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ABSTRACT

This study attempts to examine three basic characteristics of vocational-technical instructors (industrial experience, teaching experience, and college credits earned) in terms of their relationship to student shop achievement as measured by the Ohio Trade and Industrial Education Achievement Tests (OTAT). Rated in the study sample were 31 instructors, and 876 junior and senior students from three vocational technical schools. Findings from the study indicate that of the three teacher characteristics, the greatest relationship existed between teaching experience and college credits earned, although only college credits earned demonstrated a significantly positive relationship to student shop achievement. In some cases, years of industrial experience appeared to be negatively related to shop achievement. Findings further pointed to a relatively low relationship between student ability and shop achievement, a result which was not expected. (Author/PC)

THE
PENNSYLVANIA
STATE
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DEPARTMENT
OF
VOCATIONAL
EDUCATION

CHARACTERISTICS OF VOCATIONAL-TECHNICAL INSTRUCTORS AND THEIR RELATIONSHIP TO STUDENT SHOP ACHIEVEMENT

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Bureau of Vocational, Technical and Continuing Education
Research Coordinating Unit
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PREFACE

This research monograph is one of a continuing series which reports the results of studies conducted as part of the longitudinal Vocational Development Study (VDS) project underway at Penn State since the Fall of 1968. The VDS project is being supported by Pennsylvania's Research Coordinating Unit (RCU) in Vocational Education in cooperation with the Department of Vocational Education at Penn State and several large school systems in Pennsylvania. The project has undertaken both basic and applied research studies dealing with topics in vocational education and vocational guidance.

The study reported here is very much of an applied nature. The authors have attempted to explore an age old question dealing with the characteristics of vocational-technical instructors and their relationship to successful teaching as evidenced by student shop achievement. The task was a difficult one especially from the point of view of gathering an adequate and representative sample of teachers and students for whom data was available. Although a larger teacher sample would have enhanced the reliability and generalizability of the findings, there is still good reason to believe that the results of the study provide a fairly accurate representation of the nature of the phenomena under investigation. The authors wish to express their appreciation to the Altoona, Hazleton and Jefferson-DuBois AVTS personnel for their cooperation in conducting this study.

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VDS CAPSULE

These blue pages have been included in this report in order to provide a brief overview of the study including its major findings and implications. Although for many readers this capsule may be sufficient, it is hoped that many of those educators and others who have a particular responsibility for vocational-technical education will find the entire report useful. The study itself attempts to examine three basic characteristics of vocational-technical instructors (industrial experience, teaching experience, and college credits earned) in terms of their relationship to student shop achievement as measured by the Ohio Trade and Industrial Education Achievement Tests (OTAT). The sample for the study consisted of 31 instructors and ~~882~~ 876 junior and senior students from three area vocational technical schools in non-metropolitan Pennsylvania (Altoona, Hazleton and Jefferson-DuBois). Although each of the three school systems involved is described in some detail in this monograph, they have been nominally coded as X, Y, and Z to preserve some degree of anonymity. The following sections include a brief summary of the major findings of the study as well as some, but not all, of the implications which may be drawn from the findings.

Findings

1. The three teacher characteristics of industrial experience, teaching experience and college credits earned are fairly independent of one another. The greatest relationship exists between teaching experience and credits earned.

2. Among the three teacher characteristics examined, only college credits earned demonstrated a significant positive relationship to student shop achievement.

3. In some cases, years of industrial experience appears to be negatively related to student shop achievement.

4. The relationship between student ability and shop achievement was relatively low considering the expected relationship between ability and achievement.

5. There was evidence of a great deal of variability from one school system to another in the direction and degree of relationships among the characteristics examined.

6. In all three school systems studied, junior students achieved higher OTAT scores than senior students compared to national norms.

Implications

1. Because college credits earned were most highly related to student shop achievement it may be important to increase the amount of college level teacher preparation available to vocational-technical instructors. It may also be helpful to raise the minimum credit requirements for initial certification.

2. Since neither industrial or teaching experience were highly related to student shop achievement there appears to be every reason to encourage young men and women directly out of high school to pursue full-time college level preparation towards vocational teacher certification with the full expectation that they can become competent teachers soon after graduation.

3. Since many years of teacher industrial experience does not improve student shop achievement (in some cases as industrial experience increases, student achievement decreases) it may be necessary to minimize industrial experience as a criteria for initial teacher certification, or at least consider other competencies more important.

4. Given that the relationship between student ability and achievement was fairly low, emphasis for selection of students in vocational programs should be shifted from the cognitive domain to the affective domain (interest, values and motivation should receive greater attention).

5. Since junior students out performed senior students in comparison to national norms in all three samples, the nature of the senior year vocational shop experience should be closely examined. Perhaps senior students would benefit more from a cooperative vocational program than the traditional third year now offered.

6. Because there was such a great deal of variability (from one school system to another) in the relationships examined between teacher characteristics and student shop achievement, vocational educators need to be cautious in interpreting the results of this study. Additional studies using larger samples and examining a wider variety of characteristics are necessary before any of the above implications can be accepted with any degree of confidence.

I

ORIGIN AND IMPORTANCE OF THE STUDY

Introduction

It is generally agreed that the teacher is the key person in the school organization. Upon his or her shoulders rests the responsibility for the success or failure of the educational program in the classroom or school shop. Closely related to the success of an educational program is the process of selecting and training the best qualified persons to become teachers.

It is often assumed that the teacher in vocational education needs both practical experience in industry and professional education. Is there some amount of experience beyond the minimum required for certification which is desirable, or are some combinations of experiences most useful?

Barr (1947) states that "one of the big jobs of professional education is to handle its resources through proper selection, guidance, recruitment, education, and placement, such as to secure competent persons to do the school's work" (p. 5). His study defines four different approaches to the evaluation of teacher effectiveness: 1) the qualities of the person (consideration, attractiveness, drive, and dependability); 2) performance (teacher-pupil activities); 3) the controls over behavior or prerequisites of success (specific knowledges, skills, interests, attitudes, and ideals of teachers); and 4) results (pupil growth and achievement).

Barlow (1967), writing about teacher effectiveness states that:

> The call in 1917 for the "master craftsman" and fifty years of experience bear out the wisdom of the ideal of occupational competency in teachers. This is the cornerstone of trade and industrial education. Unfortunately, it is frequently misunderstood by some of our own group, and we do not always interpret and implement the principle adequately (p. 71).

The traditional interpretation requires that essential skill-knowledge aspects of the teacher make-up be supported by a sound educational background and practical competency in a variety of related areas. Barlow suggests that the profile of the successful trade and industrial instructor could well include the following elements. The instructor must: 1) be a master craftsman; 2) have more than ordinary grasp of applied science and math; 3) acquire a formal educational background equal to or better than other teachers; 4) be a student of the sociology of trade and industrial education; 5) understand with usual clarity the economic significance of trade and industrial education; 6) be a dynamic, creative, imaginative person with great potential for adaptability; and 7) dedicate himself to life-long study of the art of teaching.

Regarding teacher qualities, Weaver (1966) states that:

> . . . the industrial teacher is a mature person who has spent from five to ten years in industry. Such a teacher is a mature person who has family responsibilities and cannot resign a good job to attend college for one or two years in preparation for a teaching position. He is willing and able, however, to spend a reasonable amount of time in proper preparation for entrance into the teaching profession (p. 149).

It is generally recognized that knowledge is not the only prerequisite for effective teaching. Kelley (1952) emphasized this fact in the following statement:

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It is generally recognized that knowledge is not the only prerequisite for effective teaching. Kelley (1952) emphasized this fact in the following statement:

> The notion that any person who has a large store of knowledge can teach is not valid. Knowledge is half the requirement. Before it can be useful to the teacher, he has to know how to bring it to bear on an infinite variety of situations involving unique people (p. 349).

Hager (1952) answers Kelley's remark by posing the following question: "How much professional preparation for teachers is needed in addition to, or along with, the mastery of the subject or subjects to be taught?" Hager's question has no easy answer. There are those, however, who believe that practical experience in industry, plus a minimum of pedagogical preparation will produce the most effective teacher. Others believe that those graduating from a teacher training institution who have a minimum of industrial experience will produce better results. There are still others who believe that years of occupational experience is equated with occupational competency.

Individual differences make this question difficult to answer, but there does seem to be some logic in having had an instructor who has "lived in the working environment" in which he plans to teach, as opposed to one who has had only a school experience in the occupational area. Although specific studies are not conclusive, the evidence apparently does not indicate that the vocational instructor must be a tradesman.

There are no easy answers to the question of competencies necessary to serve in the cause of human development. When the teacher recognizes his educational task as essentially that of working with people to develop meaning and personal adequacy, he will discover he is only partially prepared to do his job. Discussing the education of vocational-technical teachers, Nelson (1956) stated that, "By today's standards, which seem to define more broadly the role of the teacher in school and

community life, subject matter competence would appear to be only one of the many competencies necessary for teacher effectiveness" (p. 209). On the other hand, Shoemaker (1971), in a study relating to teacher qualifications, stated that the ability of the vocational instructor to encourage learning is more directly related to his competency in the occupation he is teaching and his ability to relate to youth, than to the number of credit hours shown on his transcript. This conclusion is supported by the results of a similar study conducted at Ohio State Instructional Materials Laboratory (Ohio Trade and Industrial Education Services, 1965), entitled "Factors Contributing to Student Achievement."

Vocational instructors are generally zealous in their areas of specialization and this enthusiasm contributes to the educational development of interested students who pursue occupationally oriented programs. The objectives of vocational instruction have changed from mere teaching the skills necessary for survival, to providing those technical and specialized skills, knowledges, and attitudes which will enable students to compete in our highly complex society. The vocational program in the last two or three years of high school is designed to help the student develop competence in performing tasks associated with a specific occupational area. In addition, students also need to understand the information directly related to their chosen field or the specific area for which they are being trained.

In recent years, and especially since the passage of the Vocational Education Act of 1963, federal expenditures have increased for vocational education. In view of this, vocational educators need to develop effective procedures for evaluating their programs in terms of pupil

achievement and teacher performance. Indicators of ability and achievement are school grades, standardized achievement tests, general intelligence tests, special aptitude tests, and standardized test batteries. Some of the tests that are available are useful in predicting achievement in vocational education programs, as well as success in occupations.

The development of objective instruments for measuring skills and knowledge for vocational education programs is at a relatively immature stage when compared with other academic areas of education. A recent development in objective types of instruments for measuring achievement in vocational education is the Ohio Trade and Industrial Education Achievement Test (OTAT) Program. This program, which was originated in 1958, has concentrated on developing achievement tests for trade and industrial education. (Ohio Trade and Industrial Education Services, 1970.) Initially, testing was limited to Ohio; but in recent years it has been undertaken in a number of other states.

The program is designed for testing cognitive achievement in trades and industries at the secondary level. At present, it includes the fields of auto body, auto mechanics, basic electricity, basic electronics, carpentry, cosmetology, dental assisting, machine trades, mechanical drafting, printing, sheet metal, welding, and industrial and communication electronics. Tests have been normed (using large samples) so that both local and national comparisons can be made concerning a student's achievement.

As mentioned, the OTAT measures knowledge and understanding in a particular trade area. There have been several studies conducted using the OTAT as a criterion measure to assess students' success in vocational

education programs. Other measures of students' success, such as grade point average and shop grade have also been investigated (Kapes and O'Reilly, 1973). Studies have revealed that the OTAT is a valid predictor of success, and that it has a high degree of stability (Kapes and Long; 1971). It should be noted that grade point average and shop grade are subjective assessments of achievement which include considerations other than knowledge in a specific trade area.

Statement of the Problem

Properly taught, and properly organized, vocational education can serve not only as a means of preparing youth for employment, but also as a method of education for a significant number of youth who are not academically motivated. Youth can be motivated to achieve in a program if it provides for reasonable choice and if the quality of the program earns its respect. In order to make valid judgements about the relationship between student achievement and teacher characteristics, it is essential that differential achievement must be associated with specific teacher characteristics. Learning depends so strongly on student-teacher interactions that there must be more known about what teacher characteristics enhance the outcome of these interactions.

What teacher factors such as abilities, past experiences, personality attributes, educational background, styles of life, and the like are related to proficiency in teaching vocational students? Some have postulated that innate abilities and/or other personalities of the teacher are most important; others have emphasized formal training of skills; others have suggested length of teaching service; while still others

reflect the point of view that the conditions of the school environment, physical and attitudinal, determine the proficiency with which a teacher performs in the classroom. If we consider the total variance of teacher competency, differing portions of that variance may be attributed to any number of the hypothesized factors. Thus, it is important to determine the degree, if any, to which certain factors contribute to teacher proficiency as measured by student shop achievement.

The background characteristics of vocational education teachers selected for this study were: 1) educational background, 2) occupational experience other than teaching experience, and 3) teaching experience. The criterion of student performance selected was the OTAT. In addition, student's abilities as measured by the Short Form Test of Academic Aptitude (SFTAA) was selected as a moderator variable.

In an attempt to explore the effects of certain background characteristics of teachers relating to student shop achievement the following questions were posed, and are answered separately for eleventh and twelfth grade samples.

1. What is the relationship among the three teacher background characteristics?
2. What is the relationship between each of the three teacher background characteristics and student achievement?
3. What is the relationship between student ability and achievement?
4. What is the combined effect of the three teacher background characteristics on student achievement under conditions in which student ability is controlled?

Definition of Terms

The following definitions will provide a clear description of some of the terms that are used in this study.

Achievement - In vocational programs is referred to as the total score a student receives on the OTAT in the student's area of specialization (as converted to a standard score based on national norms).

Aptitude - Specific capacities and abilities required in order to learn or perform adequately a job, duty or a task. Aptitude suggests that an individual possesses multiple capacities and abilities. For the purposes of this study, however, aptitude is considered as a single score on the SFTAA.

Teacher Characteristics - Are defined as those characteristics which pertain to the teacher sample in this study. They are: age, ~~occupational~~ industrial experience, teaching experience and educational background.

Educational Background - Is defined as the amount of formal education an individual possesses or has completed in terms of amount of college credits earned.

~~Occupational~~ Industrial Experience - Is defined as the number of years of full-time work experience (related to area of specialization) possessed by teachers in this study.

Teaching Experience - Is defined as the number of years of experience teaching (related or non-related to area of specialization) at the secondary or post-secondary levels possessed by teachers in this study.

Vocational Education Program - Is defined as a systematic arrangement of courses and activities designed to prepare students for immediate

employment after high school in a particular occupation. For the purposes of this study, the vocational program includes the following areas: auto body, automotive, carpentry, cosmetology, dental assisting, printing, welding, sheet metal, construction electricity, industrial electronics, communication electronics, machine trades, and drafting and design technology.

II

REVIEW OF RELATED LITERATURE

The review of literature was helpful in developing a rationale for this study. Three major topics were of concern:

1. Studies and/or publications relating to factors and various measures of student achievement, particularly vocational-technical shop achievement.
3. Studies and/or publications concerning characteristics of instructors and their relationships to student achievement.

Studies and/or Publications Relating to Specific Background Characteristics of Vocational Instructors

In a national study conducted by Kay (1971) a sample of 4,472 instructors from most vocational areas were identified using such variables as age, sex, total years of teaching and industrial experience, and educational background.

Kay found that the typical vocational instructor was in his forties: nineteen percent of the teachers were under thirty; forty-seven percent between thirty and forty-four; and thirty-four percent over forty-five. Approximately fifty percent of the teachers in trade and industry and forty percent in home economics were over forty-five years old. Sixty percent of the teachers had less than ten years vocational and non-vocational teaching experience (the median was less than five years). Length of teaching experience varied with age, while trade experience averaged five years. Sixteen percent of the teachers under thirty had less than four years teaching and industrial

experience. Seventy-five percent of all vocational teachers possessed a bachelor's degree or better, thirty-three percent a master's degree or better. The group holding a degree other than those mentioned presumably held a normal school certificate or an associate degree. The percentage of teachers without degrees were: less than five percent under thirty years of age; thirteen percent between the ages of thirty-one and forty-four; ten percent for those over forty-five.

Kurth and Gianini (1967) endeavored to determine whether the professional competency of technical education teachers was a function of several educational background variables. Their findings indicated that no single piece of information can stand by itself in the analysis of an individual, and that all information contributes to the mossiac make-up of the individual which makes him what he is and what he can become.

Using a sample of one-hundred Pennsylvania vocational-technical instructors, Finch (1969) measured teacher attitudes, resource availability and utilization, and characterized them by: age, years of industrial and teaching experience, and college credits accumulated.

Bowman (1966), Detwiler (1967), Getzels and Jackson (1963), Ohio Trade and Industrial Education Services (1965), and Wilk et al. (1967) identified vocational-technical teachers using similar characteristics.

Most of the studies reviewed characterized the typical vocational-technical instructor as holding no degree, and possessing many years of occupational experience as well as several years of teaching experience. Finch (1969), concerned about the many research studies that did not sample the typical vocational-technical instructor stated that "the

prime reason for the lack of relevance is that the samples have usually been taken from a population of teachers with college degrees and little, if any, industrial experience" (p. 55).

Studies and/or Publications Relating to Factors and Various Measures of Student Achievement, Particularly Vocational-Technical Achievement

This review was primarily concerned with studies relating to the Ohio Trade and Industrial Education Achievement Test (OTAT), although other studies are included.

Baldwin (1969) stated that there exists the feasibility of developing standardized instruments for measuring student learning in vocational-industrial education. He demonstrated that valid and reliable measures for assessing student achievement can be produced with careful attention to test construction procedures involving curriculum analyses, the use of a committee of experts to generate items, validation testing, analysis, and norming.

In 1958, one successful undertaking in the field of standardized testing for vocational-technical education was completed by the Instructional Materials Laboratory of the Ohio State University, with the development of the OTAT.

Finch and Bjorkquist (1970) report success and promise for the use of the OTAT as a measure of student learning outcomes. In addition, this achievement measure, oriented toward specific vocational-technical specialty areas, may provide useful information relative to the instructional process. However, they caution that the OTAT (a paper and pencil test) measures the academic component of achievement in the shop or

laboratory, rather than trade skill compentence. They further caution that, although relationships have been found between OTAT test scores and course shop grades (instructor's ratings) in a training situation, no studies have been found that examine the relationship of test scores with actual job performance in the world of work.

Kapes and Long (1971) conducted a study also assessing the relationship between the OTAT total test score and end-of-course shop grades and reported that the OTAT may validly measure that portion of achievement that is related to course content knowledge. However, and understandably so, it measures only a small portion of the many criteria that instructors use to determine grades. Shop instructors, when assigning grades, consider a variety of components not directly related to factual knowledge of the occupational areas. Kapes and Long indicated that the OTAT is most useful in evaluating vocational programs when evaluation is concerned with course content, and that the OTAT is a more stable measure of student achievement in vocational-technical programs than are shop grades.

Enderlein (1972) and Kapes and O'Reilly (1973) suggested the use of the OTAT as a measure of shop success, and also determined its relationship to other measures of student characteristics. Enderlein found the OTAT to be a useful instrument in evaluating cognitive skills, however, the OTAT was not found to be related to manipulative abilities as measured by the GATB. Kapes and O'Reilly concluded that shop grade or overall GPA were the best measures of success in the overall vocational-technical program, and that the OTAT was the best measure of assessing student knowledge in a specific trade area.

In 1970 the Industrial Materials Laboratory, Ohio Trade and Industrial Services conducted a study to develop and validate tests of student's achievement in twelfth grade vocational printing programs. Results indicated that the test was valid and that reliability coefficients obtained were similar to trade tests previously developed. Renderer and Orr (1972) compared two mental ability tests that are part of the OTAT battery with other ability measures (using the same student samples for all tests) to see whether there were any significant differences between these IQ scores. They concluded that no direct comparisons should be made between the SFTAA and other general ability measures. However, the SFTAA was found to be a valid assessment of student abilities.

Studies and/or Publications Concerning Characteristics of Instructors and Their Relationships to Students' Achievement

What constitutes teacher performance and how can it be measured? The research conducted to determine the relationships between educational and other biographical factors and quality of performance offered varied and conflicting results.

In a study using 89 teachers with certification and non-certification backgrounds, Shim (1965) found no significant differences in pupil achievement when comparing the two types of teachers.

Hall (1962) evaluated teacher effectiveness of thirty-eight beginning elementary school teachers in Dade County, Florida, using the Stanford Achievement Test scores of 785 pupils, concluded that fully certified teachers promoted greater student achievement except for the

area of arithmatic computation. Hours of professional education had consistently positive relationships with pupil gain on achievement tests.

Proficiency and success are usually measured by tasks of information and/or skill in the performance of tasks. Super and Crites (1972, p. 36) cite Flanagan's (1947) study using 105 technical school instructors which illustrated that the relationship between final exam grade in ground school and final average grade for flying was moderately high ($r = .49$). As the level of teacher competence increased the relationship was stronger.

In a study of the relationships of selected background characteristics of electronics teachers and occupational competency, Musgrove (1968) states that:

> Student ratings and the teacher self-ratings obtained in this study indicated that there is no significant relationship between the amount of electronics-technical training and subsequent rated teacher effectiveness. It would appear that a simple measure of the quantity of electronic training is not likely to be indicative of teacher effectiveness in this area (p. 209).

Shoemaker's (1971) study, based on five years of results in achievement tests administered at the end of two-year programs in auto mechanics and machine shop, made comparisons between student achievement and instructor qualifications. College credits earned, age, and teaching experience showed no significant relationship with student achievement. The factor showing significant relationship with student achievement were the number of years the instructor had spent in the occupation before he became a teacher.

Rumpf (1954) conducted a survey using 236 vocational-industrial education teachers in Pennsylvania. Their teaching performance was

based on the salary they received, together with present age of the instructor. The study concluded that there seems to be no significant relationship between teaching performance and age. Since there was little variation between means, whether a teacher was younger or older, seemed to have little bearing on teaching performance. There were no significant relationships between industrial experience and teaching performance. The mean industrial experience for the teachers in the sample was 13.5 years, although state certification required only two years. Rumpf also investigated teacher performance and its relationship to the number of college credits earned. Although a low correlation was obtained ($r = .11$), there seemed to be a slight improvement of teacher performance as number of college credits earned increased. Teacher performance and teaching experience also correlated very little ($r = .16$).

A pilot study by the Industrial Materials Laboratory, Ohio Trade and Industrial Education (1970), was conducted to develop and validate tests of student achievement in twelfth-grade vocational printing programs. This study pointed out that the instructor's occupational skills and knowledge are the two most important factors contributing to student achievement.

Other significant findings of this study were:

1. Teacher personality, in terms of self-concept, is an indicator of how students will achieve. Teachers of the high-achieving groups displayed a higher intellectual quality concept than did teachers of the low-achieving groups.
2. Teacher age, grade level, education completed, years of teaching experience in present trade, total teaching experience and

degrees held, do not appear to be significant factors in student success.

3. Teachers industrial experience is a significant, positive factor relating to student achievement.
4. Student intelligence is a factor in trade achievement; however, some of the low-achieving schools reported mental maturity scores at or above those of the high-achieving schools.
5. Teacher attitudes and certain environmental factors also contributed to the difference found in students' achievement.

Summary

1. Kay (1971) indicated that the typical vocational instructor was over forty years old, possessed less than ten years of occupational experience, and less than five years of teaching experience. It was also reported that seventy-five percent of the vocational instructors held bachelors degrees.
2. Using small samples of vocational-technical instructors in studies by Bowman (1972), Detwiler (1967), Finch (1969), Getzels and Jackson (1963), Ohio Trade and Industrial Education Services (1965), and Wilk et al. (1967), found teacher characteristics similar to those found by Kay, with two exceptions--educational background, and occupational experience. These studies indicated that the typical instructor possessed no degree, and that the majority (60 percent) acquired 10 to 15 years occupational experience.

3. The OTAT was found to be a useful instrument in assessing student's shop achievement (Enderlein, 1972; Finch and Bjorkquist, 1970; Kapes and Long, 1971; Kapes and O'Reilly, 1973; and Ohio Trade and Industrial Education Services, 1970). Renderer and Orr (1972) concluded that the California Short Form Test of Academic Aptitude administered as part of the OTAT, is a valid instrument for measuring student's general ability.
4. Some studies indicated that occupational experience contributed significantly to student shop achievement (Ohio Trade and Industrial Education Services, 1970; Shoemaker, 1971), while others (Flanagan, 1947; Hall, 1962; Rumpf, 1954) indicated that credits earned contributed to student shop achievement.
5. Teacher attitudes (self-concept) relate positively to student achievement (Ohio Trade and Industrial Education Services, 1965), however Finch (1969) found negative correlations between occupational experience and the instructor's attitude toward teaching.
6. In terms of subject matter competency, positive relationships were found between teaching experience and teacher performance (Flanagan, 1947; Rumpf, 1954).

III

PROCEDURE

A description of the samples, the collection of the data, the instrumentation used, and the statistical applications are discussed in this chapter.

Sample

The samples selected for study were all secondary vocational-technical instructors and their eleventh and twelfth grade students in three Pennsylvania school districts; Altoona, Hazleton, and Jefferson-DuBois. These samples may be considered representative of their counterparts from Pennsylvania and from the entire country.

Altoona

Altoona is located in Blair County having a population of approximately 70,000 people, and is situated eighty miles east of Pittsburgh. Though founded in 1849 by the Pennsylvania Railroad, today in Altoona new and diversified industry now provide the major payroll. Unemployment in the town remains around the 1972 national average of five and one-half percent.

During the 1971-72 school year, the Altoona School District estimated student population was 16,000 of which approximately 1,230 students, with varied backgrounds, were enrolled in secondary vocational programs.

Altoona's educational organization is set up on a six-three-three plan, utilizing a number of elementary schools, three junior high

schools, one central high school, and one area vocational technical school.

Hazleton

Hazleton is located in Luzerne County in the northeastern part of Pennsylvania, approximately 25 miles south of Wilkes-Barre. The Greater Hazleton Chamber of Commerce (1971) identified Hazleton as being the crossroads of the East and Hazleton has been chosen as an All-American City. Early stages of development of this town were very slow, however, the discovery of anthracite coal in 1836 had given Hazleton its initial growth. The collapse of the coal mining industry in 1956 forced Hazleton into a period of economic hardship. Today, through industrial diversification, economically Hazleton is slowly picking up its own feet.

According to the 1970 Census the population is approximately 30,450, with an unemployment rate of approximately four percent (below the national norm). The school district population is about 70,000.

The Hazleton Area School District serves about 13,000 students, with approximately 650 students enrolled in secondary vocational-technical programs. The School District's educational organization is set up on a six-three-three plan, utilizing a number of elementary and junior high schools, three public high schools, one parochial high school, and one area vocational-technical school.

Jefferson-DuBois

The Jefferson-DuBois Area Vocational-Technical School is located in Reynoldsville, Pennsylvania. Reynoldsville is located in Jefferson

County in northwestern Pennsylvania, approximately twenty miles southwest of DuBois, and approximately ninety miles northeast of Pittsburgh. It was not until 1849 that Reynoldsville gained a distinct name and a post office, and it was not until after the Civil War that it became more than a mere way-station along the old-time pike. Profitable deposits of coal found in this region and the dependence of vast resources of timberland helped Reynoldsville to prosper through its first fifty years. It was not until the late 1890's that Reynoldsville was first alarmed that its greatest natural resources--timber and coal--might soon be exhausted. In light of this, people were encouraged to reestablish the town on a permanent basis by investing some of their personal money.

It was not until the early 1940's and 50's that large businesses were established that made the town prosper up until now. One of these large companies is the Heinz Corporation, a world-famous food grower and canner.

The school districts of Brockway, Brookville, DuBois and Punxsutawney consolidated to provide sufficient school population and taxable wealth to support an area vocational-technical school. During the 1971-72 school year, the Jefferson-DuBois School District serviced approximately 5,000 students, of which approximately 600 were enrolled in secondary vocational-technical programs in the tenth- eleventh- and twelfth-grades. The Jefferson-DuBois County Educational Organization is set up on a six-three-three plan, having several elementary schools and comprehensive junior-senior high schools, and one full-time area vocational school.

Combined Samples

In order to provide a reasonable sample size of both students and teachers (an important condition necessary to conduct the statistical analysis), student samples and their corresponding teachers were combined among the three selected schools for eleventh and twelfth grades. Any descriptive data or statistical analysis that represent the individual schools were coded X, Y, and Z to provide each school with complete anonymity. The means, standard deviations, and ranges of the four teacher characteristics and the two student characteristics for Schools X, Y, and Z are represented in Tables 1, 2, and 3. Descriptive data for the combined junior and senior samples is shown in Table 4.

Data for the students who were administered the OTAT test battery in March, 1973, were collected in July, 1973. Twelve trade tests were administered: Auto Body; Automotive Mechanics; Carpentry; Communication Electronics; Construction Electricity; Cosmetology; Drafting and Design Technology; Industrial Electronics; Machine Trades; Printing; Sheet Metal; and Welding.

Data for the teacher samples were collected in August, 1973. Only those teachers who have been teaching in the same shop for at least two years and have accumulated at least four college credits were included in the sample.

Out of a total of ~~818~~ 876 students, ~~432~~ 487 were juniors, and 389 were seniors. Twenty-eight teachers taught both juniors and seniors, three

Table 1. Means, Standard Deviations, and Ranges, of Four Selected Teacher Characteristics and Two Selected Student Characteristics for Eleventh and Twelfth Grades, School X.

Variables[a]	$\bar{X}$	SD	Range
Teacher Characteristics - Juniors (N = 11)			
1. Age[b]	44.72	8.74	28-54
2. Industrial Experience	15.73	7.99	6-31
3. Teaching Experience	8.73	6.51	2-23
4. Credits Earned	58.18	24.76	6-97
Student Characteristics - Juniors (N = 254)			
1. OTAT (Standard Score $\bar{X}$ = 500 SD = 100)	500.64	28.78	461-564
2. SFTAA (Max. Score = 90)	53.04	5.57	43.3-61.7
Teacher Characteristics - Seniors (N = 11)			
1. Age[b]	47.00	8.39	28-57
2. Industrial Experience	17.45	7.72	7-31
3. Teaching Experience	9.27	6.51	2-23
4. Credits Earned	62.09	26.17	6-97
Student Characteristics - Seniors (N = 194)			
1. OTAT (Standard Scores $\bar{X}$ = 500 SD = 100)	463.91	35.32	403-518
2. SFTAA (Max. Score = 90)	55.65	6.48	45.5-64.0

[a]Age, Industrial Experience and Teaching Experience are all reported in years.

[b]Was not used as a predictor variable in the statistical analysis.

Table 2. Means, Standard Deviations, and Ranges, of Four Selected Teacher Characteristics and Two Selected Student Characteristics for Eleventh and Twelfth Grade, School Y.

Variables[a]	$\overline{X}$	SD	Range
Teacher Characteristics - Juniors (N = 10)			
1. Age[b]	45.6	8.08	32-56
2. Occupational Experience	13.8	7.24	4-24
3. Teaching Experience	9.3	8.71	2-27
4. Credits Earned	57.2	29.05	8-90
Student Characteristics - Juniors (N = ~~103~~) 107			
1. OTAT (Standard Score $\overline{X}$ = 500 SD = 100)	492.20	57.07	433-581
2. SFTAA (Max. Score = 90)	52.30	7.04	34.9-60.1
Teacher Characteristics - Seniors (N = 10)			
1. Age[b]	47.80	7.33	32-56
2. Occupational Experience	15.90	7.45	4-26
3. Teaching Experience	10.20	8.32	2-27
4. Credits Earned	60.30	25.48	8-90
Student Characteristics - Seniors (N = ~~126~~) 92			
1. OTAT (Standard Score $\overline{X}$ = 500 SD = 100)	440.60	84.06	267-550
2. SFTAA (Max. Score = 90)	52.08	5.93	38.2-58.3

[a]Age, Industrial Experience and Teaching Experience are all reported in years.

[b]Was not used as a predictor variable in the statistical analysis.

Table 3. Means, Standard Deviations, and Ranges, of Four Selected Teacher Characteristics and Two Selected Student Characteristics for Eleventh and Twelfth Grade, School Z.

Variables[a]	$\overline{X}$	SD	Range
Teacher Characteristics - Juniors (N = 10)			
1. Age[b]	43.80	9.88	29-65
2. Industrial Experience	14.00	4.85	8-22
3. Teaching Experience	7.70	8.74	4-32
4. Credits Earned	83.80	34.58	61-175
Student Characteristics - Juniors (N = 126)			
1. OTAT (Standard Score $\overline{X}$ = 500 SD = 100)	551.60	50.18	436-620
2. SFTAA (Max. Score = 90)	55.41	6.05	49.5-65.3
Teacher Characteristics - Seniors (N = 10)			
1. AGE[b]	43.80	9.88	29-65
2. Industrial Experience	14.00	4.85	8-22
3. Teaching Experience	7.70	8.74	4-32
4. Credits Earned	83.8	34.58	61-175
Student Characteristics - Seniors (N = 103)			
1. OTAT (Standard Score $\overline{X}$ = 500 SD = 100)	497.8	89.87	341-678
2. SFTAA (Max. Score = 90)	56.94	7.81	46.2-72.5

[a]Age, Industrial Experience and Teaching Experience are all reported in years.

[b]Was not used as a predictor variable in the statistical analysis.

Table 4. Means, Standard Deviations, and Ranges, of Four Selected Teacher Characteristics and Two Selected Student Characteristics for the Total Junior and Senior Sample.

Variables[a]	$\bar{X}$	SD	Range
Teacher Characteristics - Juniors (N = 31)			
1. Age[b]	44.71	8.96	28-65
2. Industrial Experience	14.55	6.70	4-31
3. Teaching Experience	8.58	7.76	2-32
4. Credits Earned	66.13	31.15	6-175
Student Characteristics - Juniors (N = ~~429~~ 497)			
1. OTAT (Standard Score $\bar{X}$ = 500 SD = 100)	514.36	51.99	433-620
2. SFTAA (Max. Score = 90)	53.56	6.16	34.9-63.9
Teacher Characteristics - Seniors (N = 31)			
1. Age[b]	46.2	8.76	28-65
2. Industrial Experience	15.84	6.76	4-31
3. Teaching Experience	9.07	7.68	2-32
4. Credits Earned	68.52	29.96	6-175
Student Characteristics - Seniors (N = 389)			
1. OTAT (Standard Score $\bar{X}$ = 500 SD = 100)	467.32	74.23	267-678
2. SFTAA (Max. Score = 90)	54.91	6.86	38.2-72.5

[a]Age, Industrial Experience and Teaching Experience are all reported in years.

[b]Was not used as a predictor variable in the statistical analysis.

taught only seniors and three taught only juniors. Thus, 31 teachers and 389 students represented the senior sample, and 31 teachers and ~~429~~ 497 students represented the junior sample. Data analyses were conducted separately for junior and senior samples.

Essential Data

Independent Variables

Previous studies suggested the use of certain predictor variables that were assumed to relate to the criterion measure (OTAT scores). On the basis of this review, four predictor variables were selected. Three were teacher background characteristics and one a measure of student academic aptitude. Aptitude was included as a moderator variable.

The independent variables are: 1) industrial experience, 2) teaching experience, 3) credits earned, and 4) the student's score on the SFTAA.

Industrial experience was used as a continuous variable, and represents the total number of years of industrial experience each vocational-technical instructor acquired. Furthermore, it is experience that was related to the instructors teaching specialization.

The second variable was teaching experience. This variable was used as a continuous measure and represents the total years teaching experience a vocational-technical shop instructor had acquired regardless of whether this teaching experience was related to an instructors area of specialization.

The third teacher characteristic was the total number of college credits accumulated. This variable was used as a continuous measure and for the instructors who obtained degrees (e.g., B.A., M.ED., etc.), a set number of credits were assigned.

Holders of a bachelors degree were given 140 credits while those who obtained a master's degree received 170 credits. To be included in the sample a teacher had to have at least 4 college credits and at least two years of teaching experience.

The fourth variable was the students academic aptitude as measured by the California Short Form Test of Academic Aptitude (SFTAA). The SFTAA administered as part of the OTAT test battery; is composed of four subparts, included in two categories--(1) Language (Vocabulary, Memorization), and (2) Non-Language (Analogies, Sequences).

Each section is composed of 45 items, and takes approximately 30 minutes to be administered. Using a standardization sample of 16,000 students, the average Kuder-Richardson 20 reliability coefficient for four SFTAA sections was .93.

Dependent Variable

The criterion, the Ohio Trade and Industrial Education Achievement Test (OTAT), total raw score was used as an indicator of student shop achievement. It is a cognitive objective measure of student's vocational-technical shop achievement in specific trade areas, which takes approximately 1-1/2 to 3 hours to administer.

Presently, the OTAT, is administered primarily to eleventh and twelfth grade vocational-technical shop students and encompasses thirteen trade areas.

These trade tests are based upon a course outline which was developed prior to the trade test. The program relies heavily upon committees consisting of subject matter specialists, educational specialists and test and measurement specialists. Through item analysis and revision and readministration, the program has produced tests with adequate reliability and validity.

The trade achievement subtests within each trade area differ. Tests vary from a low of 100 items in basic electronics to 248 in cosmetology. Kuder-Richardson 20 reliability coefficients range from .83 to .95 for the total tests.

According to the Ohio Trade and Industrial Education Service (1965), test validity studies have been developed in various ways: first, content validity of items was established by test developers; then construct validity was determined by test battery intercorrelations. Predictive validity was established by correlating test scores and teacher's grades.

For the purpose of this study, raw scores for each shop were used and converted into percentile ranks based upon national norms, and then into standard scores with a mean of 500 and a standard deviation of 100. It was necessary to carry out the above described procedure so that all students would remain at the same relative position in the combined sample as they were in their own shops compared to national norms.

The procedure for determining the students standard score corresponding to his total OTAT raw score is as follows:

1) Find the percentile rank in the national norm sheet associated with the student's total OTAT raw score.

2) Find the value of z (the normal unit deviate) that has the same percentage as the corresponding percentile rank, and

3) Insert the z value in the following formula to obtain the standard score. Formula used:

Standard Score = Value of z X 100 + 500

For example: If a student's total OTAT raw score is associated with the 84th percentile, his z score would be equal to + 1.0. Inserting the z value in the above formula would result in a student's standard score of 600.

600 = +1.0 x 100 + 500

Statistical Analysis

The Pearson product-moment correlation (PPMC) and Multiple Linear Regression Analysis (MRA) were the two statistical methodologies used. Separate analyses were conducted for each sample of teachers and students for eleventh and twelfth grade. Due to small sample sizes in each school MRA was only utilized for the entire sample. PPMC were calculated for each school as well as for the entire sample. Since the mean OTAT total raw score for each shop was used, the number of vocational-technical shop instructors controlled the size of the sample.

In order to provide meaningful and interpretable answers to the questions proposed in Chapter 1, statement of the problem, questions number 1, 2, and 3 were answered using PPMC while question number 4 utilized MRA.

The Multiple Linear Regression Analysis used is mathematically expressed in the linear function . . .

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_i X_i + e,$$

where

Y = dependent variable,

$X_1, X_2, \ldots X_i$ = independent variables,

$b_0, b_1, b_2, \ldots b_i$ = partial regression coefficients, and

e = error term.

Specifically the equation used here is:

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + e,$$

where

Y = Dependent variable: OTAT total raw score average for a particular trade area converted to a standard score (a continuous variable),

and

X_1 = Industrial experience in years (a continuous variable),

X_2 = Teaching experience in years (a continuous variable),

X_3 = Credits earned (a continuous variable), and

X_4 = Student's SFTAA total score (a continuous variable).

Only the full model analyses (using all independent variables) was necessary since neither produced a significant F-Ratio needed to calculate a restricted model.

It is possible when using MRA to measure and test the significant effect of each of the independent variables (teacher characteristics and student's aptitude) on the dependent variable (OTAT), holding constant the effects of other independent variables in the equation. The addition or subtraction of any of the independent variables to the model would result in a redistribution of the explainable variance among the new set of independent variables.

The F distribution was used to test the significance of the multiple R with K and N-K-1 degrees of freedom. This is testing the null

hypothesis that all partial regression coefficients are equal to zero. Alpha levels of .10 and .05 were used to test the significance of each variable although other significance levels are indicated.

The computer program selected for this analysis was written by Hallberg (1969) and is available under the title of QSASE at the Penn State Computation Center. This program, in addition to providing a test for significance for each partial regression coefficient and an overall F test, provided Person product-moment correlations among all variables.

IV

FINDINGS

Introduction

All statistical information is presented in table form and will be discussed sufficiently in order to explain its meaning. Conclusions supported by the results of this study are presented in the following chapter.

Descriptive data for all variables for the combined junior and senior samples of teachers and students are provided in Table 4 on p. 26. Many years of industrial experience, a strong attribute of all teachers in the sample, seems necessary to earn a position as a vocational-technical instructor. Older teachers have more industrial and teaching experience and have accumulated more credits than the younger teachers. The positive relationship between age and other teacher characteristics is understandable, since it takes time to accumulate both experience and credits.

From Table 4 it can be seen that the junior students scored higher on the achievement test than the senior students (juniors, 514.36; seniors, 467.32), and that the difference is approximately one-half standard deviation. Academic aptitude differ only slightly (juniors, 53.56; seniors, 54.91).

The information presented in Table 4 will help in the interpretation of the results of this study, and can be used to test the differences between groups (using a conventional "t" test). From the review of the literature teacher variables and student aptitude were selected because

they appeared to have a unique and possibly a combined effect on student shop achievement. For this reason multiple linear regression analysis was used in this study. The variables selected must also be considered in terms of their relationships to each other. If there are strong relationships among the independent variables, (nonorthogonal relationships) the amount of unique information available from each variable for predicting student achievement in the combined MRA decreases.

Based on data provided in Tables 1 through 5, the four independent variables were used in the MRA model to determine the total amount of useful and unique information they possess in order to answer Question #4. PPMC were used to answer Questions #1, #2, and #3.

Question #1

What is the relationship among the three teacher background characteristics?

This question will be answered separately for the total sample as well as for each school. Table 5 indicates the intercorrelations among all the variables for juniors and seniors, all schools taken together. Correlations for these variables with the criterion (represented within the triangular outline) range from -.07 to .29 for juniors and from -.12 to .24 for seniors. Industrial and teaching experience are negatively related having values of -.07 for juniors and -.09 for seniors. Correlations of .29 for juniors and .24 for seniors, indicate a moderate positive relationship between teaching experience and credits earned, while credits earned and industrial experience have values of .00 for juniors and -.12 for seniors.

Table 5. Zero-Order Correlations Among the Five Selected Variables for the Total Junior and Senior Samples.

(N = 31)

Variables	2	3	4	5
JUNIORS				
1 OTAT	.00	.21	.43***	.19
2 Industrial Experience		-.07	.00	-.10
3 Teaching Experience			.29*	.07
4 Credits Earned				.29*
5 SFTAA				
SENIORS				
1 OTAT	-.18	.09	.31*	.23
2 Industrial Experience		-.09	-.12	-.08
3 Teaching Experience			.24	-.25
4 Credits Earned				.35**
5 SFTAA				

*Significant at .10
**Significant at .05
***Significant at .02

NOTE: The top row correlations are the relationships between the four predictor variables and the criterion OTAT.

In Table 6 for eleventh grade, in school X the correlations range from -.11 to .47, in school Y -.53 to -.09, and in school Z .00 to .79. Two of the three schools yielded negative correlations between industrial experience and teaching experience. Teaching experience and credits was significant for school Z ($P<.01$, $r = .79$).

In Table 7 for twelfth grade, the correlations range from -.13 to .48 for school X, -.53 to -.09 for school Y, and -.11 to .76 for school Z. Schools X, Y, and Z reported negative correlations between industrial experience and teaching experience. Teaching experience and credits earned were significant for school Z ($P<.02$, $r = .76$) while the relationship between industrial experience and credits earned was not significant.

A pattern which was similar for each school (Tables 6 and 7) and the combined samples (Table 5) was the negative relationship between teaching experience and industrial experience; the results indicate that as industrial experience increases teaching experience decreases. That is, teachers with more industrial experience generally have less teaching experience than those teachers who have less industrial experience. Two of the three schools (X and Z) yielded a high positive relationship between credits earned and teaching experience while one school (Y) yielded a slight negative relationship between these two variables. Smallness of the samples in each school influenced to some degree the inconsistent results, and in all cases but two, the relationships were not significant. Although most relationships were not statistically significant the teacher characteristics variables are not totally independent of one another.

Table 6. Zero-Order Correlations Among the Five Selected Variables for Eleventh Grade by School.

	Variables	2	3	4	5
	School X (N = 11)				
1	OTAT	.60*	.39	-.19	-.01
2	Industrial Experience		-.11	-.04	.22
3	Teaching Experience			.47	-.34
4	Credits Earned				.12
5	SFTAA				
	School Y (N = 10)				
1	OTAT	-.41	-.14	.29	-.03
2	Industrial Experience		-.12	-.53	-.10
3	Teaching Experience			-.09	-.17
4	Credits Earned				.60*
5	SFTAA				
	School Z (N = 10)				
1	OTAT	-.06	.66**	.53	.24
2	Industrial Experience		.00	.54	-.40
3	Teaching Experience			.79****	.23
4	Credits Earned				-.04
5	SFTAA				

*Significant at .10
**Significant at .05
****Significant at .01

NOTE: The top row correlations are the relationships between the four predictor variables and the criterion OTAT.

Table 7. Zero-Order Correlations Among the Five Selected Variables for Twelfth Grade by School.

Variables	2	3	4	5
School X (N = 11)				
1 OTAT	.04	-.19	-.56*	.59*
2 Industrial Experience		-.13	.02	.06
3 Teaching Experience			.48	.19
4 Credits Earned				.25
5 SFTAA				
School Y (N = 10)				
1 OTAT	-.71**	.01	.41	.14
2 Industrial Experience		-.12	-.53	-.40
3 Teaching Experience			-.09	-.18
4 Credits Earned				.82****
5 SFTAA				
School Z (N = 10)				
1 OTAT	.11	.41	.38	.00
2 Industrial Experience		-.11	.26	.05
3 Teaching Experience			.76***	-.69**
4 Credits Earned				-.53
5 SFTAA				

*Significant at .10
**Significant at .05
***Significant at .02
****Significant at .01

NOTE: The top row correlations for each school are the relationships between the four predictor variables, and the criterion, OTAT.

Question #2

What is the relationship between each of the three teacher background characteristics and student achievement?

In order to provide an answer to this question, zero-order correlations were calculated between the three teacher characteristics and the dependent variable, OTAT. The top row correlations in each table (blocked off by dashes) indicate these relationships, and are discussed separately for each school as well as for the combined samples.

Referring to Table 5, it can be seen that similar relationships exist in each sample and that the correlations range from .00 to .43 for juniors, and -.18 to .31 for seniors. For both samples credits earned is significantly related to the criterion OTAT having values of .43 ($P<.02$) and .31 ($P<.10$) for juniors and seniors respectively. Teaching experience and the criterion have correlations of .21 for juniors and .09 for seniors, while industrial experience and the criterion correlates .00 and -.18 respectively.

For both samples, teaching experience has a stronger positive relationship with the criterion than does industrial experience; however, neither are significantly related due somewhat to small sample sizes. As teaching experience increases, there is a slight increase in achievement, while an increase in industrial experience results in either no increase or a decrease in achievement. Credits earned is the only teacher characteristics (for both samples) that is significantly related to the criterion, indicating that the more credits earned by the instructor the higher his students achieve on the OTAT. Although causation can not be associated through correlational analysis, credits earned is

related to increases in student achievement while the effects of the other teacher characteristics indicate no relationship.

Referring to Table 6 eleventh grade, the correlations among the three teacher characteristics and the criterion (OTAT) ranged from -.19 to .60 for school X, -.41 to .29 for school Y, and -.06 to .66 for school Z. Industrial experience and student achievement yielded non-significant negative correlations for schools Y and Z, while for school X a significant positive correlation ($P<.10$, .60) was observed. Teaching experience and achievement (OTAT) yielded a significant correlation only for school Z ($P<.05$, .66). No significant correlations existed between credits earned and the criterion.

Referring to Table 7 twelfth grade, the correlations range from -.56 to .04 for school X, -.71 to .41 for school Y, and .11 to .41 for school Z. Industrial experience and student achievement possessed a significant negative correlation for school Y ($P<.05$, -.71). No significant relationship existed between teaching experience and the criterion. Credits earned and student achievement yielded a significant negative correlation for school X ($P<.10$, -.56). Again, the impact of small sample sizes can be noted by the lack of statistical significance for relatively large correlations.

Question #3

What is the relationship between student ability and achievement?

Again referring to Table 5, for both juniors and seniors, students academic aptitude is not significantly related to the criterion OTAT. The reported values of .19 and .23 are for juniors and seniors

respectively. Though not significant, there is reason to believe that aptitude has some effect on achievement, but does not show up in this study due to small sample size.

Examining each school by grade level, only one significant relationship appears between aptitude and achievement--for school X twelfth grade for which Table 7 reported a value of .59 ($P<.10$).

Overall, student academic aptitude as measured by the SFTAA did not have a significant relationship with student shop achievement.

Question #4

What is the combined effect of the three teacher background characteristics on student achievement under conditions in which student ability is controlled?

In order to examine the total amount of unique information possessed by the four independent variables for predicting student's shop achievement, MRA was employed. The results of the full regression models for the junior and senior samples are presented in Tables 8 and 9.

The total multiple correlation (R) obtained from the analysis in Table 8, is equal to .445. After adjustment for degrees of freedom, $\bar{R}^2$ is equal to .0783 which indicates that approximately 8 percent of the variation in the criterion OTAT is related to the array of independent variables.

The significance of the multiple correlation coefficient was tested using the overall F-ratio with 4 (K) and 26 (N-K-1) degrees of freedom. The value of the F-ratio is 1.6375 and was not significant at the .10 level, and therefore no further analysis was conducted.

Table 8. Regression Analysis Between the Four Independent Variables in the Full Model and the Dependent Variable OTAT: Eleventh Grade.

(N = 31)

Variables	Partial Regression Coefficient	Standard Error	Student "t"
2 Occupational Experience	0.1437	1.3731	0.1047
3 Teaching Experience	0.7800	1.2489	0.6246
4 Credits Earned	0.6173	0.3240	1.9053
5 SFTAA	0.7696	1.5814	0.4867
INTERCEPT (Constant)	423.5292	87.0157	

Standard Error of Estimate = 49.92

Multiple Correlation Coefficient (R) = .447

Coefficient of Determination $(\bar{R}^2)^a$ = .0783

Overall F-Ratio $(\frac{MSR}{MSE})$ = 1.6375

[a]Adjusted for Degrees of Freedom

Note: Full model is not significant

Table 9. Regression Analysis Between the Four Independent Variables in the Full Model and the Dependent Variable OTAT: Twelfth Grade.

(N = 31)

Variables	Partial Regression Coefficient	Standard Error	Student "t"
2 Occupational Experience	-1.4827	2.0267	0.7316
3 Teaching Experience	0.5901	1.9658	0.3002
4 Credits Earned	0.5495	0.5203	1.0562
5 SFTAA	1.7275	2.2763	0.7589
INTERCEPT (Constant)	352.9451	128.6381	

Standard Error of Estimate = 74.1389

Multiple Correlation Coefficient (R) = .374

Coefficient of Determination $(\bar{R}^2)^a$ = .0025

Overall F-Ratio $(\frac{MSR}{MSE})$ = 1.0185

[a]Adjusted for Degrees of Freedom

NOTE: Full model is not significant

Table 9. Regression Analysis Between the Four Independent Variables in the Full Model and the Dependent Variable OTAT: Twelfth Grade.

(N = 31)

Variables	Partial Regression Coefficient	Standard Error	Student "t"
2 Occupational Experience	-1.4827	2.0267	0.7316
3 Teaching Experience	0.5901	1.9658	0.3002
4 Credits Earned	0.5495	0.5203	1.0562
5 SFTAA	1.7275	2.2763	0.7589
INTERCEPT (Constant)	352.9451	128.6381	

Standard Error of Estimate = 74.1389

Multiple Correlation Coefficient (R) = .374

Coefficient of Determination $(\bar{R}^2)^a$ = .0025

Overall F-Ratio $(\frac{MSR}{MSE})$ = 1.0185

[a]Adjusted for Degrees of Freedom

NOTE: Full model is not significant

Table 9 indicates that the full regression model for the twelfth grade sample is not significant. The total multiple correlation (R) obtained is approximately equal to .374. Adjusted for degrees of freedom $\bar{R}^2$ is equal to .0025 with a non-significant F-ratio value of 1.0185. Less than one percent of the variation in the criterion is related to all independent variables taken together. Since the overall F-ratio was not significant no further analysis was conducted.

V

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

Introduction

Since the passage of the Vocational Education Act of 1963 and subsequent acts which increased funding for vocational education programs, an effective method for evaluating these programs has been of urgent concern. Evaluation can be applied to facilities, curriculum, personnel and student learning. Economists and many educators believe that the most important input into the educational program is the teacher's competency. This competency may result from knowledge of subject matter, trade skill proficiency, good teaching methods, and sound pedagogical preparation. Of course, other factors are important, but these competencies have been isolated as essential to successful vocational instruction.

Some researchers have hypothesized that trade skill competency plus sound teacher education training are most important. Others have suggested knowledge of subject matter; still others feel trade skill competency alone is most important for successful teaching in the vocational-technical shop programs.

Although all competencies are important, very often they have been considered independent of their interrelationships. Would there be a combination of or certain quantity of each that would be most beneficial for successful teaching? This is difficult to answer, and indeed,

difficult to comprehend since studies that have been conducted relating teacher competencies to performance are limited and results have been inconsistent.

Statement of the Problem

It was decided that an investigation into the effects of selected vocational-technical teacher characteristics on student achievement be conducted since past research has revealed inconsistencies. Four questions were posed:

1. What is the relationship among the three teacher background characteristics?
2. What is the relationship between each of the three teacher background characteristics and student achievement?
3. What is the relationship between student ability and achievement?
4. What is the combined effect of the three teacher background characteristics on student achievement under conditions in which student ability is controlled?

Procedure

Student and teacher samples were drawn from three area vocational-technical schools in Pennsylvania: Altoona, Hazleton and Jefferson-Dubois. Thirty-one teachers and 497 students represented the junior sample; 31 teachers and 389 students the senior sample. Data for each sample was collected during the summer of 1973 as part of the longitudinal Vocational Development Study (VDS) Project conducted by the Department of Vocational Education at The Pennsylvania State University.

Two student characteristics and three teacher characteristics were used. The three teacher characteristics of teaching experience (years), industrial experience (years), credits earned, along with the student's academia aptitude (Short Form Test of Academic Aptitude) were selected as the four independent variables. The student's Ohio Trade and Industrial Education Achievement Test (OTAT) total mean raw score (converted to standard scores, Mean = 500, SD = 100) was used as the dependent or criterion variable.

Pearson Product-Moment Correlations (PPMC) were used to answer questions 1, 2, and 3, and Multiple Linear Regression Analysis (MRA) for question 4.

Results

The intercorrelations among the independent variables ranged from -.10 to +.29 for juniors and from -.25 to +.35 for seniors. The correlations between the independent variables and the criterion (OTAT) ranged from .00 to .43 for juniors and from -.18 to +.31 for seniors. Only credits earned was significantly ($P<.02$, .43 for juniors; $P<.10$, .31 for seniors) related to the criterion (OTAT).

Industrial experience and teaching experience were negatively correlated with each other (-.07 for juniors, and -.09 for seniors), while credits earned and teaching experience were positively correlated (.29 for juniors, .24 for seniors). Low correlations (.00 for juniors, -.12 for seniors) between industrial experience and credits earned were also observed. The relationship between student ability as measured by the SFTAA and the criterion (OTAT) was relatively low (.19 for juniors, .23 for seniors).

The four independent variables used in the full MRA models for the junior and senior samples yielded moderately high multiple R's (.45 for juniors, and .37 for seniors); however, these values were not statistically significant due to the small degrees of freedom available.

Conclusions

Question #1

This question is concerned with the relationships among the three teacher characteristics; industrial experience, teaching experience, and credits earned. It was indicated that for teachers of both juniors and seniors, similar relationships among the teacher characteristics existed. It was found that there was little, if any relationship (.00, juniors; -.12, seniors) between college credits and industrial experience. However, teaching experience and credits earned were moderately related (.29, juniors; .24, seniors). Low negative relationships were found between teaching experience and industrial experience (-.07, juniors; -.09, seniors).

Teachers who have more industrial experience have less teaching experience and college credits earned than teachers who have less industrial experience. Teachers with more teaching experience accumulated more college credits than those with less teaching experience. All in all, the correlations among the teacher characteristics were uniformly low, and therefore, they are relatively independent of one another.

Question #2

Dealing with the relationships between the three selected teacher characteristics and student achievement, only credits earned possessed a significant relationship with student achievement as measured by the OTAT (.43, P<.02, juniors; .31, P<.10, seniors). The correlations indicate that the variable college credits is accounting for less than 17 percent (juniors) and 10 percent (seniors) of the variance in student achievement.

These findings seem to support others (Hall, 1962; Flanagan, 1947; Rumpf, 1954) that college credits earned related significantly with student achievement. On the other hand, Shoemaker (1971) who studied secondary vocational students found college credits earned not significantly related to shop achievement. Shim (1965) using non-vocational elementary school children found no significant relationship between achievement and college credits earned.

From the results of this study it can be concluded that while industrial and teaching experience are not related to student shop achievement, college credits earned are related in a positive manner (i.e., more college credits earned by the teacher is concommitant with greater achievement on the part of his or her students). It is important to point out that industrial experience while considered a necessary condition for entry into vocational-technical education as a teacher, yielded either no relationship or a small negative relationship with shop achievement. Also, there appeared to be great fluctuation from one sample to another concerning this relationship. One possible explanation for this finding may be that there is a curvilinear

relationship between industrial experience and quality teaching as evidenced by shop achievement (e.g., experience between 1 and 6 years may be positively related; between 6 and 15 years experience may yield no relationship, and greater than 15 years experience may yield a negative relationship). Whatever the explanation, this finding cast some doubts on the need for a great amount of industrial experience before becoming a vocational-technical teacher.

Question #3

This question addressed itself to the nature of the relationship between student ability as measured by the SFTAA and student shop achievement as measured by the total test score on the OTAT. Although positive relationships were found (.19 for juniors; .23 for seniors) the size of the relationships were not great enough to be statistically significant at even the .10 level. While previous research has generally found academic aptitude and achievement to be significantly related, the lack of such a relationship in this study can be somewhat attributed to small sample size. However, the distinct possibility must be considered that shop achievement and academic aptitude are less related than in the more academic domains of high school.

Question #4

This question is concerned with the combined effects of the three teacher characteristics on student shop achievement while controlling for the effects of student academic aptitude. Moderately high, although non-significant, relationships were obtained ($R = .445$ for juniors; $R = .374$ for seniors). The reason for not achieving statistical

teacher characteristics examined. It should be mentioned, however, that there was considerable variation concerning these relationships from one sample to another. Nevertheless, the findings of this study cast serious doubt on the notion that a teacher with a great deal of industrial experience and some pedagogical training will provide the vocational-technical student with an enriching educational experience.

Although the study was cross sectional rather than longitudinal it is also worth noting that the eleventh grade students performed better on the OTAT in comparison to national norms than did the twelfth graders ($\bar{X}$ = 514.36 for juniors and 467.35 for seniors). Theoretically, it would appear that student shop achievement would improve from eleventh to twelfth grade or at least remain relatively the same in terms of national norms for that grade. No explanation for this phenomena of a decreased performance from eleventh to twelfth grade is apparent from this data since 84 percent of the teachers in the sample taught both grades and the trend was present in all three schools. Whether or not this finding is a reflection on the quality of teaching is hard to say; furthermore, the relationship between this outcome and the teacher characteristics examined in this study is not known from the data reported in the study.

Perhaps the most important finding of this study is that characteristics of both teachers and students not investigated in the study probably play a more important role in student shop achievement than those chosen for investigation. These characteristics are most likely from the affective domain and include such factors as: attitude, motivation, interest, values, vocational maturity, etc. It is important

significance even though the multiple R's were relatively large was, for the most part, due to small sample size. However, even if the relationships were significant they would have only accounted for approximately 20 percent of the variance in shop achievement for juniors and 13 percent for seniors. This finding suggests that many other factors not considered in this study are probably related to shop achievement. Many of these other factors probably lie in the affective domain such as teacher attitudes and self concepts as was discussed in the review of the literature in studies conducted by Ohio Trade and Industrial Education Services, 1965 and Finch, 1969. Other student characteristics such as motivation, interest, and values would also probably account for variance in shop achievement not accounted for by academic aptitude.

Discussion

Achievement test scores are frequently used as a criterion in evaluating student performance in various school programs. Typically, if these scores are high the program is evaluated positively, and if they are low, negatively. It is assumed, however, that achievement may be genetically determined through ability and influenced by many environmental factors, particularly the school environment. Similarly, it can be assumed that student shop achievement can be associated with level of teacher competence. Those teachers in our sample who were more experienced in teaching but possessed less industrial experience showed a trend toward being effective in producing higher student achievement. Also, for both samples of students and teachers, credits earned had more effect on student shop achievement than the other two

that both teacher and student characteristics be considered simultaneously in examining the relationship between teacher characteristics and student achievement.

Recommendations

Based on the findings and focus of this study the following recommendations for education and for further research are offered.

For Education

1. Overall, the findings of this study indicate that many years of industrial experience does not improve student shop achievement (as industrial experience increases, student achievement may even decrease). Therefore, it may be necessary to minimize industrial experience as a criteria for initial teacher certification and/or consider other competencies more important.

2. A major finding indicated that credits earned were significantly related to student achievement (as credits earned increased student achievement increased). To promote higher student achievement it is necessary to encourage in-service teachers to pursue their professional training more seriously. It may also be important to raise the minimum credit requirement for initial certification.

3. Since findings indicate that teachers who have more trade and industrial experience may produce students with lower shop achievement, it is important that younger men and women be recruited into the teaching profession rather than recruiting those who have accumulated many years of experiences.

For Research

4. It is recommended that a similar study be replicated using another larger group of eleventh and twelfth grade vocational-technical students and their teachers in other communities. In such a study, additional measures of student achievement shall also be used. It is important that this be done so that the validity, and generalizability of the findings of this study can be ascertained.

5. In addition to the variables used in this study, variables from the affective domain should be included in a similar study. This should provide additional information concerning characteristics which are predictive of student shop achievement. Variables that should be included are measures of motivation, attitude and self-concept for teachers, and measures of interests, values and vocational maturity for students.

6. From the results of this study, there was suspicion that industrial experience possessed a curvilinear relationship with student shop achievement. In order to test this hypothesis, it would be necessary to determine at what level of experience this relationship occurs. This could be done by using a larger sample size and establishing levels of industrial experience. For example, the partitioning of industrial experience could be in three levels: 1-6, 6-15 and over 15 years.

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