences are
variable from one specific trade knowledge area to another, and from
one shop program to another. The importance of any differences
depends somewhat on what basic knowledge is necessary to a specific
trade or trade area. Some shop programs may suffer more than others
from the elimination of the 10th grade year. (Author/NM)

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SHOP ACHIEVEMENT AS AN OUTCOME
OF ONE YEAR VERSUS TWO YEARS
OF AVTS INSTRUCTION

PAUL L. McQUAY

VOCATIONAL – TECHNICAL EDUCATION Research Report

Shop Achievement as an Outcome of
One Year Versus Two Years of AVTS Instruction

Paul L. McQuay

The Pennsylvania State University
University Park, Pennsylvania

May, 1974

PREFACE

This monograph is the eighteenth in a series of such reports which have been published as part of the longitudinal Vocational Development Study (VDS) project. The project was begun in the Fall of 1968 and since that time has focused on longitudinal data collection and research in order to help provide answers to questions concerning the vocational development process and the evaluation of vocational education programs. The VDS project is jointly sponsored by the Department of Vocational Education at Penn State and Pennsylvania's Research Coordinating Unit (RCU) in Vocational Education.

The research reported here by Paul McQuay is of a program evaluation nature. It is aimed at answering an important curriculum question dealing with the relative merits, in terms of student shop achievement, of beginning AVTS instruction in tenth grade as opposed to eleventh grade. In addition to providing tentative answers to the major question posed for the study, the findings go beyond the question in pointing out the complexities of program evaluation, where comparisons are made among different groups of students undergoing different educational treatments. The results of this study yield implications which should be of concern to all curriculum planners, but are of particular usefulness to those involved in adopting a career education curriculum format for the high school years.

Jerome T. Kapes, Assistant Professor
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VDS Project Director

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VDS CAPSULE

This blue page section has been included in this report in order to provide a brief summary of the findings and implications of this study. Teachers, counselors, administrators, and others interested in Vocational-Technical education hopefully can determine through this capsule whether or not the full report warrants their investigation. The purpose of this study was to compare the shop achievement of secondary vocational-technical students who received one year versus two years of AVTS instruction (one group attended the AVTS for both the tenth and eleventh grade while the other attended only for the eleventh grade year). The criterion variable used to make this comparison was the Ohio Trade and Industrial Education Achievement Test (OTAT). A brief description of the major findings is followed by a listing of some of the possible implications which may be drawn from the findings.

Findings

1. The study sought to investigate the relative benefits of beginning AVTS instruction in tenth as opposed to eleventh grade. When ability was not taken into consideration, the one year group did at least as well as the two year group in terms of shop achievement (OTAT).

2. The two groups selected for study were not equal in terms of ability and since ability is highly related to achievement in most cases, it was necessary to take ability into consideration when making comparisons.

3. When differences in ability were taken into account the findings suggest that those students who received twice as much instruction did do somewhat better on the shop achievement test as a total group.

4. When the question of achievement differences was examined independantly for each of five shop groups (Automotive, Machine Trades, Auto Body, Carpentry and a Mixed group of shops consisting of: Welding, Electricity, Electronics and Mechanical Drafting) only the Mixed group yielded significant differences in achievement. The lack of differences in shop achievement for the individual shops can, for the most part, be attributed to small sample size.

5. The two groups selected for study were also compared on OTAT sub-part scores to further identify where differences and similarities existed. The profiles generally show the one year group to possess higher achievement than the two year group apparently due to ability differences which are also evident on the profiles. However, there are evidences of reversals in the pattern in a number of specific trade knowledge areas.

Implications

1. When making comparative evaluations of the effectiveness of vocational programs it would be a great mistake to assume that all other factors affecting student achievement are equal and that differences found are due to the treatment (e.g., the teacher, the curriculum, etc.).

2. Student ability is one obvious factor which must be considered in evaluating educational programs. Affective factors such as maturity,

interests and values also probably play a significant role. Because of the potentially great differences which may exist among groups of students, comparative studies (whether among vocational programs or between vocational and non-vocational programs) which do not consider all possible differences are likely to reach the wrong conclusions, especially concerning cause and effect relationship.

3. Beginning AVTS instruction in tenth grade does appear to result in greater student shop achievement at the end of eleventh grade than if only (one year) eleventh grade instruction is undertaken. However, the amount of increase in achievement appears to be small and may not be of practical importance. By the end of twelfth grade, it is possible that the differences may disappear altogether.

4. While certain gains in achievement are apparent for the tenth and eleventh grade group over the eleventh grade only group, the differences are quite variable from one specific trade knowledge area to another and from one shop program to another. Therefore, the importance of any differences depend somewhat on what is absolutely necessary to know about ones trade and what trade area is being considered. Some shop programs may suffer more than others from the elimination of the tenth grade year.

ORIGIN OF THE STUDY

Introduction

In 1917, a pioneering piece of legislation, the Smith-Hughes Act, provided the first major stimulus for federally supported vocational education programs. The Smith-Hughes Act appropriated 7.2 million dollars to be directed to the states for distribution to local programs. Three occupational areas were supported and eligible for the funding: agriculture, trades and industry, and home economics. The ensuing years brought about other major legislation affecting vocational education. In 1936, the George-Deen Act added distributive occupations to vocational education authorizations. Amended in 1946 to become the George-Barden Act, this act has the distinction of providing more flexibility in designating how funds should be used and included vocational guidance in its provision. The Health Amendment of 1956, added practical nursing programs to the act. In response to the technological advances being made by the Russians, especially in terms of space exploration and Sputnik, Congress passed the National Defense Education Act in 1958 to improve the quality of elementary and secondary education, particularly in the technical areas. The rationale for passage of this act was that strength in this area was essential to the national security. In reply to the high rate of unemployment in the nation and the continued threat of technological displacement of workers, Congress passed the Manpower Development and Training Act in 1962. This act provided funds for training and retraining of unemployed workers so that they could

secure jobs. However, not until the passage of the Vocational Education
Act of 1963 did federal vocational legislation focus on people in need
of vocational education, a departure from all previous legislation which
focused on type of occupation. This act was much more flexible than
previous legislation, and added business and office occupations to the
list of fundable programs. Additionally, it approved funds for courses
at the post-secondary level, and specifically included courses in com-
munity or junior colleges, area vocational schools and comprehensive
high schools. Funds for research was another unique aspect of the 1963
Vocational Education Act. Unlike earlier legislation, the 1963 Voca-
tional Education Act required that State and Local programs be subject
to evaluation for relevance and quality, and provide a systematic pro-
gram of national evaluation to be conducted by a special ad hoc commis-
sion every five years (United States Department of Health, Education and
Welfare, 1968).

Due in part to the funding that is being made available for support
of vocational education and the questionable relevance traditional
education holds for some individuals, vocational education has grown in
both size and scope. It was reported by the United States Department of
Health, Education, and Welfare that during 1969, secondary education
programs received about 31 percent of the funds spent for vocational
education under the 1963 Vocational Education Act. With the total
expenditure increasing from $364,973,936 in 1968 to $451,033,667
(approximately 86 million dollars), with the federal proportion increas-
ing from $67,969,615 to $70,602,561 (approximately 2.6 million dollars)
during this same period. The number of students in secondary vocational
programs also increased from 3,842,896 in 1968 to 4,070,395 in 1969.

During this same period most occupational programs also grew, as
witnessed by the fact that the range was from 1.5 percent in agriculture
to 10.8 percent in health occupations. The only exception to this
growth was in technical education which decreased 12.3 percent (United
States Department of Health, Education, and Welfare, 1969).

The federally supported occupational areas have also grown from
three to six since the initial piece of federal legislation of 1917.
Over the years our philosophy of education has changed considerably,
particularly the philosophy of formal school based vocational education.
Some schools have seen a separation of the vocational programs from the
traditional educational programs into a completely self governed system.

In spite of these changes Evans (1971) states vocational education
is almost non-existent below the ninth grade. Evans further states,
"The little (vocational education) that exists (below ninth grade) is
found in large city schools for the chronic truants, the mentally
retarded, and other students who for some reason have not secured
enough credits to admit them to secondary school . . ." (Evans, 1971,
p. 165). Three reasons he cites for the fact that vocational education
does not begin until high school are:

1. Vocational education is understood by most educators to be
    highly specialized and hence not an appropriate part of the
    general education programs of the elementary school and junior
    high school.

2. Specialized vocational education is best offered close to the
    time a person will use this education in employment. It is
    almost impossible for a person to secure meaningful employment
    before age sixteen, two years after the typical student leaves
    the eighth grade.

3. There are few examples of integrated curriculum plans which
    bridge the gap between elementary and secondary schools. Thus,
    even pre-vocational education is nearly non-existent below the
    ninth grade (Evans, 1971, pp. 165-166).

Keeping in mind Evan's observation concerning vocational education,
it was refreshing when former Commissioner Marland, of the United States
Office of Education set about to implement major reform in our present
educational system. The United States Office of Education has proposed
a school based plan that is designed to guarantee all students, gradu-
ates and dropouts, the opportunity to develop an entry level skill and
the necessary background should they wish to pursue further education.
According to Marland, "Career education increases the relevance of
school by focusing on the learner's career choice. It gives students
informed guidance, counseling and instruction throughout their school
years" (United States Department of Health, Education and Welfare, 1971,
p. 3). The school based portion of Career Education as proposed will
begin in kindergarten with the main focus upon career awareness and
should continue through secondary education and on into adulthood using
a system of continuing education.

While some schools of thought advocate a career awareness at the
age of four, others cite reasons why very little has been done to date
to begin vocational education before high school. Then, there are
those who suggest students might not be vocationally mature enough to
make vocational decisions at the beginning of their high school
education.

Generally, it has been accepted that in the ninth grade (at approxi-
mately 14 years of age) students would make certain curricula decisions
that have an important bearing on their vocational future. This deci-
sion tracks the individual into one of several curriculum selections
that are for the most part the beginning of an irreversible career
pattern, (i.e., the student that chooses the academic track can go on to

college after high school, but the student that chooses the vocational track is locked into that system for the most part and usually cannot easily go on to college if he/she does experience a change in occupational goal). Besides being locked into a vocational curriculum the student is committed to a specific occupation at a time when individuals might not be ready to make occupational decisions.

It was stated by Evans (1971) that because of the high degree of specialization of vocational education, with few exceptions, it has not begun until high school. In an attempt to answer the question concerning the readiness of ninth grade boys to choose among different occupations, Super and Overstreet (1960) report:

> . . . the data of this study suggest that a substantial number of boys are not yet ready, in the ninth grade, to decide on direction of endeavor, or, specifically, on a future occupation. This early adolescent stage is one, not of making and implementing a vocational choice, but rather of developing planfulness, of preparing to make a series of educational and occupational decisions (Super and Overstreet, 1960, p. 152).

If, as Super and Overstreet's data suggests that ninth grade boys are not ready to make occupational decisions, the question remains, what is the grade at which youths can be considered mature enough to formulate occupational decisions. Specifically, is an occupational decision more appropriate in the tenth grade or the eleventh grade?

Statement of the Problem

The general purpose of this study was to examine the difference in shop achievement between students who had entered a specific vocational program in tenth grade as opposed to eleventh grade. This study consisted of two groups of vocational students, the first group of students had completed both the tenth and eleventh grades of the vocational

program and the second group had completed only one year of study
(the eleventh grade) of the same vocational program The shop achieve-
ment of these two groups was measured by the Ohio Trade and Industrial
Education Achievement Tests (OTAT) total score.

The specific purpose of this study was to examine the differences
between these two groups in an attempt to answer the following questions:

1. Is there any difference in shop achievement, as measured by
    the OTAT total score between the group of students that have
    completed two years of vocational education (tenth and eleventh
    grades) and the group of students that completed one year
    (eleventh grade only) considering all occupations together?

2. Is there any difference in shop achievement, as measured by
    the OTAT total score, between the two groups of students
    (tenth and eleventh grade versus eleventh grade only) for the
    following occupational shops?

Shop Areas

      I. Automotive Mechanic

     II. Machine Trades

    III. Auto Body

     IV. Carpentry

      V. Mixed Group (consisting of
          the following shops: Welding,
          Electricity, Electronics, and
          Mechanical Drafting)

3. Do the profiles of the two groups of students (tenth and
    eleventh grade versus eleventh grade only) differ on the OTAT
    subtest scores for each shop area?

REVIEW OF RELATED LITERATURE

Introduction

In order to identify research studies or published materials which contain relevant information for this study, a review of the related literature was conducted. The literature reviewed was grouped into the following two categories:

1. Publications concerning career development which relate specifically to the theoretical aspects of this study.

2. Studies or other publications which relate to the criterion (Ohio Trade and Industrial Education Achievement Tests) used in this study.

In an effort to place this study in proper perspective, a variety of pertinent literature such as books, periodicals, journals, dissertations, and unpublished materials were reviewed. But, rather than reproducing the studies in total, only those parts that are relevant to this study will be discussed.

Publications Concerning Career Development Which Relate Specifically to the Theoretical Aspects of This Study

The theoretical premise of this study focuses on whether students are more ready to make educational/occupational selections at one particular time as compared to another. The assumption is, that students who are better prepared (vocationally mature) to make a selection should perform better (educationally as well as occupationally) than students that are not ready to make this selection.

Herr and Cramer (1972) feel that the appropriate term to use in describing vocational development is "vocationalization." They consider vocationalization, or vocational development to be analogous to the more familiar term "socialization." Socialization being described as a maturity process in which the child begins to accept and internalize the beliefs and norms controlling the inter-action of people. Additionally, they view socialization as a process of articulation of the psychological self with the structure of the social system. Similarly, they feel that:

> . . . the process of vocationalization, or vocational develop-
> ment, speaks to the various inputs--psychological, socio-
> logical, cultural, economic--which across time results in such
> outcomes as effective vocational behavior, decision-making
> ability, and vocational maturity. Vocationalization, in sum,
> has to do with those processes and factors which aid or impede
> young people's acquisition of the value, knowledge, and skills
> which lead to effective vocational behavior (Herr and Cramer,
> 1972, p. 29).

This seems to suggest that vocational maturity is a developmental process, with events taking place at fairly precise times in an individual's life. Ginzberg reports that: "Occupational choice is a process; the process is largely irreversible; compromise is an essential aspect of every choice" (Ginzberg, et al., 1951, p. 186). Then, Super (1953), who seemingly was stimulated by what Ginzberg had done, published as part of his Career Pattern Study, a developmental theory.

The original vocational behavior theory of Super (1953) contained ten propositions and five vocational life stages, which were revised in 1957, to include eleven propositions and the original vocational life stages. Because of the importance of some of the propositions to this study, those that are most relevant are reproduced here in full.

1. Vocational development is an ongoing, continuous, and generally irreversible process.

2. Vocational development is an orderly, patterned process and thus predictable.

3. Vocational development is a dynamic process of compromise or synthesis.

4. Self-concepts begin to form prior to adolescence, become clearer in adolescence, and are translated into occupational terms in adolescence.

5. Reality factors (the reality of personal characteristics and the reality of society) play an increasingly important part in occupational choice with increasing age, from early adolescence to adulthood.

6. Identification with a parent or parent substitute is related to the development of adequate roles, their consistent and harmonious interrelationship, and their interpretation in terms of vocational plans and eventualities (Super, 1957, pp. 89-96).

Kapes (1971), as a member of a team at The Pennsylvania State University, Department of Vocational Education publishes as part of the Vocational Development Study a Monograph (Number 2), which explores the relationship between selected characteristics of ninth grade boys and curriculum selection and success in the tenth grade. Extracted directly from this study is Kapes' "Summary" of information uncovered in reviewing the literature and reproduced for its relevance to this study (Kapes, 1971, pp. 33-34).

Summary

1. Super's theory of career development has evolved considerably since its inception in 1951 and at the present time it appears to be most promising for explaining vocational behavior (Super, 1953, 1963, 1961, 1969a; Super, et al., 1957, 1960; Tiedeman, et al., 1963).

2. The career model appears to have replaced the occupational model in much of vocational development research (Super, et al., 1957; Super 1961, 1969a, 1969b; Tiedeman, 1961; Tiedeman, et al., 1963).

3. The concept of stages of career development is fairly well accepted among psychologists, sociologists and career development researchers (Buehler, 1933; Miller and Form, 1951; Ginzberg, 1951; Super, et al., 1969a; Tiedeman and O'Hara, 1963).

4. Most career development researchers appear to be in agreement concerning the end on ninth grade as a critical vocational decision point at which to study the constructs and determinants of career development (Super, et al., 1957, 1960; Crites, 1961; Jordaan, 1963; Tiedeman and O'Hara, 1963).

5. Super's theoretical model appears to lend itself well to the type of study of vocational development and career prediction model proposed and explored by Cooley and Lohnes (Cooley and Lohnes, 1968; Super, 1969a, 1969b).

In conclusion it can be stated that students have had to make educational decisions at the end of the ninth grade. For the most part, these decisions tracked them into one program or another with little regard to whether they were ready or not. Super and Overstreet (1960) state "in grade nine vocational maturity is not characterized as goal-attainment, as the having of consistent, realistic preferences, nor as having begun to make a place for oneself in the world of work" (Super and Overstreet, 1960, p. 63). Recently a study conducted by Gribbons and Lohnes (1967) has shown that this might not be true for all. Their

study suggests that some degree of vocational maturity is a reality for
some students in the eighth grade. They even go so far as to suggest
that among a few students vocational maturity might be present even
earlier than the eighth grade

Generally both studies allude to a period of readiness. Super and
Overstreet (1960) suggest vocational maturity is not present in ninth
grade. Then again, Gribbons and Lohnes (1967) found that some students
are vocationally mature to make occupational decisions at least by the
time they are in the ninth grade.

Studies or Other Publications Which Relate to the
Criterion (Ohio Trade and Industrial Education
Achievement Tests) Used in This Study

Vocational/technical education has long been void in developing
objective means of assessing student learning. In 1958, at the demand
of Ohio educators, the Ohio Trade and Industrial Education Achievement
Test (OTAT) to measure success in trade areas were developed at the
Ohio Trade and Industrial Education Local Supervisors Workshop. The
tests were specifically constructed to evaluate and diagnose vocational
achievement. Prior to 1963, the use of these tests were limited to
Ohio. However, since then, several states as well as the District of
Columbia and individual schools have requested and used the test battery
(Department of Education, State of Ohio, 1972).

The purpose of the OTAT is outlined by the following eight goals:

1. to help determine if the objectives of instruction have been
   achieved.

2. to provide a basis for reviewing the curriculum and improving
   instruction.

3. to provide motivation for students and teachers

4. to identify facility and equipment deficiencies.

5. to assist in the process of supervision.

6. to help identify strengths and weakness of the instruction.

7. to help identify strengths and weaknesses of the student.

8. to help evaluate reference materials (Department of Education, State of Ohio, 1972, preface).

In discussing the OTAT as a predictor of achievement, Finch and Bjorkquist (1970) call attention to the fact that as a paper and pencil test, it measures the academic component of achievement rather than performance in the shop or laboratory. They further state, that although relationships have been found between OTAT test scores and course grades (instructor's ratings) in a training environment, no studies have been found that examine the relationship of OTAT test scores with actual job performance in the work situation.

In an attempt to assess the criterion-related validity of the OTAT, Kapes and Long (1971) conducted a study, published in the Journal of Industrial Education. Their findings suggest, that although the OTAT total test score may validly measure that portion of achievement related to knowledge of course content, it measures only a small portion of that criteria that constitutes shop grades. Kapes and Long conclude that, shop grades probably are influenced by a number of complex circumstances, some of which are not measured by the OTAT. They further state that the OTAT, a paper and pencil test, may be useful in evaluation of course content. Additionally, they report that the OTAT is a stable predictor of students' success in vocational programs.

Enderlein (1972) found the OTAT total score to be a more objective measure of achievement than teacher grades. He further suggests that

end-of-course shop grades did not contain the same information as the OTAT and at the same time was unable to determine if end-of-course shop grade was a valid measure of achievement. However, the OTAT shop scores were found to correlate significantly with shop grades. But, as a pencil and paper instrument the OTAT was found to be a cognitive-oriented measure and was not found useful in assessing manipulative skills.

Summary

1. The OTAT is a stable predictor of students' success in vocational programs (Kapes and Long, 1971).

2. A significant correlation seems to exist between OTAT scores and end-of-course shop grades (Enderlein, 1972).

3. Caution should be used in certain applications of the OTAT (Finch and Bjorkquist, 1970; Kapes and Long, 1971).

4. One objective of the OTAT is to provide a basis for reviewing the curriculum and improving instruction (Department of Education, State of Ohio, 1972).

III

PROCEDURE

Community and Sample

The following is a description of the community and sample under
consideration, it is not intended to be extensive, nor detailed. A more
descriptive, detailed over-view is included in a study titled, The Ninth
Grade Characteristics of Students Entering Different Tenth Grade Cur-
ricula: VDS Williamsport Sample, Monograph Number 12, which is part of
a longitudinal study under investigation at The Pennsylvania State
University.

Instead, included herein is a brief description of the community
and sample, including: the history, population, economy, housing, land
use, finance, transportation, social needs and characteristics, educa-
tional system, and study sample, needed to give the reader an under-
standing of those community factors effecting the Williamsport sample.

Williamsport is located in north central Pennsylvania in Lycoming
County. It was once known as the "Lumber City," because of the timber
industry which abounded there, producing 300 million feet of sawed
lumber each year. After exhaustion of the timber, the city turned to an
industrial base, which provided a modest amount of prosperity for the
community.

Williamsport was chosen as the location of the county seat of
Lycoming County in 1796, because of its level land and accessibility to
the hopefully navigable Susquehanna River. It was chartered as a
Borough in 1806 and incorporated as a City in 1866.

The city experienced a steady continuous population growth from 1890 to 1930. The population reached its apex of 45,729 in 1930. From 1930 to 1950 the population held fairly stable, and after 1950 it began to decline, until 1970 when it reached 37,918. The Lycoming County Planning Commission is projecting to 1980 a slight decline in population reaching a low of 36,500 and then forecasting a modest increase to the year 2000 with the population reaching 40,400.

The present economic base of Williamsport centers on manufacturing, wholesaling and retail trade, and services, which account for 85 percent of the employment, with manufacturing clearly being the dominate economic activity. The future economic growth is very difficult to predict because of the multitude and complexity of all the variables involved.

Williamsport is composed of five neighborhoods, namely: West End, Central, North End, East End, and Downtown. The declining population reflects a low percent of new housing construction taking place. Only 7.8 percent of the houses have been built in the past 20 years, as compared with a statewide figure of 31.9

The majority of the early growth of Williamsport was close to the river. Because of construction along the river, the town has taken on an east-west growth pattern. The total land area is 9.1 square miles; with approximately 70 percent of this area developed and 30 percent vacant. The largest single use of the developed area is residential, constituting approximately 36 percent of the useable area.

As a result of a decreasing population and the closing of commercial enterprises, coupled with an increase in the demand for public service requirements, Williamsport has experienced financial chaos. In order to offset this financial dilemma the city derives its major source

of revenue from real estate taxes. Additional revenue is derived from a
per capita tax, $20 per resident over 21 years of age; income tax, one
percent; occupational privilege tax, $10; and occupation tax, 160 mills
on value of occupation.

The major forms of transportation available to Williamsport are:
road, rail, and air. Following the trend of the United States, Lycoming
County has adapted an overwhelming reliance on motor vehicles as the
primary mode of transportation. From 1960 to 1970 the registration of
motor vehicles has increased 46 percent in the county. Railroads no
longer provide passenger service to the community. However, the Reading
Railroad and the Penn Central serve Williamsport with rail freight
service. Truck terminals are an important industry in Williamsport,
because of its geographic location as the center of north central
Pennsylvania. Daily air commuter service is available providing
service to Washington, Philadelphia, and Albany.

The mean family income in Williamsport in 1970 was $9,175 as com-
pared to the Pennsylvania mean income of $10,877, which is among the
lowest family income of the Pennsylvania cities. This low income
figure has been attributed to the heavy out migration of the 25-44 age
group.

The ethnic make-up of Williamsport demonstrates its long existence
with a stable population. Of the total population, less than 10 percent
are foreign born or have foreign born parents. Of the foreign born,
Italians and Germans are the most prevalent. By race, the largest non-
caucasian population is Black, with 1,121 persons, compared to 942 in
1960 representing a 19 percent increase

The city of Williamsport is part of the Williamsport Area School

District, which includes Lewis, Hepburn, Lycoming, Old Lycoming, and

Woodward Townships (all in Lycoming County). The school district

encompasses an area of 98 square miles and is under the administrative

control of a nine-member board of directors and one superintendent. The

system follows the organizational concept of K-6-3-3, (K = kindergarten;

6 grades in elementary, 3 grades in junior high and 3 grades in high

school). There are 19 public schools in the district, which include:

15 elementary, 3 junior highs, and one senior high.

A new senior high school was completed in 1971, and has a capacity

of 2,700 students. The present enrollment is 2,300 students. A wide

variety of courses, except vocational courses, are provided at the new

high school. The vocational courses are offered as part of the Area

Vocational School at the Williamsport Area Community College.

The Williamsport Area Community College also operates within the

city. Although the major emphasis of the college focuses on the occupa-

tionally oriented programs, it also provides a comprehensive Liberal

Arts and Sciences program.

The Williamsport area has one four-year liberal arts institution,

Lycoming College. This school is related to the United Methodist Church

and has an enrollment of 1600 students. The close-working relationship

between Lycoming College and the City makes it an important entity in

Williamsport.

Study Sample

During the fall of 1968 the Department of Vocational Education at

The Pennsylvania State University undertook a ten-year longitudinal

Vocational Development Study (VDS). The study was initiated to investigate the effects of certain high school experiences and decisions made by students in an attempt to isolate factors that could be pertinent to curriculum planning and guidance. The sample from the Williamsport area was not added to the project until 1970. All high school students from the Williamsport High School who graduated as the class of 1974 were included in the sample. The original (1970) Williamsport sample consisted of approximately 900 students. The graduating Williamsport sample consisted of approximately 750 students.

The Williamsport student sample under consideration as part of this study was initially tested and inventoried during the Winter of 1970-71. The testing and inventoried material collected consisted of students' abilities, interests and biographical information; along with their data file for the seventh grade through tenth grade. This study utilized the criterion variable OTAT that was administered only to the eleventh grade vocational curriculum portion of the much larger sample. This data was collected during the spring of 1973. The Williamsport vocational sample size was 71.

The contrast group with which the Williamsport sample was compared consisted of a totally non-Williamsport sample. Both groups were enrolled in vocational classes at the vocational school that is offered as part of the Williamsport Area Community College. The non-Williamsport sample consisted of 46 students that had completed both the tenth and eleventh grades in the shop area in which they were measured. A closer breakdown by shop areas and numbers of students in each area follows.

Tenth and Eleventh Grade, and
Eleventh Grade Only Sample by Shops

		Tenth and Eleventh Grade	Eleventh Grade Only
		N	N
1.	Automotive Mechanics	11	10
2.	Machine Trades	9	5
3.	Auto Body	5	9
4.	Carpentry	14	19
5.	Mixed Group (Welding, Electricity, Electronics and Mechanical Drafting)	7	28
	Total	46	71

Because of the small numbers in the electrical, electronics,
mechanical drafting, and welding shops, these shops were grouped
together and analyzed as a single identity titled mixed group.

Essential Data

The Ohio Trade and Industrial Education Achievement Test

The Ohio Trade and Industrial Education Achievement Test (OTAT)
is a test battery designed to measure achievement in trade and indus-
trial areas. This test battery is specifically designed for the evalua-
tion and measurement of vocational achievement. The OTAT is composed of
sub-tests which vary in number from one shop area to another. The num-
ber of sub-tests range from a low of eight in the electronics area to a
high of eighteen in the mechanical drawing area. The number of items

vary within the sub-tests and the total test score is composed of the
sum of the items in the sub-tests within each individual area. Each
total test contains a large number of items and the reliability coeffi-
cients (KR-20) for the total test scores range from .83 to .95; however,
no reliability coefficients are reported for the sub-tests. Because of
the lack of reliability information of the sub-tests it was decided that
the total score was the only useful measure of achievement for the pur-
pose of this study.

Taking into consideration that the total test scores differ in
number of items for each shop area, the OTAT total scores were converted
to standard scores for each of the eight shop areas (Automotive
Mechanics, Machine Trades, Auto Body, Carpentry, Welding, Electricity,
Electronics and Mechanical Drafting). The standard score selected had
a mean of 50 and standard deviation of 10. The procedure used for the
conversion was based on each individual's raw mean score for the total
test in his shop area. This score was then compared to the percentile
score based on the OTAT achievement test Ohio State norms for that shop.
This percentile was then converted to a standard score.

California Short Form
Test of Academic Aptitude

In addition to providing sub-test scores and a total score for each
shop, the OTAT also includes a test of academic aptitude, referred to as
the California Short Form Test of Academic Aptitude, Level 5. This test
is composed of four sub-tests, each separately timed. The sub-tests are
in two major sections, one is language, the other is non-language. The
language section consists of; vocabulary and memory, while the non-
language section consists of; analogies and sequences.

Analysis

The hypothesis test usually employed to test the difference between the means of two samples, $\overline{X}_1 - \overline{X}_2$, is equal to zero against the alternative hypothesis that the means are different from zero is the t test. However, the major difficulty with this method of testing is that the test is non-robust if the assumption of homogeneous variances is not met (Glass and Stanley, 1970). In order to overcome the violation of homogeneous variances, a statistic generally referred to as the Behrens-Fisher t' can be used. This test does not require homogeneous variances or equal N's.

The statistic was originally studied by Behrens (1929) and was explored further by Fisher (1935), is as follows:

$$\frac{\overline{X}_1 - \overline{X}_2}{\sqrt{s_1^2/n_1 + s_2^2/n_2}}$$

In discussing the Behrens-Fisher test (t'), Kohr (1970) states, "the test worked very well with only a very slight loss of power compared to the t test when all assumptions are met. When the assumptions were not met, and $n_1 \neq n_2$, it [Behrens-Fisher (t')] was much better than the t test."

According to Games (1972), the Behrens-Fisher (t') is a big improvement over the regular t because it protects against the violation of homogeneous variances. Additionally, he suggests that any time in doubt as to which test to use--the universal application should be the Behrens-Fisher test (t').

The statistical methodology utilized in this study tested the hypothesis that $\overline{X}_1 - \overline{X}_2 = 0$ (for each of the shops and for the mixed group) between the group of students receiving one year of shop instruction as compared to a group receiving two years.

Research seems to indicate that much error in experimentation may be traced to those characteristics of individual subjects that correlate highly with the dependent variable (in this case the total score for each shop on the OTAT). For example, evaluation of the effects of the shop achievement as measured by the OTAT would be difficult to inter-rupt, if the general intelligence level of the individuals differed. Variability in intelligence among subjects increases variability in performance within groups. Furthermore, if the average intelligence is higher for some groups than for others, the effects of the independent variable may be either obscured or spuriously enhanced (Myers, 1972).

To insure homogeneity of intelligence between groups (the tenth and eleventh grade versus the eleventh grade only), the achievement as measured by the California Short Form Test of Academic Aptitude were compared using the Behrens-Fisher t' test. The results of this test are shown in Table 1.

The results of this test (Behrens-Fisher t') reveal that the mean intelligence score of the one year sample (eleventh grade only) is 54.85 with a standard deviation of 12.13. This compares to a mean intelligence score of 48.72 and a standard deviation of 11.23 for the two year group (tenth and eleventh grade). The results of this test produced a t-value of 2.792. This value is significant at the .01 level, suggesting that the one year group has an intelligence advantage over the two year group. Thus the results of the t test between the

different shops might not be solely attributed to the amount of exposure
to a given instructional program, but might addititionally be attributed
to a learning advantage (intelligence).

Table 1. Mean Scores, Standard Deviations and t-Value for the
California Short Form Test of Academic Aptitude as Measured
by the Ohio Trade and Achievement Test

Group	N	$\overline{X}$	S.D.	t-value
Tenth and Eleventh Grade	46	48.72	11.23	
				2.792*
Eleventh Grade Only	71	54.85	12.13	

*Significant at .01 level.

In order to overcome the difference of intelligence, a technique
suggested by Myers (1972) will be used. The technique is the analysis
of covariance. According to Myers (1972), this approach assumes that
some portion of the usual error is predictable if we have knowledge of
the individual's score on some related measure, X_1, the covariate.
Elimination or removal of the variance of these predicted error com-
ponents leaves a smaller error variance and thus a more efficient, more
powerful test of treatment (OTAT) effects.

However, the author realizes a weakness in this test for this par-
ticular study, namely this test (analysis of covariance) requires
normally. It is hardly likely that the samples under consideration are
normal because of the small N's in each group. Thus, presented in a
later chapter are both a Behrens-Fisher t' test with the intelligence

differential playing whatever role it will, and an analysis of covari-
ance test (with removal of the intelligence factor) comparison between
groups and shops. In each case the results of both tests have been
reported in t values and probabilities of obtaining the observed t value
by chance.

Profiles were constructed for each sub-test for the following
shops: Automotive, Auto Body, Metal Trades and Carpentry. The sub-
test group means were converted to percentiles based on the Ohio State
norms. Profiles on the other shops were not constructed because of the
small N's in those areas.

IV

FINDINGS

Introduction

The results of this investigation are reported here in terms of the research questions presented in the statement of the problem. All statistical information relevant to each question in this study is presented in tables and figures and is discussed only to sufficiently explain and interpret its meaning. Any conclusions that may be supported by this data are reported in Chapter 5.

Question #1

Is there any difference in shop achievement, as measured by the OTAT total score between the groups of students that have completed two years of vocational education (tenth and eleventh grades) and the group of students that completed one year (eleventh grade only) considering all occupations together?

In an attempt to answer this question the two different samples (one having completed two years of vocational education, the other completing only one year) were compared using the Behrens-Fisher t' test and the analysis of covariance.

The results of the t' test between the two groups are shown in Table 2 and reveal a mean score of 48.10 with a standard deviation of 7.92 for the students that had studied in the vocational shops for one year (eleventh grade). Whereas, the other group of students that have

Table 2. Group Means, Standard Deviations, Coverted Group Means and t-Values for the Four Curriculums (Carpentry, Auto Body, Machine Trades, and Automotive), Mixed Groups, and Totals (One Year versus Two Years).

Analyses	Total (n=71)[a] (n=46)[b]	Automotive (n=10) (n=11)	Machine Trades (n=5) (n=9)	Auto Body (n=9) (n=5)	Carpentry (n=19) (n=14)	Mixed Group[c] (n=28) (n=7)
t-test						
1-year (mean)	48.10	52.80	48.00	52.67	49.21	44.21
S.D.	(7.92)	(10.87)	(2.24)	(8.34)	(7.20)	(5.98)
2-years (mean)	50.48	50.36	48.67	48.20	51.21	53.14
S.D.	(9.66)	(9.77)	(9.11)	(7.01)	(12.44)	(6.62)
t-value	-1.394	.538	-.209	1.066	-.540	-3.253
Significance Level	N.S.	N.S.	N.S.	N.S.	N.S.	.01
Covariance						
Converted Means						
1-year	47.32	51.02	44.92	51.91	48.36	44.15
2-years	51.68	51.98	50.38	49.56	52.37	53.41
t-value	-2.862	.208	-1.745	.607	-1.520	-3.694
Significance Level	.01	N.S.	N.S.	N.S.	N.S.	.01

[a] Sample of students with one year of shop experiences

[b] Sample of students with two years of shop experiences

[c] Consisting of students from the following shops: Welding, Electricity, Electronics, Mechanical Drafting

been in the vocational shops for two years (tenth and eleventh grade) had a mean score of 50.48 with a standard deviation of 9.66. The t' test produced a t-value of -1.394, which was not significant at the .05 level.

Therefore, the answer to this part of question number one is--no it does not appear to make a difference if students receive one year of vocational instruction or two years. That is, their mean OTAT total scores were not significantly different. However, it must be pointed out that the two groups differ in terms of intelligence, as detected by an analysis reported in Table 1.

Referring to Table 2, the analysis of covariance showed that (this analysis partialed-out the effect which might have been caused by intelligence) the adjusted OTAT mean score was 47.32 for the one year group. Whereas, the adjusted OTAT mean for the two year group was 51.68. The converted t-value for this analysis is -2.86, which is significant at the .01 level.

Therefore, the answer to this part of question number one is--yes (remembering that this analysis was conducted with small n's), in this case the students that received the most instruction (two years, tenth and eleventh grade) did have a higher mean score when compared with the one year group (eleventh grade only), partialing out the confounding effect of heterogenous intelligence.

Question #2

Is there any difference in shop achievement, as measured
by the OTAT total score, between the two groups of stu-
dents (tenth and eleventh grade versus eleventh grade
only) for the following occupational shops?

Shop Areas

I.   Automotive Mechanic

II. Machine Trades

III. Auto Body

IV. Carpentry

V.   Mixed Group (consisting of the following shops:
     Welding, Electricity, Electronics, and Mechanical
     Drafting).

In an attempt to answer this question of whether receiving more or
less vocational instruction effects shop achievement as measured by the
OTAT, the two groups (one group containing tenth and eleventh grade stu-
dents and another containing only eleventh grade students) were compared.
The groups were compared on their total shop scores which were con-
verted to standard scores, with a mean of 50 and a standard deviation
of 10.

The statistical tests employed for this question was the Behrens-
Fisher t' test and the analysis of covariance which compared the mean
scores of the groups under investigation.

At this point the author would caution the reader that a signifi-
cant intelligence difference has been detected between the two groups
under consideration. In order to avoid a misinterpretation of the

discussion of the analysis that follows, it is suggested that the statistical analysis section (presented in Chapter 3) be read, for an understanding of the findings.

A discussion of the statistical results of these tests for each cluster follows. Additionally, Table 2 was devised to enable the reader to visually inspect the results of both tests. Table 2 provides the means, standard deviations, converted group means and t-values for each test.

Automotive Mechanic

The total score means of the automotive mechanic shop were compared between the two groups of students who had varying lengths of vocational instruction. Table 2 reveals a mean OTAT score of 50.36, with a standard deviation of 9.77 for the group that received two years of instruction (tenth and eleventh grades). The same table shows the other group of students that received only one year of instruction (eleventh grade) with a mean OTAT score of 52.80 and a standard deviation of 10.87. The t' test between the means produced a t-value of .538, which is not significant at the .05 level.

Therefore, the results of the t' test suggest that there was no significant difference between the total shop scores for the students that received one year of instruction, when compared to the students that received two years.

The analysis of covariance test between the one year group and the two year group produced converted mean OTAT scores of 51.02 and 51.98 respectively. The analysis between the two OTAT means produced a t-value of .208, which is not significant at the .05 level.

Therefore, the results of the analysis of covariance suggest that there was no significant difference between the total shop scores for the students that received one year of instruction, when compared to the students that received two years.

Machine Trades

The OTAT total score means of machine trades shop were compared between the two groups of students who had varying lengths of vocational instruction. Table 2 reveals a mean OTAT score of 48.67, with a standard deviation of 9.11 for the group that received two years of instruction (tenth and eleventh grades). The same table shows the other group of students that received only one year of instruction (eleventh grade) with a mean OTAT score of 48.00 and a standard deviation of 2.24. The t' test between the means produced a t-value of -.209, which is not significant at the .05 level.

Therefore, the results of the t' test suggest that there was no significant difference between the total shop scores for the students that received one year of instruction when compared to the students that received two years.

The analysis of covariance test between the one year group and the two year group produced converted mean scores of 44.92 and 50.38 respectively. The analysis between the two means produced a t-value of -1.745, which is not significant at the .05 level.

Therefore, the results of the analysis of covariance suggest that there was no significant difference between the total shop scores for the students that received one year of instruction when compared to the students that received two years.

Auto Body

The OTAT total score means of the auto body shop were compared between the two groups of students who had varying lengths of vocational instruction. Table 2 reveals a mean score of 48.20, with a standard deviation of 7.01 for the group that received two years of instruction (tenth and eleventh grades). The same table shows the other group of students that received only one year of instruction (eleventh grade) with a mean score of 52.67 and a standard deviation of 8.34. The t' test between the means produced a t-value of 1.066, which is not significant at the .05 level.

Therefore, the results of the t' test suggest that there was no significant difference between the total shop scores for the students that received one year of instruction, when compared to the students that received two years.

The analysis of covariance test between the one year group and the two year group produced converted mean scores of 51.91 and 49.56 respectively. The analysis between the two means produced a t-value of .607, which is not significant at the .05 level.

Therefore, the results of the analysis of covariance suggest that there was no significant difference between the total shop scores for the students that received one year of instruction, when compared to the students that received two years.

Carpentry

The OTAT total score means of the carpentry shop were compared between the two groups of students who had varying lengths of vocational

instruction. Table 2 reveals a mean score of 51.21, with a standard deviation of 12.44 for the group that received two years of instruction (tenth and eleventh grades). The same table shows the other group that received only one year of instruction (eleventh grade) with a mean score of 49.21 and a standard deviation of 7.20. The t' test between the means produced a t-value of -.540, which is not significant at the .05 level.

Therefore, the results of the ' test suggest that there was no significant difference between the total shop scores for the students that received one year of instruction, when compared to the students that received two years.

The analysis of covariance test between the one year group and the two year group produced converted mean scores of 48.36 and 52.37 respectively. The analysis between the two means produced a t-value of -1.520, which is not significant at the .05 level.

Therefore, the results of the analysis of covariance suggest that there was no significant difference between the total shop scores for the students that received one year of instruction, when compared to the students that received two years.

Mixed Group (Consisting of the
Following Shops: Welding, Electricity,
Electronics and Mechanical Drafting)

The OTAT total score means of the mixed group were compared between the two groups of students who had varying lengths of vocational instruction. Table 2 reveals a mean score of 53.14, with a standard deviation of 6.62 for the group that received two years of instruction (tenth and eleventh grades). The same table shows the other group of students

which received only one year of instruction (eleventh grade) with a mean

score of 44.21 and a standard deviation of 5.98. The t' test between

the means produced a t-value of -3.253, which is significant at the .01

level.

Therefore, the results of the t' test suggest that there was a

significant difference between the total shop scores. The group of stu-

dents that received two years of instruction had a higher mean score on

the OTAT.

The analysis of covariance test between the one year group and the

two year group produced converted scores of 44.15 and 53.41 respectively.

The analysis between the two means produced a t-value of -3.694, which

is significant at the .01 level.

Therefore, the results of the analysis of covariance suggest that

there was a significant difference between the total shop scores. The

group of students that received two years of instruction had a higher

mean score on the OTAT than the students with one year of instruction.

Question #3

Do the profiles of the two groups of students

(tenth and eleventh versus eleventh grade only)

differ on the OTAT sub-test scores for each shop

area?

In order to answer this question Figures 1, 2, 3 and 4 have been

devised to visually display the mean OTAT sub-test scores for the two

groups (tenth and eleventh grade versus eleventh grade only) for each

shop. The sub-tests scores include the sub-divisions of each shop and

the short form test of academic aptitude. The percentile profiles are

based upon the State of Ohio 1973 norms for eleventh grade students.

The sub-test scores include major divisions of each shop, and vary in numbers ranging from a high of 18 to a low of 8. The Mechanical Drafting test has 18 sub-tests and Basic Electronics has only 8. Additionally, the sub-test score provides the short form test of academic aptitude (SFTAA), which according to the Ohio Trade and Industrial Education Services can provide a relatively short, but accurate estimation of the intelligence level and academic aptitude of the vocational students tested.

The Williamsport group (grade eleven only) is indicated in Figures 1, 2, 3 and 4 by the solid line. Whereas, the non-Williamsport group (tenth and eleventh grades) is indicated by the dash line.

An examination of the profiles show the one year group with higher scores than the two year group on the Short Form of Academic Achievement. Additionally, this achievement advantage seems to have benefited the one year group, because generally their sub-part scores were higher than the two year group. Where this is not the case, and the two year group achieved higher, the reason could be that the instructional unit being measured had not been covered by the one year group. Of all the profiles, the carpentry shop groups were the most similar.

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Figure 1. Ohio Automotive Mechanics Achievement Test Student Profiles for the Tenth and Eleventh Grade (dotted line) and Eleventh Grade (solid line).

Note: [a]Short Form of Academic Aptitude [b]Ohio Automotive Mechanic Achievement Test Total

Figure 2. Ohio Machine Trades Achievement Test Student Profiles for the Tenth and Eleventh Grade (dotted line) and Eleventh Grade (solid line).

Note: [a]Short Form of Academic Achievement [b]Ohio Machine Trades Achievement Test Total

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Figure 3. Ohio Auto Body Achievement Test Student Profiles for the Tenth and Eleventh Grade (dotted line) and Eleventh Grade (solid line).

Note: [a]Short Form of Academic Aptitude

[b]Ohio Auto Body Achievement Test Total

Row labels (top to bottom): Applied Math, Applied Science, Shop Management, Cooling and Conditioning, Electrical System, Frame and Unit Body, Fiber Glass Repair, Glass Replacement, Alignment, Parts Replacement, Trim and Hardware, Refinishing, Body Filler, Metal Forming, Welding, OABAT TOTAL[b], Total, Memory, Vocabulary, Analogies, Sequences, SFTAA[a]

Axis: 99%ile, 90%ile, 80%ile, 70%ile, 60%ile, Median 50%ile, 40%ile, 30%ile, 20%ile, 10%ile, 1%ile

Special Options

Interior Finish

Exterior Finish

Insulation

Roofing

Roof Framing

Wall Framing

Floor Framing

Foundations

Applied Science

Applied Math

Blueprint Reading

Orientation

OCYAT TOTAL[b]

Total

Memory

Vocabulary

Analogies

Sequence

SFTAA[a]

99%ile
90%ile
80%ile
70%ile
60%ile
Median 50%ile
40%ile
30%ile
20%ile
10%ile
1%ile
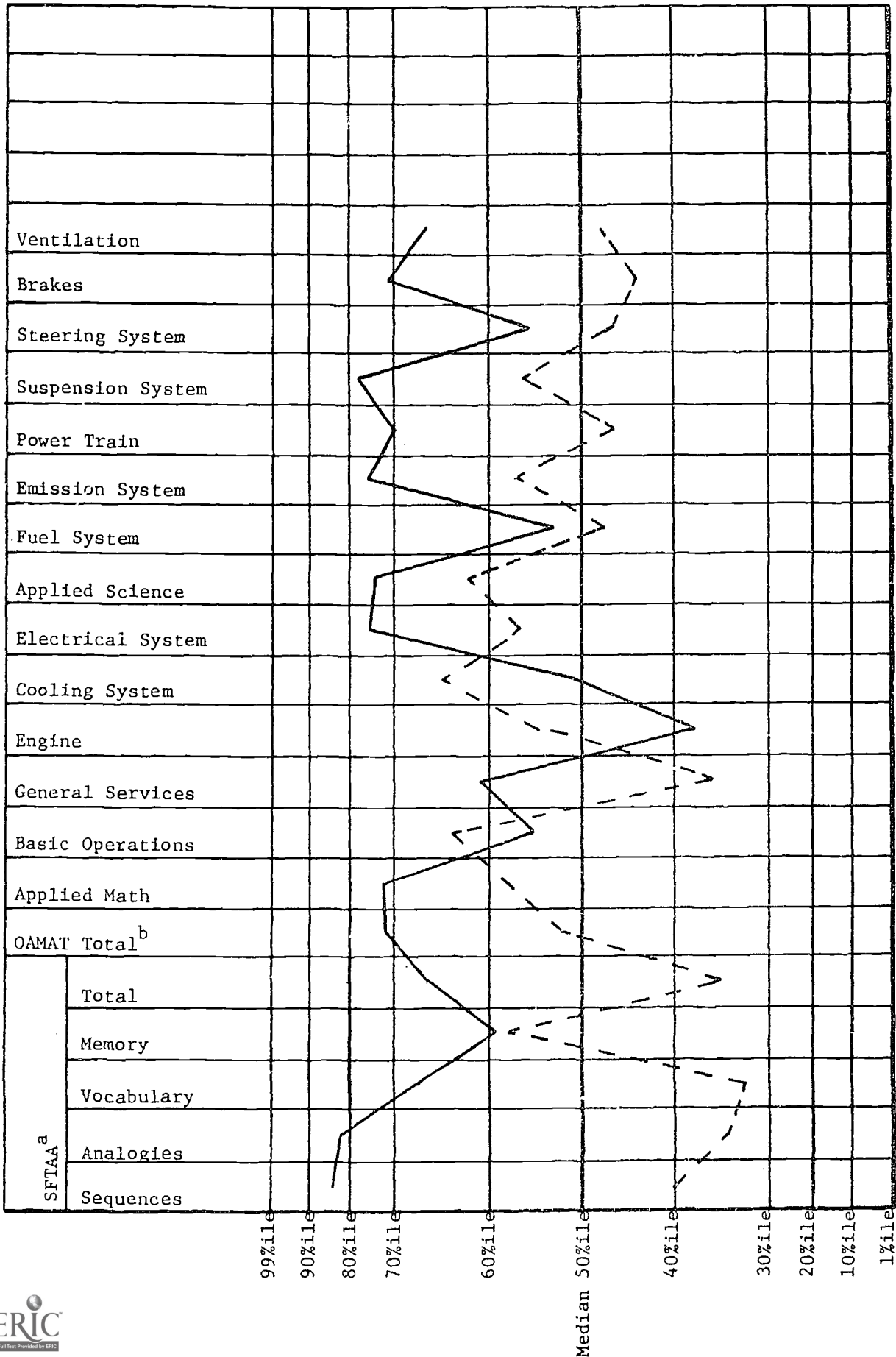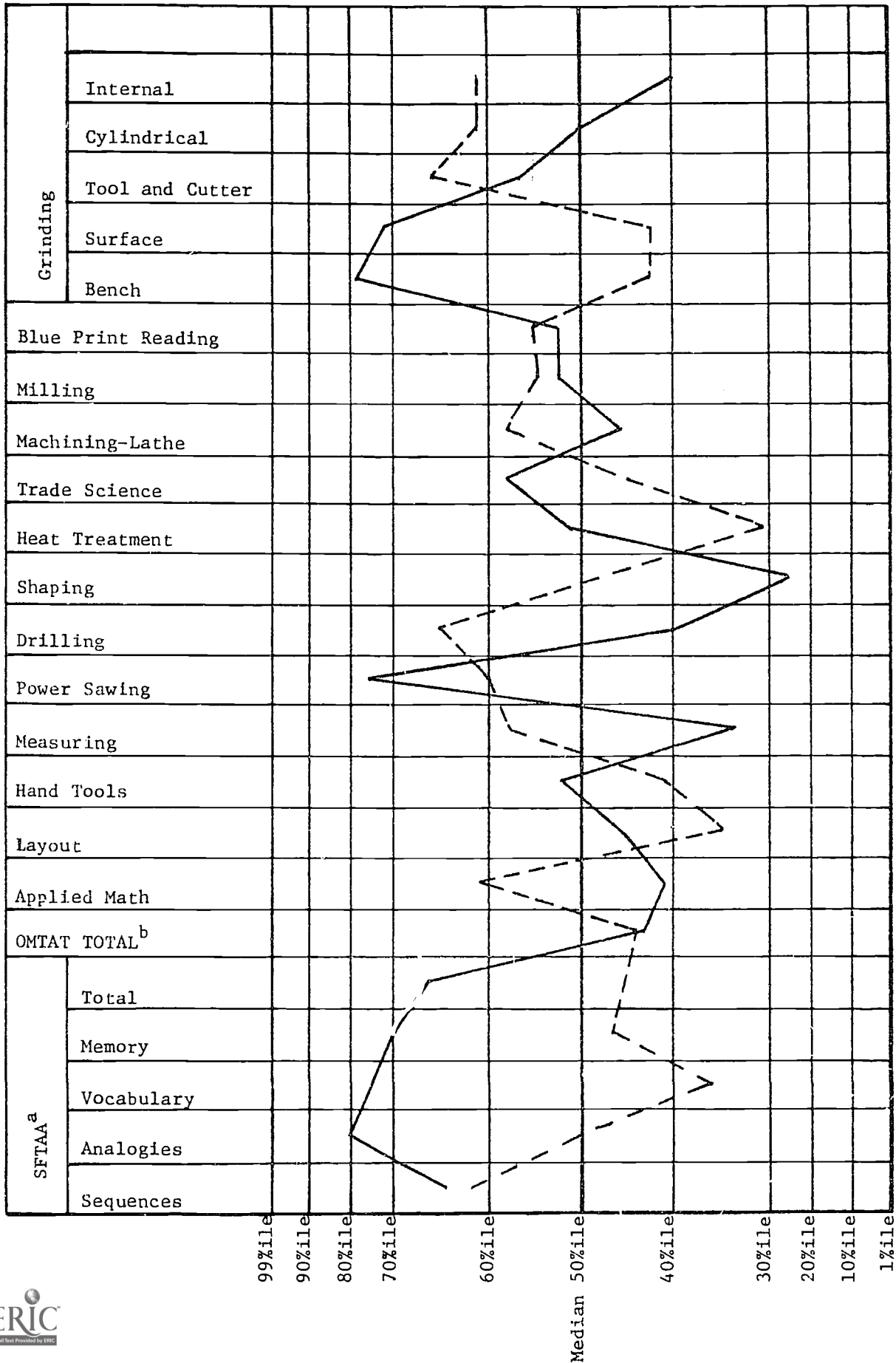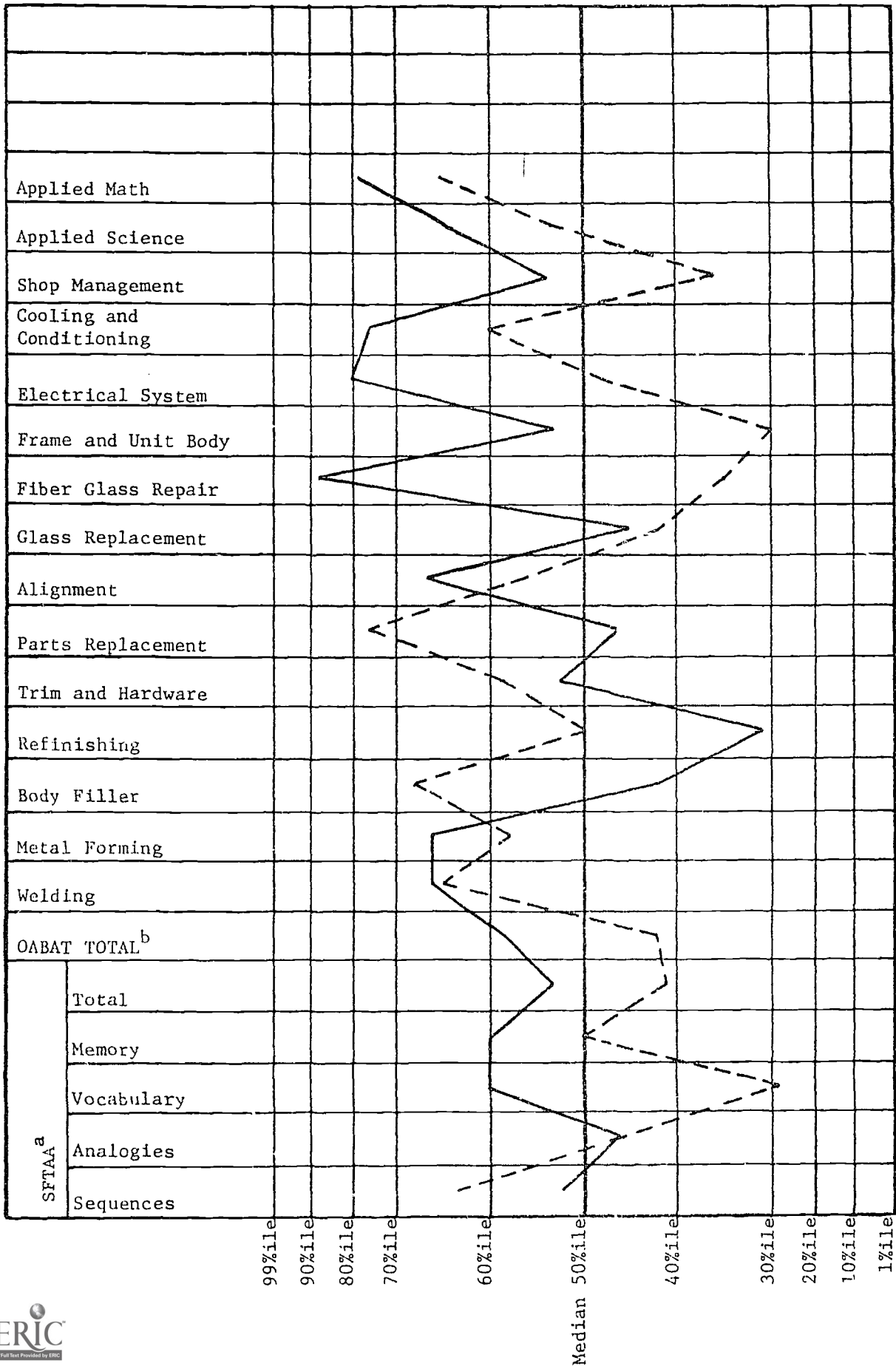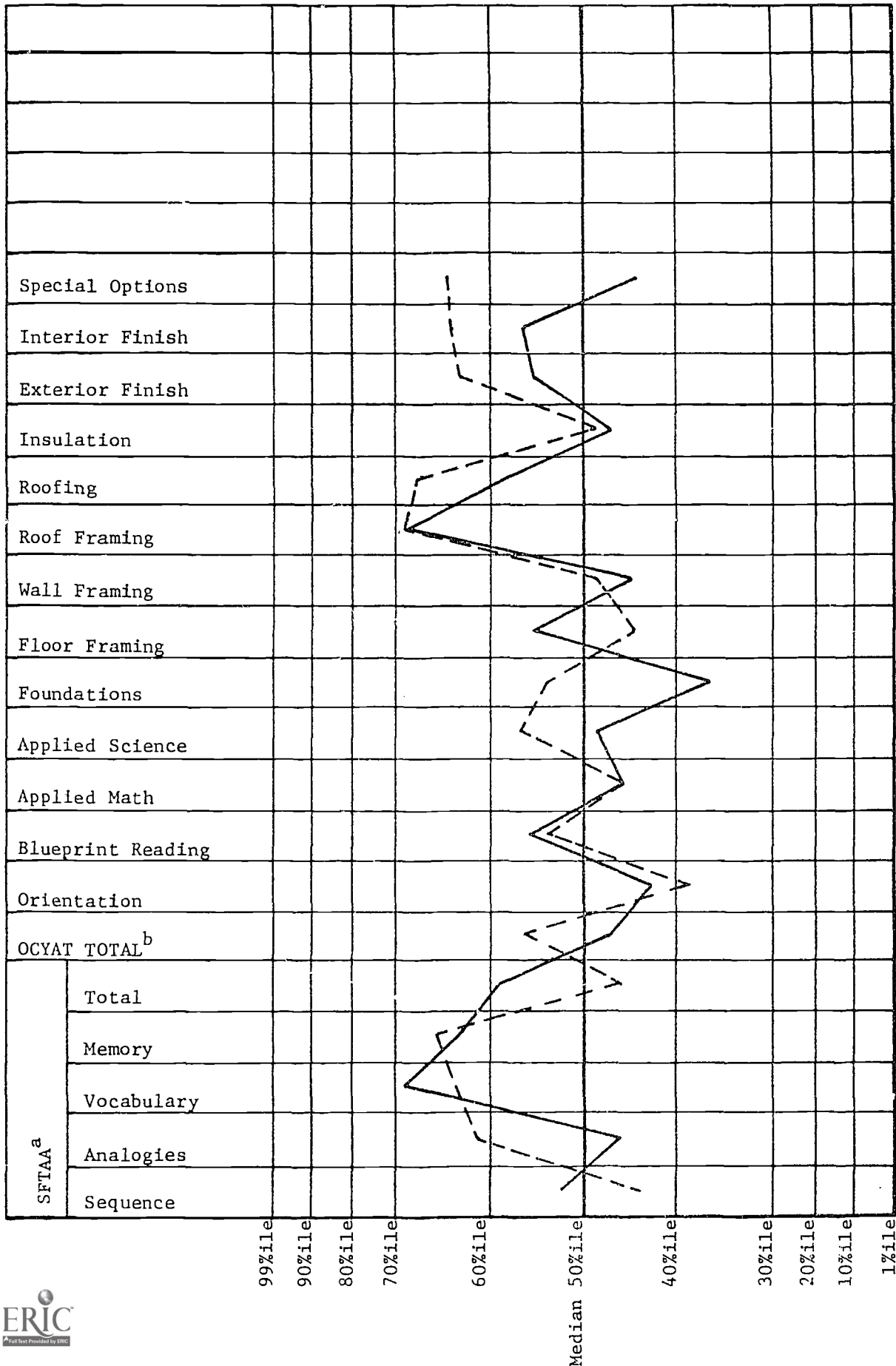
Figure 4. Ohio Carpentry Achievement Test Student Profiles for the Tenth and Eleventh Grade (dotted line) and Eleventh Grade (solid line).

Note: [a]Short Form Test of Academic Aptitude

[b]Ohio Carpentry Achievement Test Total

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter provides a summary of this study, conclusions based on
the findings, implications for vocational instruction and recommenda-
tions for further study.

Summary

Introduction

Vocational education received its first major stimulus from monies
provided for in the Smith-Hughes Act of 1917. The ensuing years since
this Act witnessed many additions and revisions to vocational education.
However, not until the passage of the Vocational Education Act of 1963
did federal vocational education legislation focus on people in need of
vocational education, which was a departure from all previous legisla-
tion which emphasized type of occupation. Due in part to the funding
that is being made available for support of vocational education and the
questionable relevance traditional education holds for some individuals,
vocational education has grown in size and scope. But, the growth in
vocational education (as well as all education) raises a serious
philosophical question that has perplexed behavioral science researchers
for some time--When is an individual sufficiently mature to make a
reasonably accurate occupational choice?

This study was conducted in an attempt to answer the question con-
cerned with whether delayed selection of an occupational shop will
enhance or retard an individual's achievement in that program.

Statement of the Problem

The general purpose of this study was to examine the difference in
shop achievement between students who had entered a specific vocational
program in tenth grade as opposed to eleventh grade. This study con-
sisted of two groups of vocational students, the first group of students
had completed both the tenth and eleventh grades of the vocational
program and the second group had completed only one year of study (the
eleventh grade) in the same vocational program. The shop achievement of
these two groups was measured by the Ohio Trade and Industrial Education
Achievement Tests (OTAT) total score.

The specific purpose of this study was to examine the differences
between these two groups in an attempt to answer the following questions:

1. Is there any difference in shop achievement, as measured by

    the OTAT total score between the group of students that have

    completed two years of vocational education (tenth and eleventh

    grades) and the group of students that completed one year

    (eleventh grade only) considering all occupations together?

2. Is there any difference in shop achievement, as measured by

    the OTAT total score, between the two groups of students

    (tenth and eleventh grade versus eleventh grade only) for the

    following occupational shops?

Shop Areas

    I.   Automotive Mechanic

   II.   Machine Trades

  III.   Auto Body

   IV.   Carpentry

    V.   Mixed Group (consisting of
the following shops: Welding,
Electricity, Electronics, and
Mechanical Drafting)

3. Do the profiles of the two groups of students (tenth and

eleventh grade versus eleventh grade only) differ on the OTAT

subtest scores for each shop area?

Procedure

The sample used in this study consisted of two groups of vocational

high school pupils. One group of students (from Williamsport) had

studied in the shop in which they were compared for one year (eleventh

grade). Whereas, the other group (a totally non-Williamsport group) had

exposure to the same shops for twice as long (tenth and eleventh

grades). The students were from the following shop areas: Automotive

Mechanic, Machine Trades, Auto Body, Carpentry, Welding, Electricity,

Electronics and Mechanical Drafting.

The total sample consisted of 117 participants: 71 from the

eleventh grade only, and 46 from the tenth and eleventh grade.

The criterion data used to compare the two groups of students who

had varying lengths of vocational instruction was the Ohio Trade and

Industrial Education Achievement Test (OTAT). This data was collected

in conjunction with the longitudinal Vocational Development Study (VDS)

project currently being conducted in the Dpeartment of Vocational Educa-
tion at The Pennsylvania State University. This test battery is speci-
fically designed for the evaluation and measurement of vocational
achievement.

Two statistical approaches were utilized to analyze the data--
Behrens-Fisher t' test and the analysis of covariance. In addition to
analyzing the data by these two techniques--profiles of the sub-part
mean scores of the following shops were developed: Automotive, Machine
Trades, Auto Body and Carpentry.

Findings

A t' test and an analysis of covariance was conducted between the
two groups of students in the study for the total sample and for five
separate shop groups. The criterion variable used to compare the groups
was mean total OTAT scores standardized across all shops.

The t-value was calculated to test the general null hypothesis,
that the mean total OTAT scores of the groups were equal using the t'
test. In addition, because a significant difference in intelligence was
detected between the two groups studied, the groups were also compared
using an analysis of covariance (which partialed-out the effect of
intelligence). This test also had for its general null hypothesis, that
the converted mean OTAT scores of the groups were equal. This methodo-
logy was used to answer questions one and two.

The t' test for question one found the two Mixed Groups (consisting
of the Welding, Electricity, Electronics and Mechanical Drafting) to be
significantly different at the .01 level in terms of OTAT scores. The
analysis of covariance found the two Total groups (consisting of all

shops) and the two Mixed Groups to be significantly different at the .01 level on the criterion-OTAT. In all cases the two year group scored higher than the one year group.

Question three was answered by developing profiles of the mean OTAT sub-part scores for the following shops: Automotive, Machine Trades, Auto Body and Carpentry. The results of these profiles generally show the one year group with higher mean achievement scores than the two year group. Additionally, the one year group usually had higher mean OTAT sub-part scores than the two year group. This finding could be attributed to the fact that the one year group possessed higher intelligence. Where the two year group did score higher than the one year group, the material in question may not have been covered by the one year group.

Conclusions

Question One

This question is concerned with whether students receiving two years of vocational instruction are more knowledgable in their trade, compared with students that received one year of instruction. The groups of students being compared had completed the eleventh grade in their respective shops. The major difference between the two groups was; the one group entered their respective shops in the tenth grade, whereas the other group did not enter their shops until the eleventh grade. The criterion variable used to compare the two groups under consideration was the mean total OTAT score for each trade area converted to standard scores based on Ohio norms.

However, prior to the statistical tests that were conducted on the groups, a significant intelligence difference was detected between the groups, thus two different statistical tests were employed to determine if the two groups differed in terms of mean total OTAT scores. The first test (t') was conducted without concern for the differences in the intelligence factor, whereas the second test (analysis of covariance) equated the mean total OTAT scores as if the two groups possessed homogeneous intelligence.

When the mean total OTAT scores were not adjusted to compensate for the intelligence factor, the statistical test did not detect a difference between the two groups, thus suggesting the two year group had not benefited from the additional year of instruction. However, when the mean total OTAT scores were adjusted as if both groups had equal intelligence, the statistical tests reveal that the two year group did benefit from the additional year of instruction.

Question Two

This question compared the mean total OTAT scores of the shop areas under consideration to ascertain if receiving two years of vocational instruction will effect learning in a particular shop when compared with a group of students that had studied in the same shop for only one year. The shop areas being compared were: Automotive Mechanic, Machine Trades, Auto Body, Carpentry and Mixed Group (consisting of the following shops: Welding, Electricity, Electronics and Mechanical Drafting).

Because a difference in intelligence between the two groups has been detected, the same two statistical tests were conducted as were used for question one. The first test (t') was conducted without regard

for the intelligence factor, whereas the second test (analysis of covariance) equated the mean total OTAT scores as if the two groups had homogeneous intelligence.

Using both types of analysis, the group of students that had studied two years from the Mixed Group had significantly higher mean total OTAT scores than the one year group. The other groups (Automotive, Machine Trades, Auto Body and Carpentry) were not found to differ on their mean total scores.

The conclusion is that the only group of students that benefited from the additional year of vocational instruction was the Mixed Group. At least part of the explanation for why significant differences were not found for individual shops lies in the very small sample sizes available. Conversely, the Mixed Group and the total sample (question one) did not suffer from this problem and therefore did yield differences.

Question Three

In an attempt to answer this question, profiles (Figures 1, 2, 3 and 4) were developed to give the reader a visual display of the two groups under consideration. The one year group (totally Williamsport – 1 year) was displayed by a solid line, whereas the two year group (non-Williamsport – 2 years) was displayed by a dotted line.

In all cases the one year groups had higher mean intelligence test total scores (SFTAA) than the two year groups and were usually higher on most sub-parts of the test. The one year group of students from Automotive and Auto Body had higher mean total shop achievement scores than the two year group. However, the two year groups from the Machine Trade and Carpentry had higher mean total shop achievement scores than the one

year group. The groups that came closest to resembling each other were those in Carpentry, where generally their profile on the sub-part means scores were similar.

The added advantage of intelligence appears to have benefited the one year group, because in many cases their sub-part scores were higher than those of the two year group. Where this was not the case, this may be attributed to the nature of the programs (i.e., the unit under consideration might not as yet have been covered by the one year group).

Recommendations

In view of the findings and conclusions of this study the following recommendations are suggested

1. The findings suggest that students who begin vocational education in the tenth grade do somewhat better than those beginning in eleventh grade when achievement is measured at the end of eleventh grade. Further research needs to be conducted to determine if this is true for all shops and would hold up over longer time periods (i.e., at the end of twelfth grade). Because the findings suggest that although some students seem to benefit from an early shop selection and entry, there is reason to believe that this is not true for all students in all shops, or for all time periods. Also, the amount of increase in trade knowledge for the two year group is small compared to the additional one year time advantage.

2. It is recommended that this study be replicated. This time with a larger group of students that have homogeneous intelligence.

Also, the comparison would be made at the end of twelfth grade
when one group has had three years of shop instruction versus
two years for the other group.

3. It is recommended that in replicating this study other measures
in addition to the Ohio Trade and Industrial Education Achieve-
ment Test (a pencil and paper achievement test) be used as a
criterion variable. Measures of performance, satisfaction and
on-the-job success should also be employed.

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