Predictors of student persistence among technical programs at Montana State University-Northern
by Virgil Carolus Hawkinson

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Education
Montana State University

Abstract:
The purpose of this study was to identify predictors of persistence, as measured by semester credit hours earned, for students enrolled in technical programs at Montana State University-Northern (MSUN) from Fall semester 1993 to Spring semester 1997. Based on data provided by the Registrar, a list of student background variables and organizational measures of academic achievement was identified to help compare predictors of persistence for each program of study. Correlation and stepwise regression analyses confirmed the statistical significance that eight variables predicted persistence in various technical programs at MSUN. These eight variables were college grade point average, ACT composite scores, ACT math scores, ACT science scores, ACT reading scores, high school grade point average, high school rank and number of semesters enrolled at MSUN.

PREDICTORS OF STUDENT PERSISTENCE AMONG TECHNICAL PROGRAMS AT MONTANA STATE UNIVERSITY-NORTHERN

by

Virgil Carolus Hawkinson

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of the requirements for the degree

of

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APPROVAL

Of a dissertation submitted by

Virgil Carolus Hawkinson

This dissertation has been read by each member of the dissertation committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate studies.

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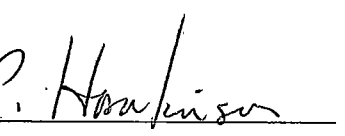
Signature 

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ABSTRACT

The purpose of this study was to identify predictors of persistence, as measured by semester credit hours earned, for students enrolled in technical programs at Montana State University-Northern (MSUN) from Fall semester 1993 to Spring semester 1997. Based on data provided by the Registrar, a list of student background variables and organizational measures of academic achievement was identified to help compare predictors of persistence for each program of study. Correlation and stepwise regression analyses confirmed the statistical significance that eight variables predicted persistence in various technical programs at MSUN. These eight variables were college grade point average, ACT composite scores, ACT math scores, ACT science scores, ACT reading scores, high school grade point average, high school rank and number of semesters enrolled at MSUN.

CHAPTER 1

INTRODUCTION

Studies of student persistence have been conducted at many post-secondary institutions and the authors of these studies have reported varying results. The purpose of this study was to identify predictors of persistence for students enrolled in technical programs at Montana State University-Northern (MSUN). MSUN, at the time of this study, served 2,000 students from four Indian reservations and a rural area in Northcentral Montana of nearly 32,000 square miles. MSUN is a statewide resource for technology education and has undergraduate technical programs that provide transfer opportunities for Montana's colleges of technology, tribal colleges, and community colleges (Montana State University- Northern Catalog, 1997).

MSUN admits graduating high school seniors with a 2.5 high school GPA and an ACT composite test score above 20, or SAT combined verbal and math scores of 930 or higher, or rank in the upper half of their high school graduating class. Students over the age of 21, part-time students,

transfer students and students enrolling in certificate or associate's degree programs are exempt from these requirements (Montana State University-Northern Catalog, 1997).

At the time this study was conducted, technical programs encompassed vocational/technical degrees (auto body, auto mechanics, diesel mechanics, drafting, farm mechanics, machining, railroad operations, and welding), technical management degrees (agriculture, computer information systems, manufacturing technology, and water quality), and engineering technology degrees (civil and electronics). These technical programs had diverse requirements for manual skills, levels of mathematical and scientific abstraction, and interdisciplinary studies. Any attempt to apply predictors of success from previous studies was complicated by variation among MSUN vocational/technical, technical management, and engineering technology programs regarding mission, goals, leadership styles of program faculty, academic expectations, and accreditation requirements.

Problem Statement

MSUN has a graduation rate considerably lower than the national average of its peer institutions which causes financial problems as a result of its enrollment driven funding. Students enter academic programs with a variety of family backgrounds and academic experiences which may influence their expectations, commitment to education, and ability to persist. Studies on attrition suggest student background characteristics are related to persistence and that students may leave an academic program for multiple and disparate reasons (Cope & Hannah, 1975; Pantages & Creedon, 1978; Spady, 1970; Tinto, 1975). Leaving an academic program may be due to a mismatch between the student and the institution, a temporary condition due to finances or personal problems, or a result of changing goals (Tinto, 1975).

Retention of students from fall 1996 to school year 1997-98 in technical majors ranged from 25% to 100% (MSUN registrar, 1998). These data are shown in Table 1.

Table 1. Retention From Fall 1996 to School Year 97-98 by Major.

Major	Number of students	Retention
Ag Mechanics A.S.	10	80%
Ag Mechanics B.S.	11	82%
Ag Technology A.S.	25	72%
Autobody A.S.	13	31%
Auto Mechanics A.S.	24	71%
Auto Mechanics B.S.	32	94%
Auto Mechanics B.T.	3	67%
Civil Eng. Tech. A.S.	4	100%
Civil Eng. Tech. B.S.	15	60%
Civil Tech. B.S.	3	67%
Computers A.S.	11	55%
Computers B.A.	36	69%
Diesel Tech. A.S.	19	74%
Diesel Tech. B.S.	58	83%
Diesel Tech. B.T.	4	25%
Drafting A.S.	21	76%
Drafting B.S.	49	78%
Electronics A.S.	9	67%
Electronics B.S.	32	60%
Manufacturing A.S.	2	50%
Manufacturing B.S.	13	62%
Metals Tech. A.S.	6	33%
Railroad Operations A.S.	1	100%
Water Quality A.S.	11	55%
Water Quality B.S.	8	63%

Note. A.S. = Associate of Science Degree; B.S. = Bachelor of Science Degree B.T. = Bachelor of Technology Degree.

Clearly, some technical programs did considerably better and some did considerably worse than the institutional average of 68% retaining their students from Fall semester of 1996 to the Fall semester of the following school year.

Need for the Study

MSUN had an average graduation rate of 28.2% for a six year cohort beginning Fall semester 1988 compared to an average graduation rate of 42.5% with its peer institutions

(AASCU, 1995). This difference in graduation rate suggests a need to study persistence at MSUN.

Initial attrition research centered on psychological attributes that defined the dropout-prone student. This line of inquiry resulted in few significant results and contradictory profiles (Pantages and Creedon, 1978).

Nationally, student attrition has remained fairly constant at about 45% for the past century (Tinto, 1982a). Tinto (1982b, 1989) estimated that 57% of all freshmen leave college without completing a degree. Porter (1989) indicated that only 15.5% of students at four year institutions graduate in four years and Johnson (1994) reported that 42% of full-time students who entered a university in 1985 failed to get a degree from that university within five years.

Beal & Noel's (1980) national survey indicated that retention rates vary from one type of post-secondary institution to another and by programs within institutions. Consequently, one can not necessarily apply predictors of success found in previous and more generic retention studies of large urban institutions, vocational schools, community colleges, or liberal arts colleges as predictors of success in technical majors at MSUN.

There were few studies of different disciplines within comprehensive institutions that could help differentiate predictors of success among diverse majors. Hativa and Marincovich (1995) found that "issues related to disciplinary differences continue to be vaguely defined and underexplored". Of the literally thousands of studies of teaching, learning, and teacher evaluation in higher education, very few have examined disciplinary differences" (p. 2).

Academic disciplines exist in different types of colleges and universities, and the distinctive missions of these institutions may work to enhance or diminish the significance of different predictors of success. Thus, the distinctive disciplinary perspectives regarding undergraduate education curriculum noted by Lattuca and Stark (1994, 1995) must be considered within the institutional context where respective disciplines exist, as those differences are not consistent across the diverse types of colleges and universities. To neglect disciplinary or institutional context is to risk an incomplete, and potentially misleading, picture of undergraduate education in American higher education (Smart & Ethington, 1995).

Failure to match students with majors in which they will succeed results in unnecessary financial burdens to students, to the educational institution, to taxpayers, and to the business community. Data related to academic program completion may prove useful for establishing a clearer context for student advising, preparing accreditation self-studies, reviewing program content, and developing more effective retention and recruitment programs.

Significance of This Study

Studies on student persistence have been conducted at a multitude of both private and public institutions. The significance of the variables found to be related to persistence vary from study to study. While there were many factors that contributed to student persistence, these clearly were linked to both the background variables of the student and the record of academic performance within the institution.

Research in persistence is important because both the income and expenditures of an educational institution are directly related to the number of students in attendance. Institutional decisions must be based on some rationale

that alleviates wasted resources associated with poor college persistence rates. Each institution must maximize the efficiency of admissions selection, financial aid, and counseling with students who are likely to persist. The success of institutional efforts to improve persistence rates depends on matching students who are likely to persist with a program of study that best meets their academic qualifications. This needs to be done as soon as possible because most attrition in higher education occurs in the freshman year (Terenzini & Pascarella, 1977).

This study helped determine which variables were related to persistence for students enrolled in technical programs from Fall semester 1993 to Spring semester 1997 at MSUN. Knowledge of these variables can aid in developing appropriate strategies to remedy potential problems, to analyze institutional policies, and to implement changes in policy. Although this study was limited to technical programs at MSUN, the findings may prove useful to counselors, academic program advisors, and administrators who are responsible for developing and funding similar programs at other post-secondary institutions similar to MSUN.

Purpose

The purpose of this study was to identify predictors of persistence for students enrolled in technical programs at MSUN. MSUN, a state-supported, comprehensive college, has programs of study that are similar to programs found in other state-supported colleges. The technical programs at MSUN cover much of the spectrum of Biglan typology (Biglan, 1973) in regard to level of paradigm development (hard vs. soft), application (theoretical vs. applied), and objects of study (life vs. nonlife).

A list of student variables was used to help predict the likelihood that students would complete various technical programs. These variables included student background information such as ACT scores and high school grade point point averages (Pascarella, 1982) and college grades. This study utilized data sources and definitions that are commonly available at colleges and universities. Using information from transcripts should help identify and compare predictor variables for student success in various majors (Lanni, J. C., 1997).

Research Question

The question to be answered in this study is which student background variables and performance measures related to college are most useful as predictors of persistence for students enrolled in technical programs at MSUN from Fall semester 1993 to Spring semester 1997?

Definition of Terms

The following terms (excluding persistence), which were used in this study, were adapted from the National Center for Higher Education Management Systems and came from a set of categories developed by Terenzini (1987).

Persister- A person who is continuously enrolled in an approved program of study--certificate, diploma, associate's degree, or developmental--until ontime/sometime completion of requirements for graduation.

Persistence- The number of semester credit hours earned at MSUN.

Withdrawal- A student whose enrollment termination is

individually or institutionally requested before the end of the term. Individual withdrawals can be formal or informal.

When formally withdrawing, the student applies voluntarily for termination. An informal withdrawal means that the student simply walks-off from the college without any warning. An informal withdrawal may be converted to formal withdrawal by administrative action.

Institutionally initiated withdrawals--suspensions and dismissals--are administrative actions taken unilaterally by the college to cancel/prevent temporarily or permanently the student's course registration.

Research Methodology

Background data and college grades were collected on 691 students enrolled in thirteen associate's degree technical programs and nine bachelor's degrees in technical programs at Montana State University- Northern from Fall Semester 1993 to Spring Semester 1997. Existing college student records were downloaded from the college mainframe to Excel spreadsheet files.

Data collected for this study included: first term of attendance at MSUN, gender, birthdate, race, ACT scores

(English, math, reading, science, and composite), high school GPA, high school rank, size of high school graduating class, last term attended at MSUN, college program (major), cumulative credit hours passed, and cumulative GPA. Persistence was measured by the number of semester credit hours earned at the time of withdrawal or graduation at MSUN.

Independent variables were categorized into two classes: (a) background variables, and (b) organizational variables (Pascarrella, 1982). The following background variables represent facts about students before they entered college: ACT English scores, ACT Math scores, ACT Reading scores, ACT Science scores, ACT Composite scores, birthdate, race, gender, high school grade point average, high school rank, and size of high school graduating class.

Organizational variables indicated performance within MSUN and were derived from the academic record of the student. Organizational variables represent facts about students after they entered college: program major, credit hours earned, and college grade point average.

Data analysis was conducted in two phases. First, a preliminary analysis of the data (frequencies, means, standard deviations) took place to compute descriptive

statistics of the students' background variables and record of academic performance (organizational variables) at MSUN. Pearson correlations were used to examine the background and organizational variables relative to persistence (measured in semester credit hours) and to provide a basis to screen out variables that were not related or collinear.

The second phase of the analysis developed predictive equations from the remaining variables. Multiple regression was then used to examine the comparative impact of each independent variable on the dependent variable persistence with all other independent variables controlled. An Excel Spreadsheet (Excel 97) and the Statistical Package for the Social Sciences (SPSS 8.0) was used to conduct the statistical analysis. A review of the literature that was conducted concerning these variables is covered in Chapter 2.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

No single variable or theoretical model explains student persistence at the college level. Students who withdraw from college are not homogenous with respect to their background, personal characteristics, socialization to the college, or their reasons for attending a particular institution. In addition, there is a lack of common definitions about who should be considered as dropouts (voluntary or nonvoluntary), temporary stopouts, transfer students, or returning students. This review of the literature helped determine the appropriate variables to be used in this study. The background variables utilized in this study included ACT/SAT scores, age at initial enrollment, ethnicity, gender, high school grade point average, high school rank, and size of high school graduating class. The organizational variables used in this study included program of study, number of semesters

at MSUN, average credit hours per semester, and cumulative grade point average.

Models of Student Attrition

Many models of student attrition were developed from the 1920s to the present to explain the apparent inconsistencies among groups of students regarding success in college. These various approaches to understanding why some students persisted and others did not can be grouped into the following models: environmental models, business models, socialization models, models based on prematriculation characteristics, person-role fit models, longitudinal-process models, and Tinto's model.

Environmental Models

Some models of college effects on students were developed based on definitions of the environment. These models defined environment as a reality external to individuals, while other perceptual models defined the environment as based on the individual's perception (Pascarella & Terenzini, 1991). Wicker (1973) found that behavior was shaped according to a balance among the number

of people in the setting, activities performed, and physical size of the setting. Other models (Heilweil, 1973; Schroeder, 1980) were based on the idea that architectural features of the campus created environments which shaped the behavior of people occupying them, regardless of their individual differences.

Holland (1985) maintained that environments were determined by the personality of the individuals who dominated them. Pascarella (1985) proposed a general causal model that considered an institution's structural characteristics and general environment as factors for student change. In their book, *How College Affects Students*, Pascarella and Terenzini (1991) also looked for environments in which students were most comfortable.

Business Models

Bean (1980, 1983) attempted to explain the college persistence process by using models of organizational turnover and models of attitude-behavior interactions. Bean maintained that student attrition was analogous to turnover in business organizations and stressed the importance of intention (to stay or leave) as a predictor of persistence behavior. In an article in *Research in*

Higher Education, Bean (1980) applied a model of employee turnover in industrial settings to the study of student attrition in a university. His theory was modified by Bean and Metzner (1985) to fit nontraditional students, (defined as older, part-time, commuters) and they subsequently applied this model to a study of a commuter university (Metzner & Bean, 1987).

Socialization Models

Socialization models focus on the process and origins of changes in students. One of the earliest models was developed by Astin (1970) and was known as the "input-process-output" model.

Spady (1970), Tinto (1975), and Bean (1980) described models to account for the retention of college students aged 18-24 who were enrolled full-time in residential four-year colleges or universities. Spady (1970) developed concepts of academic and social integration, which were included in retention models developed by Tinto (1975) and Bean (1980). Writing for the *Review of Educational Research*, Bean (1985) surveyed 5,235 students at a major Midwestern research university and found that social life had large significant effects on institutional fit for

freshmen, sophomores and juniors. Students seemed to have a much greater effect on the attitudes of other students than do faculty members. Therefore, students could be considered the primary agents of socialization.

The student/institution interaction theories of Rootman (1972), Spady (1971), Tinto (1975,1987), Astin (1984) and Bean (1985) focused on what occurred between the student and the institution during a student's tenure at the institution.

Aitken's (1982) model was based on the premise that a student's decision to remain at a specific university or college was directly determined by first year student retention (GPA), academic satisfaction (perceived GPA), living satisfaction (peer group relationships, material aspects of residential living), and academic performance (high school rank and SAT scores).

In his book, *Achieving Educational Excellence: A Critical Assessment of Priorities and Practices in Higher Education*, Astin (1985) proposed a "theory of involvement" to explain student development. This theory proposed that the institutional role was an important factor in how students interact with different people and new ideas. Weidman (1989) also developed a model of undergraduate

socialization that included both psychological and social structural influences on student change.

Ashar and Skenes (1993) found smaller sized classes were more likely to retain students than less socially integrated and larger classes. They also suggested that what kept adult learners in educational programs were the social aspects of the learning environment.

Atheoretical Models: The Descriptive Studies

The early descriptive studies were atheoretical because these were not based on a theory that linked the variables. Institutional researchers only described the extent of attrition, the time when students were most likely to drop out, and identified selected characteristics of the dropout. (Bean, 1982a).

Models Based on Prematriculation Characteristics

Other studies attempted to identify factors that predicted which students would persist or drop out. In their book *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research,* Fishbein and Ajzen (1975) postulated that dropout decisions at a university should be the result of past behavior, attitudes, and

norms. They believed intent replaced institutional commitment as the immediate precursor to dropout decisions. Outcomes of these studies focused on strategies for admission and not on strategies for retention. These studies did not explain why predictive factors work (Bean, 1982a).

Rootman: Person-Role Fit

Writing in *Sociology of Education*, Rootman (1972) used data collected on 343 freshmen at the United States Coast Guard Academy to study the relationship between characteristics of the individual and requirements of the student role. Students who discussed leaving the academy with both outsiders and insiders were more likely to leave. Interpersonal fit and person-role fit were negatively associated with voluntary withdrawal. In Rootman's model, voluntary student withdrawal was viewed as a result of the failure of the socialization process.

Longitudinal-Process Models

The longitudinal models of Spady (1970), Tinto (1975), Pascarella & Terenzini (1980), and Bean (1980) contained four common sets of predictor variables: background variables, social integration, external and environmental

variables, and student satisfaction with instruction & grades. Spady (1970) built on Durkheim's (1961) idea that shared group values and friendship support were expected to reduce suicide. In Spady's model, shared group values, grade performance, normative congruence, and friendship support were expected to lead to increased social integration. As social integration increased satisfaction and institutional commitment, the likelihood of dropping out of school was reduced. Spady identified family background, academic potential, ability, and socio-economic status as important in the dropout process.

Writing in *Review of Educational Research*, Tinto (1975) used the following background characteristics: family background, individual attributes, and precollege schooling. He concluded these background characteristics influenced commitment to graduation and institutional commitment.

Pascarella (1980) emphasized the importance of informal student contact with faculty members. Background characteristics of students were expected to interact with institutional image, administrative policies and decisions, size, admissions, and academic standards to directly influence persistence/withdrawal decisions. Pascarella,

Smart, and Ethington's (1986) study also confirmed the importance of the person-environment fit for degree persistence and completion.

Research conducted by Bean (1980, 1985) drew from Tinto's model of departure to develop a theory of dropout syndrome. Writing in *Research in Higher Education*, Bean (1980) found that men and women leave the university for different reasons. Institutional commitment was the most important variable in explaining dropout for students of both sexes. Men were more likely than women to leave a university even though they were satisfied and women who were satisfied were more committed to the institution and less likely to leave.

Bean's (1982b) model contained variables which reflected the student's interaction with the institution (grades, practical value of the education received, the sense of self-development due to schooling, the repetitiveness of school life, information related to the student role, participation in decision making, having close friends, having the courses one wants to take, being treated fairly, and memberships in campus organizations). Using these variables, Bean was able to describe about 50 percent of the variance in dropout in a study of a single

institution.

Tinto's Model

The most well known model of college attrition was Tinto's (1975, 1987), a longitudinal model that attempted to explain the college student attrition process. Tinto developed a "Model of Student Departure" using the work of Van Gennep (1960) and Spady (1970). The predictive validity of Tinto's "Model of Student Departure" (1975, 1987) was supported by Pascarella & Terenzini (1980).

Tinto described the dropout decision as the consequence of a process in which each student brings to college various personal and academic characteristics. These characteristics were modified through interactions with members of the academic and social systems of the institution. The positive interactions led to greater integration and retention, while negative interactions isolated the individual and led to withdrawal. Tinto found the disposition of the student (intention and commitment) and the nature and extent of interactions within the institution (adjustment, difficulty, incongruence, and isolation) to be critical factors in a student's decision to withdraw.

According to Tinto (1975), a student's lack of integration into the social system of a college resulted in low commitment to the institution and increased the probability of dropping out. Insufficient academic integration resulted in voluntary or forced student dropout.

Tinto viewed the attrition process as a series of changing commitments and experiences affecting students' integration and decisions to withdraw or continue in the institution. This model was based on the assumption that students enter an institution with certain specifiable background characteristics and a measurable level of initial commitments. Interaction with the institution affected academic and social integration.

Most of the criticisms of this model were based on its limited explanatory power and inconsistent results. In his paper presented at the annual meeting of the American Educational Research Association, Bean (1979) suggested these inconsistent results were often due to different operational definitions (attrition, dropping out, persistence and retention) used by the researchers.

Studies Based on Tinto's Model

Terenzini and Pascarella (1977) assessed the validity of Tinto's (1975) theory of student attrition. A random sample of 500 freshmen from Syracuse University was mailed questionnaires. The findings from this study largely supported the predictive validity of the principal elements of Tinto's model of student attrition. Persisters had significantly more positive perceptions of both their academic programs and their nonacademic lives than did leavers. Persisters reported more contacts with faculty members and also reported their nonacademic lives to be more demanding and challenging than did leavers.

A longitudinal study of 1,905 incoming freshmen at Syracuse University by Pascarella and Terenzini (1979,1980) generally supported the predictive validity of the major dimensions of Tinto's model. Persisters considered student-faculty relationships more important than peer relationships.

Terenzini, Wendell, and Pascarella (1981) tested the predictive validity of Tinto's model of college student attrition by comparing freshmen (2,100 to 2,400) at two large, comprehensive, research-oriented institutions. The results of their replication of one of their former studies

(Terenzini and Pascarella, 1978) appeared reasonably consistent.

Writing in the *American Educational Research Journal* and *Research in Education*, Pascarella and Chapman (1983a, 1983b) supported the predictive validity of Tinto's model. These researchers found social integration played a stronger role in influencing persistence at a four-year, residential institutions and academic integration was more important at two and four-year commuter institutions.

Pascarella, Duby, and Iverson (1983) found evidence that structural integration (grades) and normative integration (intrinsic reward of intellectual development) are significant in predicting persistence regardless of the type of post-secondary institution. Writing in the *Journal of Educational Psychology*, Pascarella and Terenzini (1983), based on a study of a sample of 763 university freshmen generally supported Tinto's contention that persistence/withdrawal behavior was essentially the result of a longitudinal process of person-environment. Getzlaf, Sedlacek, Kearney, and Blackwell (1984) used a questionnaire sent to 388 undergraduate Washington State University students that also validated the major constructs of Tinto's model.

Terenzini and Pascarella (1984) used a random sample of 1,905 freshmen at a large, independent, residential university in New York State. They found that men living in a residential environment characterized by a comparatively higher level of institutional and goal commitment were more likely to continue their education than men living in residential units whose occupants had lower commitment levels. These results were consistent with theoretical expectations based on Tinto's (1975) model.

Terenzini et al., (1985) used a sample of 1,105 students at a large, comprehensive, research-oriented university. The results of this study again supported the major constructs and causal linkages in Tinto's model of college student attrition by showing predictive validity of voluntary attrition between the freshman and sophomore year.

Pascarella, Terenzini, and Wolfle (1986) found exposure to orientation had an effect on freshman year persistence using variables from the constructs of Tinto's model. Nora (1987) in a study based on Tinto's attrition model found high school grades and encouragement by others before entering a community college were two precollege factors significant in the retention process.

Writing for the *Journal of College Student Development*, Stoecker, Pascarella, and Wolfle (1988) sampled 10,326 students from among 487 colleges and universities and supported Tinto's contention that persistence-withdrawal behavior was largely the result of a longitudinal process of person-environment fit. Stage's (1988,1989) survey of 313 nontransfer students at a major public university in the Southwest also supported Tinto's suggestion (1975, 1988) that relationships among variables undergo continuous modification based on a student's interaction with the college environment and that student background variables influence persistence.

Nora, Attinasi Jr., and Motanak (1990) used a sample of 1,036 first-time college freshmen enrolled in developmental education courses in a large community college. Their study supported the constructs in Tinto's model by finding a positive effect of academic integration on retention.

Writing in the *Journal of College Student Development*, Mutter (1992) supported Tinto's (1987) theory of departure in factors of social and academic integration and goal and institutional commitment. The students reported fewer social than academic links to the (community) college and persisters were surer of their career choices than

nonpersisters.

Using Tinto's model, Lam (1984) studied freshman dropouts and found six significant variables: student status (full-time, part-time), residence, financial resources, distance of home from the university, goal fulfillment, and satisfaction with the university atmosphere. Lam found part-time status increased the tendency to dropout; residence off campus increased dropout tendency, financial resources reduced dropout probability; those who lived within 150 miles of the institution were less likely to withdraw than those who came from farther away; and satisfaction with the campus environment decreased the tendency to withdraw. These findings, in the context of Tinto's model, demonstrated the varying degrees of readiness with which students entered a university.

Problems of Predictive Validation

Perhaps the most important concern is assuring data quality when attempting to define and measure student goals and institutional policies. Student centered theorists defined attrition as mutual student/institution failure to meet the student's goal for development or education (e.g.

Tinto, 1987; Cope and Hannah, 1975). Student persistence/withdrawal behavior was thought to be influenced by a variety of institutional practices and different aspects of the institutional environment such as admissions policies, academic quality, teaching quality, intellectual development, student-faculty interactions and the quality of residential life (Pascarella, 1982). Getzlaf, Sedlacek, Kearney, & Blackwell, (1984) concluded that the population of students who withdrew from college was not homogenous with respect to educational history, reasons for attrition, and prognosis for continuing higher education.

The problems of predictive validation can be classified into the following groups: maturation, control, rationalizations, race, timing issues, variation among high schools and inconsistencies of definitions.

Maturation

In an article in *Sociology of Education*, Eckland (1964b) stated that a variety of factors may intervene between dropping out and returning to college. Some of the predictive items and self-reported reasons were associated with early attrition, while other items appeared to be

significantly correlated with later career decisions.

Berdie and Prestwood (1975) found the variables which best predicted academic success in the freshman year had little or no usefulness in predicting academic success over four years of college for certain students. In his report titled *A Review of Research on the Prediction of "Academic Performance" After the Freshman Year*, Wilson (1983) observed that the predictive validity of preadmissions measures for both minority and non-minority students were higher for long-term college GPA than for short-term college GPA.

Control

The person-role-fit strategy (Rootman, 1972) was limited because public institutions had little control over the personality types of the students who matriculated. In his book *New Directions for Institutional Research: Studying Student Attrition*, Terenzini (1982) observed that attrition studies, without exception, were correlational because no causal links could be established in an educational setting.

Rationalizations

Braxton, Brier, and Hossler (1988) observed that reasons given by withdrawing students through either exit interviews or post-hoc surveys may have been socially acceptable rationalizations. They concluded these reasons should not be readily accepted as primary reasons for student attrition.

Race

In his book *Measures in the College Admissions Process: A College Board Colloqium*, Sedlacek (1986) argued against use of the freshman year grade-point average (FGPA) as the primary criterion for measuring the academic success of minorities. Sedlacek's argument was based on the idea that adjustment to college took longer for many minority students.

Timing Issues

Humphreys (1968), Lunneborg and Lunneborg (1970), and Humphreys and Taber (1973) found that academic prediction decreased through four years of college. Writing for the journal *College and University*, Berdie and Prestwood (1975) also concluded that variables which predicted freshman success did not predict success over four years for all

students.

In his monograph *Population Validity and College Entrance Measures*, Breland (1979) reported additional long-range criterion problems because college GPA was based on different courses where freshman shared more common courses than upper division students. Subsequently, Willingham (1985) found that prediction for the third and fourth years of college was less reliable than for the freshman year.

Variation Among High Schools

Astin (1971, 1993) believed that the type of high school attended had an effect on achievement in college. Singleton & Smith (1978), writing in the *Journal of Educational Measurement*, argued that using high school grade point average as a predictor was a problem because of grade inflation. Klitgaard (1985) observed that using high school grade point average as a predictor was a problem because grades were influenced by uncontrolled factors of grading policies within and among high schools, judgments made by instructors, and differences in grading patterns. Weiler and Pierro (1988) pointed out that students were not randomly assigned in many studies of retention or attrition and this made comparisons difficult.

Inconsistencies of Definitions

One of the major criticisms of attrition research was the lack of a consistent definition of the phenomenon. Research and theory development tended to utilize the researcher's frame of reference. Student centered theorists defined attrition as mutual student/institution failure to meet the student's goal for development or education (e.g. Tinto, 1987; Cope and Hannah, 1975). Single institutional studies defined attrition as including any student who departed from the institution without completing his degree (e.g. Bean, 1986).

Persistence has been defined in some studies as remaining in the institution of initial enrollment and in other studies as remaining in higher education, though not in the institution of initial enrollment. As the definition of college dropout changed from one who simply fails to re-enroll for a particular semester to one who fails to re-enroll for a specified length of time, the interaction of academic and social variables with persistence changed (Williamson & Creamer, 1988). Another criticism of previous studies of prediction bias observed in the *Journal of Educational Measurement* was that students chose different programs of study that had widely varying

grading standards (McCornack and McLeod, 1988).

Selected Variables Used in Previous Studies

The following variables were previously studied in order to explain success in college: absenteeism, academic achievement, athletic participation, course load, cumulative grade point average, financial aide, freshman grade point average, goal commitment, high school grade point average, housing, institutional commitment, institutional size, marital status, program of study, race, gender, social integration, socio-economic status, and time of withdrawal.

Absenteeism

The effect of absenteeism on attrition was found to depend on the student's college GPA. Bean (1982c), in a paper presented to the annual meeting of the American Education Association stated that absenteeism was not related to dropout for students with high college grade point averages, but was related to higher dropout rates for students with low college grade point averages.

Academic Achievement

Researchers used different measures of academic success in their studies of persistence. Siegleman (1971) found that the predictive validity of the Scholastic Aptitude Test for college women increased as the criterion was broadened from first year grade point average to total grade point average for four years. Bean & Covert (1973) found that the academic aptitude measure of SAT verbal scores and SAT math scores discriminated between persisters and academic dismissals. DeBoer (1981) observed that for 1690 freshmen at a selective four year liberal arts college, the SAT was a more useful predictor of college performance than the high school record. In a single institutional study of 162 football recruits, Walter et al. (1987) found the SAT an equally poor predictor for Blacks and non-Blacks. The graduation rate for blacks was predicted about as well by high school GPA as by college GPA.

Wolfe and Johnson's (1995) findings were consistent with Willingham et al. (1990) by concluding SAT was redundant with high school records in predicting cumulative college GPA. Stricker et al. (1996) sampled 981 students at a large state university's main campus and found that

the SAT and collateral variables from the high school record did predict college grades in different academic areas. Validity of the ACT compared favorably with other standardized achievement tests used for college performance and its reliability was deemed reasonable for group comparisons (Tinto, 1975, Ott 1988).

Voorhees (1985), Pascarella et al. (1986), Bers (1988), and Biddar (1995), found a significant effect of cumulative grade point average (CGPA) on graduation rates. Writing for the *American Educational Research Journal*, Bean (1985) stated that prematriculation academic performance was far and above the best predictor of college GPA for freshmen, sophomores, and juniors at a major Midwestern university.

McArdle and Hamagami (1994), using longitudinal data on the academic performances of 3,224 student athletes, found that high school core grades and SAT or ACT test scores to be noteworthy predictors for college graduation rates. They found test scores were slightly stronger predictors than the high school grades.

Age

Results from studies about persistence and age of the student were mixed. Pascarella, Duby, Miller, & Rasher (1981) found that persisters tended to be younger than nonpersisters. Conversely, Johnson (1994) found that students who were required to withdraw from a large Western Canadian university were on average younger than the persisting comparison group. Kercher (1996) also found that students who persisted in postsecondary vocational programs tended to be older than the students who did not persist. This differences may have been related to Grosset's (1991) observation that integration with the institution was more important to the persistence of younger students (17 to 24 years) than it was for the older cohort (25+ years).

Athletic Participation

The American College Testing Program and the Educational Testing Service (1984) compared over 2,000 athletes with nonathletes. These students were matched on ACT or SAT, high school grade point average, and ethnicity. The study found that on measures of persistence, such as good standing at the end of the freshman year, the athletes

consistently had higher success rates than the matched group of nonathletes.

In an article in the *Research Quarterly for Exercise and Sport*, Walter et al. (1987) concluded that membership in the subgroup "athlete" appeared to be a more positive predictor of graduation than ethnic group. Pascarella & Smart (1991) also found a positive impact of athletic participation on degree completion after controls were made for pre-college characteristics, college selectivity, and levels of social involvement and academic achievement.

Course Load and Credit Hours Attempted

Okun, Weir, Richards, & Benin (1990) identified credit hours enrolled as a variable that significantly predicted the retention of community college students. Okun, et al. (1990) administered questionnaires to 375 students enrolled in social science courses at a community college. They found credit load positively influenced the retention of community college students. The variables found to predict retention were the number of credit hours students enrolled for in the spring semester, hours of homework, and students' intention to return to the college in the fall semester.

Johnson (1994), writing for the *Alberta Journal of Educational Research*, found students who were taking full course loads were more likely to persist. Biddar (1995), in his doctoral dissertation claimed that students who enrolled for 12 or more credit hours each semester had better odds for graduation compared to those enrolled on a part-time basis.

Cumulative Grade Point Average (CGPA)

Hall & Gahn (1994) found that the cumulative grade point average (GPA) prior to dismissal and transfer GPA was a good predictor of success for readmitted students. They also found that the GPA of a transfer student was a good predictor of success.

Financial Aid

Conclusions from studies on financial aide and persistence were mixed. Fields & LeMay (1973) contended that financially needy students who had their financial needs met with aid competed favorably with other students in terms of academic achievement and persistence through the freshman year. Supporting the Fields & LeMay study, (Astin, 1975; St. John, 1989) stated that student aid as a whole has a positive influence on student persistence.

Redovich & Rodriguez (1990) found the most important reason for leaving cited by nonreturning Milwaukee Area Technical College students was financial problems.

Conversely, other researchers stated that receipt of grants and loans did not seem to have any positive effect on persistence (Herndon, 1984a; Kramer, Moss, Taylor, Hendrix, 1985). Participation in the college work-study program, on the other hand, did increase chances of persistence. Moline (1987) also found that awarding larger amounts of financial aid or specific grants to 227 freshman did not affect persistence. Somers (1996) observed that large scholarships, while attracting students to an urban public institution, were associated with high attrition rates.

Freshman Grade Point Average (FGPA)

The majority of investigators on prediction of academic outcomes have concentrated on the forecast of freshman grade point average (FGPA) or persistence over the freshman year (Astin, 1971; Manning et al., 1977; Bean and Metzner, 1985; Hand & Prather, 1985; Breland, 1981; Pascarella, 1982; Willingham, 1983 1985; Willingham et al., 1990; Bank et al., 1994; Martinez-Lahoz, 1994). Morrisey

(1971) found persistence reliably associated with freshman grade point average (FGPA). The students with a low FGPA had a greater tendency to drop out, and those with a high FGPA had a greater tendency to persist.

Pascarella, Duby, Miller, & Rasher (1981) concluded that only after first-quarter academic performance is considered, can relatively clear distinctions be made between students who persist into their sophomore year and those who decide to leave early. Wilson (1983) found that FGPA tended to be more valid than admissions measures for predicting post-freshman GPA and that the GPA at the end of any given term remained relatively stable from freshman to senior years. Brooks-Leonard (1991), in a study of demographic and academic factors associated with first-to-second-term retention in a two-year college, noted the only academic factor related significantly to retention was first-term GPA.

Writing for the *Sociological Quarterly*, Bank, Biddle, and Slavings (1994) stated that initial grades had significant, positive effects on the extent to which self-concepts became more favorable to persistence. In his doctoral dissertation, Martinez (1994) concluded the most important factors in persistence of freshmen were GPA and

intent to register the next semester.

Goal Commitment or
Purpose for Enrolling

Students with solid academic competence but moderately low commitment tended to withdraw from college (Hackman & Dysinger, 1970). Goal commitment (purpose for enrolling) was shown to be a significant predictor of the retention of community college students (Alfred, 1973; Bers & Smith, 1991; Brunner, Packwood, & Wilson, 1978; Pascarella & Chapman, 1983; Voorhees, 1987; Walleri, 1981).

Munro (1981) utilized a sample of 6,018 drawn from the National Longitudinal Study of the High School Class of 1972. He found that among students who persisted in higher education, commitment to the goal of college completion had the strongest effect on the decision to remain in school. Waldo (1996) concluded in her doctoral dissertation that goal commitment made the greatest contribution for predicting retention of 215 college students 25 years of age or older.

High School Grade Point Average (HSGPA)

Astin (1972) found that high school grade point average was positively related to retention in community college students. Munro (1981) also observed high school academic performance was a better predictor of college academic performance than measured aptitude and Ethington (1990) concluded that high school GPA and rank had the greatest total influence of background variables on persistence.

In his book *Success in College: The Role of Personal Qualities and Academic Ability*, Willingham (1985) concluded that the use of the HSGPA was generally found to be a valid criterion because it represented the accumulated judgment of various instructors through high school years. Many researchers found the HSGPA to be the strongest preadmissions measure of persistence (Bean & Metzner, 1985; Willingham et al., 1990; Astin 1993, Martinez-Lahoz, 1994: Wolf & Johnson, 1995).

Housing

Living on campus versus commuting to college has been found to affect persistence in college and degree attainment (Anderson, 1981; Astin, 1973; Baird, 1969;

Chickering & Kuper, 1971; Chickering, McDowell & Campagna, 1969; Herndon, 1984; Pascarella & Chapman, 1983; Sullivan & Sullivan, 1980). A sample of 226 first-time freshmen at a California State College (Herndon, 1984a), showed that students who lived on campus were more likely to persist than those who did not. Also, residence halls have helped retain students relative to retention rates of commuters (Upcraft, 1985). At least one study, (Segura, 1993) found that campus residents had a larger percentage of persisters than commuters did.

Institutional Commitment

Mallette and Cabrera (1990) surveyed 2,954 freshmen at North Carolina State University and concluded that institutional commitment predicted was related to persistence. Segura (1993) and Pascarella and Chapman (1983) also determined goal and institutional commitment to be important in predicting and discriminating among persisters and nonpersisters.

Program of Study

Personal commitment to either an academic or occupational goal was the single most important determinant of college persistence in multiple studies (Cope & Hannah,

1975; Rose & Elton, 1971). Muskat (1979) also found students who dropped out of college were less likely than persisters to have decided on their academic and career goals.

Most students define college as an important type of preparation for the achievement of lifelong occupational goals. Simpson, Baker, & Mellinger (1980) observed that vocational orientation increased withdrawal among failing students but decreased withdrawal among passing students.

Bean (1982b) using a sample of 1,574 college freshmen included the student's program of study as a variable related to student withdrawal. Academic requirements and college experiences differed for different programs of study.

Brigman, Kuh, & Stager (1982) concluded that the majority of transfer students tended to leave because the institution did not offer the desired type of academic program. Naylor & Sanford (1982) revealed that students in professional programs in medicine, dentistry, and law, persisted at a rate noticeably higher than students in other programs of study.

Bers (1988) used data on 2202 community college students and identified choice of major and the number of

times students changed their major as significant variables associated with the retention of community college students. Biddar (1995) showed a significant effect of choice of major on graduation rates. Guthrie and Loveder (1990) found that attrition from technical programs was higher than from less technical programs. But Johnson & Buck (1995) found that the highest percentage of withdrawals in a large western Canadian university were from the Arts and Sciences. Wilson-Cook (1990) concluded that a change of major signaled students who would likely experience academic difficulty.

Conversely, Lewallen (1992) using longitudinal data from the Cooperative Institutional Research Program obtained from over 20,000 college freshmen attending over 300 institutions concluded that undecided students were more similar than different from decided students. After accounting for variables previously established as predictors of persistence (student background characteristics, college environment measures, student involvement measures), Lewallen found no measures of "being undecided" as significant predictors of college student persistence. Entering students who had already decided about academic major or career choice did not exhibit any

increased chances of persisting.

Menendez (1996) using data from all the applicants who were admitted to the University of Puerto Rico determined that prediction of persistence by major fields was stronger than prediction for the whole system. This finding was explained as a result of less diversity within each major field in terms of course content and grading practices.

Race

Results from studies about race and persistence were mixed. Attrition was often found to be higher among Black students than among Whites. Astin (1972) found being black had a significant negative correlation with persistence. This difference in attrition rates was even larger in institutions that were predominately public and White (Sedlacek & Webster, 1978). Peng & Fetters (1978), concluded that among four-year college students, white students were more likely than blacks to withdraw from colleges when variables such as socio-economic status (SES), achievement and aspirations were controlled for. Bynum & Thompson (1983) observed that minority students of any race (American Indian, Black, or White) were much more likely than students of the racial majority to drop out of

college prior to graduation. Christoffel (1986) also found that minorities in the past had been less likely than Whites to complete the baccalaureate degree.

Conversely, Cronklin (1976), Sanford (1979), and Atkinson, Jennings, & Liongson (1990) indicated that when predictor variables such as high school grades and ability test scores were controlled for, black students at four-year institutions were less likely to drop out of school. Black students were also less likely to experience academic dismissal. Donovan (1984) also found that persistence for 403 low-income black students was similar to college students in general. In an article for the *Journal of College Development*, Carrol (1988) observed that high school grade point average did not consistently contribute to the prediction of academic success for educationally underprepared Black students.

Gender

(Lavin, 1965, Astin, 1971, 1993, and Martinez-Lahoz 1994) found evidence that there were differences in predictors for achievement levels between males and females. In an article written for the *North Central Association Quarterly*, Cope (1969) stated that men at the

University of Michigan who dropped out of college more frequently experienced academic difficulty. Cope also observed that women who dropped out of college more often indicated social and religious problems. Men most often stated academic reasons for dropping out while women more often stated nonacademic reasons (Elliott, 1973).

Cross (1971) and Pantages and Creedon (1978) also reported that there were differences by gender with attrition by the type of institution and by institutions with differing ratios of men and women. Bynum & Thompson (1983) discovered that the gender ratio tends to be self-adjusting over time, with the surplus gender group in the class-cohort experiencing the heaviest attrition.

McCornack and McLeod (1988) in a study of 11,153 students enrolled in introductory course at a large, urban state university concluded that the relationship between success in college and scholastic aptitude and high school grades was not the same for men and women. They found a small but significant amount of underprediction for women when success was measured by GPA.

Social Integration

Tinto's (1975) model of student college attrition shows that, other factors being equal, the greater the student's level of involvement in the social and academic life of the college, the more likely the student is to continue at that particular institution. Terenzini & Pascarella (1980b) found the frequency of students' informal contact with faculty members outside the classroom was consistently found to be positively related to the likelihood of freshman year persistence.

Nelson, Scott, & Bryan (1984) found that persisters reported a greater frequency of encouragement in their college experience and that nonpersisters were less satisfied with their social life than were persisters. Allen & Nelson, 1989; Bers, 1988; Pascarella & Chapman, 1983; Pascarella, Smart, & Ethington, 1986; Voorhees, 1987; confirmed the importance of person-environment fit on degree persistence. Hawken, Duran, and Kelly (1991) observed that students who withdrew from college reported being less socially conforming than those who persisted.

Socioeconomic Status

Peng & Fetters (1978) found that socioeconomic status (SES) was significantly related to college withdrawal after other predictor variables were controlled. Pascarella, Smart, & Ethington, (1986) writing for *Research in Higher Education*, concluded that higher SES had positive significance for women on graduation rates. Cabrera, Stampen, and Hansen (1990) supported the above studies when they found that students from the upper SES quartile were more likely to persist than students from the lowest SES quartile.

Time of Withdrawal

Eckland (1964a) and Pantages and Creedon (1978) observed the greatest dropout rate from the first to the second year of college. In his book *The Prediction of Adacemic Performance: A Theoretical Analysis and Review of Research*, Lavin (1965) indicated that performance at different levels and at several points in time should be considered when predicting academic success.

Transfer

Studies of transfer students and persistence revealed mixed results. Eckland (1964a) found that academic

difficulties often led to "stopping out" or transferring rather than leaving higher education altogether. Hills, 1965; Velez, 1985; Alba & Lavin, 1981; concluded that transfer students are less likely to graduate from a four year college than a nontransfer student and that it will probably take longer to graduate if he/she does.

Conversely, Maudal, Butcher, & Mauger (1974) found transfer students to be more like persisters than like dropouts. They also concluded that personality variables were stronger predictors in the case of transfer students than were academic variables.

Summary of Review of the Literature Related to Variables Used in This Study

Bean's rules (Bean, 1982a) were used to select the background and organizational variables in this study:

1. Background variables should probably include only objective information about a student before matriculation.
2. Organizational variables should include only those variables that can be verified by observing a student or the student's record.

In addition to considering Bean's rules, the variables

selected for this study were selected on the basis of availability of data from the Registrar and the size of the sample.

Background Variables

Pascarella, Duby, and Iverson (1983) determined that student background characteristics had a direct effect on retention regardless of the degree of academic or social integration. The background variables utilized in this study included: ACT/SAT scores, age at initial enrollment, ethnicity, gender, high school grade point average, high school rank, and size of graduating class.

1) **ACT/SAT scores**- Bean & Covert (1973) and DeBoer (1981) observed that SAT scores discriminated between persisters and academic dismissals. Tinto (1975) and Ott (1988) found the reliability of ACT scores "reasonable" for group comparisons.
2) **Age at initial enrollment**- The results from studies of student age and persistence were mixed. Pascarella, Duby, Miller, & Rasher (1981) found that persisters tended to be younger than nonpersisters. Johnson (1994) found that potentially persistent undergraduates were not too

young or too old. Kercher (1996), however, found that students who persisted in postsecondary vocational programs tended to be older than the students who did not persist.

3) **Ethnicity**- Preer (1981) found race to be a predictor of withdrawal from college. Blacks were most likely to withdraw and Whites and Asians were less likely to withdraw. However, Cronklin (1976), Sanford (1979), and Atkinson, Jennings, & Liongson (1990) determined that when predictor variables such as high school grades and ability test scores were controlled for, black students at four-year institutions were less likely to drop out than non-Blacks.

4) **Gender**- The results from studies concerning student gender and persistence were mixed. Cross (1971) and Pantages and Creedon (1978) reported that there were differences by gender with attrition according to the type of institution and by institutions with differing ratios of men and women. Peng & Fetters (1978) discovered that in two-year but not in four-year colleges, females were more likely than male students to withdraw. Fischbach (1990) and Brooks-

Leonard (1991) found that gender was not related to persistence, but Voorhees (1987), Feldman (1993), and Segura (1993) found that it was.

5) **High School Grade Point Average (HSGPA)**- Astin (1972) observed that high school grade point average was positively related to retention in community college students. Munro (1981) found high school academic performance was a better predictor of college academic performance than measured aptitude.

6) **High School Rank**- Blanchfield (1971) found that high school rank proved significant when correlated with persistence. Ethington (1990) found that high school rank and GPA had the greatest total influence of background variables on persistence.

7) **Size of High School Graduating Class**- Baird (1969) found found little relationship between high school size and college achievement. Conversely, Kamens (1971) concluded that larger schools have greater impact on students' occupational commitments than smaller schools, and consequently show lower dropout rates.

Organizational Variables

The organizational variables utilized in this study included the program of study and cumulative grade point average.

1) **Program of Study-** Cope & Hannah (1975), and Rose & Elton (1971) stated that personal commitment to either an academic or occupational goal as the single most important determinant of college persistence. Simpson, Baker, & Mellinger (1980) found that vocational orientation increased withdrawal among failing students but decreased withdrawal among passing students. Guthrie and Loveder (1990) observed that attrition from technical majors was higher than from less technical majors.

2) **Cumulative grade point average-** Voorhees (1985); Pascarella et al. (1986); Bers (1988); Biddar (1995); found a significant effect of Cumulative Grade Point Average (CGPA) on graduation rates.

CHAPTER 3

METHODOLOGY

The purpose of this study was to identify predictors of persistence for students enrolled in technology programs at MSUN. To accomplish this, a study of background variables and organizational variables of students who enrolled in associate's and bachelor's degrees in technical programs at MSUN from Fall semester 1993 to Spring semester 1997 was conducted. Semester credit hours earned and cumulative GPA were tracked through the conclusion of Spring semester 1999, the most recent semester for which these data were available.

Assumptions

The review of the literature concerning persistence of college students provided a basis for the following assumptions:

1. Previous research findings on student persistence among academic programs were inconclusive due to various institutional and programmatic entrance

requirements and multiple perspectives of the researchers.

2. College student persistence could be influenced by numerous precollege experiences and institutional characteristics.
3. Academic program choice was a variable that could be evaluated for better understanding of student persistence.

Hypotheses

Based on the assumptions stated, the following hypotheses were tested:

Hypothesis 1: Academic program choice is significantly ($p.<0.05$) related to persistence when other student variables are controlled.

Hypothesis 2: Students from each technical program differ significantly ($p.<0.05$) on organizational variables from students in other technical programs.

Population Description

The population (N=691) in this study included all freshman enrolled in thirteen associate's degree and nine bachelor's degree technical programs listed in the college catalog at Montana State University- Northern from Fall Semester 1993 to Spring Semester 1997. Transfer students who entered these programs during the same time frame were also included in the population.

Method of Data Collection

The Registrar at MSUN provided access to existing college student records by downloading data from the college mainframe to desktop computer spreadsheet files (Microsoft Excel). Any corrupted data found on the desktop computer spreadsheet files was compared to hard copies of student transcripts also provided by the Registrar. Any records containing corrupted student identification numbers were not used. Data included first term of attendance at MSUN, gender, birthdate, race, ACT scores (English, math,

reading, science, and composite), high school GPA, high school rank, size of high school graduating class, last term attended at MSUN, college program (major), cumulative credit hours passed, and cumulative GPA. These data were selected for this study because they were commonly used in other studies and are typically available on institutional computer records systems.

Dependent Variable

This study used persistence as measured by semester credit hours earned for the dependent variable. Defining persistence proved troublesome because most students do not complete an associate's degree program in two years or a bachelor's degree program in four years; some students transfer, some stop out, and some drop out. As a result, persistence was measured by the number of semester credit hours earned at the time of withdrawal or graduation from MSUN.

Independent Variables

Independent variables were categorized into two classes: (a) background variables, and (b) organizational variables (Pascarrella, 1982). This approach was used to explore correlations between the student's proior academic background and his/her college experience.

Background Variables

Background variables represent facts about students before they enter college. The most important of these variables as predictors of persistence are high school grades and ACT scores (Bean, 1982a, Bontekoe, 1992, Myers, & Pyles, 1992) which typically account for about 25-50% of the variance in college grades. Table 2 lists the eleven labels, names, and the definitions of all the background variables used in this study.

Table 2. Background Variables.

Variable Label	Variable Name	Definition
ACTE	ACT English	ACT English Score
ACTM	ACT Math	ACT Math Score
ACTR	ACT Reading	ACT Reading Score
ACTS	ACT Science	ACT Science Score
ACTCOMP	ACT Composite	ACT Composite Score
BIRTH	Birthdate	Age at enrollment
RACE	Race	Race codes as defined by Registrar
GENDER	Gender	Gender
HSGPA	High School GPA	High School Grade Point Average
HSRANK	High School Rank	High School Rank in percentile
HSIZE	High School Size	Size of Graduating Class

Organizational Variables

Organizational variables are indicators of the student's academic performance within MSUN. These variables were derived from the academic record of the student. Table 3 lists the labels, names, and definitions of the three organizational variables used for this study.

Table 3. Organizational Variables.

Variable Label	Variable Name	Definition
MAJOR	Program Major	Program Major
CREDHRS	Credit Hours	Semester Credit Hours Earned
CGPA	College GPA	Cumulative College Grade Point Average

Data Analysis

Data analysis was conducted in two phases. First, a preliminary descriptive analysis of the data (frequencies, means, standard deviations) for students' background variables and record of academic performance (organizational variables) at MSUN was calculated. Pearson correlations were used to examine the background and organizational variables relative to persistence (measured in semester credit hours) and to provide a basis to screen out variables that were not related or were collinear.

The second phase of the analysis developed predictive equations from the remaining variables. Multiple regression was then used to examine the comparative impact of each independent variable on the dependent variable (persistence) with all other independent variables controlled. An Excel (Excel 97) spreadsheet and the Statistical Package for the Social Sciences (SPSS 8.0) were used to organize the data and conduct the statistical analysis.

Limitations of the Study

There were a number of limitations with the data and methods used in this study:

1) Curricular content and the requirement for passing a placement test have changed for assignment into entry level English and math courses during the interval of this study.
2) Various high schools have different standards for testing academic achievement and assessing GPA.
3) Academic programs have evolved during the study and names of academic programs have changed.
4) Some students were simultaneously enrolled in multiple majors and degrees.
5) Minority students were not well represented in most programs of study.
6) ACT scores were not typically available for nontraditional students.
7) Females were not well represented in most programs of study.
8) Student change of major was not always reported to the

Office of the Registrar in a timely manner

9) Information on race of the student could not be fully verified because it was self reported.

10) Some programs had options that did not neatly fall into categories of vocational/technical, engineering technology or technical management.

11) Vocational/technical students often secured employment in their field before graduation and consequently did not complete their program of study. This may have influenced the profile of the persister in this study.

12) The definition of persistence combined with the time interval used in this study may not be of sufficient duration to include all students who graduated or re-entered a program of study at a later date.

13) The selection of variables may be too interdependent for regression techniques to be useful.

CHAPTER 4

RESULTS

The purpose of this study was to predict persistence, as measured by semester credit hours earned, of students in technical programs at Montana State University- Northern using available background variables from student applications and academic measures of organizational success. The Registrar identified 691 students who enrolled in technical programs from Fall semester of 1993 to Spring semester 1997. The results reported in this chapter are based upon 691 students who enrolled in vocational/technical programs, technical management programs, and engineering technology programs between Fall Semester 1993 and Spring Semester 1997. Semester credit hours earned and cumulative GPA were tracked through Spring Semester 1999, the most recent semester for which these data were available for this study.

The Population

Montana State University-Northern admits graduating high school seniors with a 2.5 high school GPA and ACT composite test scores above 20, or SAT combined verbal and math scores of 930 or higher, or rank in the upper half of their high school graduating class. Students over the age of 21, part-time students, transfer students and students enrolling in certificate or associate's degree programs are exempt from these requirements (Montana Board of Regents policy 301). Students in technical programs at MSUN during this study were enrolled in vocational/technical programs (auto body, auto mechanics, diesel mechanics, drafting, farm mechanics, machining, railroad operations, and welding), technical management programs (agriculture, computer information systems, manufacturing technology, and water quality), and engineering technology programs (civil and electronics).

The majority of students, identified by race, seeking technical degrees were Caucasian (67%) with American Indian (8%) as the largest identified minority. The mean age of

students at the time of their initial enrollment was 23.7 years and the typical student was traditional (three years or less out of high school).

In Table 4 (N=691) the counts of students in programs of study by gender, and degree are presented. There were more male students than female students (86% male, 14% female) in thirteen major programs of study. Women were most heavily enrolled in the computer associate's degree program (58%), followed by computer information systems bachelor's degree (45%), drafting associate's degree (21%), and drafting bachelor's degree (21%).

Table 4. Number of Students by Major from Fall Semester 1993 to Spring Semester 1997 Who Enrolled in Technical Programs.

Major	Gender		Total	Percent
	Female	Male		
Agriculture (A)	1	17	18	2.6
Ag Mechanics (A)		1	1	0.1
Ag Mechanics (B)		12	12	1.7
Automotive (A)	2	45	47	6.8
Automotive (B)	6	44	50	7.2
AutoBody (A)		30	30	4.3
Civil Eng Tech (A)	3	8	11	1.6
Civil Eng Tech (B)	3	30	33	4.8
Computers (A)	21	15	36	5.2
Computers (B)	24	29	53	7.7
Diesel Mechanics (A)		28	28	4.1
Diesel Mechanics (B)	1	91	92	13.3
Drafting (A)	8	31	39	5.6
Drafting (B)	18	67	85	12.3
Electronics (A)	2	14	16	2.3
Electronics (B)	1	47	48	6.9
Manufacturing (A)		5	5	0.7
Manufacturing (B)	1	19	20	2.9
Metals Tech (A)	2	24	26	3.8
Railroad (A)		2	2	0.3
Water Quality (A)	3	21	24	3.5
Water Quality (B)	1	14	15	2.2
Total	97	594	691	100.0

Note. (A) denotes an Associate's degree.
(B) denotes a Bachelor's degree.

The ethnicity of students at MSU-Northern are self-reported and optional on their application form for admission. This accounts for the large group of students with unknown ethnicity (23.9%). The majority of students in technical programs by race (Table 5) were Caucasian (67.3%) with American Indian (8.0%) as the largest minority.

Table 5. Number of Students by Race from Fall Semester 1993 to Spring Semester 1997 Who Enrolled in Technical Programs.

Race	Frequency	Percent
Unknown	165	23.9
Caucasian	465	67.3
American Indian	55	8.0
Black	1	0.1
Asian/Pacific Islander	2	0.3
Hispanic	2	0.3
Other	1	0.1
Total	691	100.0

The ages of students (Table 6) at the time of their enrollment ranged from 17 years to 54 years with a mean of 23.7 years and a standard deviation of 7.67 years. Students who were eighteen and nineteen years old at the time of their initial enrollment accounted for 40.2 percent of the population enrolled in technical programs at MSUN. Approximately one-half the students were out of high school less than three years and consequently met the Montana Board of Regents definition of a traditional student. About 17% of the students were over thirty at the time of their initial enrollment at MSUN.

Table 6. Number of Students by Age at Time of Enrollment in Technical Programs from Fall Semester 1993 to Spring Semester 1997.

Age	Frequency	Percent
17	4	0.6
18	119	17.2
19	159	23.0
20	69	10.0
21	51	7.4
22	43	6.2
23	27	3.9
24	30	4.3
25	22	3.2
26	12	1.7
27-29	37	5.4
30-39	74	10.7
Over 40	44	6.4
Total	691	100.0

Available high school grade point averages (Table 7) ranged from 1.18 to 4.0 on a four point scale with a mean of 2.71 and a standard deviation of 0.63. Missing high school grade point averages were due to the Board of Admissions Requirements (Regents Policy Section 301) that only requires Traditional Students (first semester with less than 3 years out of high school and less than 21 years old) to report their high school grades. This high rate (63.8%) of missing high school grade point averages and the average age (23.7) of the students suggests that the majority of students who registered for technical programs at MSUN during this study were not first time traditional freshmen.

Table 7. High School Grade Point Averages (HSGPA) of Students Who Registered for Technical Programs Fall Semester 1993 to Spring Semester 1997.

HSGPA*	Frequency	Percent
Missing	441	63.8
0.01-0.99	1	0.1
1.00-1.49	2	0.3
1.50-1.99	36	5.2
2.00-2.49	53	7.7
2.50-2.99	66	10.0
3.00-3.49	61	8.8
3.50-3.99	28	4.1
4.00	3	0.4
Total	691	100.0

*based on a 4.0 scale

Available ACT composite scores for students (N=310) enrolled in technical programs from Fall semester 1993 to Spring semester 1997 (Table 8) ranged from a minimum of 11 to a maximum of 30 with a mean of 19.27 (a 42 percentile ranking) and a standard deviation of 3.56. This composite score was lower than the mean ACT composite score of 19.6 reported by the Registrar for all students attending MSUN in 1995 and lower than the 20.9 national average reported for all tested high school graduates 1994 to 1997 (American College Testing, Inc., 1999). Unreported ACT scores are due to Board of Regents Admissions Requirements (Section 301) that only requires ACT scores from Traditional Students (first semester with less than 3 years out of high school and less than 21 years old). Scholastic Aptitude Test scores for math and verbal comprehension were converted in the Office of the Registrar at MSUN to

equivalent ACT comprehensive scores.

Table 8. ACT Composite Scores For Students Who Registered for Technical Programs Fall Semester 1993 to Spring Semester 1997.

ACT Scores	Frequency	Percent
Unreported	381	55.2
11	1	0.1
12	1	0.1
13	3	0.4
14	15	2.2
15	16	2.3
16	36	5.2
17	34	4.9
18	39	5.6
19	36	5.2
20	34	4.9
21	25	3.6
22	13	1.9
23	13	1.9
24	16	2.3
25	8	1.2
26	8	1.2
27	3	0.4
28	5	0.7
29	2	0.3
30	2	0.3
Total	691	100.0

Available ACT English scores (N=299) of the students in the study (Table 9) ranged from a minimum of 8 to a maximum of 32 with a mean of 17.48 (a 34 percentile ranking) and a standard deviation of 4.10. This average score is lower than the average national ACT English scores of 20.3 for all high school graduates from 1994 to 1997 (American College Testing, Inc., 1999).

Table 9. ACT English Scores for Students Who Registered for Technical Programs Fall Semester 1993 To Spring Semester 1997.

ACT Scores	Frequency	Percent
Unreported	392	56.7
8	2	0.3
10	3	0.4
11	8	1.2
12	11	1.6
13	17	2.5
14	31	4.5
15	25	3.6
16	44	6.4
17	30	4.3
18	23	3.3
19	27	3.9
20	19	2.7
21	11	1.6
22	8	1.2
23	12	1.7
24	9	1.3
25	6	0.9
26	2	0.3
27	5	0.7
28	4	0.6
31	1	0.1
32	1	0.1
Total	691	100.0

The ACT Math scores of the students in this study (N=300) are illustrated in Table 10. The scores ranged from a minimum of 9 to a maximum of 35 with a mean of 19.30 and a standard deviation of 4.06. These scores were lower than the average national ACT math scores of 20.3 for all high school graduates from 1994 to 1997 (American College Testing, Inc.,1999).

Table 10. ACT Math Scores For Students Who Registered in Technical Programs Fall Semester 1993 to Spring Semester 1997.

ACT Scores	Frequency	Percentage
Unreported	391	56.6
9	1	0.1
11	1	0.1
12	1	0.1
13	9	1.3
14	8	1.2
15	18	2.6
16	35	5.1
17	40	5.8
18	45	6.5
19	23	3.3
20	28	4.1
21	20	2.9
22	12	1.7
23	9	1.3
24	14	2.0
25	10	1.4
26	6	0.9
27	7	1.0
28	4	0.6
29	4	0.6
30	1	0.1
31	1	0.1
32	1	0.1
33	1	0.1
35	1	0.1
Total	691	100.0

ACT Reading scores of the students in this study (N=296) are illustrated in Table 11. These scores ranged from a minimum of 9 to a maximum of 36 with a mean of 19.33 and a standard deviation of 5.22. These scores were lower than the average national ACT reading scores of 21.3 for all high school graduates from 1994 to 1997 (American College Testing, Inc., 1999).

Table 11. ACT Reading Scores For Students Who Registered for Technical Programs Fall Semester 1993 To Spring Semester 1997.

ACT Scores	Frequency	Percentage
Unreported	395	57.1
9	2	0.3
10	2	0.3
11	7	1.0
12	13	1.9
13	22	3.2
14	18	2.6
15	13	1.9
16	14	2.0
17	17	2.5
18	23	3.3
19	33	4.8
20	13	1.9
21	30	4.3
22	15	2.2
23	18	2.6
24	8	1.2
25	10	1.4
26	11	1.6
27	10	1.4
28	2	0.3
29	3	0.4
30	3	0.4
31	1	0.1
32	3	0.4
33	2	0.3
35	2	0.3
36	1	0.1
Total	691	100.0

The ACT science scores (N=295) of the students in this study are listed in Table 12. The scores ranged from a minimum of 14 to a maximum of 33 with a mean of 20.6 and a standard deviation of 3.63. SAT science scores were not converted to ACT science scores. These scores were lower than the average national ACT science scores of 21.1 for all high school graduates from 1994 to 1997 (American

College Testing, Inc., 1999).

Table 12. ACT Science Scores For Students Who Registered for Technical Programs Fall Semester 1993 To Spring Semester 1997.

ACT Scores	Frequency	Percentage
Unreported	396	57.3
14	6	0.9
15	10	1.4
16	16	2.3
17	23	3.3
18	36	5.2
19	25	3.6
20	47	6.8
21	28	4.1
22	27	3.9
23	18	2.6
24	13	1.9
25	10	1.4
26	15	2.2
27	7	1.0
28	5	0.7
29	4	0.6
30	1	0.1
31	3	0.3
33	1	0.1
Total	691	100.0

The number of semester credit hours passed by students who registered from Fall Semester 1993 to Spring Semester 1997 was recorded through Spring Semester 1999 (Table 13) to track those students who had not yet graduated. Three values (0.4%) were missing due to corrupted student identification numbers. Semester credit hours passed were tabulated in 15 credit hours intervals to reflect the Board of Regent's definition of a full time equivalent student. The semester credit hours passed (N=688) in Table 13 ranged

from a minimum of 0 to a maximum of 235 with a mean of 47.75 and a standard deviation of 42.12. Approximately one quarter of all students registered in this six year period completed less than the equivalent of one semester.

Table 13. Semester Credit Hours Passed for Students Enrolled in Technical Programs Fall Semester 1993 to Spring Semester 1999.

Credit Hours	Frequency	Percentage
Missing	3	0.4
0-15	181	26.2
16-30	118	17.1
31-45	94	13.6
46-60	56	8.1
61-75	75	10.9
76-90	46	6.7
91-105	33	4.8
106-120	27	3.9
121-135	27	3.9
136-150	17	2.5
151-165	5	0.7
166-190	5	0.7
Over 191	3	0.4
Total	691	100.0

The grade point averages earned at MSUN by students who enrolled from Fall Semester 1993 until Spring Semester 1997 was recorded through Spring semester 1999. The grade point average earned by students enrolled in technical programs (Table 14) ranged from a minimum of 0.0 to a maximum of 4.0 with a mean of 2.29 and a standard deviation of 1.20. The average grades earned by students in technical programs at MSUN were, on average, approximately one half grade lower

than their average high school grades, with about twice the standard deviation. Students with 0.0 credit hours are for those students who registered for classes and attended longer than three weeks without earning any passing credit hours. Twenty three grade point averages (3.3%) were missing due to corrupted student identification numbers.

Table 14. College Grade Point Average (CGPA) Earned by Students Enrolled in Technical Programs Fall Semester 1993 to Spring Semester 1999.

CGPA*	Frequency	Percentage
Missing	23	3.3
0.00	69	9.9
0.01-0.49	16	2.3
0.50-0.99	32	4.6
1.00-1.49	42	6.1
1.50-1.99	67	9.8
2.00-2.49	99	14.3
2.50-2.99	109	15.8
3.00-3.49	121	17.5
3.50-3.99	75	10.9
4.00	36	5.2
Total	691	100.0

*Based on a 4.0 scale

Descriptive Statistics of Academic Variables by Program Major

Descriptive statistics of high school GPA, ACT scores, credit hours earned, and cumulatuve GPA and Pearson correlations between these variables and persistence were calculated in the following program areas: agriculture, agriculture mechanics, automotive mechanics, civil

engineering technology, computer information systems, diesel mechanics, drafting, electronics engineering technology, manufacturing, metals technology, and water quality.

Agriculture

Students enrolled in the associate's degree program in Agriculture (Table 15) scored on average about one-half point lower on their ACT composite, English, math, and reading scores, and about a point and one-half lower on their ACT science scores than other students enrolled in associate's degree technical programs. On average, they completed about eight credit hours more than other students enrolled in associate's degree programs in technology (Table 51, p. 103).

Table 15. Academic Variables for Associate's Degree Students Enrolled in Agriculture Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	14	13	21	17.71	31	2.58
ACTE	14	8	22	16.14	26	3.70
ACTM	14	14	20	17.50	36	1.99
ACTR	14	10	24	18.07	35	4.38
ACTS	14	14	21	18.79	37	2.01
CUMCRED	18	0	90	41.33		26.92
CUMGPA*	17	0	2.97	2.10		0.77
HSGPA*	7	1.96	3.48	2.65		0.52

*Based on a 4.0 scale

For students enrolled in the associate's degree program in Agriculture, correlations among background academic measures with persistence (Table 16) were not significant ($p<.05$). The college grade point average (CUMGPA) was the only academic variable significantly correlated ($r= .673$, $p< .05$) with the dependent variable, credit hours earned (CUMCRED).

Table 16. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees In Agriculture Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.874*	.718*	.940*	.803*	.170	-.224	.559
ACTE	.874*	1.000	.449	.774*	.595*	.145	-.261	.270
ACTM	.718*	.449	1.000	.623*	.587*	.158	-.098	.513
ACTR	.940*	.774*	.623*	1.000	.650*	-.339	.625	
ACTS	.803*	.595*	.587*	.650*	1.000	.304	.107	.417
CUMCRED	.170	.145	.158	.014	.304	1.000	.673*	.529
CUMGPA	-.224	-.261	-.098	-.339	.107	.673*	1.000	.200
HSGPA	.559	.270	.513	.625	.417	.529	.200	1.000

Note. Pearson Correlation
*P < .05.

Agriculture Mechanics

Students enrolled in the bachelor's degree program in Agriculture Mechanics (Table 17) averaged about one-half point lower on ACT composite scores, about three-quarters of a point lower on ACT reading scores, about one and one-half point lower on ACT English scores than other bachelor's degree students in technology (Table 53). Their ACT math scores, however, were about one-half point higher.

ACT science scores, number of college credit hours earned, college grade point average, and high school GPA were typical for students enrolled in bachelor's programs in technology at MSUN.

Table 17. Academic Variables for Bachelor's Degree Students Enrolled in Agricultural Mechanics Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	8	16	22	19.38	43	2.26
ACTE	8	11	21	16.63	28	2.97
ACTM	8	18	26	20.50	58	2.51
ACTR	8	13	22	19.25	41	3.65
ACTS	8	15	25	21.13	56	3.09
CUMCRED	12	0	150	58.17		44.74
CUMGPA*	12	0	3.82	2.39		1.26
HSGPA*	7	1.89	3.26	2.62		0.47

*Based on a 4.0 scale

For students enrolled in the bachelor's degree program in Agricultural Mechanics, (Table 18) correlations among background academic measures with persistence were not significant ($p<.05$). The college grade point average was the only academic variable significantly correlated ($r= .646$, $p< .05$) with the dependent variable, credit hours earned.

Table 18. Correlations Among Academic Variables for Students enrolled in Bachelor's Degrees in Agricultural Mechanics Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.809*	.692	.747*	.789*	-.151	-.381	.073
ACTE	.809*	1.000	.470	.352	.550	.183	-.235	-.046
ACTM	.692	.470	1.000	.327	.525	-.197	-.708*	.620
ACTR	.747*	.352	.327	1.000	.477	-.336	-.166	-.179
ACTS	.789*	.550	.525	.477	1.000	-.100	-.168	.376
CUMCRED	-.151	.183	-.197	-.336	-.100	1.000	.646*	.440
CUMGPA	-.381	-.235	-.708*	-.166	-.168	.646*	1.000	.818*
HSGPA	.073	-.046	.620	-.179	.376	.440	.818*	1.000

Note. Pearson Correlation
*P < .05.

Automotive Mechanics

Students enrolled in the associate's degree program in Automotive Mechanics (Table 19) scored about the same as other students enrolled in associate's degree programs in ACT composite scores, credit hours earned, and high school GPA. They averaged about one-half point lower in ACT English, ACT reading, college GPA, but about one-half point higher in ACT math and science (Table 51).

Table 19. Academic Variables for Associate's Degree Students Enrolled in Automotive Mechanics Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	32	14	29	18.50	37	3.86
ACTE	31	10	28	16.29	27	4.39
ACTM	31	11	30	18.68	46	4.42
ACTR	31	11	27	18.06	35	4.30
ACTS	31	14	31	20.71	53	4.32
CUMCRED	47	0	104	32.34		30.05
CUMGPA*	46	0	3.70	1.65		1.12
HSGPA*	19	1.54	3.57	2.54		0.49

*Based on a 4.0 scale

Several measures of academic performance proved significantly correlated ($p<.05$) with persistence for students enrolled in the associate's degree program in Automotive Mechanics (Table 20). The measures were: ACT composite scores ($r=.477$), ACT math scores ($r=.694$), ACT science scores ($r=.468$), college grade point average ($r=.715$), and high school grade point average ($r=.620$).

Table 20. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees in Automotive Mechanics Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.868*	.879*	.870*	.915*	.477*	.538*	.596*
ACTE	.868*	1.000	.646*	.713*	.748*	.303	.509*	.638*
ACTM	.879*	.646*	1.000	.653*	.832*	.694*	.700*	.608*
ACTR	.870*	.713*	.653*	1.000	.697*	.028	.379*	.544*
ACTS	.915*	.748*	.832*	.697*	1.000	.468*	.555*	.467
CUMCRED	.477*	.303	.694*	.028	.468*	1.000	.715*	.620*
CUMGPA	.538*	.509*	.700*	.379*	.555*	.715*	1.000	.642*
HSGPA	.596*	.638*	.608*	.544*	.467	.620*	.642*	1.000

Note. Pearson Correlation
*P < .05.

Students enrolled in the bachelor's degree program in Automotive Mechanics (Table 21) scored about a half point lower in ACT math but about one-third point higher in ACT science than other technical students in bachelor's degree programs. They scored about one point higher in ACT composite and ACT English and about two points higher in ACT reading (Table 53). Their high school GPA, college GPA, and credit hours earned were about average.

Table 21. Academic Variables for Bachelor's Degree Students Enrolled in Automotive Mechanics Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	32	11	30	20.75	54	4.31
ACTE	32	10	28	19.31	46	4.62
ACTM	32	9	32	19.63	52	4.51
ACTR	31	11	36	21.81	58	6.45
ACTS	31	14	31	21.29	58	4.22
CUMCRED	47	0	188	58.69		47.95
CUMGPA*	49	0	3.71	2.45		1.08
HSGPA*	25	1.93	4.00	2.90		0.56

*Based on a 4.0 scale

Background measures of academic performance did not prove to be significantly ($p<.05$) correlated to persistence for bachelor's degree seeking students in Automotive Mechanics (Table 22). College grade point average ($r=.525$, $p<.05$) was the only academic variable significantly correlated to the dependent variable credit hours earned.

Table 22. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Automotive Mechanics Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.870*	.696*	.901*	.887*	.044	.390*	.682*
ACTE	.870*	1.000	.512*	.718*	.661*	-.089	.198	.514*
ACTM	.696*	.512*	1.000	.342	.480*	-.112	.306	.588*
ACTR	.901*	.718*	.342	1.000	.780*	.089	.309	.530*
ACTS	.887*	.661*	.480*	.780*	1.000	.253	.505*	.388
CUMCRED	.044	-.089	-.112	.089	.253	1.000	.525*	.190
CUMGPA	.390*	.198	.306	.309	.505*	.525*	1.000	.530*
HSGPA	.682*	.514*	.588*	.530*	.388	.190	.530*	1.000

Note. Pearson Correlation
*P < .05.

Automotive Body Repair

Students enrolled in the associate's degree program for Automotive Body Repair (Table 23) averaged about one point lower on their ACT composite scores, ACT English scores, and ACT science scores compared to other associate's degree students enrolled in technology programs (Table 51). Their ACT reading scores were about average and their ACT math scores were more than two points lower than average. Their high school grade point average and college grade point averages were about one-third grade lower than the average for other associate's-degree-seeking technology students. They completed ten fewer credit hours on average than other associate's degree students in technology programs.

Table 23. Academic Variables for Associate's Degree Students Enrolled in Automotive Body Repair Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	15	14	21	17.47	29	2.50
ACTE	14	11	21	15.72	23	3.38
ACTM	14	13	19	15.86	21	1.75
ACTR	14	11	27	18.29	37	5.06
ACTS	14	16	22	19.21	41	2.12
CUMCRED	30	0	69	23.67		16.94
CUMGPA*	29	0	3.15	1.69		0.73
HSGPA*	14	1.56	2.94	2.17		0.39

*Based on a 4.0 scale

Background measures of academic performance did not prove to be significantly ($p<.05$) correlated for students

enrolled in the associate's degree program in Autobody Repair (Table 24). College grade point average ($r=.623$, $p<.05$) was the only academic variable significantly correlated to the dependent variable credit hours earned.

Table 24. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees in Autobody Repair Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.892*	.337	.863*	.850*	-.133	-.094	-.138
ACTE	.892*	1.000	.149	.657*	.825*	-.216	-.029	.118
ACTM	.337	.149	1.000	.031	.404	.063	-.328	.181
ACTR	.863*	.657*	.031	1.000	.575*	-.108	.031	-.459
ACTS	.850*	.825*	.404	.575*	1.000	.010	-.066	.183
CUMCRED	-.133	-.216	.063	-.108	.010	1.000	.623*	.172
CUMGPA	-.094	-.029	-.328	.031	-.066	.623*	1.000	.133
HSGPA	-.138	.118	.181	-.459	.183	.172	.133	1.000

Note. Pearson Correlation
*P < .05.

Civil Engineering Technology

Students enrolled in the associate's degree program for Civil Engineering Technology (Table 25) were about one-half point higher on their high school GPA and about average on their college GPA compared to other associate's degree seeking students enrolled in technical programs (Table 51). They completed about thirteen fewer credit hours, on average, than other students enrolled in technology programs.

Table 25. Academic Variables for Associate's Degree Students Enrolled in Civil Engineering Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Ranking	SD
ACTCOMP	3	16	20	18.00	33	2.00
ACTE	2	14	16	15.00	19	1.41
ACTM	2	19	21	20.00	55	1.41
ACTR	2	18	23	20.50	49	3.54
ACTS	2	21	21	21.00	55	0.00
CUMCRED	11	0	70	20.91		18.74
CUMGPA*	11	0	4.00	2.11		1.35
HSGPA*	4	2.61	3.58	3.18		0.49

*Based on a 4.0 scale

Students enrolled in the bachelor's degree program for Civil Engineering Technology (Table 26) averaged about one-half point lower on their ACT composite, about one point lower on their ACT reading and ACT science, and about two points lower on their ACT English scores than other bachelor's degree seeking technology students. Their ACT math scores averaged about one point higher. Their high school grade point average was about two-tenths higher than average and their college grade point average was about the same as other technology students (Table 53). They averaged about five more credit hours than other bachelor's degree students.

Table 26. Academic Variables for Bachelor's Degree Students Enrolled in Civil Engineering Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Ranking	SD
ACTCOMP	14	16	26	19.36	43	2.92
ACTE	14	12	25	16.07	25	3.12
ACTM	14	16	33	20.93	60	4.45
ACTR	12	12	24	18.58	38	3.78
ACTS	12	14	23	19.92	48	2.61
CUMCRED	33	0	204	63.37		49.00
CUMGPA*	33	0	4.00	2.30		1.34
HSGPA*	10	2.32	3.80	3.03		0.44

*Based on a 4.0 scale

Surprisingly, ACT math scores were not significantly ($p<.05$) correlated to persistence for students in the bachelor's degree program in Civil Engineering Technology. ACT reading ($r=.728$) and college grade point average ($r=.548$) were the only academic variables significantly ($p<.05$) related to the dependent variable credit hours earned for students seeking bachelor's degrees in Civil Engineering Technology (Table 27).

Table 27. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Civil Engineering Technology Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.645*	.845*	.772*	.649*	.495	.692*	.342
ACTE	.645*	1.000	.366	.440	.299	.361	.473	.493
ACTM	.854*	.366	1.000	.313	.538	.233	.396	.060
ACTR	.772*	.440	.313	1.000	.411	.728*	.811*	.670*
ACTS	.649*	.299	.538	.411	1.000	.295	.492	.341
CUMCRED	.495	.361	.233	.728*	.295	1.000	.548*	.362
CUMGPA	.692*	.473	.396	.811*	.492	.548*	1.000	.301
HSGPA	.342	.493	.060	.670*	.341	.362	.301	1.000

Note. Pearson Correlation

*P < .05.

Computer Information Systems

Students enrolled in the associate's degree program in Computer Information Systems (Table 28) averaged about one point higher on their ACT composite, ACT math, and ACT science scores than other students enrolled in associate's level technical programs. They averaged more than two points higher on their ACT English scores and more than three points higher on their ACT reading scores (Table 51). Their high school grade point average was about the same as other associate's degree seeking technology students and their college grade point average was about one-half grade point higher. They completed about five more credit hours than students enrolled in other associate's degree programs.

Table 28. Academic Variables for Associate's Degree Students Enrolled in Computer Information Systems Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Ranking	SD
ACTCOMP	14	14	30	19.64	45	4.70
ACTE	12	12	32	19.00	44	6.30
ACTM	12	15	29	18.92	47	4.52
ACTR	12	13	33	21.83	58	6.49
ACTS	12	15	28	20.83	54	3.41
CUMCRED	36	0	142	28.13		34.00
CUMGPA*	35	0	4.00	2.41		1.64
HSGPA*	8	1.74	3.78	2.49		0.78

*Based on a 4.0 scale

The background academic measures ACT composite scores (r=.540), and ACT math scores (r=.639), were significantly correlated to persistence for students enrolled in the associate's degree program in Computer Information Systems (Table 29). College grade point average (r=.405) was also significantly ($p<.05$) correlated to the dependent variable credit hours earned.

Table 29. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees in Computer Information Systems Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.954*	.919*	.936*	.789*	.540*	.356	.605
ACTE	.954*	1.000	.856*	.859*	.657*	.574	.745*	.776
ACTM	.919*	.856*	1.000	.774*	.701*	.639*	.713*	.915*
ACTR	.936*	.859*	.774*	1.000	.706*	.391	.595*	.619
ACTS	.789*	.657*	.701*	.706*	1.000	.189	-.232	.238
CUMCRED	.540*	.574	.639*	.391	.189	1.000	.405*	.508
CUMGPA	.356	.745*	.713*	.595*	-.232	.405*	1.000	.665
HSGPA	.605	.776	.915*	.619	.238	.508	.665	1.000

Note. Pearson Correlation
*P < .05.

The average ACT reading and ACT science scores for students enrolled in the bachelor's degree program in Computer Information Systems (Table 30) were about the same as other bachelor's degree seeking technology students. Their scores were about one point higher in ACT composite and ACT math, and about two points higher in ACT English (Table 53). Their high school grade point average was about three-tenths higher than other students seeking a

bachelor's degree in technical programs. Their college grade point average and credit hours earned were about average.

Table 30. Academic Variables for Bachelor's Degree Students Enrolled in Computer Information Systems Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Ranking	SD
ACTCOMP	9	16	27	20.67	54	4.18
ACTE	9	12	31	19.89	51	6.05
ACTM	9	15	25	20.89	59	3.33
ACTR	9	12	29	20.00	45	5.55
ACTS	9	15	29	20.78	54	4.47
CUMCRED	53	0	235	61.45		50.22
CUMGPA*	50	0	4.00	2.52		1.36
HSGPA*	11	2.28	4.00	3.03		0.52

*Based on a 4.0 scale

ACT scores and high school performance were not significantly ($p<.05$) correlated to persistence for students enrolled in the bachelor's degree program in Computer Information Systems (Table 31). College grade point average ($r=.565$) was the only academic variable found to be significantly ($p<.05$) correlated to the dependent variable credit hours earned.

Table 31. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Computer Information Systems Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.932*	.535	.846*	.932*	.222	.631	.632
ACTE	.932*	1.000	.371	.745*	.827*	.281	.622	.561
ACTM	.535	.371	1.000	.128	.359	-.115	.619	.476
ACTR	.846*	.745*	.128	1.000	.888*	.253	.314	.526
ACTS	.932*	.827*	.359	.888*	1.000	.064	.426	.538
CUMCRED	.222	.281	-.115	.253	.064	1.000	.565*	.020
CUMGPA	.631	.622	.619	.314	.426	.565*	1.000	.563
HSGPA	.632	.561	.476	.526	.538	.020	.563	1.000

Note. Pearson Correlation
*P < .05.

Diesel Mechanics

Students enrolled in the associate's degree program in Diesel Mechanics (Table 32) scored about one point lower in ACT math and ACT science scores than other associate's degree seeking students in technical programs. They scored more than a point lower in ACT English and ACT composite and about three points lower in ACT reading (Table 51). Although their college grade point average and credit hours earned were typical of students enrolled in associate's degree programs in technology, their high school grade point average was slightly lower.

Table 32. Academic Variables for Associate's Degree Students Enrolled in Diesel Mechanics Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Ranking	SD
ACTCOMP	17	13	23	16.88	24	2.55
ACTE	17	12	19	15.29	21	2.02
ACTM	17	13	22	17.24	34	2.84
ACTR	17	9	26	15.59	22	4.32
ACTS	17	16	28	19.29	42	2.95
CUMCRED	28	0	92	36.11		25.51
CUMGPA*	27	0	3.71	2.20		1.05
HSGPA*	11	1.49	3.20	2.37		0.56

*Based on a 4.0 scale

ACT scores and high school grade point average were not significantly ($p<.05$) correlated to persistence for students enrolled in the associate's degree program in Diesel Mechanics (Table 33). College grade point average was the only academic variable significantly correlated ($r=.628$, $p<.05$) to the dependent variable credit hours earned.

Table 33. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees in Diesel Mechanics Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.723*	.713*	.860*	.861*	.209	.509*	.166
ACTE	.723*	1.000	.585*	.437	.654*	.417	.454	.278
ACTM	.713*	.585*	1.000	.513*	.565*	.246	.407	.341
ACTR	.860*	.437	.513*	1.000	.657*	-.083	.326	-.084
ACTS	.861*	.654*	.565*	.657*	1.000	.178	.382	.128
CUMCRED	.209	.417	.246	-.083	.178	1.000	.628*	.595
CUMGPA	.509*	.454	.407	.326	.382	.628*	1.000	.710*
HSGPA	.166	.278	.341	-.084	.128	.595	.710*	1.000

Note. Pearson Correlation
*P < .05.

Students enrolled in the bachelor's degree program in Diesel Technology (Table 34) scored about one-half point lower in ACT science and about one point lower in ACT English, ACT math ACT reading and ACT composite than other bachelor's degree seeking students enrolled in technology programs (Table 53). Their high school grade point average, college grade point average, and number of credit hours earned were typical.

Table 34. Academic Variables for Bachelor's Degree Students Enrolled in Diesel Mechanics Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	53	12	26	18.85	40	3.07
ACTE	52	8	25	16.88	30	3.79
ACTM	52	13	28	18.87	47	3.19
ACTR	51	9	32	18.61	38	4.83
ACTS	51	16	28	20.53	52	3.04
CUMCRED	91	0	168.5	59.57		45.63
CUMGPA*	88	0	4.00	2.40		1.11
HSGPA*	43	1.68	3.75	2.73		0.57

Based on a 4.0 scale

ACT scores and high school grade point average were not significantly ($p<.05$) correlated to persistence for students enrolled in the bachelor's degree program in Diesel Mechanics (Table 35). College grade point average ($r=.558$, $p<.05$) was the only academic variable related to the dependent variable credit hours earned.

Table 35. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Diesel Mechanics Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.898*	.666*	.870*	.693*	-.198	-.029	.086
ACTE	.898*	1.000	.587*	.712*	.547*	-.244	-.124	.011
ACTM	.666*	.587*	1.000	.365*	.203	-.043	.131	.071
ACTR	.870*	.712*	.365*	1.000	.499*	-.244	-.115	.160
ACTS	.693*	.547*	.203	.499*	1.000	-.038	.042	.035
CUMCRED	-.198	-.244	-.043	-.244	-.038	1.000	.558*	.227
CUMGPA	-.029	-.124	.131	-.115	.042	.558*	1.000	.561*
HSGPA	.086	.011	.071	.160	.035	.227	.561*	1.000

Note. Pearson Correlation
*P < .05.

Drafting

Students enrolled in the associate's degree program in Drafting (Table 36) scored about one-third point higher in ACT composite, and one-half point higher in ACT English, ACT reading, and ACT science than other technology students. They scored over one point higher in ACT math. Their high school grade point average was slightly higher and their college grade point average was more than one-half point higher than other associate's degree seeking technology students (Table 51). Credit hours earned were typical for associate's degree seeking students in technology.

Table 36. Academic Variables for Associate's Degree Students Enrolled in Drafting Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	10	14	28	18.70	38	4.22
ACTE	10	14	27	17.30	32	4.00
ACTM	10	16	27	19.40	51	3.63
ACTR	10	12	29	18.90	39	6.33
ACTS	10	15	29	19.60	44	4.48
CUMCRED	39	0	106	36.53		25.04
CUMGPA*	38	0	4.00	2.65		0.86
HSGPA*	10	1.76	3.77	2.79		0.67

*Based on a 4.0 scale

There were no background academic variables significantly ($p<.05$) related to the dependent variable credit hours earned for students enrolled in the associate's degree program in Drafting (Table 37). College grade point average also lacked significance ($p<.05$) to persistence.

Table 37. Correlations Among Academic Variables for Students Enrolled in Drafting Associate's Degrees Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.882*	.837*	.864*	.929*	-.396	.633*	.783*
ACTE	.882*	1.000	.741*	.589	.839*	-.481	.520	.660
ACTM	.837*	.741*	1.000	.578	.837*	-.491	.669*	.667
ACTR	.864*	.589	.578	1.000	.759*	-.200	.486	.734*
ACTS	.929*	.839*	.688*	.759*	1.000	-.320	.612	.791*
CUMCRED	-.396	-.481	-.491	-.200	-.320	1.000	.317	.159
CUMGPA	.633*	.520	.669*	.486	.612	.317	1.000	.834*
HSGPA	.783*	.660	.667	.734*	.791*	.159	.834*	1.000

Note. Pearson Correlation
*P < .05.

Students enrolled in the bachelor's degree program in Drafting (Table 38) scored about average on ACT composite and about one-third point higher on ACT English and ACT math, but about one-third point lower on ACT reading and ACT science, than other technology students (Table 53). Their high school grade point average was about the same as other bachelor's degree seeking technology students but their college grade point average was slightly higher. They earned about an average number of credit hours compared to other bachelor's degree seeking students in technology.

Table 38. Academic Variables for Bachelor's Degree Students Enrolled in Drafting Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	36	15	26	19.72	46	3.44
ACTE	34	12	25	18.35	40	3.32
ACTM	34	13	31	20.26	57	4.36
ACTR	34	12	35	19.62	43	4.96
ACTS	34	14	31	20.59	52	4.02
CUMCRED	82	0	159.67	54.09		41.84
CUMGPA*	81	0	4.00	2.67		1.05
HSGPA*	29	1.18	3.92	2.87		0.75

*Based on a 4.0 scale

The background academic measures of ACT science scores ($r=.352$), and high school grade point average ($r=.483$) were significantly ($p<.05$) related to the dependent variable credit hours earned for students enrolled in the bachelor's

degree program in Drafting (Table 39). College grade point average (r=.510) was also significantly (p<.05) correlated to persistence.

Table 39. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Drafting Fall 1993 to Spring 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.843*	.815*	.826*	.845*	.301	.573*	.591*
ACTE	.843*	1.000	.607*	.553*	.710*	.166	.521*	.514*
ACTM	.815*	.607*	1.000	.553*	.596*	.291	.466*	.437*
ACTR	.826*	.553*	.553*	1.000	.570*	.250	.390*	.576*
ACTS	.845*	.710*	.596*	.570*	1.000	.352*	.640*	.394
CUMCRED	.301	.166	.291	.250	.352*	1.000	.510*	.483*
CUMGPA	.573*	.521*	.466*	.390*	.640*	.510*	1.000	.635*
HSGPA	.591*	.514*	.437*	.576*	.394	.483*	.635*	1.000

Note. Pearson Correlation
*P < .05.

Electronics Engineering Technology

Students enrolled in the associate's degree program in Electronics Engineering Technology (Table 40) scored about a point higher in ACT math, ACT reading, and ACT science, and about two points higher in ACT composite, and two and one-half points higher in ACT English than other associate's degree seeking students in technology programs (Table 51). Their high school grade point average was about the same as other technology students but their college grade point average was slightly lower. They completed about 12 credit hours more than average for all associate's degree seeking students in technology.

Table 40. Academic Variables for Associate's Degree Students Enrolled in Electronics Engineering Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	7	17	24	20.14	49	2.41
ACTE	7	16	23	19.14	45	2.91
ACTM	7	16	22	19.43	51	2.37
ACTR	7	14	25	19.57	43	3.95
ACTS	7	17	26	21.29	58	2.93
CUMCRED	16	0	180.33	46.19		49.74
CUMGPA*	16	0	4.00	1.87		1.13
HSGPA*	6	1.78	3.30	2.67		0.56

*Based on a 4.0 scale

ACT scores and high school grade point average were not significantly correlated to the dependent variable credit hours earned for students enrolled in the associate's degree program in Electronics Engineering Technology (Table 41). College grade point average was the only academic variable ($r=.760$, $p<.05$) significantly correlated to persistence.

Table 41. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees in Electronics Engineering Technology Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.923*	.717	.865*	.773*	.315	.595	.894
ACTE	.923*	1.000	.545	.774*	.659	.294	.476	.735
ACTM	.717	.545	1.000	.468	.364	.743	.820*	.551
ACTR	.865*	.774*	.468	1.000	.574	-.039	.525	.794
ACTS	.773*	.659	.364	.574	1.000	.038	.137	.924
CUMCRED	.315	.294	.743	-.039	.038	1.000	.760*	.533
CUMGPA	.595	.476	.820*	.525	.137	.760*	1.000	.189
HSGPA	.894	.735	.551	.794	.924	.533	.189	1.000

Note. Pearson Correlation
*$P < .05$.

Students enrolled in the bachelor's degree program in Electronics Engineering Technology (Table 42) scored about one and one-half points higher in ACT composite, ACT English, and ACT reading than other bachelor's degree seeking technology students (Table 53). They scored two points higher in ACT science and almost three points higher in ACT math. Their high school GPA was about average for bachelor's degree seeking technology students but their college grade point average was about three-tenths points lower. They completed about ten fewer credit hours than the average for bachelor's degree seeking students enrolled in technical programs.

Table 42. Academic Variables for Bachelor's Degree Students Enrolled in Electronics Engineering Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	22	16	29	21.45	60	3.79
ACTE	21	13	27	19.76	50	4.36
ACTM	22	13	35	22.77	70	5.16
ACTR	22	13	35	21.41	55	6.27
ACTS	21	18	33	23.05	72	4.33
CUMCRED	47	0	149	48.28		38.83
CUMGPA*	48	0	4.00	2.16		1.34
HSGPA*	19	0.25	4.00	2.72		0.89

*Based on a 4.0 scale

Background academic measures of ACT scores and high school grade point average were not significantly ($p<.05$) correlated to persistence for students enrolled in the

bachelor's degree program in Electronics Engineering Technology (Table 43). College grade point average ($r=.393$, $p<.05$) was the only academic variable significantly correlated to the dependent variable credit hours earned.

Table 43. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Electronics Engineering Technology Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.910*	.731*	.742*	.867*	-.033	.296	.693*
ACTE	.910*	1.000	.677*	.610*	.676*	.037	.392	.558*
ACTM	.731*	.677*	1.000	.386	.586*	-.054	.072	.718*
ACTR	.742*	.610*	.386	1.000	.592*	-.260	-.007	.408
ACTS	.867*	.676*	.586*	.592*	1.000	-.081	.228	.534*
CUMCRED	-.033	.037	-.054	-.260	-.081	1.000	.393*	-.033
CUMGPA	.296	.392	.072	-.007	.228	.393*	1.000	-.001
HSGPA	.693*	.558*	.718*	.408	.534*	-.033	-.001	1.000

Note. Pearson Correlation
*P < .05.

Manufacturing

Students enrolled in the associate's degree program in Manufacturing (Table 44) had a college grade point average that was about one-half point higher than average for associate's degree students in technology (Table 51). They earned about seven more credit hours than average.

Table 44. Academic Variables for Associate's Degree Students Enrolled in Manufacturing Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	SD
ACTCOMP	1	20	20	20	
ACTE	0				
ACTM	0				
ACTR	0				
ACTS	0				
CUMCRED	5	15	77.67	40.27	26.98
CUMGPA*	5	1.90	3.60	2.54	0.71
HSGPA*	2	2.43	2.91	2.67	0.34

*Based on a 4.0 scale

Students enrolled in the bachelor's degree program in Manufacturing (Table 45) scored about average in ACT composite and ACT science compared to other bachelor's degree seeking students in technology. They scored about one half point lower in ACT English and ACT math but almost one point higher in ACT reading (Table 53). Bachelor's degree students in Manufacturing had typical high school grade point averages and scored about one-half point higher on their college grade point average. They earned about twelve credit hours more than other bachelor's degree seeking students enrolled in technology programs.

Table 45. Academic Variables for Bachelor's Degree Students Enrolled in Manufacturing Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	9	15	24	19.89	47	3.02
ACTE	9	14	22	17.33	32	2.35
ACTM	9	12	29	19.56	52	4.98
ACTR	9	13	25	20.67	51	3.81
ACTS	9	15	26	20.89	54	3.37
CUMCRED	19	0	153	70.05		56.25
CUMGPA*	20	0	4.00	2.84		1.08
HSGPA*	9	1.89	3.67	2.85		0.62

*Based on a 4.0 scale

Background measures of academic achievement were not significantly ($p<.05$) correlated to persistence for students enrolled in the bachelor's degree program in Manufacturing Technology (Table 46). College grade point average was the only academic variable ($r=.472$, $p<.05$) significantly correlated to the dependent variable credit hours earned.

Table 46. Correlations Among Academic Variables for Students Enrolled in Bachelor's Degrees in Manufacturing Technology Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.783*	.911*	.747*	.846*	.187	.514	.788*
ACTE	.783*	1.000	.550	.770*	.416	.246	.417	.746*
ACTM	.911*	.550	1.000	.459	.921*	.316	.452	.851*
ACTR	.747*	.770*	.459	1.000	.338	-.056	.408	.416
ACTS	.846*	.416	.921*	.338	1.000	.252	.539	.780*
CUMCRED	.187	.246	.316	-.056	.252	1.000	.472*	.533
CUMGPA	.514	.417	.452	.408	.539	.472*	1.000	.612
HSGPA	.788*	.746*	.851*	.416	.780*	.533	.612	1.000

Note. Pearson Correlation
*P < .05.

Metals Technology

Students enrolled in the associate's degree program in Metals Technology (Table 47) scored one-half point higher in ACT math, about one and one-half points higher in ACT composite and ACT English, and about two points higher in ACT reading and ACT science than other students seeking associate's degrees in technology (Table 51). Their high school grade point average was typical and their college grade point average was about one-third point lower than other technology students. The average number of credit hours completed was typical for students enrolled in associate's degree programs in technology.

Table 47. Academic Variables for Associate's Degree Students Enrolled in Metals Technology Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	8	16	25	19.88	47	2.85
ACTE	8	15	24	18.13	38	2.95
ACTM	8	14	27	18.63	45	4.07
ACTR	8	14	27	20.63	50	4.75
ACTS	8	20	25	22.25	67	2.12
CUMCRED	26	0	190.33	35.37		45.61
CUMGPA*	25	0	3.89	1.76		1.34
HSGPA*	10	1.99	3.45	2.61		0.59

*Based on a 4.0 scale

The background academic measures ACT composite scores ($r=.749$) and ACT science scores ($r=.852$), were significantly ($p<.05$) correlated to the dependent variable credit hours earned for students enrolled in the

associate's degree program in Metals Technology (Table 48). College grade point average (r=.636) was also significantly (p<.05) correlated to persistence.

Table 48. Correlations Among Academic Variables for Students Enrolled in Associate's Degrees in Metals Technology Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.869*	.821*	.851*	.880*	.749*	.461	.263
ACTE	.869*	1.000	.850*	.555	.611	.596	.255	.200
ACTM	.821*	.850*	1.000	.457	.452	.652	.355	.181
ACTR	.851*	.555	.457	1.000	.876*	.572	.310	.119
ACTS	.880*	.611	.542	.876*	1.000	.852*	.681	.443
CUMCRED	.749*	.596	.652	.572	.852*	1.000	.636*	.536
CUMGPA	.461	.255	.355	.310	.681	.636*	1.000	.623
HSGPA	.263	.200	.181	.119	.443	.536	.623	1.000

Note. Pearson Correlation
*P < .05.

Water Quality

Students enrolled in the associate's degree program in Water Quality (Table 49) earned about seven credit hours more than other students enrolled in associate's degree programs in technology. They achieved about one-third lower college grade point average (Table 51) than typical for associate's degree seeking students enrolled in technical programs.

Table 49. Academic Variables for Associate's Degree Students Enrolled in Water Quality Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	2	15	18	16.50	22	2.12
ACTE	2	12	14	13.00	10	1.41
ACTM	2	16	17	16.50	27	0.71
ACTR	2	14	14	14.00	14	0.00
ACTS	2	16	28	22.00	65	8.49
CUMCRED	24	0	100.33	40.27		29.96
CUMGPA*	23	0	3.60	1.78		1.14
HSGPA*	2	1.80	3.09	2.45		0.91

*Based on a 4.0 scale

Students enrolled in the bachelor's degree program in Water Quality (Table 50) had a college grade point average slightly above the average for students enrolled in associate's degree programs in technology (Table 53). They earned about ten more credit hours than typical.

Table 50. Academic Variables for Bachelor's Degree Students Enrolled in Water Quality Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	3	16	23	20.00	48	3.61
ACTE	2	14	21	17.50	34	4.95
ACTM	2	16	18	17.00	31	1.41
ACTR	2	15	21	18.00	35	4.24
ACTS	2	17	23	20.00	48	4.24
CUMCRED	15	5	195	67.26		54.32
CUMGPA*	13	0	3.74	2.70		1.08
HSGPA*	4	1.67	2.61	2.11		0.40

*Based on a 4.0 scale

Descriptive Statistics of Academic Variables for All Students Enrolled in Technical Associate's Degrees

Descriptive statistics and Pearson correlations between academic variables were calculated for all students seeking associate's degrees in technical programs as a group. This was done to explore whether there were more similarities among associate's degree seeking students as a group or whether the similarities were stronger within a disciplinary area despite the degree level sought.

Students enrolled in thirteen associate's degree programs (Table 51) scored lower, on average, on all academic variables when compared to all other students enrolled in technology programs. On average, they scored one point lower in ACT composite, 0.8 points lower in ACT English, 1.2 points lower in ACT math, 0.8 points lower in ACT reading, and 0.4 points lower in ACT science Their high school and college grade point averages were 0.2 points lower than the average for all students enrolled in technology programs.

Table 51. Academic Variables for All Students Enrolled in Technical Associate's Degrees Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	124	13	30	18.36	36	3.40
ACTE	118	8	32	16.65	29	4.01
ACTM	118	11	30	18.09	41	3.52
ACTR	118	9	33	18.47	38	5.01
ACTS	118	14	31	20.16	49	3.46
CUMCRED	283	0	190.33	33.69		31.17
CUMGPA*	275	0	4.00	2.04		1.18
HSGPA*	93	1.49	3.78	2.54		0.58

*Based on a 4.0 scale

When academic variables for all students enrolled in associate's degree programs in technical majors were correlated with the dependent variable credit hours earned, only ACT reading scores did not significantly ($p<.05$) correlate with the dependent variable credit hours earned (Table 52). As can be seen in Table 52, ACT composite scores ($r=.294$), ACT English scores ($r=.222$), ACT math scores ($r=.460$), ACT science scores ($r=.257$), high school grade point average ($r=.410$), and college grade point average ($r=.529$) proved to be significantly ($p<.05$) correlated with the dependent variable credit hours earned for these students.

Table 52. Correlations Among Academic Variables for Students Enrolled in all Associate's Degrees in Technical Majors Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.877*	.806*	.867*	.834*	.294*	.360*	.514*
ACTE	.877*	1.000	.639*	.706*	.639*	.222*	.348*	.494*
ACTM	.806*	.639*	1.000	.546*	.671*	.460*	.525*	.576*
ACTR	.867*	.706*	.546*	1.000	.609*	.080	.286*	.397*
ACTS	.834*	.639*	.671*	.609*	1.000	.257*	.215*	.467*
CUMCRED	.294*	.222*	.460*	.080	.257*	1.000	.529*	.410*
CUMGPA	.360*	.348*	.525*	.286*	.215*	.529*	1.000	.533*
HSGPA	.514*	.494*	.576*	.397*	.467*	.410*	.533*	1.000

Note. Pearson Correlation
*P < .05.

Descriptive Statistics of Academic Variables for All Students Enrolled in Technical Bachelor's Degrees

Descriptive statistics and Pearson correlations between academic variables were calculated for all students seeking bachelor's degrees in technical programs as a group. This was done to explore whether there were more similarities among bachelor's degree seeking students as a group or whether the similarities were stronger within a disciplinary area despite the degree level sought.

Students enrolled in nine bachelor's degree programs (Table 53), on average, scored higher on all academic variables when compared to the average scores of all other technical students. They scored, on average, 0.6 points higher on ACT composite scores, 0.5 points higher on ACT English scores, 0.7 points higher on ACT math scores, 0.6 points higher on ACT reading scores, and 0.4 points higher

on ACT science scores. Bachelor's degree students scored, on average, 0.2 point higher on their high school grade point average and a 0.1 point higher college grade point average. They completed about 10 credit hours more than the average of all students enrolled in technical programs.

Table 53. Academic Variables for Students Enrolled in All Technical Bachelor's Degrees Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	186	11	30	19.87	47	3.54
ACTE	181	8	31	18.03	37	4.07
ACTM	182	9	35	20.08	55	4.21
ACTR	178	9	36	19.90	44	5.30
ACTS	177	14	33	20.98	55	3.72
CUMCRED	399	0	235	58.32		46.05
CUMGPA*	394	0	4.00	2.47		1.19
HSGPA*	157	0.25	4.00	2.81		0.64

*Based on a 4.0 scale

High school grade point average (r=.222) was the only academic background variable significantly ($p<.05$) correlated with the dependent variable credit hours earned for all students enrolled in bachelor's degree technical programs (Table 54). College grade point average (r=.511) was also significantly ($p<.05$) correlated with persistence.

Table 54. Correlations Among Academic Variables for Students Enrolled in All Bachelor's Degrees in Technical Majors Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.865*	.725*	.837*	.826*	.026	.290*	.471*
ACTE	.865*	1.000	.530*	.659*	.633*	-.031	.189*	.361*
ACTM	.725*	.530*	1.000	.389*	.501*	.013	.210*	.462*
ACTR	.837*	.659*	.389*	1.000	.613*	-.033	.150*	.384*
ACTS	.826*	.633*	.501*	.613*	1.000	.108	.300*	.339*
CUMCRED	.026	-.031	.013	-.033	.108	1.000	.511*	.222*
CUMGPA	.290*	.189*	.210*	.150*	.300*	.511*	1.000	.435*
HSGPA	.471*	.361*	.462*	.384*	.339*	.222*	.435*	1.000

Note. Pearson Correlation
*P < .05.

Descriptive Statistics of Academic Variables for All Students Enrolled in Engineering Technology Programs

Descriptive statistics and Pearson correlations between academic variables were calculated for all students seeking engineering technology degrees as a group. This was done to explore whether there were more similarities among students enrolled in engineering technology programs compared to students enrolled in other technology programs. These students were grouped together (Biglan, 1973a) because these programs require the highest math and science requirements to meet Accreditation Board of Engineering Technology (ABET) requirements.

Students enrolled in engineering technology programs (civil and electronics) scored, on average, higher than other students enrolled in technical management and vocational/technical programs in all academic variables

except college grade point average (Tables 57 & 59). On average, they scored 1.0 point higher in ACT composite, 0.6 point higher in ACT English, 1.9 points higher in ACT math, and 1.0 point higher in ACT reading and ACT science. Their high school grade point average was 0.1 point higher than other technology students but their college grade point average was about average. They completed about five more credit hours than the average completed for all technology students.

Table 55. Academic Variables for Students Enrolled in Engineering Technology Programs Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	56	15	29	20.30	50	3.27
ACTE	53	12	27	18.11	37	3.80
ACTM	54	12	35	21.22	61	4.67
ACTR	52	12	35	20.35	48	4.99
ACTS	51	14	33	21.61	61	3.68
CUMCRED	131	0	204	52.38		45.51
CUMGPA*	133	0	4.00	2.27		1.28
HSGPA*	50	0.25	4.00	2.83		0.68

*Based on a 4.0 scale

The academic background variables ACT scores and high school grade point average were not significantly ($p<.05$) correlated to the dependent variable credit hours earned for all students enrolled in engineering technology programs (Table 56). College grade point average ($r=.488$, $p<.05$) was the only academic variable significantly ($p<.05$)

correlated to persistence.

Table 56. Correlations Among Academic Variables for Students Enrolled in Engineering Technology Degrees Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.838*	.779*	.752*	.845*	.153	.338*	.500*
ACTE	.838*	1.000	.535*	.593*	.626*	.123	.238	.389*
ACTM	.779*	.535*	1.000	.410*	.647*	.126	.216	.570*
ACTR	.752*	.593*	.410*	1.000	.539*	-.012	.217	.384*
ACTS	.845*	.626*	.647*	.539*	1.000	.057	.240	.430*
CUMCRED	.153	.123	.126	-.012	.057	1.000	.488*	.191
CUMGPA	.338*	.238	.216	.217	.240	.488*	1.000	.210
HSGPA	.500*	.389*	.570*	.384*	.430*	.191	.210	1.000

Note. Pearson Correlation
*P < .05.

Descriptive Statistics of Academic Variables for All Students Enrolled in Technical Management Programs

Descriptive statistics and Pearson correlations between academic variables were calculated for all students seeking degrees in the area of technical management as a group. These students were grouped together (Biglan, 1973a) because of the moderate math and science requirements in these programs.

Students enrolled in technical management programs (agriculture, computer information systems, manufacturing, and water quality) scored about average on ACT composite and ACT reading (Table 57). They scored, on average, 0.7 point lower on ACT math and 0.5 point lower on ACT science.

Technical management students scored 0.3 point higher on ACT English than average. Their high school grade point average, college grade point average, and credit hours earned were about the same as students enrolled in engineering technology programs and vocational/technical programs.

Table 57. Academic Variables for Students Enrolled in Technical Management Programs Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	42	13	30	19.10	41	3.87
ACTE	39	8	32	17.79	36	5.32
ACTM	39	14	29	18.64	46	3.43
ACTR	39	10	33	19.46	43	5.47
ACTS	39	14	29	20.10	49	3.52
CUMCRED	146	0	235	47.85		43.76
CUMGPA*	138	0	4.00	2.34		1.34
HSGPA*	32	1.67	4.00	2.66		0.65

*Based on a 4.0 scale

ACT composite scores (r=.373), ACT English scores (r=.364), and ACT math scores (r=.369) were academic background variables significantly ($p<.05$) correlated to the dependent variable credit hours earned for all students enrolled in technical management majors (Table 58). College grade point average (r=.488) was also found to be significantly ($p<.05$) correlated to persistence.

Table 58. Correlations Among Academic Variables for Students Enrolled in Technical Management Programs Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.931*	.796*	.900*	.775*	.373*	.351*	.587*
ACTE	.931*	1.000	.680*	.814*	.612*	.364*	.456*	.483*
ACTM	.796*	.680*	1.000	.581*	.508*	.369*	.574*	.688*
ACTR	.900*	.814*	.581*	1.000	.641*	.195	.229	.515*
ACTS	.775*	.612*	.508*	.641*	1.000	.209	-.011	.408*
CUMCRED	.373*	.364*	.369*	.195	.209	1.000	.488*	.325
CUMGPA	.351*	.456*	.574*	.229	-.011	.488*	1.000	.551*
HSGPA	.587*	.483*	.688*	.515*	.408*	.325	.551*	1.000

Note. Pearson Correlation
*P < .05.

Descriptive Statistics of Academic Variables for All Students Enrolled in Vocational/Technical Programs

Descriptive statistics and Pearson correlations between academic variables were calculated for all students seeking degrees in the vocational/technical programs. These students were grouped together (Biglan, 1973a) because these programs required intensive skill development.

Students enrolled in vocational/technical programs (auto body, auto mechanics, diesel mechanics, drafting, farm mechanics, metals technology, and railroad operations) scored, on average, 0.3 point lower in ACT composite, 0.2 point lower in ACT English, 0.4 point lower in ACT math, and 0.2 point lower in ACT reading (Table 59). They scored about the same, on average, in ACT science, credit hours earned, college grade point average, and high school grade point average as students enrolled in engineering

technology and vocational/technical programs.

Table 59. Academic Variables for Students Enrolled in Vocational/Technical Programs Fall Semester 1993 to Spring Semester 1997.

Variable	N	Minimum	Maximum	Mean	Percentile Rank	SD
ACTCOMP	212	11	30	19.03	40	3.53
ACTE	207	8	28	17.27	32	3.90
ACTM	207	9	32	18.92	47	3.87
ACTR	205	9	36	19.05	40	5.22
ACTS	205	14	31	20.52	52	3.62
CUMCRED	402	0	190.33	46.24		40.28
CUMGPA*	352	0	4.00	2.25		1.18
HSGPA*	168	1.18	4.00	2.68		0.61

*Based on a 4.0 scale

ACT math scores (r=.184), ACT science scores (r=.199), and high school grade point average (r=.358) were academic background variables significantly ($p<.05$) correlated to the dependent variable credit hours earned for all students enrolled in vocational/technical programs (Table 60). College grade point average (r=.570) was also significantly ($p<.05$) correlated to persistence.

Table 60. Correlations Among Academic Variables for Students Enrolled in Vocational/Technical Degrees Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.872*	.753*	.861*	.836*	.131	.357*	.486*
ACTE	.872*	1.000	.588*	.671*	.661*	.016	.243*	.419*
ACTM	.753*	.588*	1.000	.446*	.546*	.184*	.380*	.464*
ACTR	.861*	.671*	.446*	1.000	.630*	-.001	.222*	.399*
ACTS	.836*	.661*	.546*	.630*	1.000	.199*	.385*	.362*
CUMCRED	.131	.016	.184*	-.001	.199*	1.000	.570*	.358*
CUMGPA	.357*	.243*	.380*	.222*	.385*	.570*	1.000	.594*
HSGPA	.486*	.419*	.464*	.399*	.362*	.358*	.594*	1.000

Note. Pearson Correlation
*P < .05.

Correlations for Academic Variables for All Students Enrolled in Technical Programs

Pearson correlations were calculated to identify academic variables significantly ($p<.05$) correlated to persistence and to identify their degree of correlation to each other for all students enrolled in technical programs.

Pearson correlation coefficients between academic variables for all students enrolled in technical programs are shown in Table 61. The academic variables ACT composite scores (.168), ACT Science scores (.181), college GPA (.530), and high school grade point average (.313) were significantly correlated at the 95 percent level of confidence to the dependent variable, number of cumulative credit hours earned.

Table 61. Correlations Among Academic Variables for All Students Enrolled in Technical Programs Fall Semester 1993 to Spring Semester 1997.

	ACTCOMP	ACTE	ACTM	ACTR	ACTS	CUMCRED	CUMGPA	HSGPA
ACTCOMP	1.000	.873*	.764*	.850*	.829*	.168*	.345*	.509*
ACTE	.873*	1.000	.583*	.684*	.641*	.090	.272*	.425*
ACTM	.764*	.583*	1.000	.459*	.569*	.191	.344*	.522*
ACTR	.850*	.684*	.459*	1.000	.617*	.036	.219*	.414*
ACTS	.829*	.641*	.569*	.617*	1.000	.181*	.281*	.395*
CUMCRED	.168*	.090	.191*	.036	.181*	1.000	.530*	.313*
CUMGPA	.345*	.272*	.344*	.219*	.281*	.530*	1.000	.487*
HSGPA	.509*	.425*	.522*	.414*	.395*	.313*	.487*	1.000

Note. Pearson Correlation
*p < .05.

Regression Analyses

A multiple regression equation uses variables that are known to individually predict (correlate with) the dependent variable to make a more accurate prediction (Gay, 1996). A series of stepwise multiple regression analyses were conducted based on variables correlated with persistence for students enrolled in associate's and bachelor's degree programs. These variables were used to determine the amount of variance in the dependent variable persistence, as measured by the number of semester credit hours earned at MSUN. These regression equations were built using nine background variables shown in Table 62 and four organizational variables shown in Table 63.

Table 62. Background Variables Used for Regression Analysis.

Variable Label	Definition
ACTE	ACT English Score
ACTM	ACT Math Score
ACTR	ACT Reading Score
ACTS	ACT Science Score
ACTCOMP	ACT Composite Score
AGE	Age at initial enrollment
HSGPA	High School Grade Point Average
HSRANK	High School Rank (percentile)
HSIZE	Size of Graduating Class

Table 63. Organizational Variables Used for Regression Analysis.

Variable Label	Definition
CREDHRS	Semester Credit Hours Earned
CGPA	Cumulative College Grade Point Average
CREDSEM	Average Credits per Semester Earned
SEMNUM	Number of Semesters Attended at MSUN

Stepwise analysis was chosen because the SPSS statistics program determines whether to enter or remove sets of variables in steps empirically. This approach should account for the greatest amount of variance with the fewest and most important predictors from the data set. Because multicollinearity exists between ACT scores and grade point averages, collinearity diagnostics were run on (stepwise) multiple regression equations with the SPSS 8.0 advanced statistics package.

There were complete records for all nine background and four organizational variables on 52 associate's degree students and 91 bachelor's degree students registered in

techology programs. The mean scores for academic variables for all associate's degree and bachelor's degree students (Tables 51 & 53) enrolled from Fall Semester 1993 to Spring Semester 1997 are within a few tenths of a standard deviation of those students having complete records on all nine background variables (Tables 64 & 65).

Table 64. Descriptive Statistics for Academic Variables for Technical Associate's Degree Students With All Variables Recorded Fall Semester 1993 to Spring Semester 1999.

Variable	N	Minimum	Maximum	Mean	SD
ACTCOMP	52	13	28	18.63	3.31
ACTE	52	8	28	16.79	3.64
ACTM	52	11	29	18.17	3.67
ACTR	52	11	29	18.58	4.82
ACTS	52	14	29	20.40	3.49
CUMCRED	52	0	138.00	42.92	39.08
CUMGPA*	52	0	3.83	1.98	1.02
HSGPA*	52	1.72	3.78	2.60	0.57

*Based on a 4.0 scale

Table 65. Descriptive Statistics for Academic Variables for Technical Bachelor's Degree Students With All Variables Recorded Fall Semester 1993 to Spring Semester 1999.

Variable	N	Minimum	Maximum	Mean	SD
ACTCOMP	91	14	29	20.37	3.51
ACTE	91	11	31	18.62	4.12
ACTM	91	13	31	20.71	3.91
ACTR	91	11	32	20.19	5.08
ACTS	91	14	33	21.36	3.72
CUMCRED	91	0	151	69.49	50.92
CUMGPA*	91	0	4.00	2.29	1.17
HSGPA*	91	1.68	4.00	2.89	0.58

*Based on a 4.0 scale

Stepwise Regression Analysis Using Background Variables to Predict Accumulated Credit Hours Passed

A stepwise regression analysis (Table 66) of background variables for all students enrolled in associate's degree programs in technology from Fall Semester 1993 to Spring Semester 1997 resulted in an adjusted R^2 = .095 for high school GPA. This means high school GPA accounted for 9.5% of variance for persistence for all students enrolled in associate's degree programs in technology.

Table 66. Summary of Stepwise Regression Analysis for Background Variables Predicting Accumulated Credit Hours Passed for All Students Enrolled in Associate's Degree Programs in Technology Fall Semester 1993 to Spring Semester 1997 (N=51).

Variable	B	SE B	β
Step 1			
High School GPA	0.231	.092	0.335

Note. R^2 = .112 for Step 1; Adusted R^2 = .095. ($p < .05$).

A stepwise regression analysis (Table 67) of background variables for all students enrolled in bachelor's degree programs in technology from Fall Semester 1993 to Spring Semester 1997 resulted in an adjusted R^2 = .181 for high school rank. This means high school rank

accounted for 18.1% of variance for persistence for all students enrolled in bachelor's degree programs in technology.

Table 67. Summary of Stepwise Regression Analysis for Background Variables Predicting Accumulated Credit Hours Passed for All Students Enrolled in Bachelor's Degree Programs in Technology Fall Semester 1993 to Spring Semester 1997 (N=90).

Variable	B	SE B	β
Step 1			
High School Rank	0.849	0.186	0.436

Note. R^2 = .190 for Step 1; Adusted R^2 = .181. ($p < .05$).

A stepwise regression analysis (Table 68) of background variables for all students enrolled in engineering technology degree programs from Fall Semester 1993 to Spring Semester 1997 resulted in an adjusted R^2 = .103 for age at time of initial enrollment. This means age at time of enrollment accounted for 10.3% of variance for persistence for all students enrolled in engineering technology programs.

Table 68. Summary of Stepwise Regression Analysis for Background Variables Predicting Accumulated Credit Hours Passed for All Students Enrolled in Engineering Technology Degree Programs Fall Semester 1993 to Spring Semester 1997 (N=35).

Variable	B	SE B	β
Step 1			
Age	-16.771	7.495	-.358

Note. R^2 = .128 for Step 1;
Adusted R^2 = .103 (p < .05).

A stepwise regression analysis (Table 69) of the background variables for all students enrolled in technical management programs from Fall Semester 1993 to Spring Semester 1997 resulted in an adjusted R^2 = .278 for for high school rank. This means high school rank accounted for 27.8% of variance for persistence for all students enrolled in technical management programs.

Table 69. Summary of Stepwise Regression Analysis for Background Variables Predicting Accumulated Credit Hours Passed for All Students Enrolled in Technical Management Degree Programs Fall Semester 1993 to Spring Semester 1997 (N=23).

Variable	B	SE B	β
Step 1			
High School Rank	0.708	0.225	0.556

Note. R^2 = .310 for Step 1;
Adusted R^2 = .278 (p < .05).

A stepwise regression analysis (Table 70) of the background variables for all students enrolled in

vocational/technical programs from Fall Semester 1993 to Spring Semester 1997 resulted in an adjusted R^2 = .137 for for high school rank. This means high school rank accounted for 13.7% of variance for persistence for all students enrolled in vocational/technical programs.

Table 70. Summary of Stepwise Regression Analysis for Background Variables Predicting Accumulated Credit Hours Passed for All Students Enrolled in Vocational/Technical Programs Fall Semester 1993 to Spring Semester 1997 (N=114).

Variable	B	SE B	β
Step 1			
High School Rank	0.526	0.120	0.381

Note. R^2 = .145 for Step 1;
Adusted R^2 = .137 ($p < .05$).

Stepwise Regression Analysis Using Background and Organizational Variables to Predict Accumulated Credit Hours Passed

The organizational variables credit hours per semester, number of semesters, and college GPA were added to the following regression analyses in an attempt to increase the accountability for variance in the dependent variable persistence.

A stepwise regression analysis (Table 71) was run for the background and organizational variables for all students enrolled in associate's degree programs in

technology from Fall Semester 1993 to Spring Semester 1997. The variables in this regression analysis demonstrate the importance of number of semesters in attendence and credit load per semester. The variable number of semesters entered in the first step resulted in an adjusted R^2 = .935 and the variable credit hours per semester entered in the second step resulted in an adjusted R^2 = .973. This means over 97% of the variance of persistence was accounted for by the number of semesters in attendance and the credit hours taken per semester for all associate's degree seeking students enrolled in technical programs.

Table 71. Summary of Stepwise Regression Analysis for Background and Organizational Variables Predicting Accumulated Credit Hours Passed for All Associate's Degree Seeking Students Enrolled in Technical Programs Fall Semester 1993 to Spring Semester 1997 (N=16).

Variable	B	SE B	β
Step 1			
Number of Semesters	13.342	0.877	0.969
Step 2			
Number of Semesters	12.431	0.593	0.903
Credits per Semester	2.514	0.529	0.205

Note. R^2 = .939, Adusted R^2 = .935 for Step 1; R^2 = .977, Adusted R^2 = .973 for Step 2; ($p < .05$).

A stepwise regression analysis (Table 72) was run for the background and organizational variables for all students enrolled in bachelor's degree programs in

technology from Fall Semester 1993 to Spring Semester 1997. The variables in this regression analysis demonstrate the importance of number of semesters in attendence and credit load per semester. The variable number of semesters entered in the first step resulted in an adjusted R^2 = .885 and the variable credit hours per semester entered in the second step resulted in an adjusted R^2 = .954. This means over 95% of the variance of persistence was accounted for by the number of semesters in attendance and the credit hours taken per semester for all students enrolled in bachelor's degree programs in technology.

Table 72. Summary of Stepwise Regression Analysis for Background and Organizational Variables Predicting Accumulated Credit Hours Passed for All Bachelor's Degree Seeking Students Enrolled in Technical Programs Fall Semester 1993 to Spring Semester 1997 (N=59).

Variable	B	SE B	β
Step 1			
Number of Semesters	13.129	0.616	0.942
Step 2			
Number of Semesters	11.133	0.445	0.799
Credits per Semester	3.673	0.394	0.298

Note. R^2 = .887, Adusted R^2 = .885 for Step 1; R^2 = .955, Adusted R^2 = .954 for Step 2; ($p < .05$).

A stepwise regression analysis (Table 73) was run for the background and organizational variables for all engineering technology students from Fall Semester 1993 to

Spring Semester 1997. The variables in this regression analysis demonstrated the importance of college GPA, number in high school class, and ACT reading scores for engineering technology students in predicting persistence. The variable college GPA entered in the first step resulted in an adjusted R^2 = .400, the variable number in high school class entered in the second step resulted in an adjusted R^2 = .456, and the variable ACT reading score entered in the third step resulted in an adjusted R^2 = .510. This means over 51% of the variance of persistence for engineering technology students was accounted for by the variables college GPA, number in high school class, and ACT reading score.

Table 73. Summary of Stepwise Regression Analysis for Background and Organizational Variables Predicting Accumulated Credit Hours Passed for All Engineering Technology Students Enrolled Fall Semester 1993 to Spring Semester 1997 (N=35).

Variable	B	SE B	β
Step 1			
College GPA	0.220	0.045	0.646
Step 2			
College GPA	0.231	0.043	0.670
Number in High School Class	-0.109	0.051	-0.267
Step 3			
College GPA	0.269	0.044	0.791
Number in High School Class	-0.120	0.049	-0.292
ACT Reading Score	-2.292	1.067	-0.278

Note. R^2 = .417, Adusted R^2 = .400 for Step 1;
R^2 = .487, Adusted R^2 = .456 for Step 2;
R^2 = .552, Adusted R^2 = .510 for Step 3;
($p < .05$).

A stepwise regression analysis (Table 74) was run for the background and organizational variables for all technical management students from Fall Semester 1993 to Spring Semester 1997. The variable college GPA resulted in an adjusted R^2 = .329. This means over 32% of the variance of persistence for technical management students is accounted for by the variable college GPA.

Table 74. Summary of Stepwise Regression Analysis for Background and Organizational Variables Predicting Accumulated Credit Hours Passed for All Technical Management Students Enrolled Fall Semester 1993 to Spring Semester 1997

Variable	B	SE B	β
Step			
College GPA	0.286	0.083	0.600

Note. R^2 = .359, Adusted R^2 = .329 for Step 1; ($p < .05$).

A stepwise regression analysis (Table 75) was run for the background and organizational variables for all vocational/technical students from Fall Semester 1993 to Spring Semester 1997. The variable college GPA resulted in an adjusted R^2 = .348. This means 34.8% of the variance of persistence for vocational/technical students was accounted for by the variable college GPA.

Table 75. Summary of Stepwise Regression Analysis for Background and Organizational Variables Predicting Accumulated Credit Hours Passed for All Vocational/Technical Students Enrolled Fall Semester 1993 to Spring Semester 1997 (N=110).

Variable	B	SE B	β
Step			
College GPA	0.197	0.026	0.595

Note. R^2 = .354, Adusted R^2 = .348 for Step 1; ($p < .05$).

A Summary of The Impact of Selected Background and Organizational Variables on Persistence

The results of this study support Pascarella, Duby, and Iverson's (1983) observation that student background characteristics have an effect on retention. This study revealed a relationship to persistence for the following variables: ACT scores, age at time of initial enrollment, gender, high school grade point average, high school rank, program of study, credit hours per semester, and cumulative grade point average.

ACT Scores

The results of this study support Tinto (1975) and Ott's (1988) conclusion that ACT scores are "reasonable" for comparisons in college programs. ACT comprehensive,

ACT English, ACT math, and ACT science scores were significantly ($p<.05$) correlated to persistence when all associate's degree technical programs were grouped together (Table 78).

ACT comprehensive, science, and math scores were also correlated to persistence for students enrolled in associate's degree programs in computer information systems, automotive mechanics, and metals technology. Only ACT science scores proved significantly ($p<.05$) correlated to persistence for bachelor's degree seeking students in the drafting program (Table 79).

Age at Time of Initial Enrollment

This study revealed a correlation of age at time of enrollment ($r=.139$, $p<.05$) to persistence when all students enrolled in associate's degree technical programs were grouped together. This study also revealed a correlation of age ($r =.105$, $p<.05$) to persistence when all bachelor's seeking technical students were grouped together.

Race

This study resulted in no significant ($p<.05$) correlation between race and persistence. This may be

probably due to the large preponderance of Caucasian (67.3%) and unknown (23.9%) in the study population (Table 5).

Gender

Most programs in technology were predominately male and consequently had insufficient numbers of females to attempt a correlation of gender with persistence (Table 4). These programs of study with sufficient numbers of women to calculate correlations of gender to persistence were the associate's and bachelor's degree program in computer information systems and the associate's and bachelor's degree program in drafting.

There were differences in correlation to persistence between men and women enrolled in the associate's degree in computer information systems. College grade point average ($r=.545$, $p<.05$), ACT math ($r=.966$), ACT science ($r=.934$), and ACT composite ($r=.932$) were correlated to persistence for males, while and only high school grade point average was correlated ($r=.958$) to persistence for females. Age ($r=.392$) was correlated to persistence for men enrolled in the associate's program in drafting, but there were no correlations to persistence for women.

College grade point average was the only variable correlated to persistence for both males (r=.669) and females (r=.454) enrolled in the bachelor's program in computer information systems. Persistence for males in the bachelor's degree program in drafting was correlated to college grade point average (r=.591), ACT math (r=.424), ACT science (r=.457), ACT composite (r=.431), high school grade point average (r=.523), and high school rank (r=.447). These variables did not correlate significantly to persistence for females in the bachelor's program of drafting.

High School Grade Point Average (HSGPA)

This study supports Astin's (1972) observation that high school grade point average was positively related to persistence. High school grade point average was correlated to persistence ($r=.410$, $p<.05$) when all students enrolled in associate's degree programs were grouped together (Table 57). High school grade point average was also correlated to persistence ($r=.222$, $p<.05$) when all bachelor's degree seeking students in technical programs were grouped together (Table 58). A stepwise regression analysis (Table 66) for all students enrolled in

associate's degree programs in technology revealed that high school grade point average accounted for 9.5% of variance for persistence.

High School Rank

There was no significant correlation between high school rank and persistence when all students enrolled in associate's degree programs were grouped together. There was, however a correlation ($r=.341$, $p<.05$) to persistence when all students enrolled in bachelor's degree programs were grouped together.

A stepwise regression analysis (Table 67) for all students enrolled in bachelor's degree programs revealed that high school rank accounted for 18.1% of variance for persistence. A stepwise regression analysis (Table 69) for all students enrolled in technical management programs revealed that high school rank accounted for 27.8% of variance for persistence. A stepwise regression analysis (Table 70) for all students enrolled in vocational/technical programs revealed that high school rank accounted for 13.7% of variance for persistence.

High School Size

This study supports Baird's (1969) conclusion that there is little relationship between high school size and college achievement. There was no correlation, by academic program, between high school size and persistence.

Program of Study

Mean credit hours earned for all students enrolled in associate's degree programs in technology was 33.69 credit hours with a standard deviation of 31.17 credit hours (Table 76). Choice of program at the associate's degree level does result in differences in persistence. Persistence ranged from a low mean of 20.91 credit hours in the Civil Engineering Technology program to a high mean of 46.19 credit hours in the Electronics Engineering Technology program.

Table 76. Persistence of Students (Credit Hours Earned) Enrolled in Associate's Degree Technical Programs Fall 1993 to Spring 1997.

Program	N	Minimum	Maximum	Mean	SD
Associate Students	283	0	190.33	33.69	31.17
Engineering Technology Degrees					
Civil	11	0	70	20.91	18.74
Electronics	16	0	180.33	46.19	49.74
Technical Management Degrees					
Agriculture	18	0	90	41.33	26.92
Computers	36	0	142	28.13	34
Manufacturing	5	15	77.67	40.27	26.98
Water Quality	24	0	100.33	40.27	29.96
Vocational/Technical Degrees					
Automotive	47	0	104	32.34	30.05
Body	30	0	69	23.67	16.94
Diesel	28	0	92	36.11	25.51
Drafting	39	0	106	36.53	25.04
Metals	26	0	190.33	35.37	45.61

The mean credit hours earned for all students enrolled in bachelor's degree programs in technology was 58.32 credit hours with a standard deviation of 46.05 (Table 77). Choice of program at the bachelor's degree level appears to result in differences in persistence. Persistence ranged from a low mean of 48.28 credit hours in electronics engineering technology students to a high mean of 70.05 credit hours in manufacturing.

Table 77. Persistence of students (Credit hours Earned) Enrolled in Bachelor's Degree Technical Programs Fall 1993 to Spring 1997.

Program	N	Minimum	Maximum	Mean	SD
Bachelor Students	399	0	235	58.32	46.05
Engineering Technology Degrees					
Civil	33	0	204	63.37	49
Electronics	47	0	149	48.28	38.83
Technical Management Degrees					
Agriculture	12	0	150	58.17	44.74
Computers	53	0	235	61.45	50.22
Manufacturing	19	0	153	70.05	56.25
Water Quality	15	5	195	67.26	54.32
Vocational/Technical Degrees					
Automotive	47	0	188	58.69	47.95
Diesel	91	0	168.5	59.57	45.63
Drafting	82	0	159.67	54.09	41.84

The persistence of associate's degree students in all technical programs demonstrated a significant correlation ($p<.05$) to ACT comprehensive, English, math, and science scores, college grade point average and high school grade point average (Table 78).

Table 78. Mean Values for Background Variables, Organizational Variables And Credit Hours Earned (Persistence) of Students Enrolled in Associate's Degree Technical Programs Fall 1993 to Spring 1997.

Program	N	Mean Credits	ACT Comp	ACTE	ACTM	ACTS	CGPA	HSGPA
Associate	283	33.7	**18.4**	**16.7**	**18.1**	**20.2**	**2.04**	**2.54**
Engineering Technology Degrees								
Civil	11	20.9	18.0	15.0	20.0	21.0	2.11	3.18
Electronics	16	46.2	20.1	19.1	19.4	21.3	**1.87**	2.67
Technical Management Degrees								
Ag	18	26.9	17.7	16.1	17.5	18.8	**2.10**	2.65
Computers	36	28.1	**19.6**	19.0	**18.9**	20.8	**2.41**	2.49
Manufact	5	40.3	20.0				2.54	2.67
Water Qual	24	40.3	16.5	13.0	16.5	22.0	1.78	2.45
Vocational/Technical Degrees								
Auto	47	32.3	**18.5**	16.3	**18.7**	**20.7**	**1.65**	**2.54**
Body	30	23.7	17.5	15.7	15.9	19.2	**1.69**	2.17
Diesel	28	36.1	16.9	15.3	17.2	19.3	**2.20**	2.37
Drafting	39	36.5	18.7	17.3	19.4	19.6	2.65	2.79
Metals	26	35.4	**19.9**	18.1	18.6	**22.3**	**1.76**	2.61

Bold type shows correlation ($p<.05$) to credits earned

College grade point average and high school grade point average were significantly correlated to persistence for all bachelor's degree seeking students (Table 79). College grade point average was also correlated to persistence for all engineering technology students, all vocational/technical students, and all technical management students (excluding water quality which had no correlation with persistence).

Table 79. Mean Values for Background Variables, Organizational Variables and Credit Hours Earned (Persistence) of Students Enrolled in Bachelor's Degree Technical Programs Fall 1993 to Spring 1997.

Program	N	Mean Credits	ACT Comp	ACTE	ACTM	ACTS	CGPA	HSGPA
Bachelor	399	58.3	19.9	18.0	20.1	21.0	**2.47**	**2.81**
Engineering Technology								
Civil	33	63.4	19.4	16.1	20.9	19.9	**2.30**	3.03
Electronics	47	48.3	21.5	19.8	22.8	23.1	**2.16**	2.72
Technical Management								
Computers	53	61.4	20.7	19.9	20.9	20.8	**2.52**	3.03
Manufact	19	70.1	19.9	17.3	19.6	20.9	**2.84**	2.85
Water Qual	15	67.3	20.0	17.5	17.0	20.0	2.70	2.11
Vocational/Technical								
Ag Mech	12	58.1	19.4	16.6	20.5	21.1	**2.39**	2.62
Automotive	47	58.7	20.8	19.3	19.6	21.3	**2.45**	2.90
Diesel	91	59.6	18.9	16.9	18.9	20.5	**2.40**	2.73
Drafting	82	54.1	19.7	18.4	20.3	**20.6**	**2.67**	**2.87**

Bold type shows correlation (p<.05) to credits earned

Credit Hours per Semester

This study supports the observations that credit hours per semester significantly correlated to persistence (Okun, Weir, Richards, & Benin, 1990; Johnson, 1994; and Bidden, 1995). Credit hours per semester correlated (r=.669, p<.05) with persistence when all associate's programs were grouped together and correlated (r=.723, p<.05) with persistence when all bachelor's programs were grouped together.

Cumulative Grade Point Average

This study supports previous observations that cumulative grade point average has a significant relationship to persistence (Voorhees, 1985; Pascarella et. al., 1986; Bers, 1988; and Biddar, 1995). The cumulative (college) grade point average correlated ($r=.529$, $p<.05$) with persistence when all students enrolled in associate's degree programs were grouped together (Table 52). The cumulative (college) grade point average also correlated ($r=.511$) with persistence when all bachelor's degree programs were grouped together (Table 54).

A stepwise regression analysis (Table 73) of background and organizational variables revealed that college grade point average accounted for 40% of variance in persistence for all students enrolled in engineering technology programs and for all students enrolled in technical management programs accounted for 32.9% variance in persistence(Table 74). In addition, a stepwise regression analysis (Table 75) of all background and organizational variables run for all students enrolled in all vocational/technical programs revealed that college grade point average accounted for 34.8% of variance relative to persistence.

The findings summarized in this chapter offer information that can help interested parties to better understand the relationships among selected variables related to college student persistence in technical programs at the college level. The implications and potential applications of these findings are discussed in the next chapter.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Overview of the Study

This study had two major goals:

1. To determine which student background variables were most useful as predictors of persistence in technical programs at MSUN.
2. To determine which organizational variables (academic performance measures) were most useful as predictors of persistence in technical programs at MSUN.

A longitudinal study of background and organizational variables was used to identify predictors of persistence for students who enrolled in technology programs at MSUN from Fall Semester 1993 to Spring Semester 1997. These academic programs covered much of the spectrum of Biglan's typology (Biglan, 1973) in regard to level of paradigm development (hard vs. soft), application (theoretical vs. applied), and objects of study (life vs. nonlife). To better identify and compare predicter variables for student

persistence in various programs of study, this study utilized data sources and definitions commonly available at colleges and universities (Lanni, J.C., 1997).

The data used in this study were based on Bean's rules for selection of background and organizational variables (1982a):

1. Background variables should probably include only objective information about a student before matriculation.
2. Organizational variables should include only those variables that can be verified by observing a student or the student's record.

The cohort for this study consisted of all students who enrolled in technical programs at Montana State University- Northern from Fall Semester 1993 to Spring Semester 1997. Credit hours earned and college grade point average were followed until Spring semester 1999 for those students having complete records on all background and organizational variables. The extra two years allowed the opportunity to collect data about those bachelor's degree seeking students who did not complete their program of study in four years.

The data source for the study was the Registrar at Montana State University- Northern. The statistical techniques employed were frequencies, means, and standard

deviations to generate summary statistics of the key background and organizational variables. Pearson correlations were calculated to screen out variables not related to the dependent variable persistence or those redundant variables that were less accessible and potentially collinear. Multiple regressions were used to examine the comparative impact of each background and organizational variable on persistence.

Summary of the Findings by Academic Program

A summary of findings concerning the following programs of study are described in this section: associate's degree in agriculture, bachelor's degree in agricultural mechanics, associate's and bachelor's degree in automotive mechanics, associate's degree in autobody repair, bachelor's degree in civil engineering technology, associate's and bachelor's degree in computer information systems, associate's and bachelor's degree in diesel mechanics, associate's and bachelor's degree in drafting, associate's and bachelor's degree in electronics, bachelor's degree in manufacturing, associate's degree in metals, all associate's degrees, all bachelor's degrees,

all engineering technology degrees, all technical management degrees, and all vocational/technical degrees.

Associate's Degree in Agriculture

Students enrolled in the associate's degree program in agriculture scored lower on their ACT composite, English, math, reading, and science scores than other associate's degree seeking students. Their college grade point average was the only variable correlated to persistence and supports the arguments of Pascarella et al. (1986); Bers (1988); and Biddar (1995) that cumulative grade point average has a significant effect on graduation rates.

Bachelor's Degree in Agricultural Mechanics

Students in the bachelor's degree program in agricultural mechanics scored lower on their ACT composite, reading, and English scores and higher on their math scores than other bachelor's degree seeking students. Their college grade point average was the only variable correlated to persistence. This finding again supports college grade point average as a significant variable.

Associate's Degree in Automotive Mechanics

Students enrolled in the associate's degree program in automotive mechanics scored lower on their ACT English, reading, and college GPA but higher on ACT math and science than other students enrolled in associate's degree programs. ACT composite scores, math scores, science scores, college GPA and high school GPA were correlated to persistence. These findings support Tinto (1975) and Ott (1988) who found ACT scores reliable for group comparisons. College grade point average and high school grade point average (Astin, 1972) were again supported as positively related to retention.

Bachelor's Degree in Automotive Mechanics

Students enrolled in the bachelor's degree program in automotive mechanics scored lower on their ACT math, and higher in ACT composite, English, reading, and science than other students enrolled in bachelor's degree programs. College grade point average was again the only variable correlated to persistence.

Associate's Degree in Autobody Repair

Students enrolled in the associate's degree in autobody repair scored lower on their ACT composite, English, math, and science scores, and their high school GPA and college GPA was lower than other students enrolled in associate's degree programs. College grade point average was again the only variable correlated to persistence.

Bachelor's Degree in Civil Engineering Technology

Students enrolled in the bachelor's degree in civil engineering technology averaged lower on their ACT composite, English, reading, and science scores, and higher on their math scores and high school GPA than other students enrolled in bachelor's degree programs. The variables ACT reading score and college GPA were correlated to persistence. ACT reading scores were likely significant for bachelor degree students due to the increased requirements for interpretation of contracts and specifications.

Associate's Degree in Computer Information Systems

Students enrolled in the associate's degree in computer information systems averaged higher on their ACT composite,

English, math, science, reading, and college GPA than other associate's degree students. ACT composite, ACT math, and college grade point average were again correlated to persistence in this program.

Bachelor's Degree in Computer Information Systems

Students enrolled in the bachelor's degree in computer information systems averaged higher on their ACT composite, English, and math scores and high school GPA than other bachelor's degree seeking students. College grade point average was again the only variable correlated to persistence.

Associate's Degree in Diesel Mechanics

Students enrolled in the associate's degree program in diesel mechanics scored lower on their ACT composite, English, math, reading, science, and high school grade point average than other students enrolled in associate's programs. College grade point average was the only variable correlated to persistence.

Bachelor's Degree in Diesel Mechanics

Students enrolled in the bachelor's degree program in diesel mechanics scored lower than other students enrolled in bachelor's programs on their ACT composite, English, math, reading, and science scores. College grade point average was the only variable correlated to persistence.

Associate's Degree in Drafting

Students enrolled in the associate's degree program in drafting scored scored higher on their ACT composite, English, math, reading, science, and higher on their high school GPA and college GPA than other students enrolled in associate's degree programs. There were no variables correlated to persistence.

Bachelor's Degree in Drafting

Students enrolled in the bachelor's degree program in drafting performed lower on ACT reading and science scores but scored higher on ACT English and math than other students enrolled in bachelor's degree programs. Their college GPA was slightly higher. ACT science, college grade point average, and high school grade point average were again correlated to persistence.

Associate's Degree in Electronics Engineering Technology

Students enrolled in the associate's degree program in electronics scored higher on their ACT composite, English, math, reading, and science than other students enrolled in associate's degree programs. College GPA was the only variable correlated to persistence.

Bachelor's Degree in Electronics Engineering Technology

Students enrolled in the bachelor's degree program in electronics performed higher in ACT composite, English, math, reading, and science scores than other bachelor's degree seeking students. Although their high school GPA was about average, they had a lower college grade point average. Again, only college GPA was correlated to persistence.

Bachelor's Degree in Manufacturing

Students enrolled in the bachelor's degree program in manufacturing scored lower in ACT English and math but higher in ACT reading compared to other bachelor's degree seeking students. College grade point average was again the only variable correlated to persistence.

Associate's Degree in Metals

Students enrolled in the associate's degree program in metals technology scored higher in ACT composite, English, math, reading, and science than other students seeking associate's degrees. ACT composite, ACT science , and college grade point average were correlated to persistence.

All Associate's Degrees

When all students enrolled in associate's degree programs were grouped together, the following correlations to persistence were revealed: ACT composite, ACT English, ACT math, ACT science, high school GPA, and college GPA. These variables are consistent with those found in individual programs of study. The background variable high school GPA accounted for only 9.5% of variance in persistence and the organizational variable number of semesters completed at MSUN accounted for over 93.5% of variance in persistence.

All Bachelor's Degrees

Only high schoool GPA and college GPA were correlated to persistence when all students enrolled in bachelor degree programs were grouped together. The background

variable high school rank accounted for 18.1% of variance in persistence and the organizational variable number of semesters completed at MSUN accounted for 88.5% of variance in persistence.

All Engineering Technology Degrees

College GPA was the only variable correlated to persistence when all engineering technology students were grouped together. The background variable age at time of enrollment accounted for 10.3% of variance in persistence and the organizational variable college GPA accounted for 40% of variance in persistence.

All Technical Management Degrees

When all students enrolled in technical management programs were grouped together, the following correlations to persistence were revealed: ACT composite, ACT English, ACT math, and college GPA. The background variable high school rank accounted for 27.8% of variance in persistence and the organizational variable college GPA accounted for 32.9% of variance in persistence.

All Vocational/Technical Degrees

When all students enrolled in vocational/technical programs were grouped together, the following correlations to persistence were revealed: ACT math, ACT science, high school GPA, and college GPA. The background variable high school rank accounted for 13.7% of variance in persistence and the organizational variable college GPA accounted for 34.8% of variance in persistence.

Implications/Conclusions

This study investigated how student background variables and organizational variables by academic major are related to persistence. The results of this study have demonstrated that eight different variables are useful for predicting persistence among the various programs in technology at MSUN. These eight variables are college grade point average, ACT composite scores, ACT math scores, ACT science scores, ACT reading scores, high school grade point average, high school rank, and number of semesters enrolled at MSUN.

College Grade Point Average- College grade point average only trails number of semesters enrolled at MSUN as the most important variable related to persistence. It is

the only identifiable variable related to persistence in associate's degree programs in agriculture, autobody repair, diesel, electronics, and in bachelor's degree programs in agricultural mechanics, automotive mechanics, computer information systems, diesel, electronics, and manufacturing.

College grade point average is also related to persistence in associate's degrees in auto mechanics, and computer information systems, and also related to persistence in bachelor's degrees in civil engineering technology and drafting.

College grade point average accounted for about one-third of the variance in persistence when organizational variables were considered for all students enrolled in engineering technology programs and technical management programs. College grade point average, however, only accounted for about one-tenth of the variance in persistence for all students enrolled in vocational/technical programs.

ACT Composite Scores- ACT composite scores correlated with persistence in associate's degrees in automotive mechanics, computer information systems, and metals.

ACT Math Scores- ACT math scores, like ACT composite scores, correlated with persistence in associate's degrees in automotive mechanics and computer information systems.

ACT Science Scores- ACT science scores, like ACT composite scores, correlated with persistence in associate's degrees in automotive mechanics and metals and also correlated with persistence in the bachelor's degree in drafting.

ACT Reading Scores- ACT reading scores only correlated with persistence in the bachelor's degree program in civil engineering technology.

High School Grade Point Average- High school grade point average only correlated with persistence in the associate's degree in automotive mechanics and bachelor's degree program in drafting.

High School Rank- High school rank was a more important background variable for students in technical management programs than vocational/technical programs or engineering technology programs. High school rank accounted for over one-quarter of the variance of persistence for all students enrolled in technical management programs, and over one-tenth of the variance of persistence for all students enrolled in vocational/technical programs.

Number of Semesters- Number of semesters enrolled was the most important variable related to persistence at MSUN. This variable accounted for over nine-tenths of the variance of persistence for students enrolled in all associate's degree programs and bachelor's degree programs.

Recommendations for Action

If the rate of persistence for students enrolled in technical programs at MSUN is going to be improved, career counselors, academic support services personnel, and program advisors should be made aware of the findings in this study to implement the following actions as soon as possible:

1. Student orientation should include information about background variables that specifically relate to persistence (success) for each program of study.
2. College grade point average should be closely monitored by faculty advisors and student services personnel in order to provide, as needed, career counseling or academic support for students enrolled in associate's degree programs in agriculture, auto mechanics, autobody repair, computer information systems, diesel mechanics, electronics, and metals. College grade point average should also be closely monitored for bachelor's degree programs in agricultural mechanics, automotive mechanics, civil engineering technology, computer information systems, diesel mechanics, drafting, electronics, and manufacturing.
3. ACT composite scores should be reviewed by faculty

advisors and student services personnel before admission to associate's degree programs in automotive mechanics, computer information systems, or metals. Those students with low ACT composite scores in these programs should be closely monitored to provide career counseling or academic remediation as necessary.

4. ACT math scores should be reviewed by faculty advisors and student services personnel before admission to associate's degree programs in automotive mechanics and computer information systems. Those students with low ACT math scores in these programs should be closely monitored to provide remediation in mathematics as necessary.
5. ACT science scores should be reviewed by faculty advisors and student services personnel before admission to associate's degree programs in automotive mechanics, metals, or a bachelor's degree in drafting. Those students with low ACT science scores in these programs should be closely monitored to provide career counseling or academic support as necessary.
6. ACT reading scores should be reviewed by faculty advisors and student services personnel before admission to a bachelor's degree program in civil engineering technology. Those students with low ACT reading scores in these programs should be closely monitored to provide remediation in reading as necessary.

7. High school grade point averages should be reviewed by faculty advisors and student services personnel before admission to an associate's degree program in automotive mechanics or a bachelor's degree program in drafting. Those students with a low high school grade point average enrolled in these programs should be closely monitored to provide career counseling or training in study skills as necessary.
8. High school grade point averages of females should be reviewed by faculty advisors and student services personnel before admission to an associate's degree program in computer information systems. Those females with a low high school grade point average enrolled in the associate's degree program should be closely monitored by program faculty and student support services personnel to provide career counseling or study skills training as necessary.
9. ACT math scores, ACT science scores, and ACT composite scores should be reviewed by faculty advisors and student services personnel before admitting males to an associate's degree program in computer information systems. Those males with a low ACT math scores, ACT science scores, and ACT composite scores enrolled in the associate's degree program in computer information systems should be closely monitored to provide career

counseling or academic remediation as necessary.

10. ACT math scores, ACT science scores, ACT composite scores, and high school rank for male students should be reviewed by faculty advisors and student services personnel before admission to a bachelor's program in drafting and monitored to provide, as needed, career counseling or academic remediation.

Recommendations for Future Research

The following recommendations for follow-up research should help improve understanding persistence at institutions similar to MSUN:

1. Continue to collect data on the Fall 1993 to Spring 1997 initial enrollment cohort to include outliers due to part-time status, stopouts, and readmissions. Extending this study could also show potential changes, over time, in student background characteristics or programmatic/institutional expectations.
2. Add job placement as a variable related to persistence for students in associate's degree programs and non-professional programs. Student placement and employer hiring requirements for degrees varies by program area

and has a direct influence on persistence.

3. Replicate this study with "non-technical" programs of study at MSUN to identify background and organizational variables related to persistence.
4. Replicate this study in other institutions similar to MSUN to compare and contrast the background variables of the students and organizational variables related to persistence.

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