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A COMPARATIVE STUDY OF GENERAL PATH AND VOCATIONAL PATH HIGH SCHOOL STUDENTS AND THEIR ACHIEVEMENT IN COLLEGE TECHNICAL PROGRAMS

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A COMPARATIVE STUDY OF GENERAL-PATH AND VOCATIONAL-PATH HIGH SCHOOL STUDENTS AND THEIR ACHIEVEMENT IN COLLEGE TECHNICAL PROGRAMS

By

John Shaltry

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ABSTRACT

A COMPARATIVE STUDY OF GENERAL-PATH AND VOCATIONAL-PATH HIGH SCHOOL STUDENTS AND THEIR ACHIEVEMENT IN COLLEGE TECHNICAL PROGRAMS

By

John Shaltry

Technical education is offered throughout the United States in secondary as well as postsecondary programs. Students entering college technical programs are graduates of high school with general-path, college-preparatory, or vocational-path backgrounds. This study compared general-path and vocational-path high school graduates. The variables used in the comparison were ACT Standard scores and Interest Inventory scores, high school grade point averages, attrition rates, and college technical and nontechnical grades.

The population comprised Fall 1990 entrants into Automotive, Machine Tool, and Printing Technologies at Ferris State University, located in Big Rapids, Michigan. Data on 160 students were collected for the study.

Five research questions were developed to determine (a) whether vocational-path students differed from general-path students in academic aptitude and interest, (b) whether the two groups differed in college attrition rates, (c) whether attrition was related to ACT

Standard and Interest Inventory scores, and (d) whether the two groups differed in college technical and nontechnical course achievement.

MANOVA, specifically Wilks' lambda, ANOVA, t-tests, z-tests, multiple regression, and chi-square were used to analyze the data. Results revealed there were no significant differences between the two groups in answering any of the research questions. None of the eight null hypotheses was rejected. Vocational-path students achieved slightly higher scores throughout the study and dropped out of their college programs slightly less than general-path students.

Considering the trend of slightly higher scores by vocational-path students, recommendations include further study with similar populations. An implication might be that technical programs in colleges could articulate with high school vocational programs and cover more material that continues the experience gained in high school. The tech-prep approach of articulation between academic and vocational high school study might also improve preparation for college.

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CHAPTER I

INTRODUCTION

High percentages of secondary vocational school graduates in Michigan are opting for college-level occupational studies similar to their high school vocational studies (Office of Admissions, 1991). The Vocational Education Act of 1963 with subsequent amendments and the Carl D. Perkins Act of 1984 were primary in the development of vocational education and made it possible for many thousands of high school graduates to complete high school vocational programs. One of the reasons for the acts was to provide basic training in skilled occupations for non-college-bound students as a supplement to their regular high school required studies. Those graduates were expected to enter the work force armed with initial skills immediately upon graduation.

In Michigan, 59 public secondary shared-time vocational schools are now in existence, offering as many as 30 separate occupationally oriented programs ranging from one year to two years in length (Cleveland, 1990). A few full-time vocational schools also exist. Many more vocational programs are offered in the comprehensive high schools in addition to those specific vocational schools.

Public secondary vocational education, like traditional general secondary education, is offered throughout Michigan. It affects all

levels of further education, industry, and social class. Some possible advantages are as follows:

1. More choices of subject concentrations are available in secondary schools.

2. Varied skills are acquired from secondary education.

3. High school graduates possess more salable skills in the marketplace.

4. Graduates can gain a "jump" on related technical programs in postsecondary programs.

5. Industry can fill more of its needs with skilled persons who have completed basic skills qualifications.

6. Industry can use existing public vocational training facilities to upgrade the present skilled force through continuing education.

7. Community education has much more to offer in terms of courses available at public cost to the community than college-prep high school alone.

8. More industry involvement in public education is required, resulting in real-world relevance in public education.

Many colleges presently offer programs that extend the technical education obtained in secondary institutions. Industry is also requiring advanced technical skills in many entry-level jobs, in addition to the basic skills that secondary vocational program graduates acquire.

The increased migration of vocational program graduates to college has initiated some thought as to possible reasons why this

trend is taking place and its implications. Some of these reasons are as follows:

1. Vocational program graduates are recognizing the need for more education in their occupations because of industry demands for more qualifications in the face of newly evolving and advanced technologies (Bartlett, 1989).

2. Vocational program graduates have been convinced by teachers and counselors that further education in their occupations is needed to be successful in industry (Bolthouse, 1989).

3. Postsecondary occupational education is readily available across Michigan, allowing for a natural migration from secondary vocational education (Cleveland, 1990).

4. Vocational graduates' interests have been enhanced by their previous experiences in a vocational program.

5. Industry is not accepting vocational school graduates at the skill level they possess upon high school graduation (Householder, 1989).

Some implications of the trend are as follows:

1. The vocational program graduate is entering college along with general education graduates. Comparative research should be carried out to understand the similarities and differences, strengths and weaknesses, of these two groups as they enter college.

2. Virtually all of the 29 public community colleges and the junior college in Michigan offer similar but more in-depth vocational programs of study. In addition, many four-year public

institutions offer various occupationally related programs. General education graduates are also entering these programs in higher education, and they compete directly with the vocational-path graduates. Comparative research on the college achievement of students from these two secondary school backgrounds is needed (Rader, 1981).

Changes in laws concerning public education have brought about many changes in secondary and postsecondary education in recent years. Government spending on new technologies and the space program tended to steer the country's educational policies. Science and engineering education received a significant financial boost after the Russian satellite, Sputnik, was launched in 1957 (Lynton, 1983). The next decade witnessed a great surge in technological advancement. By 1969, the United States had not only surpassed all other countries in space technology but also had put a man on the moon (Naisbitt, 1982).

The events that led to the explosion in technology seem common to the events that brought about vocational education. The government promoted science and engineering through legislation allowing funds for high schools and colleges to build buildings and programs. Businesses were given incentives to promote "high" technology, forcing public education to respond by offering more programs in the technologies. From these events, vocational and technical education has evolved to the present numbers of programs and facilities funded through federal, state, and local legislation.

Increasing numbers of persons completing a college associate's degree in a technical field are opting to continue their education to the bachelor's-degree level in management, business, education, or engineering technology.

For years, education has taken on the responsibility of readying people for the world of work. Now industry has grown to expect that many occupations in the technical areas become an integral part of both secondary and postsecondary education's responsibilities in order to meet the additional skills required in the face of advancing technology (Galloway, 1990). Also, many technically educated college graduates gain experience in their chosen fields and then, some time later, decide on furthering their education in order to gain new positions. Those positions are related to their technical field, but at a higher level of management, business, education, or engineering technology.

People are changing jobs or levels of jobs two, three, and sometimes even four times in their lifetimes (Hodgkinson, 1987). This requires a solid background in the fundamentals of language, science, and mathematics, in addition to strength in their technical areas. "Technologies are becoming more complicated and demanding each year. A person cannot just 'acquire' an occupation by experience alone" (Nicholson, 1989). It seems to be an accepted notion that secondary vocational and technical education has been assigned as much responsibility in the matter of educating people for life careers as has general secondary education (Cleveland, 1990).

Some researchers have provided information leading to the belief that vocational experiences complement general studies because learning on the abstract level becomes easier to understand when applied in a technical learning environment. Ideas become easier to understand because more human physical-sense faculties are used in the learning, i.e., sight, sound, touch, smell, and speech. Thought processes are forced to be more organized, and learning is enhanced (Edwards, 1986).

Statement of the Problem

As indicated above, many high school graduates whose vocational programs were designed to prepare them for immediate employment after high school completion are entering postsecondary vocational education programs. The basic problem addressed in this study is a comparison of vocational-path high school graduates with general-path graduates with respect to college achievement and attrition. In other words, is graduation from a high school vocational program an asset or a liability to their success in postsecondary programs when they are compared to general-path high school graduates?

Purpose of the Study

The researcher's general purpose in this study was to compare vocational-path and general-path students enrolled in college technical programs at Ferris State University (FSU) using American College Test (ACT) scores, high school grade point averages (HSGPAs), attrition rates in the first year of college, grade point

averages (GPAs) after two terms, and grade points in nontechnical as well as technical program areas.

No studies were found comparing ACT Aptitude scores, HSGPA, and ACT Interest Inventory scores between the two groups. None was found that attempted to determine whether a relationship existed within the groups using the same parameters. The vocational-path graduates in the study were entering college programs similar to their high school vocational studies. Is there an advantage to having had previous vocational training? Grades in college technical courses and nontechnical courses were compared to determine a possible difference.

"Attrition has been and is presently a problem with all colleges" (Jungck, 1989). One of the purposes in this study was to compare the attrition rates of vocational-path and general-path students in college. What can educators do to motivate people for success at a higher rate, especially in the first year? Relationships were investigated for a possible increase in understanding of how to cope with the problem. Associating vocational interest and ACT Standard scores and relating those to dropout rates of students in collegiate technical programs might help in finding some reasons for failure in college. Another goal of this study was to determine whether a relationship existed when using these variables.

General-path students were chosen for this study instead of college-prep-path students because preliminary research indicated that the overwhelming majority of the 1989 enrollees in the

population were of a general-path high school curriculum or a vocational-path high school curriculum. There were so few college-prep-path enrollees that it was not practical to separate the population into college-prep path along with general path and vocational path.

Contrary to the original intention of secondary vocational education, many graduates of high school vocational programs that previously were thought to be terminal are now becoming college bound in similar occupational programs of study. Educators who work closely with students in college technical programs have questioned the adequacy of academic preparation of the vocational-path student (Jungck, 1989). Those vocational students entering college have previously completed a program of two hours a day, five days a week, for one to two academic years. They do not complete as many academic courses as general education graduates do, and many times they meet only minimum general education requirements for graduation (see Appendix A). A better understanding of similarities and differences of the two groups is needed. This researcher did not attempt to measure students' technical-subject-matter knowledge upon entry into college technical programs between the two groups, but success as measured by grade point average only.

Methodology

Fall 1989 enrollees in Machine Tool Technology, Automotive Technology, and Printing Technology at Ferris State University were studied. The students in these programs traditionally consist of a

mixture of vocational- and general-path high school graduates. The two groups were measured by a pretest-posttest design. Specific data were compiled after the completion of the students' first two terms of study. Pretest data included ACT Standard and Interest Inventory scores, and high school overall GPAs.

A survey was conducted in Fall 1990 of the selected population's student records at FSU in order to categorize the enrollees as vocational path or general path. The records of students who had dropped out since Fall 1989 were sought out and surveyed as well. Posttest data included college GPA, attrition rate, and selected nontechnical as well as technical course grades at the completion of the first two terms at FSU. Statistical tests included Wilks' lambda with post-hoc comparisons, t-tests, z-tests for proportions, two-way multivariate analysis of variance (MANOVA) tests, and correlational statistics.

Research Questions

The problem was to identify any differences between vocational-path and general-path high school students' college achievement and attrition. A number of research questions were developed to address the problem. They are as follows:

1. Upon entry into college technical programs, do vocational-path students differ from general-path students in academic aptitude and interest?

2a. Do vocational-path and general-path students differ in attrition rates at the completion of two terms of college studies?

2b. Is attrition related to ACT Aptitude and Interest scores for the two groups?

3. Are ACT Aptitude and Interest scores related to college grade point average (CGPA) after two terms of study for each of the two groups?

4. Is there a difference in technical and nontechnical course achievement between the two groups after two terms of college study?

Research Hypotheses

Research hypotheses addressing the preceding questions were developed. They are stated in the null form as follows:

Hypothesis 1a: Upon entry into college technical programs, vocational-path students and general-path students do not differ in academic aptitude, as measured by ACT Standard scores and high school grade point average (HSGPA).

Hypothesis 1b: Upon entry into college technical programs, vocational-path and general-path students do not differ in vocational interest, as measured by ACT Interest Inventory scores.

Hypothesis 2a: Vocational-path and general-path students do not differ in attrition rates during the first two academic terms of college study.

Hypothesis 2b: Attrition is not related to ACT Aptitude and Interest Inventory scores for vocational-path and general-path students.

Hypothesis 3a: ACT Standard test scores and high school grade point average (HSGPA) are not related to college grade point average (CGPA) after two academic terms of college study.

Hypothesis 3b: Vocational-path and general-path students do not differ in the relationship of ACT Interest Inventory scores to CGPA after two academic terms of college study.

Hypothesis 4a: There is no difference between vocational-path and general-path students' technical course achievement in college technical programs.

Hypothesis 4b: There is no difference between vocational-path and general-path students' nontechnical course achievement in college technical programs.

Value of the Study

This study is unique in that a comparison is made of vocational-path students' and general-path students' ACT scores, high school GPAs, first-year college attrition rates, college GPAs, and achievement in nontechnical as well as technical college courses.

Comparisons of vocational-path and traditionally general-path students in college may provide valuable information for use by students, guidance counselors, and teachers. Identifying the differences between them could help in realizing advantages and disadvantages for high schools and colleges to better articulate with each other and adjust to the needs of the student. Students could gain more direction in their choices of program and course offerings in high school and college. They might understand more of the academic and technical skill requirements. They might be able to make more accurate career choices with the additional information. High school, vocational school, and college counselors can make more effective and accurate recommendations on career and program offerings. High school, vocational school, and college teachers may possess additional information available for understanding the two groups. They will be able to make adjustments in their professional perspectives and act accordingly.

The value of this research is outlined in the following statements:

1. To gain data for students to use in making effective decisions regarding career, program, and course choices through an awareness of their personal and academic needs.

2. To gain data for school administrators, counselors, and teachers to use in establishing programs that prepare students for success in college technical education. More accurate conclusions can be drawn in planning and implementing effective vocational education programs.

3. To gain data for establishing objective norms in certain state and national technical competency-testing programs. Reading, writing, and math-computation skill levels can be integrated into the competency tests' written sections. Examples of competency tests now in existence include certification tests in Printing, Machine Tool, and Automotive occupations.

4. To help secondary and postsecondary educators improve the retention rate of students in their programs. The data may provide information on the characteristics of those who are dropping out.

5. To aid in determining whether previous vocational training has a bearing on retention.

This study included a comparison of vocational-path students' and general-path students' nontechnical course achievement. Loudeman (1976) presented a study of secondary vocational and general students' success in math and science in high school. He found that there was no significant difference in achievement

between the two groups. The present researcher compared the two groups in terms of success in required math and English courses in college. Some conclusions could be drawn to help increase the effectiveness of either group in nontechnical course achievement.

English was another required skill compared between the two groups. The clamor for "back to basics" education is rooted in the common need for proper use of the language (Levine, 1976). It has become increasingly evident that writing, reading, composition, and grammar are needed in all technical skill areas. "The advent of the computer and its integration within literally every aspect of business and industry has made the demand on education very clear" (Nicholson, 1989).

College technical programs accept general-path high school students as well as vocational-path students. Both groups share classroom activities. If one group is experiencing more success than the other, the educational implications are important to vocational programs, high schools, and colleges. If, for example, vocational-path students are found to be underprepared for the general college curricula requirements but advanced in certain technical areas, adaptations of both the vocational school level and the college level may be considered.

Research Variables

The measurement variables used in conducting this research were as follows:

1. Students' Standard and Vocational Interest Inventory scores as measured by ACT examination.

2. College GPA after two academic terms of study.

3. Attrition rates of first-year college technical program enrollees after two academic terms.

4. GPA in nontechnical college courses.

5. GPA in technical college courses, such as Printing, Machine Tool, and Automotive Technologies outlined in Chapter III.

Limitations

The study was inherently limited in the following ways:

1. The ratio of vocational-path students to general-path students in the sample was determined by program enrollment and could not be controlled.

2. The students identified as vocational-path students were not necessarily a product of a career center or skill center high school in Michigan but had completed a secondary program consisting of at least two hours per day, five days per week, for at least one school year but not more than two academic years in length.

3. The time interval between students' high school graduation and enrollment into college could not be controlled.

4. The researcher could not consider college-prep-path students. The number of students who fit the category as outlined in the Definition of Terms were too few to make a comparison reliable.

5. The numbers of transfer students could not be controlled.

Delimitations

The delimitations set down in this study are as follows:

1. The population studied were enrolled in Automotive, Machine Tool, and Printing Technologies at Ferris State University.

2. Students' records were collected on the Fall and Winter Term data in the 1989/90 school year.

3. The population consisted of enrollees with not more than one academic term of previous college studies before enrolling in the sampled programs. About 90% were "first time in any college" students.

4. The population consisted of no enrollees who were not residents of Michigan. Four persons were considered "out of state" and were not used in the study.

5. The population were classified as vocational-path or general-path students in terms of high school curriculum-path description.

Definition of Terms

Academic aptitude. Capacity for learning, as measured by academic scores on ACT Standard tests in English usage, mathematics usage, social studies, and natural science. High school GPA was also considered as an academic aptitude measure for the purposes of this study.

ACT. The American College Test. An accepted national college entrance assessment test, which includes four subtests and a composite average score. The subtests are: ACTE (English), ACTM

(Mathematics), ACTS (Social Studies), ACTN (Natural Sciences), and ACTC (Composite).

Attrition rate. The rate of sample student dropouts from the selected college technical programs under study.

CGPA. College grade point average.

College-prep-path student. A graduate of high school in Michigan who has completed college-preparatory education course work to meet the requirements of a college-prep major. This person has completed four years of English, three years of mathematics, three years of social sciences, three years of natural sciences, and two years of a foreign language. These are suggested courses outlined in the Presidents' Council, State Universities of Michigan, draft to high school students in 1989. The American College Test Enrollment Information Service used these same suggested courses as the standard in its 1991 report on Michigan high school graduates of 1991 (see Appendix B).

College technical program. A program of two academic years in an accredited college, terminating with an Associate in Applied Science or equivalent degree in an occupational or technical skill area.

General-path student. A graduate of high school in Michigan who has completed the minimum requirements for graduation and has not taken a vocational program. This graduate also does not meet the requirements to be labeled a college-prep-path student.

GPA. Grade point average.

HSGPA. High school grade point average.

Interest Inventory scores. Only the ACT Technical Interest scores were used in this research.

Nontechnical course achievement. GPA in nontechnical college courses offered to technical associate degree program students. The specific courses in the study were English 111, Math 111, and Math 121.

Technical course achievement. GPA of all the selected technical courses of each identified program taken in the first two terms at FSU by the target population.

Vocational-path student. A graduate of high school in Michigan who also has completed a vocational program in Auto Mechanics, Machine Trades, or Printing (graphic reproductions).

Vocational school. A shared-time area vocational school or a full-time vocational school that offers vocational programs to high school students. A shared-time school might be named a skill center or technical center in Michigan. Most of the vocational-path students in this study were graduates of a shared-time vocational program.

Organization of the Study

This study is organized into five chapters. An introduction, statement of the problem, purpose of the study, research questions, hypotheses, value of the study, limitations and delimitations, and definitions of terms were included in Chapter I. Chapter II contains a review of related literature and/or studies. Previous

studies and current activities in education within the two groups are also covered.

Chapter III includes the methodology (including the research design, measurement variables, and statistical procedures) used to conduct the study. Measurement descriptions also are presented. Chapter IV contains a presentation and analysis of the data collected in this study. A summary of the findings, conclusions, recommendations, implications, and reflections are included in Chapter V.

CHAPTER II

LITERATURE REVIEW

A review of the related literature included a search of Dissertation Abstracts, an ERIC search (Silver Platter), and computer-generated directory information. A search of texts, books, tapes, journals, and periodicals was also accomplished to facilitate a comprehensive inquiry into the research. Local, state, and national studies conducted privately and publicly were used. Interviews were held with various administrators, counselors, teachers, and business managers to give the researcher a personal perspective on the subject. On-site visits also contributed to gaining a personal perspective.

Eight hypotheses were tested in this study. Literature was searched with consideration given to the following five questions:

1. Upon entry into college technical programs, do vocational-path students differ from general-path students in academic aptitude and interest?

2a. Do vocational-path and general-path students differ in attrition rates at the completion of two terms of college studies?

2b. Is attrition related to ACT Aptitude and Interest scores for the two groups?

3. Are ACT Aptitude and Interest scores related to college grade point average (CGPA) after two terms of study for each of the two groups?

4. Is there a difference in technical and nontechnical course achievement between the two groups after two terms of college study?

General Discussion

The review of literature indicated there are few studies in existence that are directly related to the comparisons made in this study. Available information provided comparison of vocational-path to general-path students related to some of the research questions, but no study was found comparing the two groups using the same variables as in this research.

A study related to Research Question 4 compared vocational-path to general-path students' success in college math achievement (Loudeman, 1976). No significant difference in mathematics achievement was found between the two groups. A study also related to Research Question 4 compared achievement in college agricultural mechanics courses at Iowa State University of persons who had taken previous agricultural mechanics courses in high school to students who had not (Yoder, 1978). Yoder concluded that no positive relationship existed between the two groups. Fulton (1956) and Hoerner (1963) found that students with previous agricultural mechanics courses performed significantly better than students who had no previous experience.

American College Testing Program (ACT) scores were used to address Research Questions 1, 2b, and 3. The ACT Program has a history of sound research, tests, and standards that are used as tools in grade prediction and guidance for high school graduates entering higher education. Academic scores and the Interest Inventory section of ACT individual test results and profile sheets were used in this study. Research has been conducted on the use of ACT scores to predict math and English course grades in college (Sawyer & Noble, 1989). Sawyer and Noble found a high correlation between ACT scores and college grades, especially in the college courses that were emphasized in high school. This researcher found no studies predicting achievement in technical programs in college.

The Interest Inventory section of the ACT assessment measures the interest of the test-taker in various categories. Interest Inventory scores of the ACT have been useful tools in advising high school students into career families by relating the scores to the World of Work map that the ACT produces. The map is organized into four major regions: People, Data, Things, and Ideas. The Interest Inventory scores help identify regions where the students have shown the preferences reported. Those identified areas can then be related to listed college majors and programs (ACT, 1986). This assessment tool is exclusive to the ACT, and no studies were found comparing Interest Inventory scores between the two groups in this study.

College Preparation

General education and vocational education high school graduates are becoming more the norm in terms of who is going to college. College-preparatory students are still out there and moving into the mainstream of college programs, but not in the majority of numbers as they once were (Hodgkinson, 1987). The characteristics of the college-prep-path student are not well defined. School systems and institutions offer various definitions. For this research, the guidelines advised by the Presidents Council, State Universities of Michigan, were used. The specific structure was stated in the Definition of Terms in Chapter I of this study. College-prep path may also be referred to as academic track (ACT, 1991; Parnell, 1986).

Today's comprehensive high school curricula center on a wide variety of course and program offerings, as does most of higher education. Students in high school can learn about business, health, technical, and other occupations. Many enter college programs similar to their high school occupational studies. Students who do not elect specific occupational majors do not generally follow a college-prep format either (Carlson, 1990). Without choosing an occupational major, these general-path students take a variety of courses.

High schools have begun to demand more compulsory courses such as mathematics and science, in reaction to the recent criticism that public education is watered down and that students have not been graduating with the proper competencies. Hodgkinson (1987) pointed

out that demands on students entering college using the same college-preparatory types of standards as 25 years ago are not valid for two reasons. One is that the variety of degrees offered in college today is quite different from 25 years ago; therefore, academic expectations need to be varied, notwithstanding that a core of foundation subjects is needed. Second, higher education serves a different student than it did 25 years ago. At that time, about 25% of high school graduates went to college. Fewer college-age persons are available than in previous years, yet more are going to college. More than 50% of high school graduates are entering higher education at this time. Their average aptitude level is presently lower because higher education is serving greater numbers out of a smaller pool (Digest of Educational Statistics, 1988). Hodgkinson (1987) emphasized that, because of this recent phenomenon, the task of education is "more to create winners than to pick winners."

The College Freshman

Characteristics of the typical college freshman have been highlighted by a number of authors. The most recent descriptions include the statement by Chickering (1986) that freshmen entering college today are much more materialistic than in the 1960s. They are less inclined to rate themselves as above average and make decisions based on financial value of learning an occupation rather than learning for intrinsic value. They are very competitive and claim a conservative political philosophy.

Astin (1986) continued the description by pointing out that two of every five freshmen indicated that a very important reason for deciding to go to college was to "improve my reading and studying skills." Despite the downward trend in self-assessed academic competence, the freshman data show that students' high school grades have increased significantly over the past two decades. Half the fall 1986 freshmen queried agreed that "grading in high schools has become too easy."

ACT results have indicated that academic aptitude scores of persons aspiring to enter college have declined slightly from a composite score of 18.9 in 1974 to 18.6 in 1989 (ACT, 1989). The scores over that 15-year period dropped as low as 18.3 in 1976 but rebounded to 18.7 in 1988. Scholastic Aptitude Test (SAT) patterns were similar, with a slight decline from a composite verbal score of 444 in 1974 to 427 in 1989. The composite math score declined from 480 in 1974 to 476 in 1989 (National Education Association, 1990).

The College Technical Student

One might ask first, what are the descriptive characteristics of those aspiring to a technical occupation? The National Center for Educational Statistics reported in a 1984 study entitled "Occupational Aspirations and Intended Fields of Study" that those aspiring to a technical occupation are more likely to be black and less likely to be white. They are more likely to have high self-concepts and high educational aspirations. High vocational training as well as high academics were emphasized in high school preparatory

work. They have generally high aptitude and high GPAs and have completed more mathematics and science courses than other students, as well as more vocational coursework. Work is of great importance to this group, and they particularly emphasize good income and job security as reasons for selecting their occupations.

The study went on to point out that those aspiring to a technical occupation and intended field of study are not necessarily the ones completing the study and actually entering the field. Only 13% of the labor force are in technical occupations. A relatively large portion of those aspiring tend to select alternative occupations. One explanation for this difference might lie in simply the status of choice. More people select high and move down, rather than select low and move up. In Michigan, the majority of technical students have had some high school vocational experience. Most of the vocational experience was in a vocational-technical skill center (Michigan Department of Education, 1989).

The Vocational-Path Student

High school students are given the opportunity to select the type of coursework they prefer to emphasize and are classified as general path or vocational path. Some vocational programs are located in the regular high school buildings, and some are located in vocational schools separate from the students' home schools. Vocational programs are structured into blocks of at least two hours of study a day and are usually two academic years in length. A program cannot be considered vocational by the Michigan Department

of Education's Division of Vocational Education unless it operates at a minimum of two hours a day, five days per week. Vocational-path students are those who have graduated with one to two academic years in a vocational program in high school.

Evans and Herr (1978) described typical vocational-path students as 60% female. The female students not only are more numerous than male students but demonstrate a markedly higher aptitude. For males, the heaviest enrollments in vocational education are in the 40th percentile of total high school enrollment. Data have indicated that vocational students have a considerably greater ability in visual reasoning than other abilities. The age of these students is usually 16 to 17 years, depending on whether they are in a one- or two-year vocational program.

Daniel Cleveland, Director of Michigan Vocational Industrial Clubs of America (1990), pointed out that his experience with vocational students in Michigan over the last 13 years in occupational competitions has given him a great deal of positive feedback on the vocational student. He stated that vocational education does help in building self-confidence, self-concept, competitive spirit, and occupational competence in these students. The demonstrated excellence in extemporaneous speaking, chapter business procedures, opening and closing ceremonies, and competitions demonstrates that vocational students are willing to excel in other than vocational coursework itself to be competent in their occupational choices.

The researcher attended a recent national competition of Vocational Industrial Clubs of America, called the U.S. Skill Olympics. He noted that the level of scholastic character demonstrated by these vocational students seemed to be high. Industry and higher education institutions were well represented at the competition and were recruiting competitors to their businesses and institutions. Major industries throughout the United States operate the competitions. First-place winners compete in international competitions held at various locations throughout the world.

The General-Path Student

The typical general-path student is described as a high school graduate who has taken required and elective coursework in order to complete graduation requirements. He/she has not completed a one- to two-year vocational program and may or may not have aspirations for continued coursework in the college technical major. This student has not completed college-preparatory standards in high school as outlined in Advice for High School Students by the Presidents Council, State Universities of Michigan (see Appendix B). The curriculum followed by this student is not focused in any one particular area. Parnell (1986) pointed out that general-path students represent 27% of high school graduates. He also stated that colleges are raising standards to attract "better" students but are ignoring the ordinary person. In addition, he stated:

> One of the most powerful and instructive statistics about the general education track is that 63.5 percent of high school dropouts indicate they were in the general education track at the time they left high school. Only 6.7 percent of dropouts were from the academic track and 29.8 percent were from the vocational track.

Why does secondary education seem so unstructured? Parnell said that colleges and universities must share some of the blame because they are so unstructured and independent themselves.

Predictors of College Success

Both the ACT and high school GPA have proven to be reliable and valid predictors of success in college (ACT, 1986). Most institutions in the midwestern United States use ACT and HSGPA as college entrance standards and have for a number of years. This fact, along with high reliability and validity statistics, justifies their use. They are not generally used as predictors in themselves but become more reliable when used in tandem or with other proven assessments.

Interest Inventory scores were developed by the ACT Program to aid as counseling standards for making decisions about career choices based on students' interest in career subject areas. These scores are calculated from a 90-question inquiry of likes and dislikes on various stated activities. Standard scores are obtained along with percentile scores comparing the individual to a national sample of high school seniors. Six sets of scores are displayed, corresponding to six domains of vocational interest as developed by Holland in 1985. The ACT does not attempt to correlate Interest Inventory scores with any other data in the ACT assessment except

the World of Work map. The ACT plots the map according to the scores and suggests groups of occupational areas the individual might consider in planning for a future career.

Attrition in College

In view of the high attrition rates reported by many institutions of higher education (Hossler, 1986), a comparison of the two selected groups for dropout rates was deemed appropriate in answering the question, How can the attrition-rate problem in colleges be addressed more effectively?

A review of literature concerning attrition rates provided no studies that have compared the two groups in terms of whether vocational-path students entering a similar college-level occupational program drop out of school at a different rate than general-path students entering the same program. Some recent studies have indicated that the dropout rate is increasing overall, and institutions have become very concerned. College administrators have realized that dropouts consume significant amounts of resources. Up to 15% of budgets can be lost to dropouts (Hossler, 1986).

Current enrollment-management techniques include comprehensive student retention programs. Many institutions have developed remedial-studies programs for academically underprepared students who would be in the high-risk category and have the highest dropout rate in college. FSU offers a collegiate-skills program to address the needs of those high-risk students (Cairns, 1990). Institutional

studies at FSU have indicated that fewer students in the College of Technology than in Business or Arts and Sciences are taking remedial courses. Terry Doyle (1991), Coordinator of Collegiate Skills at FSU, commented in an interview with the writer that students in the technologies might indeed need remedial studies as much as any other group, but high laboratory hours per day, typical for those students, tend to keep them from taking advantage of the helper courses. Higher percentages of high school graduates going to college, more nontraditional students, and ever-increasing numbers of financially needy students are all elements included in describing the at-risk student. According to Hodgkinson (1987), this is a nationwide problem. Many others also are falling into that category because of escalating college costs.

The sample groups were located at FSU, where an open-door admissions policy exists and where a higher-than-average attrition rate also exists. Approximately 37% of first-year students at FSU drop out of college (see Appendix C). The dropout rate for technical students after two terms is only about 10%. Further investigation revealed that attrition after one year is still estimated to be only about 14% (Jungck, 1989). Jungck stated that students who enter college with definite goals in mind tend to gravitate toward those ends more consistently than those who do not have such goals. Technical students are usually more goal oriented than others. The National Center for Vocational Statistics reported that college students regard previous vocational training in high

school as important in attaining their technical program goals (Wagenaar, 1984). The data seem to indicate a positive relationship between attrition in a technical program and the choice of program. This possibly reinforces Wagenaar's statement that previous vocational training is important to attaining technical program goals. Less attrition occurs with students in college technical programs.

Studies on Vocational-Path and General-Path Students

The following is a brief summary of research that was found on vocational- and general-path students that is related to this investigation. Weisberg (1983) wrote of secondary vocational education as being terminal in the sense that graduates move immediately into the work force as a general rule from high school. He extolled the benefits of vocational education as compared to general education and its usefulness in helping the high school graduate who does not enroll in some postsecondary program to move into the work force with some skills. His evidence indicated that vocational education is a successful alternative to general education in helping high school graduates become gainfully employed in their occupational choice. Up to 50% of the graduates of some vocational programs do set a goal for higher education (Digest of Educational Statistics, 1988). This study was aimed at determining how well those graduates compare to general education graduates who go on to higher education in a technical field.

Meier (1980) found that participation in secondary vocational education did not influence those participants to go on to higher education any more than general education, but a positive correlation was found in choosing the college major. Vocational program graduates tended to enroll in college in a similar program of study. The high numbers of vocational-path students in this study, about 55%, seemed to confirm Meier's findings. As stated earlier in this chapter, Yoder (1985) found no positive relationship when investigating the influence of previous vocational training and college technical grades in a similar program, but Fulton and Hoerner (1963) concluded there was no positive relationship.

How much different academically are the two groups? Romes (1989) found that (a) vocational students' achievement in vocabulary, reading, and mathematics was no different from that of students in other curricular tracks and that (b) vocational students' feelings about themselves, as indicated by their future plans, e.g., college attendance, were no different from those of students in other tracks. The population in Romes's study consisted of almost 12,000 high school seniors. Among other items, the study indicated that vocational education, rather than detracting from basic educational achievement or limiting students' self-concept, was achieving the results for students that its proponents envisioned.

In her research on vocational program completers, Hicks (1987) found similar results. Vocational program completers found jobs

more easily than did nonvocational completers and tended to enroll in postsecondary programs similar to their high school vocational programs. Vocational programs had a high positive influence on completers in the following areas: choice of career, development of positive self-image, change in expectations about life and of a career, and inclusion of more than just job skills.

High Schools--The Future

Recently, high school completion requirements have made it more difficult for a vocational student to complete a comprehensive vocational program. The new recommended guidelines from the Presidents Council, State Universities of Michigan (see Appendix B), advise high school students intending to go on to higher education to take significantly greater amounts of math, science, and foreign languages in preparation for college. On one hand, vocational education has been given high grades for its usefulness as a motivator, and as preparation for a similar program in college. On the other hand, more general education is being promoted as a needed prerequisite for college. It is becoming increasingly difficult for a student planning on further technical education to satisfy required coursework for college entrance and to make use of secondary vocational education, considering the amount of time committed when completing the vocational program. If a high school student is interested in becoming a mathematics researcher or teacher, logic would dictate that a high degree of mathematics should be taken in high school in preparation for that career. By

the same logic, a graduate who plans on a particular occupational program in college should take similar studies in high school in preparation for those college studies. In the future, that person may be quite restricted in choice if intending to go to college. Increased academic requirements may not allow for investigation before making a choice of college major. Is there an advantage to occupational investigation before making that choice? More research is needed to answer that question satisfactorily.

General-path students in high school seem to be at a disadvantage, considering that they do not focus on any singular area of concentration in high school. This becomes evident in their attrition rate. Parnell (1986) stated that almost two-thirds of high school dropouts come from the general-path ranks. No short-term goals are in these students' future that are clear enough to motivate them to completion. Fewer than 25% of dropouts are vocational path, and fewer than 10% come from the college-preparatory ranks. As Parnell stated, "We all shoot better if we can see the target."

Vocational Education--Another Perspective

Although institutions in the United States seem to be trying to decide on the worth of vocational education as an avenue to higher education, a recent visit by this researcher to another country similar to the United States both socially and politically painted a picture somewhat similar to the tech-prep approach that is just starting to catch on in the United States. The researcher visited

the State Departments of Education, Higher Education, and Technical and Further Education in New South Wales, Australia, during August 1990.

The system of education in Australia is similar to the American system in that a kindergarten through grade 12 exists. Education is compulsory through the tenth grade. Vocational/technical education exists in high school and in Technical and Further Education (TAFE) colleges. Various programs in TAFE can lead to certificate or associate diplomas. These are fully separate from the university system and, until recently, could not transfer to the university. Entrance into universities normally required following a stringent academic coursework schedule in high school and the passing of a Universal University Entrance Exam. The system is styled similarly to education in Britain.

A visit with Greg Woodburn, Director of TAFE in New South Wales on August 4, 1990, revealed that a significant digression from the previous philosophy of education was taking place at the time. All new guidelines were being written, with major changes in the area of allowing university credit for TAFE courses. Two recent government research reports, entitled "White Paper" and "The Scott Report," provided recommendations for the changes.

An interview on August 5, 1990, with Robert Quick, New South Wales Curriculum and Planning Coordinator, revealed that universities were being studied individually for awarding TAFE credit. By 1992, all universities will have a schedule of credit

transfer from the TAFE colleges. High school students can enroll in TAFE courses at the end of their tenth-grade year, whereas American students can enter only high-school-level vocational programs. American students receive high school credit, and Australian students receive high school, TAFE, and possibly university credit for courses taken while in high school.

The trend in Australia toward articulation in vocational/ technical studies from high school through university level seems to contrast with the trends taking place in the United States toward more academics and less vocational coursework, with little articulation. The tech-prep or similar approach is currently gaining popularity in some areas of the United States. This approach articulates between academic courses and vocational courses in high school (Parnell, 1986).

An interview with Denis Davis, Professor of Education at Macquarie University on August 7, 1990, in Sydney, Australia, disclosed that the former American system of education has had a significant effect on Australian educators' recent departure from their previously accepted educational philosophy. In his recent book School to Work, the EWH Factor, Davis pointed out that Americans have successfully articulated the educational system to allow for a smoother school-to-work transition in the recent past. American secondary vocational education and associate degree technical programs in the community colleges seem to be quite successful in preparing young people for a technical occupation, in comparison to previous practices in Australia. Davis's only

negative comment was that Americans seem to be caught up in a credentialling fervor, resulting in discrimination creeping into the scene against those who, for one reason or another, cannot complete the higher standards that are expected for gaining credentials for a job, especially a job that does not necessarily require those credentials.

Parnell (1986) outlined the tech-prep approach now being considered in the United States as an alternative to the present system. It consists of a vocational program separate from other high school coursework. The approach proposes that most of the technical coursework be left to the community colleges. The high schools are to become more preparatory to both the technical and academic sides of college. High school courses would revolve around the technical areas in general terms. Courses such as physics and math might be preparatory to engineering technologies or machining technologies. Parnell also pointed out that it makes more sense to use the twelfth-grade "goof-off" year for technical programs. It might solve the dilemma of too much material for a two-year associate's degree program. He listed the five elements of the "opportunity with excellence" philosophy:

1. Community based--need to articulate with feeder schools.
2. Cost effectiveness.
3. Caring environment--high tech/high touch.
4. Competent faculty.
5. Comprehensive community college programs.

The results of this study could help determine whether there is a positive relationship between secondary vocational education and similar occupational education in college. The Australians seem to assume there is such a relationship.

Summary

The value of this study is indicated in the realization that little similar research was found on a subject with an effect on so many people and institutions in Michigan and throughout the United States. A few related studies were limited to determining a relationship between secondary vocational training and similar education in college. In the two similar studies, opposite results were found (Fulton & Hoerner, 1983; Yoder, 1978). Implications from this study might give new information to researchers, administrators, and counselors to use in their work.

Because upward mobility has been the password in the American philosophy of competitiveness, education beyond high school is becoming the norm. Allowance should be made for as many avenues as possible to college, considering that higher education has become primary in career accomplishment. Strong evidence suggests that American young people who do not enroll in college do not choose careers--they find jobs (Hamilton, 1988). Vocational education can possibly help in motivating a significant number of these students to choose and attain some career goals. In a 1990 report, Carol Carlson of the Educational Testing Service quoted the following statement from the June 19, 1989, issue of Fortune magazine:

"Quality vocational programs can motivate students to stay in school and maybe go to college--by making academics more palatable and by providing marketable skills."

Marc Tucker (1989), President of the National Center on Education and the Economy, pointed out that the nation's attitude toward the work force must change. He stated, "Our competitors invest in their blue-collar workers, while Americans tend to concentrate training and funding on those with college degrees." Vocational education seems to suffer from the same negative attitude. Hemmings (1989) pointed out: "Vocational education has not been fashionable with the academic community, despite studies that show that applied learning methods help people learn even academic subjects."

This study was designed to bring to light information that could help improve career choice making, determine educational needs of the two groups, and understand whether one group offers more in preparation for enrollment in a college technical program.

CHAPTER III

METHODOLOGY

Research procedures were established to guide the inquiry in measuring college success of vocational-path and general-path students in selected academic and technical courses at FSU. Those procedures are discussed in this chapter.

The Population/Sample for the Study

Fall 1989 enrollees in Machine Tool Technology, Automotive Technology, and Printing Technology at Ferris State University were tracked for two academic terms. It was determined that the entire population would be used in the study because a sample of only the population would bring about less effectiveness in data measurement. Enrollees were Michigan residents and had less than one term of previous college coursework. Preliminary studies from Ferris enrollment data indicated that the subjects were graduates of Michigan high schools and averaged approximately 18.5 years of age.

The Machine Tool program had 30 entrants. Fifteen were graduates of vocational programs in the high schools, and 15 were from general education studies. The Automotive Technology program had 74 entrants. Forty-two were graduates of vocational programs, and 32 were from general education programs. The Printing

Technology program had 56 entrants. Thirty-one were graduates of vocational programs, and 25 were from general education programs. Totals for the three programs included 88 vocational path and 72 general path, for a total of 160 students.

All the students in the study were fall quarter 1989 entrants. Nine students or 6% of the enrollees were not entering postsecondary education for the first time, and approximately 94% were recent high school graduates. Sixteen persons or 10% of the population were considered dropouts. They did not complete the first two terms of study.

The Vocational-Path Student

A 25% randomly selected sample was taken on the high school grades of the population under study. Vocational-path students numbered 26 and general path 14, for a total of 40 persons. Years of high school were considered four years, grades 9 through 12, in this study (see Appendix A).

The vocational-path student can be characterized as a student who has completed a mean average of 3.21 years of English, .13 years of foreign language, 2.6 years of mathematics, 2.13 years of natural sciences, and 2.74 years of social sciences. Extra courses generally included typing and computer application courses. The math consisted of an average of a half year of general math and two years of algebra or algebra and trigonometry. Natural sciences consist of physical science or biology and geography but not physics.

The typical vocational-path student in this study had attained one to two years of vocational education in a program directly related to his/her technical major in college. This person may or may not have taken some college-preparatory coursework and may or may not have had aspirations for continued college coursework beyond the technical major. The technical major is generally an associate degree level but sometimes terminates at the bachelor's degree level. Vocational program graduates were entrants into the three selected technical programs in this study. Vocational-path courses were considered to be any Machine Trades, Auto Mechanics, Diesel Mechanics, Small Engine Mechanics, Printing, Graphic Arts, or Graphic Reproduction program of secondary level that met the above-described program-duration criteria.

The General-Path Student

General-path students are graduates of high school who have completed general education studies and have not completed one to two years of a vocational program. This population also has not completed a college-preparatory program of study (see Appendix B).

The general-path student in this study can be characterized as a student who had completed a mean average of 3.4 years of English, .27 years of foreign language, 3.1 years of mathematics, 2.5 years of natural sciences, and 3 years of social sciences. Extra courses generally consisted of music and computers. Math consisted of one semester of general math, two years of algebra, and one-half year of trigonometry. Natural sciences generally comprised one semester of

physical sciences, one year of physics or chemistry, and one year of biology. Very little foreign language was taken.

In all academic subject areas, general-path students completed more coursework than their vocational-path counterparts. Their math and sciences were more advanced than those of vocational-path students. As previously stated, general-path students had a slightly higher overall GPA of 2.62, compared to 2.59 for vocational-path students. The researcher noted that vocational-path students' ACT composite score of 16.37 was slightly higher than the 16.00 of general-path students, even though general-path students completed more coursework in the tested areas.

Research Design

The study used a two-group, pretest-posttest design. The students were assigned to the general-path or the vocational-path group according to the coursework they completed while in high school. The pretest data included use of ACT Standard and Interest Inventory scores and HSGPA of the population.

The posttest data included data compiled while the enrollees were in their first year of Machine Tool, Automotive, and Printing programs at FSU. The specific data collected were overall GPA, attrition rate, selected nontechnical course grades, and technical course grades at completion of two terms of college.

Measurement Variables

Premeasures

ACT score system. The results of four academic tests are shown on students' ACT reports identified by standard score, local norms in percentiles, and national norms in percentiles. Only the standard score was used. The number of correct answers on the four tests is considered a raw score. The raw scores are then converted to a standard score on a scale of 1 to 36. Each test has a different maximum standard score. For English it is 33, for Mathematics it is 36, for Social Studies it is 35, and for Natural Sciences it is 35. The standard deviation range is 5 to 8 points, and the standard error of measurement on all four tests is 1 to 2 points (ACT, 1986). A composite of the four scores was also used.

ACT academic test information used in this study included four subject-matter areas: English, Mathematics Usage, Social Studies, and Natural Sciences. These tests were constructed to assess students' ability to complete college-level work. Individual test scores plus a composite score of these four tests were used in the study.

Another assessment in the ACT is the Interest Inventory section. These data summarize the test-takers' preferences for activities involving data, ideas, people, and things. The Interest Inventory is used in developing a Map of Majors and the World-of-Work Map used by ACT for advising students. The assessment battery is widely used in the United States for college admissions and course-placement decisions. At FSU, the test is required of all new

students for purposes of academic advising and course-placement decisions. The ACT assessment is administered on five national test dates each academic year at more than 2,900 test centers in the United States and Canada.

In this study, the researcher compared Interest Inventory *technical* scores to attrition rate for a significant correlation. Those technical scores were also compared to college GPA to find whether a relationship existed. The ACT recommends that Interest Inventory scores be used in combination with Aptitude scores when determining career choices. They should not be used alone because only interest is reported, which does not necessarily predict success in a career choice (ACT, 1989).

English Usage test. The test is a 75-item, 40-minute test that measures the basic elements of writing, punctuation, grammar, sentence structure, diction, style, logic, and organization. It does <u>not</u> stress recall of the rules of grammar. The content is proportioned as follows: grammar and punctuation--34%, sentence structure--26%, diction--23%, and logic and organization--17% (ACT, 1986).

ACT reports indicate that odd-even reliabilities from previous studies had a median of .90 with a range from .87 to .92. The median KR-20 coefficient is .89, with a range of .78 to .90.

Mathematics Usage test. The test is a 40-item, 50-minute examination that measures a student's mathematical reasoning ability. It emphasizes the answer to practical numerical problems

commonly encountered in many college courses and techniques covered in high school courses. The format of the item is a question with five alternative answers, the last of which may be "none of the above" (ACT, 1986).

The ACT has reported KR-20 reliability coefficients in the range of .85 to .91. The odd-even reliability coefficients are in the range of .86 to .90. The range of standard error of measurement is 1.96 to 2.53 (ACT, 1988).

Social Studies test. The test is a 52-item, 35-minute test that measures comprehension, analytical and evaluative reasoning, and problem-solving skills required in the social studies areas. There are two general types of items--one based on reading passages and the second on general background or information obtained primarily in high school social studies courses. The student must draw inferences and reach conclusions to extend the thought of the passage to new situations and to recognize writer bias, style, and mode of reasoning.

ACT reports indicate that the odd-even reliabilities from previous studies have shown a median of .87 and a range of .82 to .88. The median KR-20 coefficient is .85, with a range of .80 to .89.

Natural Sciences test. The test is a 52-item, 35-minute test that measures interpretation, analysis, evaluation, critical reasoning, and problem-solving skills. There are two general types of items. The first is based on reading passages and the second on information about science. All items are multiple choice with four

alternatives. The items require students to understand and distinguish between the purposes of experiments and to examine hypotheses drawn from those experiments. The discrete-information items ask students to apply what they have learned in high school science courses to familiar, new, and analogous problem contexts (ACT, 1986).

ACT reports indicate that odd-even reliabilities from previous studies have a median range of .82 to .88. The median KR-20 coefficient is .84, with a range of .80 to .87. The standard score scale of these academic tests ranges from 1 to 36, with a standard deviation of 5 to 8 and a standard error of measurement of 1 to 2. The approximate mean composite score of all college-bound high school students is 18.

Composite score. The composite score is an average of the standard scores on the English, Mathematics, Social Studies, and Natural Science tests.

The ACT Interest Inventory. This test measures six major dimensions of interest: Science, Creative Arts, Social Service, Business Contract, Business Detail, and Technical. Each of the six scales is composed of 15 work-related activities for which students indicate their degree of liking on a three-point scale. The Technical standard score has the greatest relevance to this study and was the only score used of the six.

The interest assessment procedures used by ACT were designed to counteract the effects of gender-role stereotypes on Interest

Inventory results. Those results are used to relate individuals' interests to the interests of successful and satisfied college seniors in a variety of educational majors. The scores are registered as standard scores and are then converted to percentiles for comparison to other college-bound students.

Evidence of validity has been established on a convergent and divergent validity basis through ACT research and evidence of high correlation from other measures of Holland's types (ACT, 1981). Criterion-related validity was also established in the same report through group profiles and hit rates. Criterion group profiles are determined by computing and graphing mean interest scores for each group and examining the graphs to see if they conform to the configuration expected on the basis of theory, e.g., Holland's theory of careers and common sense. The procedure of computing hit rates versus miss rates as applied to Holland's (1973) typology is used. A person's criterion group is counted as being correctly identified or a hit if the person's high point on the interest scale matches the criterion group. A college printing major would be counted a hit if a high score was made on the Interest Inventory Technical scale.

Other reports of research that further validated the Interest Inventory were provided by Hanson and Rayman (1976) and Lamb and Prediger (1980).

High school grade point average. High school grade point average (HSGPA) is the overall grade point average earned at completion of high school and is recorded in numerical form on a 0.0

to 4.0 scale. The average is recorded over a four-year period (see Table 1).

Table 1.--Letter grade to numerical grade conversion.

Letter Grade	Numerical Grade
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
D-	0.7
F	0.0

Postmeasures

College grade point average. The college grade point average (CGPA) is the overall GPA of each student at the completion of two academic terms at FSU. The students were tracked through Fall Term and Winter Term 1989-90. The grade average is numerical in form, from 0.0 to 4.0, and is the result of technical and nontechnical grade average. Those grades were converted from letter grades to numerical grades as shown in Table 1. They were collected from the School of Technology office at FSU. One hundred percent of the population grades were researched in order to validate accuracy of computer records. One hundred percent accuracy was the target.

Attrition rate. Attrition is the percentage of program leavers. They were tracked for two academic terms at the same time and on the same population as GPA. The leavers were also divided into vocational-path and general-path groups, tabulated by counting numbers of dropouts, and converted to percentage of total population. The study did not indicate whether the leaver had transferred to another program or had quit altogether. Student attrition was examined after two terms of college studies as opposed to longer intervals because previous investigation has indicated the highest attrition rate occurs within the first year (Swartz, 1989). It was determined that investigation over a longer period would not be practical considering the small benefit that might be gained.

Nontechnical course achievement. Grades in regularly required nontechnical courses were gathered and used to compare vocational-path and general-path students' achievement. Those courses include English 111, Mathematics 111, Mathematics 121, Social Science 101, and Physical Science 107. The grades were awarded on an A to F scale, with pluses and minuses converted to numerical grades (Table 1). Grades in these courses were taken from computer files in the School of Technology office at FSU. All references to nontechnical grade point average (NTGPA) are given in numerical form.

Technical course achievement. All technical courses within the programs under study were considered technical by description. They are identified by the prefix letters in the course codes. Machine Tool Technology prefix letters are designated M-T, with the exception of Machine Tool Drafting 191, which has a prefix

designation of T-D. Automotive Technology letters are A-T, and Printing Technology letters are PRI. Grades were awarded on an A to F scale and converted to numerical grades. (Table 1). Grades were obtained from the Registrar's office and the School of Technology office at FSU. All references to technical grade point average (TGPA) are given in numerical form.

College Course Descriptions

Nontechnical Course Description

To give the reader a perspective of the differences between the nontechnical and technical college courses taken by the population, a brief description of the course content, number of credits, and course length is given in the following paragraphs.

English 111--English. This is the first course in a series of three. It stresses basic skills that the student should have after a solid background from high school. This course meets for three hours per week of lecture and is a three-credit-hour course.

Mathematics 111--Fundamentals of Algebra. This course is a review of elementary operations on rational numbers, factoring, and linear equations. It meets four hours per week of lecture and is a four-credit-hour course.

Mathematics 121--Intermediate Algebra. This course is a study of exponents, radicals, fractions, functions, graphs, quadratics, and logarithms. It meets four lecture hours a week and carries four hours of credit. The course meets the minimum math requirements for Machine Tool Technology.

Technical Course Description

All three technical programs studied are heavily favored in the technical courses. These generally are set up with high lab-to-lecture ratios. Hands-on experience is stressed, compared to traditional classroom learning. The courses are constructed with significantly higher contact hours per week than general courses, as demonstrated in the course descriptions and usually encompass a significantly smaller student class size. Individual attention is used more as a teaching/learning tool than most general studies courses.

MT 111--Machine Tool I. This is a theory lab course for beginning students, covering shop safety, measuring instruments, layout, and bench work. Operation of basic machines such as drilling machines, tool room lathes, horizontal milling machines, and floor grinders is introduced. The course meets 5 lecture hours and 15 lab hours per week and is a 10-credit-hour course.

MT 121--Machine Tool II. This course is a continuation of MT 111 with more specialization in the same tool areas. It meets 5 lecture hours and 15 lab hours per week and is a 10-credit-hour course.

T-D 191--Blueprint Fundamentals and Elementary Projection. This is a course in blueprint reading, drafting theory, and practice with dimensioning of cylindrical and complex shapes. The course consists of one lecture hour per week and two lab hours per week and is a two-credit-hour course.

AT 101--Automotive Engines. The course covers fundamentals of design, operation, and problem troubleshooting of engines, with procedures in servicing all components. It meets for five hours of lecture and four hours of lab per week; it is a six-credit-hour course.

AT 102--Power Transmission Systems. The course covers function, construction, servicing, and problem solving of rear-wheel and transaxle power transmissions used in automobiles and light trucks. It meets for three lecture and three lab hours per week and is a four-credit-hour course.

AT 104--Brakes and Chassis Service. Nomenclature, theory of operation, and service procedures for brake systems, wheels, tires, and related systems are the main components of this course. Also included is instruction on wheel balancing. Basic shop skills such as tube flare, honing operations, and tool application are also part of the course. The course consists of five hours of lecture and three hours of lab per week for ten weeks; it is a six-credit-hour class.

AT 155--Automotive Electricity/Electronics. Fundamentals and applications in automotive electricity/electronics such as capacitance, inductance, series and parallel circuits, magnetism, and Ohm's law comprise this course. Also covered are wiring schematics, soldering techniques, and meter usage. The course meets for three hours of lecture and two hours of lab work per week for ten weeks and consists of four credit hours.

AT 215--Automotive Heating and Air Conditioning. Operating principles, construction, troubleshooting, and servicing procedures for automotive heating and air-conditioning systems are covered. This course consists of two hours of lecture and two hours of lab work per week for ten weeks and is a three-credit-hour course.

PRI 123--Binding and Auxiliary Operations. This course is designed to develop knowledge and skill in the finishing operations for printed products. Various methods of binding a finished job, including folding, cutting, mechanical and perfect binding, padding, and shrink wrapping are discussed and practiced in the printing laboratory. Also, the essential auxiliary operations and specialties such as scoring, perforating, die-cutting, imprinting, numbering, embossing, and foil stamping are discussed and practiced in lecture and laboratory, with emphasis on quality control. The course consists of two hours of lecture and six hours of lab work per week for ten weeks and is four credit hours.

PRI 131--Screen Printing I. This is a beginning course that explores a variety of substrates with types and uses of different screens. The course explores materials suitable for frames and bases, screen stretching methods, and squeegees used for specific purposes. Single- and multiple-color printing is also covered. This course meets for two hours of lecture and six hours of lab work per week and is a four-credit-hour course.

PRI 132--Photomechanical Reproduction Photography. The course is developed around line and half-tone photography as they relate to various printing processes, with emphasis on lithographic printing,

diffusion transfer, and densitometry skills development. The course meets for two hours of lecture and six hours of lab work per week and is a four-credit-hour course.

PRI 135--Color Theory and Ink. This is a theory course designed to acquaint students with color printing processes. The effects of light, color, paper, and inks and how they interrelate in the various printing processes are emphasized. The course meets for three hours of lecture per week for ten weeks and is a three-credit-hour course.

PRI 143--Stripping and Platemaking. The course is an introduction to stripping and platemaking. Emphasis is placed on the proper use and care of stripping tools and equipment, imposition of negatives within flats, complimentary and multiple stripping techniques, and recognition and preparation of offset plates. It meets for two hours of lecture and six hours of laboratory work per week for ten weeks and is four credits.

PRI 151--Paper Technology. This course is an introduction to raw materials and basic paper-making processes. Both groundwood and "free" paper classifications, coated and uncoated, are studied as to their compatibility with various impact printing processes and nonimpact printing processes. Paper-testing procedures, recognition of manufacturing defects in printing papers, and classifications of printing papers are covered. This course meets three hours per week for lecture and is a three-credit-hour course.

PRI 153--Photo Composition 1. This is a beginning course in typesetting; electronic typesetting computers are used. Black and white paste-up procedures, proofreading, and copy preparation are integral parts of the course. It meets for two hours of lecture and six hours of laboratory work per week for ten weeks. It is a four-credit-hour course.

PRI 161--Sheetfed Offset Presswork 1. Theory and operation of sheetfed offset presses and duplicators as well as extensive practice in set-up, make-ready, operation and press adjustments, troubleshooting, and chemistry are the content of the course. The course meets for two hours of lecture and six hours of laboratory work per week for ten weeks and is a four-credit-hour course.

PRI 171--Printing Layout and Design. This course includes the making of various layouts covering principles of conventional and modern layout and typographical treatments. It meets for two hours of lecture and two hours of laboratory work per week for ten weeks and is a three-credit-hour course.

Statistical Procedure

Each hypothesis is stated in the null form as follows:

Hypothesis 1a: Upon entry into college technical programs, vocational-path students and general-path students do not differ in academic aptitude, as measured by ACT Standard scores and high school grade point average (HSGPA).

This hypothesis was analyzed using the Wilks' lambda with post-hoc comparisons at an alpha level of .05. ACT Standard scores and HSGPA were used for data analysis.

Hypothesis 1b: Upon entry into college technical programs, vocational-path and general-path students do not differ in vocational interest, as measured by ACT Interest Inventory scores.

ACT Interest Inventory Technical scores were used. The data were analyzed with a t-test at an alpha level of .05.

Hypothesis 2a: Vocational-path and general-path students do not differ in attrition rates during the first two academic terms of college study.

This hypothesis was analyzed by using the z-test for proportions at an alpha level of .05. These rates were tabulated on Fall and Winter Terms 1990.

Hypothesis 2b: Attrition is not related to ACT Aptitude and Interest Inventory scores for vocational-path and general-path students.

The two-way MANOVA test at an alpha level of .05 was used in determining the relationship.

Hypothesis 3a: ACT Standard test scores and high school grade point average (HSGPA) are not related to college grade point average (CGPA) after two academic terms of college study.

A multiple regression with an alpha level of .05 was used to determine the degree of the relationship.

Hypothesis 3b: Vocational-path and general-path students do not differ in the relationship of ACT Interest Inventory scores to CGPA after two academic terms of college study.

The Pearson correlation-coefficient test was used to identify a relationship. An alpha level of .05 was sought. Overall GPA at the end of the first two terms of college was used.

Hypothesis 4a: There is no difference between vocational-path and general-path students' technical course achievement in college technical programs.

The specific courses in the study were within the Machine Tool Technology, Automotive Technology, and Printing Technology curricula at FSU. T-tests were used, and an alpha level of .05 was sought.

Hypothesis 4b: There is no difference between vocational-path and general-path students' nontechnical course achievement in college technical programs.

T-tests were used, with an alpha level of .05.

Data Collection

Data for this study were collected through computer retrieval from actual ACT files and grade reports on students. Information was keyed into a data file. A Statistical Package for the Social Sciences (SPSS) computer program was used to process the data, using the mainframe computer (IBM 3090 Group 110) at FSU. Processing was accomplished by using the McGill University System for Interactive Computers (MUSIC) terminal system. The gathered data were coded and recorded on the SPSS program in two records, as shown in Appendix C.

SPSS permitted computer analysis in the following areas:

1. ACT Standard scores in English, Math, Social Sciences, and Natural Sciences.
2. ACT Standard scores in the Interest Inventory Technical area.
3. Attrition rate in the first two terms of college.
4. High school grade point average.
5. College grade point average at completion of two terms.
6. Nontechnical course achievement in college.
7. Technical course achievement in college.

Research Time Frame

All data were entered during the 1990-91 academic year. The statistics were processed in winter 1990-91. Analyses were conducted and conclusions drawn in spring 1991.

CHAPTER IV

DATA ANALYSIS

The researcher's purpose in this study was to compare vocational-path and general-path students enrolled in college technical programs at Ferris State University. ACT scores, high school grade point averages (HSGPAs), attrition rates in the first year of college, and GPAs in nontechnical as well as technical courses were used in the comparison.

Overview of Methodology

One hundred sixty student records at FSU were studied. The students were Fall 1989 entrants into three technical programs: Machine Tool Technology, Automotive Technology, and Printing Technology. One hundred thirty-seven students were first time in any college (FTIAC) students. Nine more or 6% had completed one term/semester or less and were included in the total of 146. In addition, 16 persons or 10% were considered as dropouts, bringing the total population under study to 160. Of these, 88 students or 55% of the total could be classified as vocational-path high school graduates. Seventy-two or 45% of the total were identified as general-path graduates. Vocational path were students who had completed a high school vocational program. General path were

students who had not completed a high school vocational program but had fulfilled general requirements for high school completion.

A two-group, pretest-posttest design was used. Pretest data included use of ACT Standard Aptitude, Interest Inventory, and HSGPAs. The posttest data included overall GPA, nontechnical course grade point average (NTGPA), technical course grade point average (TGPA), and attrition rates after two academic terms. Hypotheses were tested comparing the two groups.

Hypotheses

Eight hypotheses were tested, as outlined in the Statistical Procedure section of Chapter III. Hypotheses 1a and 2b were analyzed using multivariate analysis of variance (MANOVA), specifically Wilks' lambda, to test for significance at the .05 level. The segments were then subjected to univariate analysis of variance (ANOVA) to determine whether any single significance occurred. Mean, standard deviation, F-values, and p-values were presented for each item in the segment to determine significance in each segment. A series of t-tests was used to analyze Hypotheses 1b, 2b, 3b, 4a, and 4b, with a t-value and two-tail probability results given. Cross-tabulation was used to analyze Hypothesis 2a, with chi-square values and p-values displayed. A series of z-tests was used to analyze Hypotheses 3a and 3b, with z-values and probability results displayed.

In the following pages, each null hypothesis is restated, followed by the results for that hypothesis.

Hypothesis 1a: Upon entry into college technical programs, vocational-path students and general-path students do not differ in academic aptitude, as measured by ACT Standard scores and high school grade point average (HSGPA).

The comparison of vocational-path and general-path students' ACT Standard scores and HSGPA in Table 2 presents the results of the test for Hypothesis 1a.

Table 2.--Comparison of vocational-path and general-path high school graduates' ACT Standard scores in English, Math, Social Studies, Natural Sciences, composite scores, and HSGPA.

MANOVA: Wilks' lambda = .945 F = 1.338 p = .244

ANOVA

Item	Vocational			General			F	p
	N	Mean	SD	N	Mean	SD		
ACTE	80	14.99	4.96	66	13.91	4.50	1.852	.176
ACTM	80	14.50	6.56	66	15.70	5.62	1.366	.244
ACTS	80	14.24	7.08	66	13.48	5.36	.506	.478
ACTN	80	21.41	5.89	66	20.30	5.41	1.379	.424
ACTC	80	16.37	5.09	66	16.00	3.90	.240	.624
HSGPA	88	2.59	0.45	72	2.62	0.44	.440	.507

The vocational-path group's ACT mean scores in all areas (n = 80) were slightly higher than those of the general-path group (n = 66) with the exception of the math score. General-path students scored slightly higher in this area. P-results in all segments and the MANOVA indicated there was no statistical difference between vocational-path and general-path students in academic aptitude, as measured by ACT Standard scores.

A Wilks' lambda of .945 and a p-value of .244 in Table 2, with a significance value of .05 sought, verified that there was no difference between the two groups. The ANOVA results for each area are presented in the following paragraphs.

ACTE. Means of 14.99 for vocational-path and 13.91 for general-path students indicate that vocational-path students scored slightly higher in ACT English aptitude than did general-path students. An F-value of 1.852 and a p-value of .176 demonstrate that the difference in means between the two groups was not significant.

ACTM. Means of 14.50 for vocational-path and 15.70 for general-path students indicate a slightly higher average ACT Mathematics score for general-path students. The F-value of 1.366 and p-value of .244 demonstrate that the difference between the two groups was not significant.

ACTS. Means of 14.24 for vocational-path and 13.48 for general-path students in Social Studies ACT scores indicate that vocational-path students were at a slightly higher achievement level in social studies. An F-value of .506 and a p-value of .478 demonstrate that the difference between the two groups was not significant.

ACTN. Means of 21.41 for vocational-path and 20.30 for general-path students in ACT Natural Science scores indicate that vocational-path students were at a slightly higher achievement level. An F-value of 1.379 and a p-value of .424 demonstrate that the difference between the two groups was not significant.

ACTC. Means of 16.37 for vocational-path and 16.00 for general-path students indicate that vocational-path students were at a slightly higher overall ACT achievement level. An F-value of .240 and a p-value of .624 demonstrate that the difference between the two groups was not significant.

HSGPA. Means of 2.59 for vocational-path and 2.62 for general-path students in HSGPA indicate that general-path students entered college with a slightly higher GPA. An F-value of .44 and a p-value of .507 demonstrate that the difference was not significant. The average GPA for the College of Technology in Fall 1989 was 2.60.

A review of the MANOVA and ANOVA testing results demonstrates that the null hypothesis was not rejected.

Hypothesis 1b: Upon entry into college technical programs, vocational-path and general-path students do not differ in vocational interest, as measured by ACT Interest Inventory scores.

Results of the analysis for this hypothesis are given in Table 3. A t-test was used to compare the two groups. A t-value of .25 and a probability value of .799 demonstrate that there was no statistical significance between the two groups when an alpha level of .05 was sought. Therefore, the null hypothesis was not rejected.

Table 3 indicates a slightly higher ACT Interest Inventory mean score for vocational-path students (57.26) compared to general-path students (56.83). The size of the population was different than it was in previous tables because some records on the ACT Interest Inventory could not be found. Those students were either transfers

and ACT records were not available for them, or the test-takers did not respond to the Interest Inventory section of the ACT assessment.

Table 3.--T-test comparison of vocational-path to general-path students on ACT Interest Inventory technical scores.

Group	N	Mean	SD
Vocational	76	57.26	9.39
General	61	56.83	10.19

T-value = .25 Probability = .799

Hypothesis 2a: Vocational-path and general-path students do not differ in attrition rates during the first two academic terms of college study.

Results of the data analysis for this hypothesis are displayed in Table 4. The cross-tabulation resulted in a chi-square value of .025 and a p-value of .873, indicating no difference in attrition rates between the two groups. Therefore, the hypothesis was not rejected.

Table 4.--Cross-tabulation of attrition rates after two academic terms of college study.

Group	Dropouts		Persisters		Total Percent
	N	Percent	N	Percent	
Vocational	8	9.1	80	90.9	100.0
General	8	11.1	64	88.9	100.0
Total	16	10.0	144	90.0	100.0

Chi-square = .025 p = .873

Table 4 compares vocational-path dropouts and persisters (persons not dropping out) to general-path dropouts and persisters. Both groups had the same number of dropouts (n = 8), but general-path students showed a slightly higher percentage rate because of a smaller total general-path (n = 64) than vocational-path (n = 80) population. The researcher noted that the 10% dropout rate for the total population under study was significantly lower than the rate for FSU for one academic year--a 37.7% dropout rate.

Hypothesis 2b: Attrition is not related to ACT Aptitude and Interest Inventory scores for vocational-path and general-path students.

Results of the data analysis for Hypothesis 2b are displayed in Tables 5, 6, 7, and 8 to demonstrate more specific comparisons. Tables 5 and 6 use a MANOVA, Wilks' lambda test for comparison of vocational-path and general-path dropouts and persisters on ACT Aptitude scores only. Individual segments are analyzed in the ANOVA section to determine whether any significance was found between dropouts and persisters within the individual ACT Aptitude scores.

Tables 7 and 8 display results of a comparison of vocational-path and general-path dropouts and persisters to ACT Interest Inventory scores only. A t-test was used with two-tail probability measures in both tables. This hypothesis was not rejected, based on the data-analysis results as presented in the following specific comparisons.

Comparison of vocational-path dropouts and persisters on ACT Aptitude. In Table 5, the comparison of vocational-path dropouts

and persisters on ACT Aptitude scores as analyzed by using MANOVA, Wilks' lambda value of .948, an F-value of .663, and a p-value of .680 demonstrated no overall difference between vocational-path dropouts and persisters in ACT Aptitude scores. The ANOVA results are presented following Table 5.

Table 5.--Comparison of vocational-path dropouts and persisters on ACT Aptitude scores.

MANOVA: Wilks' lambda = .948 F = .663 p = .680

	ANOVA					
Item	Dropouts (n=7)		Persisters (n=73)		F	p
	Mean	SD	Mean	SD		
ACTE	13.71	6.42	15.11	4.84	.500	.481
ACTM	13.85	6.91	14.56	6.57	.072	.788
ACTS	16.00	7.14	14.06	7.09	.472	.494
ACTN	21.14	8.68	21.44	5.64	.015	.900
ACTC	16.28	6.04	16.38	5.04	.002	.271

ACTE. Dropouts (n = 8) registered a slightly lower ACT English mean score of 13.71 compared to 15.11 for persisters (n = 58). An F-value of .55 and a p-value of .481 demonstrated no significance in the comparison.

ACTM. Dropouts registered a slightly lower ACT Mathematics mean score of 13.85 than persisters' mean of 14.56. An F-value of .072 and a p-value of .788 demonstrated no significance in the comparison.

ACTS. Dropouts registered a slightly higher mean score of 16.00 in ACT Social Studies compared to 14.06 for persisters. An F-value of .472 and a p-value of .494 demonstrated no significance in the comparison.

ACTN. Dropouts registered a slightly lower ACT Natural Science mean score of 21.14 as compared to 21.44 for persisters. An F-value of .015 and a p-value of .900 demonstrated no significance in the comparison.

ACTC. Dropouts registered a slightly lower composite mean score of 16.28 as compared to 16.38 for persisters. An F-value of .002 and a p-value of .271 demonstrated no significance in the comparison.

Comparison of general-path dropouts and persisters on ACT Aptitude. The comparison of general-path dropouts and persisters in ACT Aptitude scores in Table 6 displays results of MANOVA, Wilks' lambda with a value of .859, an F-value of 1.65, and a p-value of .159. The results indicated no significant difference between general-path dropouts and persisters in ACT Aptitude score measurement.

Table 6.--Comparison of general-path dropouts and persisters on ACT Aptitude scores.

MANOVA: Wilks' lambda = .859 F = 1.615 p = .159

Item	ANOVA					
	Dropouts (n=8)		Persisters (n=58)		F	p
	Mean	SD	Mean	SD		
ACTE	13.75	5.36	13.93	4.42	.011	.916
ACTM	14.75	3.77	15.83	5.84	.255	.615
ACTS	14.12	4.32	13.39	5.51	.128	.722
ACTN	20.12	3.35	20.32	5.65	.009	.922
ACTC	15.75	3.24	16.13	4.01	.037	.848

ANOVA results comparing general-path dropouts and persisters are presented as follows:

ACTE. Dropouts registered a slightly lower ACT English mean score of 13.75 compared to 13.93 for persisters. An F-value of .011 and a p-value of .916 demonstrated no significance in the comparison.

ACTM. Dropouts registered a slightly lower ACT Mathematics mean score of 14.75 compared to 15.83 for persisters. An F-value of .255 and a p-value of .615 demonstrated no significance in the comparison.

ACTS. Dropouts registered a slightly higher ACT Social Studies mean score of 14.12 compared to 13.39 for persisters. An F-value of .128 and a p-value of .722 demonstrated no significance in the comparison.

ACTN. Dropouts registered a slightly lower ACT Natural Sciences mean score of 20.12 compared to 16.63 for persisters. An F-value of .009 and a p-value of .922 demonstrated no significance in the comparison.

ACTC. Dropouts registered a slightly lower ACT Composite mean score of 15.75 than the 16.13 for persisters. An F-value of .037 and a p-value of .848 demonstrated no significance in the comparison.

The purpose of this hypothesis was to compare differences between vocational-path and general-path dropouts and persisters to determine whether a relationship existed in attrition rates between the two groups using ACT Aptitude and Interest Inventory scores. A comparison of the two groups in Tables 5 and 6 indicates that general-path students tended to register slightly lower ACT Composite scores for both dropouts (15.75) and persisters (16.13) compared to vocational-path dropouts (16.28) and persisters (16.38).

Comparison of vocational-path dropouts and persisters on ACT Interest Inventory scores. A t-test was used to compare vocational-path dropouts and persisters on ACT Interest Inventory scores. The results are displayed in Table 7. The test resulted in a t-value of .39 and a probability of .707. These results demonstrated no significant difference between the two groups.

Table 7.--T-test comparison of vocational-path dropouts and persisters on ACT Interest Inventory technical scores to attrition in college.

Group	N	Mean	SD
Dropouts	5	58.00	3.74
Persisters	71	57.21	9.68

T-value = .39 Probability = .707

Further investigation indicated that dropouts scored slightly higher (mean = 58.00) compared to persisters (mean = 57.21). The hypothesis did not suggest a difference between vocational-path and general-path students in dropouts and persisters. The researcher noted that the vocational-path dropouts' mean score in Table 7 of 58.00 was somewhat higher than the general-path dropouts' mean score of 53.00, as displayed in Table 8.

Comparison of general-path dropouts and persisters on ACT Interest Inventory scores. A t-test was used to compare general-path dropouts and persisters on ACT Interest Inventory scores. The results are displayed in Table 8. The analysis resulted in a t-value of 1.52 and a probability of .155. These results demonstrated no significant difference between the two groups.

Further investigation indicated that dropouts did demonstrate a slightly lower mean score of 53.00, compared to persisters' mean score of 57.41. Even though the difference was not significant, the probability of .155 was closer to significance than were most other comparisons in the study.

Table 8.--T-test comparison of general-path dropouts and persisters on ACT Interest Inventory technical scores to attrition in college.

Group	N	Mean	SD
Dropouts	8	53.00	7.15
Persisters	53	57.41	10.51

T-value = 1.52 Probability = .155

Hypothesis 3a: ACT Standard test scores and high school grade point average (HSGPA) are not related to college grade point average (CGPA) after two academic terms of college study.

The analysis for this hypothesis was accomplished in two phases. The first was to test for a relationship between vocational-path students' ACT Aptitude measures and HSGPA to CGPA, as displayed in Table 9. The test for a relationship with regard to general-path students is displayed in the same fashion in Table 10. The second phase of the analysis was to test for the difference between vocational-path and general-path students' ACT Aptitude and HSGPA to CGPA.

In the first phase, a stepwise multiple-regression test was used to test the relationship with vocational-path students only. The SPSS program automatically singled out ACTM in Step 2 of Table 9 because it showed the highest relationship to CGPA as compared to the rest of the ACT Standard scores. Once ACTM was removed in the test, the remaining scores had little effect on CGPA and were determined not to be of significant value by SPSS.

Table 9.--Stepwise multiple regression: relationship of vocational-path students' ACT Aptitude measures and HSGPA to CGPA.

Step No.	Variable Entered	Multiple R	Multiple R^2	F-to-Enter	Prob.
1	HSGPA/CGPA	.5173	.2676	28.494	.10
2	HSGPA+ACTM/CGPA	.5692	.3249	18.455	.10

In Table 9, Step 1 displays results of tests for the relationship between HSGPA and CGPA for vocational-path students. The R^2 of .2676 demonstrates that almost 27% of HSGPA accounted for CGPA. An F-to-enter measurement of 28.494 and a probability of .10 determined there was no significance in the test.

Step 2 in Table 9 used the ACT Mathematics score as the variable to test for a relationship to CGPA. ACTM, in addition to HSGPA, produced an R^2 of .3249. Slightly more than 32% of HSGPA and ACTM accounted for CGPA. An F-to-enter measurement of 18.455 and a probability of .10 demonstrated no significance in the test.

A stepwise multiple regression was used to test for a relationship of the same two variables with regard to general-path students. The results are displayed in Table 10. General-path students registered a slightly higher R^2 of .3314 in Step 1 compared to vocational-path students. HSGPA accounted for 33% of CGPA. The F-to-enter measurement of 31.723 and a probability of .10 demonstrated no test significance.

Table 10.--Stepwise multiple regression: relationship of general-path students' ACT Aptitude measures and HSGPA to CGPA.

Step No.	Variable Entered	Multiple R	Multiple R^2	F-to-Enter	Prob.
1	HSGPA	.5757	.3314	31.723	.10
2	ACTM	.6176	.3817	19.446	.10

The Step 2 comparison of ACTM to CGPA in Table 10 resulted in an R^2 of .3817, which was slightly higher than than for vocational-path students. HSGPA and ACTM accounted for 38% of CGPA. An F-to-enter measurement of 19.446 and a probability of .10 demonstrated no significance in the test.

The results of the second phase of testing for significance are displayed in Table 11. A z-test comparison of vocational-path to general-path students' ACT Aptitude and HSGPA scores to CGPA resulted in a z-value of .435 and a probability value of more than .05. These results demonstrated no significant difference between vocational-path and general-path students in their correlation coefficients displayed in Table 11.

Table 11.--Z-test comparison of vocational-path to general-path students' ACT Aptitude composite scores and HSGPA to CGPA.

Group	N	r	z_r
Vocational	76	.5692	.721
General	61	.6176	.647

Z-value = .435 Probability = > .05

The r-values in Table 11 resulted in z_r-values of .721 for vocational-path students and .647 for general-path students. A comparison of the z_r-values resulted in a z-value of .435. The z-value must be 1.96 to be significant. Based on the results of the two phases of tests, the hypothesis was not rejected. There was no difference in the correlation coefficients of HSGPA and ACT Aptitude scores to CGPA between vocational-path and general-path students.

Hypothesis 3b: Vocational-path and general-path students do not differ in the relationship of ACT Interest Inventory scores to CGPA after two academic terms of college study.

The analysis for this hypothesis was accomplished with a z-test comparison of vocational-path to general-path students' ACT Interest Inventory measures to CGPA correlation coefficients. The results are displayed in Table 12.

Table 12.--Z-test comparison of vocational-path to general-path students' ACT Interest Inventory technical scores to CGPA.

Group	N	r	z_r
Vocational	76	.0789	.077
General	61	.0335	.033

Z-value = .625 Probability = > .05

A z-value of .625 and a probability value greater than .05 demonstrated no difference in the relationship. The t-test results in Table 3 showed no difference between the two groups in their

Interest Inventory scores, reinforcing the failure to reject this hypothesis.

Hypothesis 4a: There is no difference between vocational-path and general-path students' technical course achievement in college technical programs.

This hypothesis was analyzed using a t-test. The results are shown in Table 13, comparing the two groups with regard to TGPA.

Table 13.--T-test comparison of vocational-path to general-path students in technical grade point average.

Group	N	Mean	SD
Vocational	85	2.727	.666
General	66	2.507	.827

T-value = 1.82 Probability = .071

The test resulted in a t-value of 1.82 and a probability of .071. It is of interest that a probability of .05 was sought and a test-value of .071 was found. This measurement was the closest to significance of all the measurements in this study. A more in-depth inquiry into Table 13 reveals a vocational-path TGPA of 2.727 compared to a somewhat lower general-path score of 2.507. Based on the evidence presented, the hypothesis was not rejected.

Hypothesis 4b: There is no difference between vocational-path and general-path students' nontechnical course achievement in college technical programs.

This hypothesis was analyzed using a t-test. The results are displayed in Table 14, comparing the two groups with regard to NTGPA.

Table 14.--T-test comparison of vocational-path to general-path students in nontechnical grade point average.

Group	N	Mean	SD
Vocational	85	2.32	.079
General	66	2.13	.929

T-value = 1.39 Probability = .166

The test resulted in a t-value of 1.39 and a probability of .166, demonstrating no significant difference between the groups; therefore, the null hypothesis was not rejected. Further observation of Table 14 reveals that the difference was closer to significance than that for other hypotheses in the study except Hypothesis 4a. Vocational-path students scored a slightly higher 2.32 GPA in nontechnical courses compared to general-path students' NTGPA of 2.13 after two terms of college study.

Summary

Results of the statistical analyses for each of the eight hypotheses were presented in this chapter. MANOVA, ANOVA, cross-tabulation, t-tests, stepwise multiple regression, and z-tests were

employed to analyze the data. SPSS software on the mainframe computer at Ferris State University was used to operate the program. Summary results of the tests are as follows:

No significant difference was found between vocational-path and general-path students in terms of academic aptitude (Hypothesis 1a).

No significant difference was found between vocational-path and general-path students in terms of ACT Interest Inventory scores (Hypothesis 1b).

No significant difference was found between vocational-path and general-path students in terms of attrition rate (Hypothesis 2a).

No significance was found in determining a relationship in attrition rates using ACT Aptitude and ACT Interest Inventory technical scores as measures between vocational-path and general-path students (Hypothesis 2b).

No significance was found in the degree of correlation coefficients of HSGPA and ACT Aptitude scores to CGPA between vocational-path and general-path students (Hypothesis 3a).

No significance was found in the degree of correlation coefficients of ACT Interest Inventory scores to CGPA between vocational-path and general-path students (Hypothesis 3b).

No significance was found in comparing vocational-path to general-path students on college technical course achievement (Hypothesis 4a).

No significance was found in comparing vocational-path and general-path students in college nontechnical course achievement (Hypothesis 4b).

Vocational-path students' mean scores in ACT Aptitude were slightly higher and their HSGPA slightly lower than those of general-path students (Table 2). Vocational-path students scored slightly higher on the ACT Interest Inventory (Table 3) and had a smaller percentage of dropouts (Table 4) than did general-path students. Vocational-path dropouts scored slightly higher in ACT Aptitude (Tables 5 and 6) and Interest Inventory technical mean scores (Tables 7 and 8). A slightly lower relationship of ACT Aptitude and HSGPA to CGPA for vocational-path (Table 9) as compared to general-path students (Table 10) was found. Tables 11 and 12 showed very little difference in the degree of relationship in ACT Aptitude scores and HSGPA to Interest Inventory scores between the two groups. Vocational-path students' TGPA was close to significance in difference and somewhat higher than general-path students' mean scores as indicated in Table 13. Finally, vocational-path students' NTGPA mean was slightly higher than that of general-path students enrolled in college technical programs at FSU, as shown in Table 14.

CHAPTER V

FINDINGS, CONCLUSIONS, RECOMMENDATIONS, IMPLICATIONS, AND REFLECTIONS

Introduction

This study was designed to compare vocational-path to general-path high school graduates and their success in selected college technical programs. The variables used in the comparison were ACT Standard score, HSGPA, attrition rate, college nontechnical course achievement, and college technical course achievement. The principal question to be answered was whether there were differences between the two groups when using given variables.

One hundred sixty student records were studied. The students were Fall 1989 entrants into three technical programs at Ferris State University. The named programs were Machine Tool Technology, Automotive Technology, and Printing Technology. One hundred thirty-seven students were entering college for the first time. Nine more had completed one term/semester or less and were included in a total of 146. In addition, 16 persons were considered as dropouts, bringing the total population to 160. There were 88 vocational-path students or 55% of the total and 72 (45%) general-path students.

Data were analyzed by Wilks' lambda with post-hoc comparisons, t-tests, z-tests, two-way MANOVA with ANOVA, and multiple

regression. The data were tested on an IBM 3090 Group 110 computer using the SPSS program.

Findings

When comparing the two groups by pretest variables, vocational-path and general-path students did not differ upon entering the college technical programs under study. Vocational-path students scored slightly higher in ACT Standard score and Interest Inventory, but general-path students entered college with a slightly higher HSGPA.

Posttest data comparison of the same two groups included measurement in attrition rates at the end of two academic terms at FSU. Vocational-path and general-path students progressed through their respective programs in college with no difference in attrition rate. Attrition was also compared to pretest variables for possible relationships.

The two groups did not differ in ACT Aptitude or Interest Inventory scores or in relationships between scores. No difference was found between dropouts and persisters in ACT Aptitude and Interest Inventory either. Dropouts in both groups had slightly lower ACT scores than persisters except for the Social Studies score. Dropouts measured slightly higher in both groups. Vocational-path dropouts demonstrated slightly higher interest in their field than persisters and were higher than dropouts and persisters in the general-path group.

A finding not specific to any of the research questions but considered as significant to note was that college technical students, whether vocational path or general path, dropped out of their programs less than the general population at Ferris.

CGPAs were compared to ACT Aptitude scores and HSGPA within each group to determine whether a difference existed. ACTM and HSGPA statistically accounted for only 38% of general-path and 33% of vocational-path students' CGPA. The remaining 62% to 67% of achievement in college was due to other factors. Success of general-path students was slightly more predictable than that of vocational-path students. The spread between vocational-path students' HSGPA and ACT Aptitude scores to CGPA was greater than that of general-path students. This might indicate one reason why vocational-path students are less predictable with regard to CGPA. Even though vocational-path students showed higher ACT scores upon entry into college, those scores accounted for a less predictable level of CGPA than for general-path students. This difference in predictability between the two groups was not significant; therefore, relatedness was the same. When adding in ACT Interest Inventory scores along with HSGPA and ACT Aptitude scores, the two groups were found to be similar. General-path students were as interested in their chosen program as were vocational-path students, although the latter again scored slightly higher.

Technical grade point average was separated from nontechnical grade point average to allow the subjects under study to be tested for differences in performance in each area. Vocational-path and

general-path students' achievement in college technical and nontechnical courses did not differ significantly. Vocational-path students achieved slightly higher GPAs in both comparisons and were very close to significance in the comparison of technical grade point average.

Conclusions

This study was designed to help in understanding vocational-path and general-path students through any differences or similarities found in testing the eight hypothesis. The researcher realizes that answering the research questions has only led to more questions. It would not be difficult to duplicate this study with other populations using the same variables. Considering that none of the null hypotheses was rejected, similar studies would help reinforce or clarify these findings.

A trend seemed to be in evidence with regularity when all the hypotheses, research questions, and data were considered. Vocational-path students demonstrated higher ACT Standard scores and Interest Inventory scores. General-path students scored a little higher in HSGPA only. Vocational-path students dropped out of college less, but those vocational-path dropouts still displayed higher ACT scores. Stepwise multiple-regression analysis indicated a higher predictability of college success using the two standards--HSGPA and ACT Standard scores--with general-path students. The two groups had very similar interest levels in the pursuit of their chosen programs. Vocational-path students demonstrated higher

average grades in technical and nontechnical courses. The technical comparison was close to significance at .071 on a two-tail probability measure. This is important to note, considering an assessment of high school courses indicated that vocational-path students averaged less coursework in English, math, natural sciences, and social sciences.

In conclusion, evidence demonstrates that vocational-path students succeed in similar college technical programs at a slightly higher rate than general-path students. More research on the subject might confirm the trend. There is a possibility that vocational education in high school is worthwhile education for completing a similar course of study in college. It should be noted that a trend is in evidence but that no tests in this study were statistically significant.

There has been much dialogue in recent years about the ability of a person graduating from a vocational program in high school to compete at a college level. This research confirmed that those vocational-path students were having at least the same success in college technical and nontechnical programs as persons graduating from general-path programs.

Recommendations

Strong evidence suggests that more study is needed to resolve whether vocational-path students succeed at a higher rate than general-path students. State Departments of Education should conduct in-depth studies considering the millions of dollars spent

on vocational education in most states, including Michigan. Within the last decade, more vocational-path students have been entering college as opposed to entering the work force after high school graduation, as originally intended. This change in high school graduates' educational direction strengthens the case for further study.

If vocational-path students demonstrated increased levels of aptitude and college grade success over general-path students, possibly more attention should be given to who is being admitted to vocational programs. Considering that so many vocational students find continuation of their education in career choice necessary, standards for admission into vocational programs should be set at the secondary level so that more persons entering those programs can take advantage of their precollege learning of knowledge and skills, such as with the new tech-prep approach. This would allow for a more formal and evenly sequenced articulation between the higher education institutions and high school vocational programs. A continuous flow of subject-matter knowledge would occur rather than the duplication that seems to be present now. More technical material at a higher technical level could be covered in the colleges. Edwards (1975) suggested that learning becomes easier with the use of more human senses, i.e., hearing, touch, and so on, such as in a technical occupation. He also suggested that more academic-type college-bound students consider taking vocational education courses in high school for the same reason.

The increase in high-tech industries might demand that education build a new structure that does not separate public secondary vocational education from similar college technical programs and does not duplicate subject areas. Higher quality college programs could result, and the needs of industry would be met more fully. High school students could see logical steps in goal setting to a technical career. Pursuit of short-term goals with career stops in between could result in successively higher levels of success. Parnell's (1986) statement that we all can shoot better if we can see the target seems to ring true in this case.

More guidance in goal setting toward an occupation in the freshman year of high school might be one possible solution to the problem of high attrition rates in high school. The 27% dropout rate cited by Parnell (1986) is largely among graduates of general studies. Setting some concrete goals toward an occupation could reduce the attrition rate if students were given an opportunity to explore careers through vocational education in high school. Even if they do not pursue the occupation further, perhaps they would be more motivated to stay in high school until completion. The result would be that the success of completing high school might motivate them to continue goal setting and further their education.

Implications

Institutions that provide technical programs need to conduct more research considering the entering students' changing social and

educational demographics. Perhaps a study of technical subject-matter knowledge, given as a precollege entrance test, would help confirm the evidence from this research. A study over a two-year period in similar college technical programs that normally terminate at the associate's degree level might produce more complete and decisive information in answering the research questions.

Vocational-path students' slightly higher success rate in college technical and nontechnical course achievement demonstrates a need for more study. Previous vocational experiences could be the easiest-to-understand reason for the higher technical achievement, but why do vocational-path students score slightly higher than their general-path counterparts in nontechnical courses? Additional study might give some concrete reasons why this is the case. Possibly increased motivation toward set goals that have not been measured by these research variables could provide a clue.

More study is needed to determine whether the higher academic requirements presently confronting high school students will significantly reduce the opportunity of experiencing sound vocational learning. This new situation might reduce the advantage of the high success rate enjoyed by college technical students and vocational high school students. The 2+2 tech-prep approach might be one way of solving the problem. More math and science experiences could be "applied" to their vocational learning. Articulation with colleges offering similar technical programs would avoid duplication of material and allow more time for those applied courses.

Vocational-path and general-path students were compared with the intention of determining whether one group entered college at a higher level than the other. Implications include possible identification of need areas in one group or the other. Identified positive relationships specified through one or more variables could help in realizing what is right with vocational or general education when entering a chosen field. Research has shown that vocational-path students enter college armed with less coursework from the four major high school subject areas. Perhaps they could not take as many of those courses, considering they have chosen a one- to two-year vocational program that requires much time and effort. High school counselors can guide students into vocational programs with more understanding of the needs and abilities of those entering vocational programs. For vocational students to continue to succeed in the future, they might need to possess at least the same HSGPA and ACT scores or higher than the vocational-path students in this study. Or perhaps counselors might now gain a more accurate picture of "who" should be counseled into vocational programs.

Reflections

The lower college attrition rate exhibited by both groups compared to the overall attrition rate at FSU could indicate that a more "focused" program in college allows for direction and goal setting, whereas general studies do not. Maybe more guidance on future occupations in the high school could help reduce the number of nonfocused individuals in college general education tracks.

Do the higher ACT scores and HSGPA of one group indicate a tendency resulting in a proportionately higher CGPA within that same group? If so, counselors, teachers, and college admissions personnel could make more informed decisions in terms of course guidance and student admissions policies. This question would make an excellent and much-needed study considering the effect the results could have on educational thinking.

Another ingredient of the inquiry process was to test the relationship of ACT Interest Inventory scores to CGPAs between the two groups. Can the use of Interest Inventory scores help in predicting success in CGPAs with one group more than the other? If so, teachers, counselors, and college admissions personnel could use Interest Inventory scores along with HSGPA and ACT Aptitude scores to more accurately predict success in college technical programs. There was no significant difference between the two groups in technical interest in this study. A more in-depth study of this topic might clarify the results.

Does one group outperform the other in college academic subjects? The researcher found that administrators, teachers, and counselors in Michigan seem to assume that vocational-path students do not perform as well in academic subjects such as math, English, or science as do general-path students. This attitudinal tendency was evidenced in conversations and interviews conducted by the researcher over the years with secondary and postsecondary educators.

It is logical to assume that if general-path students complete more academic subjects in high school, success in college academic subjects should be greater than with vocational-path students. Conversely, vocational-path students should succeed at a higher rate in similar college technical coursework because of previous high school learning, if all variables are equal. If vocational-path students achieved a high success rate in college technical programs compared to general-path students, can one conclude that it was the result of their high school vocational experience? More study seems to be needed to answer this question, considering that the difference between the two groups in technical grades was not significant in this study but that vocational-path students achieved slightly higher scores in both technical and nontechnical courses. Administrators, counselors, and teachers need to address the situation and possibly realign their thinking on vocational students' academic skill levels.

Vocational-path students achieved slightly higher grades in college nontechnical courses. Why was this so, considering that these students do not take as many general education courses in high school? Possibly vocational-path students do not have to put as much time into learning technical subject matter in college as general-path students and therefore have more time to put into study of nontechnical material. Their slightly higher nontechnical grade point average in this study might lend credence to the idea. Maybe the vocational-path students have a higher level of confidence in themselves because of their previous vocational experience. Also,

vocational-path students' "applied " learning in the technical area might aid them in learning the general education subjects. This might explain why vocational-path students' ACT Aptitude scores were a bit higher than those of general-path students, even though the latter took more coursework in the four major areas while in high school.

There were slight differences in this area and throughout the study that demonstrated tendencies. Vocational-path students demonstrated slightly higher scores than their general-path counterparts throughout the study. One possible reason is that previous vocational experience made the difference.

APPENDICES

APPENDIX A

HIGH SCHOOL COURSEWORK

Table A.1.--High school courses completed by vocational-path and general-path students (average years of school).

	English	Foreign Language	Math	Natural Sciences	Social Sciences	Other Courses
Vocational path (n=25)	3.21	.13	2.6	2.13	2.74	Typing Computer
General path (n=14)	3.40	.27	3.1	2.50	3.00	Music Computer

Note: The sample represents a 25% sampling of a population of 160 students.

APPENDIX B

DESIGNING YOUR FUTURE

Draft--For Discussion Only
June 15, 1989

DESIGNING YOUR FUTURE

ADVICE FOR HIGH SCHOOL STUDENTS

Presidents Council,
State Universities of Michigan

DESIGNING YOUR FUTURE

ADVICE FOR HIGH SCHOOL STUDENTS

As you and your parents, with the assistance of teachers and counselors, plan a high school program, you should be aware that the courses you take will have a major effect on the college and career choices that will be open to you following graduation. If you plan to attend college, your prospects for admission to particular programs and your success if admitted will be improved if you have strong academic skills and competencies. When planning for the ninth grade, however, only a few students are absolutely certain of their future goals; most will want to try out a variety of subject areas in order to learn more about their abilities and preferences. It is to this large majority of students and their parents that this statement is addressed.

Since courses tend to increase in complexity from year to year, the program you take in the ninth grade is likely to have a significant effect on the courses that can be taken in the twelfth grade. Thus it is extremely important that the first choices be made wisely. While the precise requirements for admission differ among universities, and among different programs in the same institution, the four-year public universities of Michigan have agreed that to be eligible for admission to a baccalaureate degree program at one of the state universities, a student must fulfill the requirements outlined in this statement. Certain programs (art and music, for example) have specialized admission requirements. If you

are considering such programs, you should obtain detailed information about admission requirements from school counselors or directly from the appropriate admissions office.

The requirements and recommendations in this statement will become effective for those persons seeking admission to one of the state universities for Fall Semester 1993 and thereafter. Applicants who have completed the equivalent of 30 semester hours of college level work or who have been out of high school for at least three years will not be held to these requirements and recommendations. These applicants should contact the university admission offices of their choice to obtain information about the specific admission standards that apply to them.

While these requirements and recommendations apply particularly to the schools that are sponsoring this statement, we believe that if you follow this advice, you'll have a better chance for admission to and success in any institution of higher education.

REQUIREMENTS:

ENGLISH
(4 years required)

The ability to read critically and to comprehend what is being read is a necessity in today's world, and is fundamental for success in college. You should be able to recognize assumptions, to identify the author's intentions, to recognize the various forms of literary expression and to understand and react to the author's message. While developing these skills, you should become familiar with a wide range of literature representing all literary forms and drawn from a variety of cultures.

It is as important to be able to express oneself clearly as it is to understand what has been written by others. So, you should be able to use the spelling, grammatical, and structural conventions of written English to convey ideas in an effective manner. College programs typically require the ability to organize and present information and concepts in written form, and the most successful students will be those who have practiced these skills while in high school. This includes collecting and organizing information, preparing an outline, writing a rough draft, and reorganizing, revising, and editing until the result is a logical sequence of smoothly flowing paragraphs leading to a conclusion.

The ability to speak logically and succinctly in such a way that your ideas or opinions can be understood by the listeners will be of great value to you. Try to practice this skill while in high school.

MATHEMATICS

(3 years required; 4 years strongly recommended)

Mathematics is the language of modern science and technology, and increasingly of business, finance, and other professions as well. Colleges are putting more emphasis on math preparation when they make their admissions decisions, because students who take less than four years of math in high school often find it necessary to spend valuable time making up that deficiency before they can begin work in their major.

High school preparation should include a minimum of three years of mathematics, including intermediate algebra. A fourth year course is strongly recommended, preferably precalculus if it is offered. In any event, it is important that high school seniors make every effort to enroll in a math course to keep familiar with the subject. If you have the time to take additional math courses, do so, especially if you wish to consider one of the many mathematically oriented professions (for example, engineering, science, and business). Probably the most useful fifth course for many students would be an introduction to probability and statistics, but other alternatives should be considered.

BIOLOGICAL AND PHYSICAL SCIENCES

(3 years required, to include 1 year of biological science and 1 year of physical science, and at least 1 year of a laboratory course)

As technology becomes increasingly important in everyday life, everyone needs an understanding of fundamental scientific concepts. If you're considering careers in the health sciences, engineering, or technological fields, you must have substantial preparation in the basic sciences. You should take year-long courses in biology, chemistry, and physics, and obtain experience in laboratory methods.

HISTORY AND THE SOCIAL SCIENCES

(3 years required; 1 year of world history and 1 year of American history strongly recommended)

Through the study of history and the social sciences, you should develop the ability to recognize historical trends and relationships, to understand the interactions among peoples of western and non-western civilizations, races, and cultures, and to trace the chronology of major historical events or periods and social movements.

As important as knowing the events themselves is an understanding of the underlying forces that shape those events, whether political, economic, social, or psychological. You should have exposure to these subjects, whether in individual courses or as elements in a survey course. A course which shows how the scientific method can be utilized in the social sciences to examine major issues and to solve problems will be particularly useful.

FOREIGN LANGUAGE

(3 years strongly recommended)

Language is the basic instrument of thought and expression, and only through the knowledge of people's language can one hope to understand their culture. Training in a foreign language increases one's awareness of the cultural diversity among the people of the world, and at the same time it heightens one's insights into the structure and form of the English language.

Foreign travel and communication are very important in many professions and if you can offer this skill, you'll enjoy expanded career opportunities. Many college programs require that you demonstrate proficiency in a foreign language as a prerequisite for graduation, so if you've already achieved such proficiency in high school, you'll have more time to devote to advanced work in college. Extra work in other fields, too, can sometimes lead to advanced placement and a reduction in the amount of introductory work a student must take in college.

FINE AND PERFORMING ARTS

(1 year required; 2 years strongly recommended)

The study of visual art and the performing arts enriches our lives and heightens our awareness of beauty and our aesthetic perception. You should be acquainted with each of the arts. If you intend to seek admission to a college-level program in one of the arts, you may need intensive training at the high school level, often involving private study outside the school setting.

COMPUTER LITERACY

(1 year of hands on experience strongly recommended)

As computers play a growing role in all aspects of our lives, they are also becoming increasingly important in all fields of study at the college level, including many fields not normally viewed as technical in orientation. If computer instruction is available, you should take the opportunity to gain an understanding of the use and logic of computers in word processing, problem-solving, and in data storage, retrieval, and analysis.

IT'S YOUR FUTURE

We urge you to make the best use of courses offered by your high school. Simply taking courses, even difficult ones, will not guarantee college or work success in the future. By developing your academic skills and competencies, however, you will be well-prepared for a wide variety of college programs and career options. The worksheet below is provided to help you plan and monitor your high school program. You should contact the admissions office of the university to which you intend to apply for more detailed information.

A good education provides a foundation for making many important personal decisions. So make your high school years count, it's one of the best investments you will ever make. You have our best wishes for a rewarding and productive future.

APPENDIX C

STUDENT RETENTION RATES

Table C.1.--Student retention rates by ACT score, Fall 1987 to Fall 1988, Ferris State University.

ACT Range	Counts of Fall 1987 FTIACs	Counts Remaining in Fall 1988	Retention Rates
Missing	105	51	48.6%
1-10	366	178	48.6%
11-13	557	320	57.5%
14-16	615	398	64.7%
17-19	535	353	66.0%
20-22	362	249	68.8%
23-25	213	160	75.2%
26-28	82	56	68.3%
29-35	7	6	85.7%
Total	2,842	1,771	62.3%

Table C.2.--Student retention rates by HSGPA, Fall 1987 to Fall 1988, Ferris State University.

HSGPA Range	Counts of Fall 1987 FTIACs	Counts Remaining in Fall 1988	Retention Rates
Missing	273	154	56.4%
Los-1.49	10	3	30.0%
1.5-1.99	234	126	53.8%
2.0-2.49	989	535	54.1%
2.5-2.99	797	520	65.2%
3.0-3.49	375	288	76.8%
3.5-4.00	164	145	88.4%
Total	2,842	1,771	62.3%

APPENDIX D

DATA-COLLECTION MATRIX

DATA-COLLECTION MATRIX

Record 1: Premeasures

Column #	Code	Code Explanation
1,2,3	1-200	Student ID code
4,5	1	General-education-path students
	2	Vocational-education-path students
6,7	E	ACT English Standard score
8,9	M	ACT MAthematics Usage Standard score
10,11	S	ACT Social Studies Reading Standard score
12,13	N	ACT Natural Sciences Reading score
14,15	C	ACT Composite score
16,17	II	ACT Interest Inventory Standard score
18,19,20	HSGPA	High school grade point average

Record 2: Postmeasures

Column #	Code	Code Explanation
1,2,3	TGPA	Technical grade point average
4,5,6	NTGPA	Nontechnical grade point average
7,8,9	CGPA	College grade point average after two terms
10,11,12	DO	Dropouts (leavers) at two terms
13,14,15	1-200	Student ID code

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