STUDENT CHARACTERISTICS, INSTITUTIONAL CHARACTERISTICS, AND UNDERGRADUATE ACHIEVEMENT: A STUDY OF VIRGINIA TECH, 1985 TO 1989

by

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(Abstract)

One of the most compelling questions in higher education is why some students achieve and others do not. In this study, 1323 Virginia Tech students who completed the 1985 Cooperative Institutional Research Program (CIRP) freshman survey were followed up over a four-year period in order to identify characteristics that explain differences in grades. Three major categories of characteristics were studied: institutional characteristics, student demographic characteristics, and student nontraditional characteristics. Forty characteristics were regressed on the final quality credit average (QCA) for each of the four undergraduate years. Separate regression analyses were run for the university as a whole, each of the seven undergraduate colleges, and three subject-area clusters within the College of Arts & Sciences. The outcome was a set of 44 profiles of significant characteristics related to grades. These profiles were intended as a useful reference for both faculty members and administrators.

The multivariate regression analyses identified a number of institutional and student characteristics that explained approximately 25 percent of the variance in student grades at Virginia Tech. Institutional characteristics accounted for about 6 percent of the total variance in student grades. The strongest and most consistent characteristics were selectivity and weighted student credit hours productivity. Student demographic characteristics accounted for about 12 percent of the total variance in student grades. The strongest and most consistent demographic variables were high school rank and Scholastic Aptitude Test (SAT) scores. Five other demographic characteristics -- gender, age, parent income, parent education, and race -- were also significant factors in isolated cases. Student nontraditional factors accounted for about 7 percent of the variance in student grades. Generally, student behaviors exhibited a stronger relationship with student grades than student attitudes, values, or personality traits. Study behavior and writing skills seemed to have the strongest and most consistent relationship with grades. Other nontraditional factors, including athletic interest, fraternal interest, self-efficacy, help-seeking behavior, extrinsic motivation, intrinsic motivation, locus of control, and leadership were also significantly related to grades in isolated cases.

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I would also like to express my appreciation to my wife, Ione, who kept me on track and supported me spiritually, emotionally, and financially. Most of all, I thank God, who kept us and blessed us throughout our time at Virginia Tech.

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Chapter 1

INTRODUCTION

One of the most compelling questions in higher education has always been why some students achieve and others do not. Recently, though, interest in this question has been further fuelled by two societal trends. The first of these has been the trend toward outcome assessment led by academic, business, and political leaders. Central to this trend was a perceived decrease in the quality of college education, based on indicators such as the number of students needing remedial courses and declines in student scores on standardized tests (Alexander & Stark, 1986). The second trend has been the increased competition for students resulting from an anticipated decline in the 18-21 age group. Consequently, many colleges began to "look for bodies rather than the most promising or deserving students" (Willingham, 1985, p. 2). The net result has been a growing body of research about factors which may predict student achievement, especially during the first four years of college. Among these factors, the entering characteristics of students play a critical role.

Statement of the Problem

There is a need, for a number of reasons, to further examine the relationship between student characteristics and achievement. First, the current literature reveals a

significant degree of discrepancy in the strength of this relationship. For instance, estimates of the correlation between student achievement and aptitude range from a low of .22 (Tucker, 1973) to a high of .76 (Ritchey & Lewis, 1986). Similar discrepancies can be found for many other student characteristics that have been studied (Tables 1-6).

Secondly, there are many inconsistencies in the types of samples chosen in past studies. Some studies are multi-institutional, but the majority are based on results from a few classes or a small number of students. Consequently, there seems to be a lack of information regarding the role of student characteristics within a single institution. This is a significant void, because the individual institution may be the most effective locus for dealing with achievement issues. In their recent book, How College Affects Students, Pascarella & Terenzini (1991) confirmed the importance of the individual institution as a unit of study. They stated that "the potential of such institutional assessment efforts for increasing the impact of college on students is substantial and should be encouraged" (p. 647).

Thirdly, the trend in many institutions to relax selection standards in order to compete for students has created a need to examine other nontraditional predictors of achievement. For instance, Willingham (1985) emphasized the

importance of "institutionally determined admissions policies based on multiple characteristics of students" (p. 2). Further, he emphasized the need for a "better understanding of the role and the validity of..characteristics other than high school rank (HSR) and test scores" (p. 2).

Lastly, traditional selection criteria (test scores and grades) have been criticized for their limited predictability. For example, a growing body of research has suggested that nontraditional factors may be more effective predictors of success for disadvantaged students (Johnson, 1989; Lunneborg, 1986; Ritchey, Ferris, & Lewis, 1986; Sowa, Thomson, Bennett, & Clofford, 1989; Tracey & Sedlacek, 1987; Tucker, 1973). Also, a number of studies have concluded that academic characteristics are often poor predictors of non-academic outcomes (Willingham, 1985). Others have found that nontraditional measures are more durable over time than traditional measures (Corlett, 1987; Kanarek, 1989; Tom, 1982; Willingham, 1985). Consequently, Pascarella and Terenzini have suggested the expanded use of other "student personal, attitudinal, and behavioral characteristics" (1991, p. 649) for predicting performance. Johnson (1989) aptly described this as a shift away from predictors that measure "past history" to those that measure "present characteristics" of students (p. 4). Of those

characteristics, the most commonly studied seem to be study behavior, scholastic attitudes, and personality traits. Given the importance of identifying effective predictors of achievement and the range of student characteristics yet to be examined, there seems to be a need for further study in this area.

Statement of Purpose

The purpose of this study is to develop and test a model describing the relationships between student achievement and selected student and institutional characteristics at Virginia Tech.

Research Questions

The following research questions will be investigated in this study:

1. To what extent do institutional characteristics explain the variance in student achievement for undergraduates at Virginia Tech?

2. To what extent do student characteristics explain the variance in student achievement for undergraduates at Virginia Tech?

3. Do student and institutional characteristics explain the variance in student achievement differently in each of the eleven academic units and during each of the four undergraduate years?

Significance of the Study

The primary objective of every higher education institution should be to maximize student achievement. Two important methods of accomplishing that objective are effective student selection and effective student counselling. At the present time, most universities depend heavily on such traditional selection criteria as high school grades and aptitude tests. Many educators, though, believe that these traditional criteria are inadequate, considering the broad range of students entering our universities at the present time. For this reason, Pascarella and Terenzini (1991) suggested that "there is mounting evidence that traditional admissions criteria (test scores and grades) are not the best predictors of college performance and retention for all students" (p. 649). A major outcome of this study will be the development of a set of tables that will identify characteristics that explain differences in student achievement at Virginia Tech in various academic units during each of the four undergraduate years. For instance, a profile of student characteristics for the College of Engineering may differ significantly from that of the College of Business. Similarly, the profile of student characteristics may differ significantly among colleges or clusters of majors. The use of nontraditional student characteristics, in addition to traditional

criteria, may result in more accurate student selection.

A better understanding of the role of student characteristics may also lead to the development of institutional strategies for assisting students who may be at risk academically. The intent of this study has been to identify student characteristics that are manipulable and can have an effect on achievement. For instance, various studies have shown a relationship between student study habits and achievement. If this is the case, it is conceivable that students with poor study habits could be identified and counselled in order to increase their chances of academic success.

Although the present study is directed toward student grades, it is also important to note the significant relationship between grades and other college outcomes. Pascarella and Terenzini (1991) stated that "grades are perhaps the single best predictor of obtaining a bachelor's degree and also of attending graduate or professional school and obtaining an advanced degree" (p. 388). A number of studies (Pantages and Creedon, 1978; Prather et al, 1978; Tracey & Sedlacek, 1987) also found evidence that grades have a significant effect on retention. Grades are also often associated with career outcomes (Bean, 1980; Tinto, 1975). Consequently, a better understanding of student characteristics that predict high grades may also have

important spinoffs for student retention, further education, and occupational success. These, in turn, reflect favorably on the image of the educational institution.

Theoretical Model

In this section a model of student outcomes will be examined and the scope of the present study in relation to the model will be discussed. An analysis of the literature relating to each of the individual variables considered in the study will be presented.

Pascarella and Terenzini (1991) identified two general types of models relating to student change. The first type -- "developmental" (p. 17) models -- describe the psychological stages of student growth. The second type -- "college impact" (p. 17) models -- contain variables that may influence student change. The present study is based on the college impact model.

Although there are a number of college impact models, all tend to exhibit the following three major components:

1. Student pre-enrollment characteristics that each individual brings to the learning situation.

2. Environmental characteristics within the institution that interact with student characteristics to define the learning process.

3. Student outcomes, positive and negative, intended and unintended, that result from the interaction of the

student and the environment.

One model that clearly identifies these three components is shown in Figure 1. It was developed by Alexander Astin in 1965 and has been adapted for use in higher education research in various other studies. According to this model, student outputs are affected by both student inputs and the college environment. According to Astin (1970) student outputs are "those aspects of the student's development that the college either does influence or attempts to influence (p. 224). Student inputs are "the talents, skills, aspirations and other potentials for growth and learning that the new student brings with him to college" (p.225). The college environment consists of "those aspects of the higher educational institution that are capable of affecting the student" (p.225).

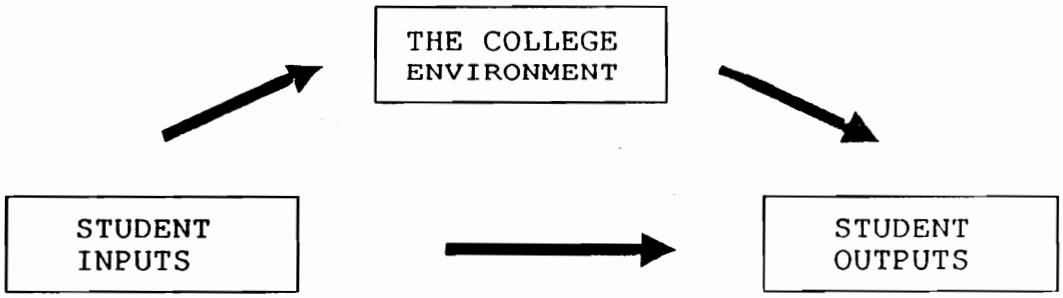


Figure 1. Alexander Astin model of student development.

The above model was utilized to identify major

categories of variables for the study. Only one student outcome -- student achievement -- was included, and it was represented by student grades. It is assumed that student grades measure basic knowledge, learning skills, and problem-solving ability. Student inputs included both demographic and nontraditional student characteristics. The college environment was represented by a set of institutional characteristics. These measures were derived from three sources: (a) the 1985 Cooperative Institutional Research Program (CIRP) survey completed by Virginia Tech students as a part of the orientation program, (b) the Virginia Tech Student Longitudinal Data File (SLF) and (c) the Virginia Tech Provost's Fact Book (VTPFB).

Literature Review

The literature relating to each of the variables included in the present study will be discussed in the following section. The major source was an ERIC search of relevant literature from the past twenty years. An initial analysis of the literature revealed that many of the sources did not provide clear, quantifiable data relating student characteristics to student grades. Consequently, a meta-analysis of only those studies which provided correlation coefficients with a significance level of .05 or less was conducted. This resulted in a total of 19 studies, as exhibited in Tables 1 - 6. The common effect chosen was the

squared correlation between each predictor variable and a measure of student achievement -- usually grade point average (GPA). This measure, known as the coefficient of determination, represents the percentage of variance in the dependent variable explained by the independent variable. Other sources which did not meet the criteria of the meta-analysis, but were considered to be important, were cited separately.

High School GPA and College Aptitude

High school GPA and college aptitude are often referred to as traditional measures of student characteristics because of their frequent use. It has been well established in the literature that these two variables are the best predictors of college achievement. Astin (1971) combined the two measures in a stepwise regression analysis and achieved a correlation of .51 for boys and .55 for girls (Table 3). Of the two measures, high school grades seem to have the greatest impact on college grades (Bean & Kuh, 1984; McCausland & Stewart, 1974; Pantages & Creedon, 1978). Nevertheless, many students attain high marks in high school and score high on college aptitude tests, yet fail to achieve in college. For instance, Astin (1971) reported that 25 percent of boys with an A average in high school fail to achieve even a B in college. This lack of consistency suggests the presence of other variables that

may also have a significant effect on student achievement. Tables 1 - 3 contain 13 studies which measure the impact of these two variables on student achievement.

A comparison of the effects of high school achievement on college achievement is included in Table 1. As indicated, high school achievement explains between 10 and 50 percent of the variance in student college achievement.

Table 1.

Summary of Correlations Between College Achievement and High School Achievement

Author/Date	Student Sample	Criterion Variable	Predictor Variable	E (r^2)
Astin, 1971	4,031 m 3,783 f	Freshman year GPA	H.S. GPA	.27** .25**
Elliott & Strenta, 1988	927 grads, Dartmouth	4th year cum. GPA	H.S. Rank	.19*
Johnson, 1989	101 l.arts students	1st year cum. GPA	H.S. Rank	.17*
Lent, Brown, & Larkin, 1986	105 fresh. & soph.	GPA (sci & tech work)	H.S. Rank	.10*
McCausland & Stewart, 1974	154 in psych lab	1st sem. fresh. GPA	H.S. Avg.	.50**
Thornell & Jones, 1986	100 fresh. small univ	1st sem. fresh. GPA	H.S. Rank	.36*
Tom, 1982	117 freshmen	Cum. GPA	H.S. GPA	.14**
Willingham, 1985	3,442 graduates	4th year cum. GPA	H.S. Rank	.20**

* p <. 05. ** p <.01.

A comparison of the effects of college aptitude scores

on college achievement is included in Table 2. As indicated, aptitude scores explain between 5 and 69 percent of the variance in college achievement.

Table 2

Summary of Correlations Between College Achievement and College Aptitude Scores

Author/Date	Student Sample	Criterion Variable	Predictor Variable	E (r^2)
Astin, 1971	4,031 m 3,783 f	Freshman yr GPA	NMSQT[a] composite	.12** .13**
Ayres & Bennett, 1983	15 Public N.C. univ.	N.T.E.[b] scores	Average SAT scores	.69*
Edwards & Waters, 1980	223 undergrads	Cum GPA	CQT[c]	.18**
Lent, Brown & Larkin, 1986	105 fresh. & soph.	GPA (sci & tech work)	Math PSAT[d]	.06*
McCausland & Stewart, 1974	154 in psych lab	1st sem. fresh. GPA	ACT[e] composite	.43**
Ritchey & Lewis, 1986	206 freshmen	Grades in 4 courses	ACT composite	.34**
Thornell & Jones, 1986	100 freshmen	1st sem. fresh. GPA	ACT composite	.16*
Tucker, 1973	200 black, male sen.	4th yr cum. GPA	SCAT[f]	.05**
Willingham, 1985	3,442 graduates	4th yr cum. GPA	SAT Scores	.20**

* $p < .05$. ** $p < .01$. [a] National Merit Scholarship Qualification Test. [b] National Teacher's Exam. [c] College Qualification Test. [d] Preliminary Scholastic Aptitude Test. [e] American College Test. [f] School and College Ability Test.

The combined effect of **both** high school achievement and college aptitude scores on college achievement is included in Table 3. In this table, the total effect was arrived at by squaring the combined correlation of the two variables. Together the two variables explained between 16 and 62 percent of the total variance in college achievement. These two variables consistently appeared as the most potent predictors of student achievement.

Table 3

Summary of Correlations Between College Achievement and a Combination of High School Achievement and College Aptitude Scores

Author/Year	Student Sample	Criterion Variable	Predictor Variable	F (R^2)
Astin, 1971	4,031 m 3,783 f	Freshman yr. GPA	H.S.Grades + NMSQT[a]	.28** .27**
Kanarek, 1989	11,771 stratified	1st yr. GPA	H.S. Rank + SAT[b]	.16**
McCausland & Stewart, 1974	154 in Psych lab	1st sem. fresh. GPA	H.S. Avg. + ACT[c]	.62**
Thornell & Jones, 1986	100 freshmen	1st sem. fresh. GPA	H.S. Rank + ACT	.38*
Tom, 1982	117 freshmen	Cum. GPA	H.S. GPA + SAT Math	.22**

* $p < .05$. ** $p < .01$. [a] National Merit Scholarship Qualification Test. [b] Scholastic Aptitude Test. [c] American College Test.

Demographic Characteristics

A number of demographic characteristics have been analyzed in relation to academic achievement. These include socio-economic status, gender, ethnicity, age, and parents' education. Astin (1971) found that when ability was controlled, both socio-economic factors and race had little effect on college achievement. He did, though, find significant relationships with both gender and parents' education (Table 4). Women consistently had higher grades than men, and students with highly educated parents achieved higher GPA's than other students. Astin (1978), in a summary of previous research, suggested that older students achieved higher grades than younger students with comparable backgrounds. Tucker (1971), in a study of black upper-classmen, found a significant relationship between occupation of father and GPA (Table 4). Finlay (1981) suggested that family background, including positive beliefs about the importance of education, may be related to student achievement. Wolfle (1980) analyzed four demographic variables (age, gender, father's education, father's socioeconomic status) in a path analysis model of achievement. He found that both age and father's education had a relatively strong total effect on achievement, as measured by verbal skills. Merante (1983), in a research summary, concluded that student achievement was related to

various demographic factors, including age, gender, birth order, income, parents' education, religious belief, and geographic location. Generally, though, most studies found that when pre-enrollment characteristics such as aptitude and high school grades are taken into consideration, demographic characteristics seem to have an insignificant effect on student achievement (Astin, 1971).

The results of two studies that examined the correlation between demographic characteristics and student achievement are summarized in Table 4. As indicated, the proportion of variance accounted for is very small.

Table 4

Summary of Correlations Between College Achievement and Selected Demographic Variables

Author/Year	Student Sample	Criterion Variable	Predictor Variable	E (r^2)
Astin, 1971	4,031 m 3,783 f	Freshman GPA	Parent education	.01**
Astin, 1971	4,031 m 3,783 f	Freshman GPA	Race	.01** .03**
Astin, 1971	4,031m	Freshman GP	Religion (Jewish)	.01**
Mills, 1978	200 undergrads	Fresh-sen cum GPA	Age	.02*
Mills, 1978	20 undergrads	Fresh-sen cum GPA	Gender (female)	.04**

* $p < .05$. ** $p < .01$.

Nontraditional Variables: Attitudes, Values, Personality Traits, and Behavior

These variables are often referred to as nontraditional variables, because they are seldom considered as predictors. Many educators, though, believe that they play an important role in student achievement (Johnson, 1989; Pascarella & Terenzini, 1991; Willingham, 1985).

Much of the research on student attitudes and values has centered on motivation (Edwards & Waters, 1980; Edwards & Waters, 1981; Lenning, 1974; Pace, 1984; Watkins, 1982). Bean and Kuh (1984) postulated that motivation may affect both GPA and increased contact with faculty. Astin (1971) found that drive to achieve was significantly related to achievement, even after controlling for high school grades, aptitude, and college selectivity. Pace (1984) found a consistent relationship between "quality of effort" and self-reported achievement gains.

Closely related to motivation is the concept of academic integration, defined by Bean and Kuh (1984) as "interest, motivation, and confidence in the student role, and perceiving that one thinks like faculty" (p. 463). Bean and Kuh (1984) found it to be the second most important influence on GPA, and similar results were reported by Bean (1985).

The value a student places on academic achievement is

also important. Both Pascarella (1985) and Weidman (1989) stressed the importance of student aspiration as a driving force in both achievement and degree attainment. Pauk (1974) also stressed the value of clear educational goals, willingness to subordinate other goals to attain educational goals, and the desire to succeed.

Astin (1978) analyzed six value factors as part of the 1966 CIRP survey, but found only two that related to achievement. Higher achievement was more likely when students were less hedonistic (self-indulgent) and had a lower business interest. Gough and Lanning (1986), among others, suggested that personality traits may be as accurate as aptitude measures for predicting academic success. One of the most important of these traits seems to be locus of control. Generally, most studies have shown that those with a strong internal locus of control attain higher scores than those with a strong external locus of control (Gilmor & Reid, 1978; Prociuk & Breen, 1977; Wilhite, 1989). In addition, there seems to be a significant correlation between internal locus of control and motivation (Edwards & Waters (1981), both of which result in higher achievement.

Another important trait is introversion-extroversion, although the results are somewhat mixed. Generally, the research indicates that introverts receive higher grades than extroverts (Cowell & Entwistle, 1971; Goh & Moore,

1977). A study by Lemke et al. (1974), though, found it to be true only for high ability students. Low ability extroverts tended to obtain better grades than low ability introverts.

Astin (1978) studied four personality factors as part of the 1966 CIRP survey. One factor, intellectual self-esteem, had a strong positive relationship with student achievement. This finding has been confirmed in a number of other studies (Lent, Larkin, & Brown, 1986; Van de Water, 1987; Wilhite, 1989; Tracey & Sedlacek, 1987).

Some research has also been invested in identifying specific student behaviors that may predict achievement. One of the most important of these is study habits. Generally, the research indicates that high achieving students have superior study habits (Astin, 1971; Capella, Wagner, & Kusmierz, 1982; Corlett, 1974; Dougherty & Schmidt, 1981; Johnson, 1989; Lenning, 1974; Lin & McKeachie, 1970; Tucker, 1973; Weigel & Weigel, 1970). Effective study habits also seem to be closely linked with student attitude and personality traits (Bean & Kuh, 1984; Rutkowski & Domino, 1974).

The impact of student involvement in co-curricular activities has exhibited mixed results in the literature. For instance, Bean & Kuh (1984) found that most students involved in campus organizations achieved higher GPA's and

had greater contact with faculty. Tucker (1973) also found that amount of extracurricular activity was significantly related to GPA. Astin (1978) suggested that student involvement, especially in honors programs and research activities, had a positive effect on grades. On the other hand, both Bean (1985) and Tinto (1975) concluded that student social life had a negative effect on grades. This seems to suggest that involvement in academic-related activities is more likely to lead to higher grades than simple social involvement.

A number of other student behaviors have also been studied in the literature. Astin (1971) found that, after controlling for high school grades, aptitude, and college selectivity, the following behaviors had a significant negative relationship with GPA: coming late to class, turning papers in late, making wisecracks in class, and attending movies. It was perhaps for this reason that Astin (1978) stressed the importance of academic involvement. He defined academically involved students as "those who spend a good deal of time at and say they work hard at their studies" (p. 222). Other behaviors that have been analyzed include classroom attendance (McCausland & Stewart, 1974), student employment (Mills, 1978), and personal productivity (Willingham, 1985).

A number of nontraditional variables that have been

studied as predictors of student achievement are summarized in Table 5. The effects, measured by the squared zero-order correlations, suggest that these variables may explain up to 30 percent of the total variance in student achievement. It is important to note, though, that these correlations fail to account for the effects of important variables such as high school achievement and college aptitude. Table 6, presented later in the chapter, provides a more realistic appraisal of these nontraditional variables when pre-enrollment achievement and aptitude are controlled for.

Table 5

Summary of Correlations Between College Achievement and Selected Nontraditional Variables

Author/Year	Student Sample	Criterion Variable	Predictor Variable	E (r^2)
Cappella & Others, 1982	100 sophomores	GPA to date	Study habits	.21**
Corlett, 1974	81 fresh Engl class	End of sem GPA	Library skills	.18**
Corlett, 1974	81 fresh Engl class	End of sem GPA	Study habits	.07*
Edwards & Waters, 1980	223 undergrads	Cum GPA	Acad job involvement	.04**
Edwards & Waters, 1980	223 undergrads	Cum GPA	Achievement motivation	.04**
Edwards & Waters, 1980	223 undergrads	Cum GPA	Satis with course	.12**
Elliott & Strenta, 1988	927 graduates	Cum 4 yr GPA	Achiev test scores	.30**
Goh, 1977	78 from sel univ	Self-rep GPA	Extrovert-introvert	.06*
Gough & Lanning, 1986	3189 freshmen	2 yr, 4 yr GPA	Personality scale	.12**
Lent, Brown & Larkin, 1986	105 fresh & soph	GPA(sci & tech wrk)	Self-efficacy	.10**
McCausland & Stewart, 1974	154 in Psych lab	1st sem fresh GPA	Study skills	.16**
Tucker, 1973	200 black, male sen	Final GPA	Study habits	.09**

* $p < .05$. ** $p < .01$.

A meta-analysis of nine studies relating student characteristics to achievement is presented in Table 6. In order to control for the impact of pre-enrollment achievement and aptitude, these variables were partialled out. The resulting effect indicates that certain student characteristics may explain up to 19 percent of the variance in student achievement, above and beyond the impact of pre-enrollment ability. It should be noted that in one study (Pace, 1984), the criterion variable was a self-reported measure of intellectual growth rather than a specific grade. It is reported, though, because it is consistently referenced in the literature.

Table 6

Summary of Partial Correlations Between College Achievement and Selected Nontraditional Student Characteristics, Controlling for Entering Ability and Aptitude

Author Year	Student Sample	Crit Var	Predictor Variable	Control For	E
Astin 1971	4031 m 3783 f	Fresh GPA	Student char (13)	H.S. gr & aptit	.03** .04**
Lent, Brown & Larkin 1986	105 fresh & soph	GPA (sci & tech work)	Self-efficacy	H.S.R. & PSAT[a]	.08**
Johnson 1989	101 fresh	Cum GPA	Study skills	H.S.R. & ACT[b]	.10*
McCausland & Stewart 1974	154 in Psych lab	Fresh GPA	Study skills	H.S. avg & aptit	.03**
Pace 1984	2299 seniors	Self-rep intell growth	Quality of effort	Student backgrnd & env	.09
Ritchey & Lewis 1986	206 fresh	Course grades	Intensive study habits	Admiss tests & GPA	.02**
Tom 1982	117 fresh	Cum GPA	Student char (4)	H.S. GPA & SAT[c]	.18**
Tucker 1973	200 b,m seniors	Final GPA	Student char (16)	SCAT[d] & stud hab	.19*

* $p < .05$. ** $p < .01$. [a] Preliminary Scholastic Aptitude Test. [b] American College Test. [c] Scholastic Ability Test [d] School and College Ability Test.

In summary, the research seems to indicate that high achieving college students are most likely to exhibit the following characteristics:

- high achievement in high school
- high achievement on college entrance examinations
- female
- highly educated parents
- older
- father in high status occupation
- positive family beliefs about education
- highly motivated
- high educational aspiration
- clear academic goals
- willingness to subordinate non-academic goals
- altruistic
- internal locus of control
- introverted
- high intellectual self-esteem
- effective study skills
- high academic involvement
- attends class regularly and punctually
- exhibits appropriate classroom behavior

Definitions

As indicated in Figure 1, three categories of variables will be discussed in this study: student inputs, the college environment, and student outputs.

Student Inputs

Student inputs include two types of student characteristics: demographic and nontraditional. Demographic characteristics define the background of the student and are essentially non-manipulable. For the purposes of this study, these include the following variables:

1. Ability as measured by high school rank.
2. Aptitude as measured by high school verbal and mathematics SAT scores.
3. Gender.
4. Age.
5. Race.
6. Parental income.
7. Parental education (highest educated parent).

Nontraditional characteristics include a variety of student attitudes, values, personality traits, and behaviors. These differ from demographic variables mainly because they are basically learned characteristics and are subject to external manipulation. The following variables are included in this study:

1. Aesthetic values as measured by student orientation towards artistic pursuits.

2. Athletic involvement as measured by student orientation towards athletic pursuits.

3. Fraternal involvement as measured by student interest in belonging to a fraternity.

4. Help-seeking behavior as measured by the extent to which a student will seek help within the institution.

5. Academic involvement as measured by student interest in carrying out academic tasks.

6. Leadership as measured by student aspiration to be involved in leadership positions.

7. Locus of control as measured by student perceptions about the extent of individual control they have over their own outcomes.

8. Political values as measured by student interest in holding political office.

9. Intrinsic motivation as measured by internal rewards for academic attainment.

10. Self-efficacy as measured by student beliefs about their emotional, social, and intellectual strength, as well as their drive to achieve.

11. Extrinsic motivation as measured by personal and occupational rewards for academic attainment.

12. Writing ability as measured by student self-

ratings.

13. Study behavior as measured by student tendency to complete homework.

College Environment

The college environment includes those variables within the institution that may have an impact on student outcomes. The following variables have been included in this study:

1. Selectivity within the institution as measured by the average total high school SAT score for each department.

2. Faculty/Student ratio by department (Student FTE/Faculty FTE).

3. GTA/Student ratio by department (Student FTE/Number of Graduate Teaching Assistants).

4. Average yearly allotment of funds by department.

5. Average class enrollment by department.

6. Average Weighted Student Credit Hours per Faculty FTE by department.

Student Outputs

For the purposes of this study, student achievement was the single dependent variable. Achievement was measured by the end of term QCA (Quality Credit Average) for each of the four years studied. The QCA is a system of grading by which a quality credit is assigned to each letter grade and then divided by the number of hours per week assigned to each course.

A breakdown of each of the individual variables and their source may be found in Table 9.

Limitations

1. This study is limited in scope to those freshman at Virginia Tech who completed the Cooperative Institutional Research Program (CIRP) survey in 1985.

2. With the exception of pre-enrollment characteristics and certain demographic characteristics, the independent variables are based on student self-responses.

Summary

Student characteristics play an important role in predicting academic success in college. Five important characteristics are pre-enrollment ability, demographic characteristics, attitudes and values, personality traits, and student behaviors. Chapter 1 presented a model explaining the relationship between these five characteristics and achievement. Chapter 2 will describe the methodology for the present study, followed by the analysis of the data in Chapter 3, and a summary, conclusions, discussion and recommendations in Chapter 4.

Chapter 2

METHODOLOGY

The purpose of this study was to develop and test a model describing the relationships between student achievement and selected student and institutional characteristics at Virginia Tech. Subjects used in the study, design of the study, and methods of analyzing the data will be discussed in this chapter.

Subjects

The subjects for this study were freshmen enrolled at Virginia Tech during the 1985 Fall semester. Surveys were distributed to the students through residence administrators as part of the annual CIRP study. Completed surveys were received from 1323 of 5130 freshmen, which represents a return rate of 26 percent. Comparisons of the sample with the 1985 freshmen population are provided in Tables 7 and 8. The tables are broken down by gender, race, and college. In general, the breakdown of the sample parallels that of the freshman population, with a few minor exceptions. The College of Arts & Sciences was underrepresented in the Fall of 1985 but by the Spring of 1989 the percentages were equal. The College of Engineering, though, was slightly overrepresented in the sample over the four year period. In terms of ethnic composition, whites were slightly overrepresented and blacks were slightly underrepresented.

Lastly, the most pronounced differences were noted in the percentage change over the four year period. The percentage decrease in the number of males was much smaller in the sample than in the population. Similarly, the percentage decrease for all three ethnic groups was smaller in the sample than in the general population. Large percentage differences were also noted in the college breakdown, especially for the colleges of Education and Human Resources. It was felt, though, that these percentage discrepancies could be largely attributed to the size of the sample in relation to the population. Overall, the consistency in numbers over the four year period indicated that the sample adequately represented the population.

An analysis of the sample, as shown in Table 7, provides some important information about the attrition rate. Over the four year period the sample was reduced by 24 percent. The breakdown indicates that females had an attrition rate almost double that of males. Of the colleges, Agriculture exhibited the greatest reduction, followed by Arts & Sciences and Engineering. Both Education and Human Resources exhibited substantial increases. It should be noted, though, that many students begin in Arts & Sciences and move to other colleges as they begin to crystallize their occupational objectives. This probably accounts for the net increases in Human Resources,

Education, and Business over the four year period. Two methods of dealing with this year-to-year decline were considered. The first was to use a regression procedure similar to that developed by Astin and Molm (1972) for dealing with non-respondents. Using this technique, a weighting factor could be developed in order to compensate for those students that had dropped out. Consequently, the population would, in theory, remain stable over the four year period. The second method was to study the population for each year independently. Those students who had completed the initial survey and had persisted at the end of each year would be considered as a separate group or cohort. This second method was chosen because (a) students drop out of the university for many different reasons, making it extremely difficult to accurately predict their achievement, had they not dropped out, (b) the population was large enough to draw statistical conclusions, even at the end of the fourth year, and (c) it was felt that the focus of the study made it unnecessary to account for those students who had left the program before completion of the four years.

Table 7

Changes in the 1985 Freshman Sample Between 1985 and 1989 by Gender, College, and Race: Virginia Tech

	Fall 1985	Spr 1986	Spr 1987	Spr 1988	Spr 1989	% Chg 85-89
Total sample	1323	1280	1129	1071	1003	-24%
Male	796 60%	774 60%	684 61%	647 60%	607 61%	-24%
Female	527 40%	506 40%	445 39%	424 40%	396 39%	-38%
Agriculture	121 9%	113 9%	84 7%	73 7%	53 5%	-56%
Architecture	53 4%	48 4%	42 4%	49 5%	45 4%	-15%
Arts & Sciences	506 38%	503 40%	390 35%	335 31%	323 32%	-36%
Business	197 15%	184 14%	190 17%	217 20%	215 22%	+09%
Education	21 2%	19 1%	25 2%	33 3%	39 4%	+86%
Engineering	398 30%	382 30%	341 30%	297 28%	264 27%	-34%
Human Resources	27 2%	31 2%	57 5%	67 6%	64 6%	+137%
White Caucasian	1233 93%	1192 93%	1055 93%	1000 93%	943 94%	-24%
Black Afr-Amer	40 3%	39 3%	30 3%	30 3%	23 2%	-43%
Asian-Amer/Orient	45 3%	45 4%	37 3%	37 3%	33 3%	-27%

Table 8

Changes in the 1985 Freshman Population Between 1985 and 1989 by Gender, College, and Race: Virginia Tech

	Fall 1985	Spr 1986	Spr 1987	Spr 1988	Spr 1989	% Chg 85-89
Total population	5130	4883	4179	3929	3422	-33%
Male	2975	2843	2423	2291	2020	-32%
	58%	58%	58%	58%	59%	
Female	2155	2040	1756	1638	1402	-35%
	42%	42%	42%	42%	41%	
Agriculture	381	290	237	215	174	-54%
	7%	6%	6%	5%	5%	
Architecture	230	235	215	196	187	-19%
	4%	5%	5%	5%	5%	
Arts & Sciences	2194	1812	1450	1329	1104	-50%
	44%	37%	34%	35%	32%	
Business	719	949	864	833	771	+07%
	14%	19%	21%	21%	23%	
Education	132	251	225	215	174	+32%
	3%	5%	5%	5%	5%	
Engineering	1308	967	863	831	752	-43%
	25%	20%	21%	21%	22%	
Human Resources	164	378	324	310	260	+59%
	3%	8%	8%	8%	8%	
White/Caucasian	4583	4336	3752	3522	3104	-32%
	89%	89%	90%	90%	91%	
Black/Afr-Amer	267	241	170	156	105	-61%
	5%	5%	4%	4%	3%	
Asian-Amer/Orient	194	148	126	121	103	-47%
	4%	3%	3%	3%	3%	

Design of the Study

This study utilized selected measures from the 1985 Cooperative Institutional Research Program (CIRP) Freshman Survey, the Virginia Tech Student Data Longitudinal File (SLF), and the Virginia Tech Provost's Fact Book (VTPFB) to predict student achievement between 1986 and 1989. The design of the study followed a three step process. The first step was to select individual student and institutional variables that were expected to have a significant relationship with grades. The second step was to create a set of composite variables representing specific student nontraditional characteristics. The third step was to regress the selected characteristics on student grades to identify those variables which were the strongest predictors of academic achievement.

Selection of Student and Institutional Variables

The major source of student variables was the CIRP Freshman Survey (Appendix A). The instrument has been in use for over 25 years throughout the U.S.A. Beginning in 1971, all institutions that had entering freshmen and that were included in the U.S. Department of Education Higher Education General Information Survey were invited to use the survey. The 1985 survey was completed by 279,985 students in 546 colleges and universities (Astin, 1987). The survey was completed by 1323 out of a total of 5130 freshmen

enrolled at Virginia Tech for the 1985-86 term. The survey included three types of measures:

1. Demographic measures: age, gender, family background, academic background, and financial need.

2. Affective-psychological measures: personality self-ratings, values, religious affiliation, and attitudes.

3. Behavioral measures: drinking, smoking, academic, athletic and social involvement, and classroom behaviors.

The second student data source was the Virginia Tech Student Longitudinal File (SLF), which contains year-to-year student information. Four types of data from the SLF were incorporated in the study:

1. Achievement, as measured by high school rank and year-end college QCA's.

2. Ability, as measured by SAT verbal and math scores.

3. Demographics, including gender, age, and race.

4. College, major, and anticipated degree.

Institutional characteristics were compiled from the Virginia Tech Provost's Fact Book for the years 1985-1989. This book contains statistical information by department for the entire university. Five types of data from it were incorporated in the study:

1. Annual budget allotments.

2. Faculty and student full time equivalents (FTE's).

3. Number of graduate teaching assistants.

4. Average class size.

5. Average weighted student credit hour (WSCH) productivity per faculty full time equivalent (FTE).

One major difference should be noted in the methodology for measuring student and institutional characteristics. For student characteristics the unit of analysis was the individual student, whereas for institutional characteristics the unit of analysis was the academic department. This method is similar to that used by Astin (1970), although his unit of analysis for institutional characteristics was the college or university. The advantage of including institutional characteristics is that the researcher can control for their effects in the regression analysis. The disadvantage is that the total variance across the student population is somewhat reduced. It was decided to include institutional characteristics in this study, though, because of their importance to the student achievement model.

The variables included in the regression analyses and the data sources from which they were gathered are included in Table 9. The zero-order correlations for each of the variables are presented in Table 10.

Table 9

Variables and Data Sources

Variables	Source
College QCA	SLF[a]
High school rank	SLF
High school SATV and SATM	SLF
Gender (1=male 2=female)	CIRP[b]
Age	CIRP
Parental income	CIRP
Father's and mother's education	CIRP
Goals (1=not important 4=essential) • Have authority in chosen field • Have recognition in chosen field • Influence politics • Influence social values • Have administrative responsibility • Help others • Create artistic works • Participate in community	CIRP
Reason for attending (1=not imp 3=very imp) • Get a better job • Gain a general education • Gain study skills • Become cultured • Make more money	CIRP
Self-rating (1=lowest 10% 5=highest 10%) • Artistic ability • Drive to achieve • Emotional health • Leadership ability • Intellectual self-confidence • Social self-confidence • Writing ability	CIRP

[a] Student Longitudinal File. [b] Cooperative Institutional Research Program.

(continued)

Table 9

Variables and Data Sources

Student Variables	Source
Expectations (1=no chance 4=very good chance) • Elected to school office • Join fraternity • Play varsity athletics • Attain at least a B average • Get tutoring • Seek vocational counseling • Seek individual counseling • Get bachelor's degree • Be satisfied here	CIRP[c]
1984 Activities (1=not at all 3=frequently) • Completed homework • Did extra classwork	CIRP
Individual can do little to change society (1=disagree strongly 4=agree strongly)	CIRP
Race (0=no 1=yes) • White Caucasian • Black/African-American • American Indian • Asian-American/Oriental • Mexican-American/Chicano • Puerto Rican American • Other	CIRP
Faculty FTE's by major	VTPFB[d]
Student FTE's by major	VTPFB
Number of GTA's by major	VTPFB
Annual budgetary allotment by major	VTPFB
Average enrollment by major	VTPFB
Weighted Student Credit Hour prod by major	VTPFB

[c] Cooperative Institutional Research Program. [d] Virginia Tech Provost's Fact Book.

Table 10

Correlation Matrix of First Year Student and Institutional Variables Entering the Regression Analysis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	QCA (dependent variable)	1.000	.036	-.002	.016	.009	.024	.012	-.215	.199	.216	.019	.078	.093	.086
2	Average SAT combined	.036	1.000	.163	-.216	-.122	-.002	-.039	-.224	.278	.549	-.010	.007	.029	-.336
3	Faculty/student ratio	-.002	.163	1.000	.200	-.467	.313	.432	-.027	-.032	.112	-.019	-.007	.004	-.001
4	GA/student ratio	.016	-.216	.200	1.000	-.057	-.119	.146	.031	-.046	-.115	-.002	-.029	-.025	.089
5	Average annual allotment	.009	-.122	-.467	-.057	1.000	-.413	-.516	.026	.009	-.097	.036	-.024	-.009	-.016
6	Average class enrollment	.024	-.002	.313	-.119	-.413	1.000	.814	.049	-.088	-.053	-.032	.005	.033	.056
7	WSCH production	.012	-.039	.432	.146	-.516	.814	1.000	.022	-.101	-.035	-.029	-.004	.008	.059
8	High school rank	-.215	-.224	-.027	.031	.026	.049	.022	1.000	-.135	-.148	.020	.105	.114	-.053
9	High school SAT verbal	.199	.278	-.032	-.046	.009	-.088	-.101	-.135	1.000	.474	-.065	.093	.187	-.064
10	High school SAT math	.216	.549	.112	-.115	-.097	-.053	-.035	-.148	.474	1.000	-.066	.038	.111	-.311
11	Age	.019	-.010	-.019	-.002	.036	-.032	-.029	.020	-.065	-.066	1.000	-.024	-.071	-.104
12	Parent income	.078	.007	-.007	-.029	-.024	.005	-.004	.105	.093	.038	-.024	1.000	.353	-.012
13	Highest educated parent	.093	.029	.004	-.025	-.009	.033	.008	.114	.187	.111	-.071	.353	1.000	.078
14	Gender	.086	-.336	-.001	.089	-.016	.056	.059	-.053	-.064	-.311	-.104	-.012	.078	1.000
15	White Caucasian	.088	-.044	-.036	-.001	.052	-.014	-.015	-.031	.148	.100	.028	.106	.123	.004
16	Black African American	-.062	-.004	.036	.062	-.037	.022	.032	.061	-.143	-.155	-.055	-.044	-.054	-.008
17	American Indian	.040	.009	.014	-.004	.000	-.027	-.035	-.033	.003	-.001	.016	-.057	-.025	-.023
18	Asian American Oriental	-.045	.051	.047	-.020	-.048	.024	.008	-.020	-.065	.029	.019	-.065	-.069	.009
19	Mexican American Chicano	.022	.026	-.008	-.001	.005	-.005	.017	-.024	.013	-.001	.011	-.054	-.059	-.016
20	Puerto Rican American	.043	.006	-.009	-.015	-.012	-.023	-.033	.024	-.007	.007	-.015	-.035	.009	-.006
21	Other races	-.016	.008	-.035	-.024	-.011	-.005	-.003	.003	.014	.017	-.026	-.037	.011	-.010
22	College of Agriculture	.015	-.114	-.227	.061	.697	-.386	-.506	.013	.009	-.108	-.001	-.034	-.010	.066
23	College of Architecture	.050	.018	.057	.156	-.047	-.288	-.010	.014	-.006	.061	.006	-.001	-.016	-.075
24	College of Arts & Sciences	-.044	-.277	-.214	-.037	-.058	.466	.346	.133	-.125	-.235	-.019	-.036	-.008	.111
25	College of Business	.025	-.223	.373	.039	-.135	.196	.285	.084	-.141	-.144	.032	.038	.022	.070
26	College of Education	-.018	-.277	.014	.198	-.050	-.236	-.069	.042	-.101	-.116	.014	.018	-.042	.096
27	College of Engineering	.008	.769	.129	-.114	-.214	-.139	-.190	-.243	.280	.505	.001	.032	.028	-.279
28	College of Human Resources	.003	-.038	-.139	-.017	.002	.001	.170	.002	.001	-.012	-.001	-.008	-.007	-.012
29	Aesthetic values	.014	-.027	-.080	.025	-.001	-.172	-.123	.039	.040	.027	.026	.030	.076	.052
30	Athletic involvement	-.012	-.010	.039	.034	.020	-.019	-.008	.077	-.082	-.011	-.018	.076	.036	-.001
31	Fraternal involvement	-.006	-.074	.027	.050	.008	.006	.023	.078	-.009	-.032	-.059	.103	.059	.135
32	Study behavior	.128	.033	.019	.003	-.018	.005	.011	-.127	-.053	-.067	.023	-.057	.001	.085
33	Help-seeking behavior	-.004	-.040	.005	.020	.015	-.017	-.001	.040	.011	-.047	-.013	.102	.026	.166
34	Academic involvement	.013	-.060	-.012	.045	-.019	-.001	.014	.015	.022	-.047	-.040	.077	.092	.099
35	Leadership ability	.001	-.030	.046	.040	-.050	.012	.015	.001	-.011	-.025	.002	.038	.109	-.040
36	Locus of control	-.009	.048	.049	-.039	-.002	.005	.009	-.036	.005	.041	-.026	.080	.003	-.030
37	Political values	-.012	-.028	.013	.037	-.020	.001	.013	.019	-.018	-.065	.003	.053	.015	.092
38	Writing ability	.102	-.009	-.051	-.001	.002	-.002	-.018	-.019	.315	.052	-.067	.098	.147	.088
39	Intrinsic motivation	.010	-.013	.035	.049	-.018	-.015	.013	-.002	-.017	-.022	-.010	.107	.047	.130
40	Self-efficacy	.063	.075	.058	-.010	-.045	.011	.019	-.058	-.016	.042	.018	.133	.106	-.035
41	Extrinsic motivation	-.005	-.044	.033	.014	-.099	.088	.089	.034	-.103	-.091	-.014	.161	.160	.089

(continued)

Table 10

Correlation Matrix of First Year Student and Institutional Variables Entering the Regression Analysis

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
15 White Caucasian	1.000	-.618	-.056	-.611	-.094	-.050	-.196	.039	-.011	.007	.004	.032	-.046	.002
16 Black African American	-.618	1.000	.157	-.008	.070	.084	.039	-.038	.036	.007	.018	-.021	-.005	.001
17 American Indian	-.056	.157	1.000	.039	.173	.201	.112	.011	-.015	.019	-.031	-.009	.014	-.012
18 Asian American Oriental	-.611	-.008	.039	1.000	.065	.078	.085	-.027	-.036	-.005	-.027	-.022	.073	-.001
19 Mexican American Chicano	-.094	.070	.173	.065	1.000	.286	.162	-.016	.062	.013	-.022	-.006	-.004	-.008
20 Puerto Rican American	-.050	.084	.201	.078	.286	1.000	.189	-.014	-.009	.028	-.019	-.005	.004	-.007
21 Other races	-.196	.039	.112	.085	.162	.189	1.000	-.025	-.016	.049	-.033	-.010	.008	-.012
22 College of Agriculture	.039	-.038	.011	-.027	-.016	-.014	-.025	1.000	-.059	-.239	-.123	-.036	-.195	-.047
23 College of Architecture	-.011	.036	-.015	-.036	.062	-.009	-.016	-.059	1.000	-.151	-.078	-.023	-.123	-.030
24 College of Arts & Sciences	.007	.007	.019	-.001	.013	.028	.049	-.239	-.151	1.000	-.314	-.094	-.498	-.121
25 College of Business	.004	.018	-.031	-.027	-.022	-.019	-.033	-.123	-.078	-.314	1.000	-.048	-.256	-.062
26 College of Education	.032	-.021	-.009	-.022	-.006	-.005	-.010	-.036	-.023	-.094	-.048	1.000	-.077	-.018
27 College of Engineering	-.046	-.005	.014	.073	-.004	-.139	.004	-.195	-.123	-.498	-.256	-.077	1.000	-.098
28 College of Human Resources	.002	.001	-.012	-.001	-.008	-.007	-.012	-.047	-.030	-.121	-.062	-.018	-.098	1.000
29 Aesthetic values	-.069	.008	.017	.085	.001	-.011	.003	-.007	.222	.049	-.136	-.012	-.038	.043
30 Athletic involvement	-.007	.076	.037	-.030	.013	-.014	.001	.078	.066	-.021	-.001	.006	-.041	-.013
31 Fraternal involvement	-.057	.090	.017	.011	.005	-.030	-.043	.007	.027	-.010	.046	.016	-.043	.009
32 Study behavior	-.009	-.035	-.026	.017	.005	.011	.036	.015	-.050	-.032	-.001	.015	.040	.001
33 Help-seeking behavior	-.073	.093	.032	.056	.037	.011	-.011	.007	.020	-.002	.011	-.013	-.041	.051
34 Academic involvement	-.013	.028	.009	.046	-.027	-.010	-.048	.014	-.010	.057	-.063	.038	-.035	.017
35 Leadership ability	.032	.071	-.009	-.063	-.006	.058	-.025	-.013	.004	-.058	.063	.063	.014	-.004
36 Locus of control	.012	.009	.001	-.036	-.034	-.022	-.029	.025	-.011	-.048	.012	.004	.042	-.009
37 Political values	-.066	.120	.012	-.007	.016	.001	-.052	.003	.025	-.039	.015	.008	-.011	.030
38 Writing ability	.017	.047	-.002	-.009	.006	-.003	-.060	.005	.003	.014	-.045	-.004	.028	-.020
39 Intrinsic motivation	-.024	.047	-.001	.013	.001	-.006	-.042	.004	.049	-.028	.015	.004	-.008	.016
40 Self-efficacy	-.005	.070	-.023	-.012	.038	.046	-.069	-.045	.010	-.087	.026	.004	.122	-.030
41 Extrinsic motivation	.061	-.021	.013	.011	.030	-.011	-.095	-.113	-.035	.044	.040	.005	-.017	.010

(continued)

Table 10

Correlation Matrix of First Year Student and Institutional Variables Entering the Regression Analysis

	29	30	31	32	33	34	35	36	37	38	39	40	41
29 Aesthetic values	1.000	.158	.127	-.010	.189	.127	.046	.028	.161	.175	.251	.079	.047
30 Athletic involvement	.158	1.000	.377	-.035	.376	.036	.117	.037	.376	.040	.431	.123	.048
31 Fraternal involvement	.127	.377	1.000	-.047	.522	.057	.069	.092	.477	.054	.581	.095	.109
32 Study behavior	-.010	-.035	-.047	1.000	-.036	.051	-.007	-.010	-.001	-.022	.022	.026	-.006
33 Help-seeking behavior	.189	.376	.522	-.036	1.000	.085	.010	.149	.456	.068	.761	.010	.106
34 Academic involvement	.127	.036	.057	.051	.085	1.000	.165	-.045	.134	.165	.108	.186	.150
35 Leadership ability	.046	.117	.069	-.007	.010	.165	1.000	-.034	.259	.241	.130	.557	.105
36 Locus of control	.028	.037	.092	-.010	.149	-.045	-.034	1.000	.027	-.024	.132	-.043	-.027
37 Political values	.161	.376	.477	-.001	.456	.134	.259	.027	1.000	.114	.550	.200	.140
38 Writing ability	.175	.040	.054	-.022	.0686	.165	.241	-.024	.114	1.000	.109	.335	.104
39 Intrinsic motivation	.251	.431	.581	.022	.761	.108	.130	.132	.550	.109	1.000	.164	.176
40 Self-efficacy	.079	.123	.095	.026	.010	.186	.557	-.043	.200	.335	.164	1.000	.218
41 Extrinsic motivation	.047	.048	.109	-.006	.106	.150	.105	-.027	.140	.104	.176	.218	1.000

Creation of Composite Nontraditional Variables

The creation of a set of nontraditional, independent, student variables was crucial in order to identify a set of manipulable student characteristics that may have an effect on student grades. Although the CIRP survey included a number of nontraditional variables, many were highly intercorrelated. Consequently, two principal components factor analyses were undertaken to identify a small set of student characteristics to be included in the regression analysis. Based on the literature, a group of 65 potential variables from the CIRP survey were included in the first analysis. Each was standardized for more effective analysis.

Three criteria were established for identifying relevant factors, as suggested by Rummel (1970). First, a factor loading of .5 or greater was required for including individual variables within a factor. This means that each factor must explain at least 25 percent of the variance of that variable. Secondly, an eigenvalue of 1.0 or greater was required for retaining a factor. This is to ensure that each factor explains at least the total variance of one variable. Thirdly, the factor must have substantive meaning to the researcher, based on the literature and on the parameters of the study.

A varimax rotation identified 13 factors meeting the

above criteria. A listing of each factor along with its eigenvalue and the proportion of variance accounted for by that factor are included in Table 11. Under each factor are the related statements from the survey along with the factor loadings.

Table 11

Initial Factor Analysis of Nontraditional Student Variables

Factor, Eigenvalue(E), Proportion of Variance(V), and Individual Survey Statements	Factor Loading
Factor 1 E=11.31 V= .17	
Become an authority in my field	.68
Obtain recognition from colleagues	.72
Influence political structure	.71
Influence social values	.67
Raise a family	.52
Have administrative responsibility	.71
Be very well off financially	.63
Help others in difficulty	.60
Develop a meaningful philosophy	.55
Participate in community programs	.59
Promote racial understanding	.57
Become expert in finance and communications	.67
Factor 2 E=4.81 V= .07	
Expect to fail one or more courses	.57
Expect to graduate with honors	.50
Expect to join a fraternity	.54
Expect to obtain at least a B average	.60
Expect to need extra time to complete degree	.71
Expect to get tutoring	.74
Expect to seek vocational counseling	.67
Expect to seek individual counseling	.66
Expect to get bachelor's degree	.67
Expect to be satisfied here	.68
Factor 3 E=2.99 V= .04	
Varsity letter in sports last year	.56
Emotional health self-rating	.57
Leadership ability self-rating	.56
Physical health self-rating	.73
Popularity self-rating	.74
Social self-confidence self-rating	.70
Factor 4 E=2.39 V= .04	
Academic ability self-rating	.80
Math ability self-rating	.68
Intellectual self-confidence self-rating	.59

(continued)

Table 11

Initial Factor Analysis of Nontraditional Student Variables

Factor, Eigenvalue(E), Proportion of Variance(V), and Individual Survey Statements		Factor Loading
Factor 5	E=2.29	
Gain a general education	V= .03	.72
Improve study skills		.68
Become more cultured		.66
Learn new things		.68
Factor 6	E=2.07	
Artistic ability self-rating	V= .03	.73
Become accomplished in the arts		.53
Create artistic works		.69
Factor 7	E=1.97	
Get a better job	V= .03	.69
Make more money		.73
Factor 8	E=1.64	
Nothing better to do	V= .02	.73
Couldn't find job		.68
Factor 9	E=1.34	
Bored in class last year	V= .02	.57
Completed homework last year		.78
Overslept and missed class last year		.63
Factor 10	E=1.27	
Asked teacher for advice last year	V= .02	.61
Did extra class work last year		.67
Factor 11	E=1.23	
Felt overwhelmed last year	V= .02	.74
Felt depressed last year		.76
Factor 12	E=1.18	
Pres of 1+ student org last year	V= .02	.60
Had a major part in a play last year		.76
Factor 13	E=1.09	
Tutored another student last year	V= .02	.52
Studied with other students last year		.64

Based on the information provided in the initial factor analysis and the literature on student achievement, nineteen standardized composite variables were created. These variables and their suggested labels are listed in Table 12.

Table 12

Initial Nontraditional Standardized Composite Variables

Social Values
- Influence social values
- Help others in difficulty
- Participate in community programs

Power Values
- Become an authority in own field
- Obtain recognition from colleagues
- Influence political structure
- Have administrative responsibility

Economic Values
- Get a better job
- Make more money

Aesthetic Values
- Artistic ability self-rating
- Create artistic works

Competence Goals
- Gain a general education
- Improve study skills
- Become more cultured

Achievement Goals
- Drive to achieve self-rating

Aspiration
- Expect to obtain at least a B average
- Expect to get Bachelor's degree

Academic Involvement
- Did extra course work

Locus of Control
- Individual can do little to change society

Self-Confidence
- Intellectual self-confidence, self-rating
- Social self-confidence, self-rating

Satisfaction
- Expect to be satisfied here

(continued)

Table 12

Initial Nontraditional Standardized Composite Variables

Emotional Health
- Emotional health self-rating

Leadership Skills
- Leadership skills self-rating

Study Behavior
- Completed homework

Political Interests
- Expect to get elected to student office

Fraternal Interests
- Expect to join fraternity

Athletic Interests
- Expect to play varsity athletics

Help-Seeking Behavior
- Expect to get tutoring
- Expect to seek vocational counseling
- Expect to seek individual counseling

Writing Ability
- Writing ability self-rating

A Pearson correlation analysis was then applied to all nineteen variables to detect the presence of multicollinearity. A zero-order correlation greater than .60 was found among some of the composite variables, and this was considered problematic (Wolfle, 1991). As a result, a further factor analysis was undertaken, and nine of the original composites were collapsed into three new composites. The results of this final factor analysis are reported in Table 13.

Table 13

Final Factor Analysis of Nontraditional Standardized Student Composite Variables

Factor, Eigenvalue(E), Proportion of Variance(V), and Individual Survey Statements		Factor Loading
Factor 1	E=4.87	
Social Values	V= .26	.73
Power Values		.71
Aspiration		.85
Satisfaction		.79
Factor 2	E=2.47	
Achievement goals	V= .13	.66
Self-confidence		.78
Emotional Health		.73
Factor 3	E=1.26	
Economic values	V= .07	.82
Competency goals		.72

A final correlation analysis confirmed that most of the composite variables were easily below the .60 criterion (Table 10). Although a correlation of .76 between help-seeking behavior and intrinsic behavior was found, it was felt that the two concepts were sufficiently different to be included separately. Each of the final composite variables, along with the variables which comprise them, are listed in Table 14.

Table 14

Final Nontraditional Standardized Composite Variables

Aesthetic Values
- Artistic ability self-rating
- Create artistic works

Athletic Involvement
- Intend to play varsity athletics

Fraternal Involvement
- Intend to join a fraternity

Study Behavior
- Completed homework last year

Help-Seeking Behavior
- Intend to get tutoring
- Intend to seek vocational counseling
- Intend to seek individual counseling

Academic Involvement
- Did extra class work last year

Leadership Ability
- Leadership ability self-rating

Locus of Control
- Individual can do little to change society

Political Values
- Intend to be elected to school office

Writing Ability
- Writing ability self-rating

Intrinsic Motivation
- Influence social values
- Help others
- Participate in the community
- Become an authority in own field
- Obtain recognition from colleagues
- Influence political structure
- Have administrative responsibility
- Achieve at least a B average
- Get a Bachelor's degree
- Intend to be satisfied here

Self-Efficacy
- Drive to achieve self-rating
- Intellectual self-confidence self-rating
- Social self-confidence self-rating
- Emotional health self-rating

Extrinsic Motivation
- Get a better job
- Make more money
- Gain a general education
- Improve study skills
- Become more cultured

Regression Procedures

Four types of data were entered into the regression equation: (a) institutional variables, (b) student demographic variables, (c) student nontraditional variables, and (d) student QCA (dependent variable). Separate regression analyses were run for each of the four undergraduate years. Separate regression analyses were also run for eleven different academic units: (a) the university as a whole, (b) the seven individual colleges, and (c) three clusters of related majors within the College of Arts & Sciences (humanities, natural sciences, and mathematics). A total of 44 regression analyses are reported on in the following chapter.

To control for the effects of institutional characteristics, all of the institutional variables were entered first, followed by the student variables. Consequently, a stepwise regression procedure was utilized in order to provide the necessary controls. The following six institutional variables were entered:

1. Average total high school SAT score by department. This provided a measure of selectivity within the institution.

2. Faculty/student ratio by department (number of student FTE's divided by number of faculty FTE's).

3. GTA/Student ratio by department (number of student

FTE's divided by number of graduate teaching assistants).

4. Average yearly budget allotment by department.

5. Average class enrollment by department.

6. Average weighted student credit hour per faculty FTE by department.

The following student demographic variables were then entered into the regression analysis:

1. High school rank.

2. High school SAT verbal score.

3. High school SAT mathematics score.

4. Age.

5. Parent income.

6. Parent education (parent with the highest education).

7. Gender.

8. Race (White Caucasian, Black African American, American Indian, Asian American Oriental, Mexican American Chicano, Puerto Rican American).

9. Current college attended (Agriculture, Architecture, Arts & Sciences, Business, Education, Engineering, Human Resources).

Lastly, the student nontraditional variables were entered into the analysis. These are outlined in Table 14. A .05 level of significance was established for a variable to remain in the regression equation.

Summary

Data were collected from three major sources in this study: (a) the 1985 CIRP Freshmen Survey, (b) the Virginia Tech Student Longitudinal File, and (c) the Virginia Tech Provost's Fact Book. Three types of data were derived from these sources: (a) institutional variables by department, (b) student demographic variables, and (c) student nontraditional variables. A principal components factor analysis was utilized to arrive at a set of unique student nontraditional variables. The three sets of variables were regressed on student QCA in a stepwise regression analysis. The results of the regression analysis for each of the four years for all students and for subgroups of students based on college and major will be reported in Chapter 3.

Chapter 3

ANALYSIS OF DATA

The purpose of this study was to develop and test a model describing the relationships between student achievement and selected student and institutional characteristics at Virginia Tech. A major outcome of this study will be the development of a set of student profiles which will identify those student characteristics that most effectively explain student achievement at Virginia Tech. These profiles will be broken down by both year and academic unit. Especially important are those characteristics that can be manipulated at the instructional level.

A total of 44 separate regression analyses were performed for eleven academic units: (a) the university as a whole, (b) seven individual colleges, and (c) three clusters of related majors within the College of Arts & Sciences. These are reported in Tables 16-59 and are organized first by academic unit and then by year to provide easy access to the information. The tables are presented in the following order:

1. Tables 16-19 -- University as a whole.
2. Tables 20-23 -- College of Agriculture.
3. Tables 24-27 -- College of Architecture.
4. Tables 28-31 -- College of Business.
5. Tables 32-35 -- College of Education.

6. Tables 36-39 -- College of Engineering.
7. Tables 40-43 -- College of Human Resources.
8. Tables 44-47 -- College of Arts & Sciences.
9. Tables 48-51 -- Humanities cluster.
10. Tables 52-55 -- Mathematics cluster.
11. Tables 56-59 -- Natural sciences cluster.

Included in each table are the significant variables entering the regression analysis, the partial regression coefficients, and the coefficient of determination (R^2) for each variable. Because the institutional variables were forced into the regression equation first, they are included in each table.

It is also important to note that, although the total sample was relatively large, some of the groupings were relatively small. Consequently, in those cases the data should be interpreted cautiously. This is true for three colleges -- Architecture, Education and Human Resources -- that exhibited first year n's of 47, 17 and 30 respectively. Also, because of student attrition from year to year, some colleges exhibited a large decrease between the first and fourth years.

Three research questions were set out in Chapter 1 to explain the relationship between student characteristics and student achievement. Each of those questions will be discussed in the following section.

Research question 1: To what extent do institutional characteristics explain the variance in student achievement for undergraduates at Virginia Tech?

Six institutional characteristics were first entered into the regression analysis as a group. Together, they explained about 6% of the variance in student QCA's. Significant R^2's were reported during at least two of the four years for the university as a whole (Tables 17-18), the College of Business (Tables 29-31), the College of Engineering (Tables 37-39), and the humanities cluster (Tables 49-51). In each case, the institutional characteristics were significant only after the first year. Only in the College of Architecture was a significant R^2 exhibited during the first year (Table 24), although not in any of the following years.

Although there was some relationship between the six characteristics as a group and student grades, a significant regression coefficient was not found for any one characteristic in all of the cases listed above. The most prevalent characteristics were selectivity and weighted student credit hours (WSCH) per faculty FTE. Selectivity was a significant factor in at least one of the four undergraduate years for the colleges of Agriculture (Table 20), Architecture (Tables 24, 26), and Business (Tables 30, 31). A significant, positive regression coefficient was

exhibited between WSCH per faculty FTE and student QCA during the second and third years for all students (Tables 17,18), during the third year in the college of Engineering (Table 38) and during the second year in the humanities cluster (Table 49). These may be the result of differences in weighting factors and grading during the four undergraduate years. Ambivalent results were found in three other characteristics, faculty-student ratio, GTA-student ratio, and average annual allotment. Consequently, it was difficult to draw any specific conclusions about their relationship to grades. Overall, it must be concluded that institutional characteristics were not consistently strong factors in explaining student achievement in this study.

Research question 2: To what extent do student characteristics explain the variance in student achievement for undergraduates at Virginia Tech?

Two types of student characteristics were examined in this study: demographic characteristics and nontraditional characteristics.

Demographic characteristics. These included high school rank, high school SAT verbal score, high school SAT mathematics score, age, parent income, parent education, gender, race, and current college attended.

The findings in this study were similar to those in the literature. The combination of high school rank, high

school SAT mathematics, and high school SAT verbal were the strongest predictors of student achievement. Together, they accounted for about 12% of the variance in student QCA's. It should be noted that a negative coefficient for high school rank occurs because rankings are scored in reverse order. The highest achieving students receive the lowest rank scores and the lowest achieving students receive the highest rank scores.

A breakdown by academic unit indicates that specific characteristics were dominant in different units. Across the university, high school rank and SAT mathematics were the strongest predictors of first year achievement (Table 16). In subsequent years, though, SAT verbal increased in strength (Tables 17-18). A similar pattern was found in both the College of Business (Tables 28-30) and in the College of Arts & Sciences (Tables 44-47). In each case the predictive strength of these variables also showed a general decline from the first to the fourth year. The strongest predictor for the College of Agriculture was SAT mathematics, but only for the third and fourth years (Tables 22,23). Conversely, SAT mathematics was a strong predictor in the first year of the College of Architecture, but had no impact in subsequent years (Tables 24-27). In the mathematics cluster, the SAT verbal was a strong predictor for each of the four years (Tables 52-55). Similarly, high

school rank was a strong predictor in the natural sciences cluster, especially during the last two years (Tables 56-59).

Although gender was not a significant characteristic throughout, it was important in a few areas. Females achieved significantly higher grades than males in both the first and fourth years for the university as a whole (Tables 16,19) and for the humanities cluster (Tables 48,51). Females also exhibited significantly higher achievement in the first year of the College of Arts & Sciences (Table 44) and in the fourth year of the mathematics cluster (Table 55). Males were significantly higher than females only in the second year of the College of Engineering, but the converse was true in the fourth year (Tables 37,39).

Age was not a major characteristic, but whenever it was present, it exhibited a positive correlation with student QCA's. It was also more prevalent in the first and second years. Older students attained significantly higher grades across the whole university (Table 16) and in the College of Engineering (Table 36) during the first year, as well as in the College of Arts & Sciences during the second year (Table 45).

Parent income was also more likely to explain student grades in the first and second years. Students with higher parental incomes were significantly more likely to attain

higher grades across the university in the first and second years (Tables 16,17), in the College of Architecture during the first and fourth years (Tables 24,27), and in the mathematics cluster during the second year (Table 53). Parent income was also an important characteristic in both the College of Education (Tables 34,35) and the College of Human Resources (Table 40), but the numbers were too small to draw any significant conclusions.

Parent education seems to be a minor factor in explaining student grades. Students with more highly educated parents attained higher grades in the College of Agriculture during the second year (Table 21), in the College of Business during the fourth year (Table 31), and in the College of Engineering during the first year (Table 36).

Race was also a factor in explaining student grades, but the effects were both positive and negative. White Caucasian students, as compared to non-whites, tended to attain higher grades across the university during the third and fourth years (Tables 18,19), in the College of Business during the second year (Table 29), in the College of Arts & Sciences during the first and fourth years (Tables 44,47), and in the humanities cluster during the fourth year (Table 51). On the other hand, white Caucasian students attained lower grades than non-whites during the first year in both

the College of Agriculture (Table 20) and the College of Architecture (Table 24). Black African American students attained significantly higher grades than non-blacks in the humanities cluster during the fourth year (Table 51), but scored significantly lower grades in the College of Business during the third year (Table 30). Asian American Oriental students attained significantly lower grades than non-orientals in the College of Agriculture during the third year (Table 22) and in the College of Engineering during the fourth year (Table 39). It must be noted, though, that whites comprised about 93% of the sample (Table 7). Consequently, it is difficult to draw any conclusions based on other racial groups.

Nontraditional characteristics. These include attitudes, values, personality traits, and behaviors of students. These characteristics were considered to be especially important to the study because they can be manipulated at the instructional level. Together they accounted for about 7% of the variance in student QCA's.

The most prevalent nontraditional characteristic was study behavior. Students who scored highest in this characteristic attained significantly higher grades (a) across the entire sample for each of the four undergraduate years (Tables 16-19), (b) during at least two of the four years in the College of Architecture (Tables 25,27), the

College of Business (Tables 28-30), the College of Engineering (Tables 37-39), and the natural sciences cluster (Tables 56,59), and (c) during the first year in both the College of Arts & Sciences (Table 44) and the humanities cluster (Table 48).

Writing ability also seemed to be an important factor, although not in all academic areas. Students with a high level of writing ability attained higher grades during at least two of the undergraduate years across the entire sample (Tables 18,19), in the College of Arts & Sciences (Tables 45,47), and in the natural sciences cluster (Tables 57,58). They also attained higher grades during the first year in both the College of Agriculture (Table 20) and the College of Business (Table 28).

Athletic interest was also a fairly prominent characteristic, but in almost every case it was negatively related to achievement. Students who showed a high interest in athletic involvement while at Virginia Tech attained lower grades during one of the four undergraduate years for the University as a whole (Table 17), the College of Agriculture (Table 23), the College of Education (Table 33), the College of Human Resources (Table 42), and the humanities cluster (Table 49). They also attained lower grades during the second and third years for both the College of Arts & Sciences (Tables 45,46) and the College of

of Architecture (Tables 25,26), although in the latter case the numbers were not large enough to make strong generalizations.

Student interest in belonging to a fraternity was also a significant characteristic in a few areas, and in all but one case it was positively related to student grades. Students with a high interest in belonging to a fraternity attained higher grades in the College of Agriculture during the first year (Table 20), in the College of Human Resources during the third year (Table 42), and in the humanities cluster during the third year (Table 50). Conversely, these students attained lower grades in the College of Engineering during the first year (Table 36).

Extrinsic motivation also exhibited some relationship to grades. Students with high extrinsic motivation attained higher grades in the College of Agriculture during the first year (Table 20), in the College of Architecture during the third year (Table 26), in the College of Education during the second year (Table 33), and in the College of Arts & Sciences during the first year (Table 44).

Five other attitudinal and personality characteristics exhibited a significant relationship to student grades, although only in isolated instances. These included locus of control (Tables 20,29,58), self-efficacy (Tables 16,48), help-seeking behavior (Tables 17,45,49), academic

involvement (Tables 34,46,56), and intrinsic motivation (Tables 31,33,56). Although many of these personality characteristics have been found to relate to student achievement in previous studies, they did not consistently explain student grades in the present study.

Research question 3: Do student and institutional characteristics explain the variance in student achievement differently in each of the eleven academic units and during each of the four undergraduate years?

In order to compare the impact of various characteristics, Table 15 provides a summary of the student characteristic data found in Tables 16-59. The mean R^2 and rankings for both demographic and nontraditional characteristics are broken down by academic unit and year.

Demographic and nontraditional characteristics each explained up to 20% of the total variance in student grades, when averaged over the four-year period. An average of all of the colleges and subject clusters, though, indicates that demographic characteristics explained about 12% of the total variance, almost twice that of nontraditional characteristics.

When the average R^2's for each academic unit were ranked, in all but four cases the rankings were similar. Both the College of Architecture and the natural sciences cluster ranked low in demographic characteristics and high

in nontraditional characteristics. Conversely, both the College of Engineering and the mathematics cluster ranked high in demographic characteristics and low in nontraditional characteristics. With the exception of the College of Education, demographic characteristics seem to have the strongest relationship with student grades in the College of Agriculture and the lowest relationship in the College of Arts & Sciences. Nontraditional characteristics seem to have the strongest relationship with student grades in the College of Architecture and the weakest in the mathematics cluster. Generally, the relationship was stronger in smaller, more homogeneous groups such as colleges or subject clusters.

A comparison of the average R^2's for both demographic and nontraditional characteristics in each of the four years indicates a fairly consistent relationship over time. When the two groups were combined, the strongest relationship with student grades was exhibited in the first year and the weakest in the second year. Similarly, when demographic characteristics were considered alone, the strongest relationship with student grades was exhibited in the first year and the weakest in the second year. When nontraditional characteristics were considered alone, the strongest relationship with student grades was exhibited in the second year and the weakest in the fourth year. This

runs counter to Astin's (1978) finding that the relationship between student characteristics and student grades weakened over the four undergraduate years.

Table 15

Summary of R^2's for Institutional and Student Characteristics by Academic Unit and Year

	Demo Char	Rank	Non-Trad Char	Rank	Tot	Rank
Academic Unit						
University	.1057	7	.0208	9	.0968	11
Agriculture	.1641	2	.0601	4	.2242	3
Architecture	.0978	9	.2090	1	.3068	2
Business	.1009	8	.0535	5	.1544	8
Education	.2021	1	.1484	2	.3505	1
Engineering	.1385	4	.0199	10	.1584	5
Human Resources	.1227	5	.0346	7	.1573	6
Arts & Sciences	.0663	11	.0343	8	.1006	10
Humanities	.1152	6	.0393	6	.1545	7
Mathematics	.1479	3	.0000	11	.1479	9
Natural Sciences	.0826	10	.1277	3	.2103	4
Average	.1195		.0679		.1874	
Year						
First	.1664	1	.0517	3	.2181	1
Second	.0706	4	.0950	1	.1656	4
Third	.1078	3	.0839	2	.1917	2
Fourth	.1324	2	.0413	4	.1757	3
Average	.1195		.0679		.1874	

Student Profile Tables

The following 44 tables have been referred to earlier in the study and are placed together for easier access. The tables are ordered first by academic unit and then by undergraduate year.

Table 16

Regression of Variables on First-Year QCA for All Students

Variables DF=15 N=1267	b	R^2
Intercept	.2981	
Institutional variables (by dept.)		.0050
• Selectivity (average SAT Total)	-.0024	
• Students per faculty member	-.0022	
• Students per GTA	.0001	
• Average annual allotment	-.0001	
• Average classroom enrollment	-.0020	
• WSCH per faculty FTE	.0001	
High school SAT Mathematics	.0260**	.0547**
High school rank	-.0019**	.0436**
Study behavior	.0981**	.0158**
Gender (1=male 2=female)	.1732**	.0117**
Parent income	.0183**	.0098**
College of Engineering	-.2979**	.0078**
High school SAT Verbal	.0099**	.0078**
Age	.0898*	.0031*
Self-efficacy	.0568*	.0029*
Sum of significant variables		.1622

* $p < .05$. ** $p < .01$.

Table 17

Regression of Variables on Second-Year QCA for All Students

Variables DF=15 N=1055	b	R^2
Intercept	1.7959**	
Institutional variables (by dept.)		.0130*
• Selectivity (average SAT Total)	-.0037	
• Students per faculty member	-.0016	
• Students per GTA	.0001	
• Average annual allotment	.0001	
• Average classroom enrollment	.0003	
• WSCH per faculty FTE	.0015**	
High school SAT Verbal	.0106**	.0328**
Study behavior	.0992**	.0188**
High school rank	-.0011**	.0120**
College of Architecture	.4643**	.0123**
High school SAT mathematics	.0125**	.0109**
Race - Other	-.6203*	.0048*
Parent income	.0127*	.0039*
Athletic involvement	-.0619**	.0038*
Help-seeking behavior	.0582*	.0036*
Sum of significant variables		.1158

* $p < .05$. ** $p < .01$.

Table 18

Regression of Variables on Third-Year QCA for All Students

Variables DF=12 N=986	b	R^2
Intercept	.7991	
Institutional variables (by dept.)		.0214**
• Selectivity (average SAT Total)	.0022	
• Students per faculty member	-.0001	
• Students per GTA	.0001	
• Average annual allotment	-.0001	
• Average classroom enrollment	-.0034	
• WSCH per faculty FTE	.0015**	
High school SAT Verbal	.0099**	.0410**
High school rank	-.0011**	.0229**
Study behavior	.0873**	.0153**
High school SAT Mathematics	.0092**	.0070**
White Caucasian	.2008*	.0047*
Writing ability	.0436*	.0036*
Sum of significant variables		.1160

* $p < .05$. ** $p < .01$.

Table 19

Regression of Variables on Fourth-Year QCA for All Students

Variables DF=14 N=962	b	R^2
Intercept	.1078	
Institutional variables (by dept.)		.0045
• Selectivity (average SAT Total)	.0041	
• Students per faculty member	-.0036	
• Students per GTA	.0001	
• Average annual allotment	.0001*	
• Average classroom enrollment	.0076	
• WSCH per faculty FTE	.0002	
High school rank	-.0009**	.0363**
White Caucasian	.3947**	.0228**
Gender	.2607**	.0199**
High school SAT Mathematics	.0169**	.0319**
College of Education	.5451**	.0126**
Study behavior	.0749**	.0115**
Writing ability	.0678**	.0079**
College of Arts & Science	-.1694**	.0088**
Sum of significant variables		.1562

* $p < .05$. ** $p < .01$.

Table 20

Regression of Variables on First-Year QCA for College of Agriculture Students

Variables DF=12 N=111	b	R^2
Intercept	-.8743	
Institutional variables (by dept.)		.0702
• Selectivity (average SAT Total)	.0583*	
• Students per faculty member	-.0059	
• Students per GTA	-.0003	
• Average annual allotment	-.0001	
• Average classroom enrollment	-.0603	
• WSCH per faculty FTE	.0043	
Fraternal involvement	.2412**	.1174**
Writing ability	.2014**	.0467*
Extrinsic motivation	-.1739*	.0430*
High school rank	-.0026**	.0330*
Locus of control	-.1457*	.0332*
White Caucasian	-.7829*	.0326*
Sum of significant variables		.3761

* $p < .05$. ** $p < .01$.

Table 21

Regression of Variables on Second-Year QCA for College of Agriculture Students

Variables DF=8 N=77	b	R^2
Intercept	-3.2847	
Institutional variables (by dept.)		.1092
• Selectivity (average SAT Total)	.0799	
• Students per faculty member	-.0703	
• Students per GTA	.0009	
• Average annual allotment	-.0004	
• Average classroom enrollment	-.0183	
• WSCH per faculty FTE	-.0060	
Parent education	-.1165*	.0566*
High school SAT Verbal	.0234*	.0459*
Sum of significant variables		.2117

* $p < .05$. ** $p < .01$.

Table 22

Regression of Variables on Third-Year QCA for College of Agriculture Students

Variables DF=8 N=67	b	R^2
Intercept	-1.2355	
Institutional variables (by dept.)		.1006
• Selectivity (average SAT Total)	.0460	
• Students per faculty member	-.0557	
• Students per GTA	.0005	
• Average annual allotment	-.0006	
• Average classroom enrollment	-.0593	
• WSCH per faculty FTE	.0108	
Asian American Oriental	-2.6766**	.1299**
High school SAT Mathematics	.0319*	.0682*
Sum of significant variables		.2988

* $p < .05$. ** $p < .01$.

Table 23

Regression of Variables on Fourth-Year QCA for College of Agriculture Students

Variables DF=8 N=52	b	R^2
Intercept	.9241	
Institutional variables (by dept.)		.1132
• Selectivity (average SAT Total)	.0080	
• Students per faculty member	-.0211	
• Students per GTA	-.0002	
• Average annual allotment	-.0003*	
• Average classroom enrollment	-.0149	
• WSCH per faculty FTE	.0039	
Athletic interest	.2429*	.0995*
High school SAT Mathematics	.0248*	.0853*
Sum of significant variables		.2980

* $p < .05$. ** $p < .01$.

Table 24

Regression of Variables on First-Year QCA for College of Architecture Students

Variables DF=4 N=47	b	R^2
Intercept	-13.8550**	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	.1317*	.1664**
High school SAT Mathematics	.0511**	.1805**
Parent income	.0679**	.0819*
White Caucasian	-.7208*	.0664*
Sum of significant variables		.4952

* $p < .05$. ** $p < .01$.

Table 25

Regression of Variables on Second-Year QCA for College of Architecture Students

Variables DF=2 N=41	b	R^2
Intercept	2.9990**	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE		.0000
Athletic interest	-.2693**	.2028**
Study behavior	.1976*	.0887*
Sum of significant variables		.2915

* $p < .05$. ** $p < .01$.

Table 26

Regression of Variables on Third-Year QCA for College of Architecture Students

Variables DF=3 N=48	b	R^2
Intercept	-20.3706*	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	.2042*	.0374
Extrinsic motivation	.4082**	.1246*
Athletic interest	-.2088*	.0962*
Sum of significant variables		.2583

* $p < .05$. ** $p < .01$.

Table 27

Regression of Variables on Fourth-Year QCA for College of Architecture Students

Variables DF=3 N=42	b	R^2
Intercept	.5255	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	.0162	.0447
Study behavior	.3328**	.3236**
Parent income	.0495*	.0622*
Sum of significant variables		.4305

* $p < .05$. ** $p < .01$.

Table 28

Regression of Variables on First-Year QCA for College of Business Students

Variables DF=10 N=182	b	R^2
Intercept	3.4994	
Institutional variables (by dept.)		.0206
• Selectivity (average SAT Total)	-.0220	
• Students per faculty member	-.0059	
• Students per GTA	-.0006	
• Average annual allotment	.0002	
• Average classroom enrollment	-.0046	
• WSCH per faculty FTE	.0021	
High school rank	-.0023**	.0953**
Writing ability	.1410**	.0386**
High school SAT Mathematics	.0207**	.0333**
Study behavior	.1257*	.0280*
Sum of significant variables		.2157

* $p < .05$. ** $p < .01$.

Table 29

Regression of Variables on Second-Year QCA for College of Business Students

Variables DF=12 N=181	b	R^2
Intercept	-3.0799	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .0265 -.0113 .0001 -.0004 .0106 .0021	.0901*
High school rank	-.0020**	.0712**
High school SAT Mathematics	.0218**	.0578**
White Caucasian	.5065**	.0281*
Extrinsic motivation	-.1725**	.0220*
Study behavior	.1035*	.0187*
Locus of control	-.0893*	.0216*
Sum of significant variables		.3095

* $p < .05$. ** $p < .01$.

Table 30

Regression of Variables on Third-Year QCA for College of Business Students

Variables DF=10 N=210	b	R^2
Intercept	-26.6212	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .2877* .0914** .0011 .0028 -.0296 -.0072	.0846**
Study behavior	.1242**	.0453**
Black African American	-.7509*	.0308**
Leadership	.0951*	.0220*
High school SAT Verbal	.0125*	.0182*
Sum of significant variables		.2009

* $p < .05$. ** $p < .01$.

Table 31

Regression of Variables on Fourth-Year QCA for College of Business Students

Variables DF=9 N=212	b	R^2
Intercept	-9.7402	
Institutional variables (by dept.)		.0671*
• Selectivity (average SAT Total)	.0900*	
• Students per faculty member	-.0117	
• Students per GTA	.0005	
• Average annual allotment	.0012	
• Average classroom enrollment	-.0049	
• WSCH per faculty FTE	-.0070	
High school rank	-.0016**	.0471**
Parent education	.0476*	.0220*
Intrinsic motivation	.1078*	.0176*
Sum of significant variables		.1538

* $p < .05$. ** $p < .01$.

Table 32

Regression of Variables on First-Year QCA for College of Education Students

Variables DF=2 N=17	b	R^2
Intercept	16.4515	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	-.1673	.0595
Gender (1=male 2=female)	1.0158*	.2791*
Sum of significant variables		.3387

* $p < .05$. ** $p < .01$.

Table 33

Regression of Variables on Second-Year QCA for College of Education Students

Variables DF=6 N=23	b	R^2
Intercept	14.9579*	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 -.1486 -.0101	.0209
Athletic interest	-.4829**	.1384*
High school SAT Mathematics	.0513**	.1248*
Extrinsic motivation	.6148**	.0961*
Intrinsic motivation	.3210**	.0911*
Sum of significant variables		.4713

* $p < .05$. ** $p < .01$.

Table 34

Regression of Variables on Third-Year QCA for College of Education Students

Variables DF=5 N=30	b	R^2
Intercept	-7.7318	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .1075 -.0338	.0210
Parent income	.0791**	.2596**
Leadership	-.3260**	.1860**
Academic involvement	.2089*	.0821*
Sum of significant variables		.5487

* $p < .05$. ** $p < .01$.

Table 35

Regression of Variables on Fourth-Year QCA for College of Education Students

Variables DF=3 N=28	b	R^2
Intercept	43.1300	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 -.4773 .3445	.3663**
Parent income	.0876*	.1449*
Sum of significant variables		.5113

* $p < .05$. ** $p < .01$.

Table 36

Regression of Variables on First-Year QCA for College of Engineering Students

Variables DF=7 N=378	b	R^2
Intercept	-22.0909	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .2005 -.0980	.0033
High school SAT Mathematics	.0440**	.1506**
High school rank	-.0032**	.0430**
Fraternal involvement	-.1293**	.0218**
Parent education	.0788**	.0240**
Age	.1471*	.0082*
Sum of significant variables		.2508

* $p < .05$. ** $p < .01$.

Table 37

Regression of Variables on Second-Year QCA for College of Engineering Students

Variables DF=10 N=291	b	R^2
Intercept	11.3474**	
Institutional variables (by dept.)		.0558*
• Selectivity (average SAT Total)	-.0693*	
• Students per faculty member	.0185*	
• Students per GTA	-.0007	
• Average annual allotment	-.0009*	
• Average classroom enrollment	-.0032	
• WSCH per faculty FTE	-.0058	
High school SAT Mathematics	.0301**	.0505**
Gender (1=male 2=female)	.2248*	.0160*
Race - other	-.9180*	.0131*
Study behavior	.0838*	.0133*
Sum of significant variables		.1487

* $p < .05$. ** $p < .01$.

Table 38

Regression of Variables on Third-Year QCA for College of Engineering Students

Variables DF=9 N=232	b	R^2
Intercept	-1.2741	
Institutional variables (by dept.)		.0994**
• Selectivity (average SAT Total)	-.0231	
• Students per faculty member	-.0059	
• Students per GTA	.0087**	
• Average annual allotment	.0021	
• Average classroom enrollment	-.0930	
• WSCH per faculty FTE	.0171**	
High school SAT Verbal	.0189**	.0975**
Study behavior	.1100**	.0273**
High school SAT Mathematics	.0145*	.0145*
Sum of significant variables		.2387

* $p < .05$. ** $p < .01$.

Table 39

Regression of Variables on Fourth-Year QCA for College of Engineering Students

Variables DF=11 N=252	b	R^2
Intercept	-38.1819**	
Institutional variables (by dept.)		.0509*
• Selectivity (average SAT Total)	.2480**	
• Students per faculty member	-.3140*	
• Students per GTA	.0172*	
• Average annual allotment	-.0047*	
• Average classroom enrollment	.0740*	
• WSCH per faculty FTE	.0463*	
High school SAT Mathematics	.0224**	.0639**
Asian American Oriental	-.4941*	.0312**
Gender (1=male 2=female)	.2748*	.0272**
Study behavior	.0940*	.0170*
High school SAT Verbal	.0111*	.0142*
Sum of significant variables		.2044

* $p < .05$. ** $p < .01$.

Table 40

Regression of Variables on First-Year QCA for College of Human Resources Students

Variables DF=5 N=30	b	R^2
Intercept	-10.1022	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .1331 -.0352 .0055	.1094
Parent income	.0750**	.1817*
Asian American Oriental	-1.2071*	.1049*
Sum of significant variables		.3960

* $p < .05$. ** $p < .01$.

Table 41

Regression of Variables on Second-Year QCA for College of Human Resources Students

Variables DF=4 N=56	b	R^2
Intercept	-1.5782	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .0727 -.1239* -.0085**	.1373*
High school SAT Mathematics	.0342**	.1407**
Sum of significant variables		.2780

* $p < .05$. ** $p < .01$.

Table 42

Regression of Variables on Third-Year QCA for College of Human Resources Students

Variables DF=7 N=66	b	R^2
Intercept	3.7398	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 -.0052 -.0280 -.0002 -.0026	.0547
High school rank	-.0039**	.0905*
Athletic involvement	-.2301**	.0731*
Fraternal involvement	.1975*	.0653*
Sum of significant variables		.2836

* $p < .05$. ** $p < .01$.

Table 43

Regression of Variables on Fourth-Year QCA for College of Human Resources Students

Variables DF=6 N=61	b	R^2
Intercept	2.0851	
Institutional variables (by dept.)		.0783
• Selectivity (average SAT Total)	.0038	
• Students per faculty member	.0593	
• Students per GTA	.0011	
• Average annual allotment	.0016	
• Average classroom enrollment	.0062	
• WSCH per faculty FTE		
Asian American Oriental	-1.5100*	.0796*
Sum of significant variables		.1580

* $p < .05$. ** $p < .01$.

Table 44

Regression of Variables on First-Year QCA for College of Arts & Science Students

Variables DF=12 N=496	b	R^2
Intercept	1.7136	
Institutional variables (by dept.)		.0128
• Selectivity (average SAT Total)	-.0130	
• Students per faculty member	-.0013	
• Students per GTA	.0001	
• Average annual allotment	.0002	
• Average classroom enrollment	.0019	
• WSCH per faculty FTE	-.0006	
High school rank	-.0015**	.0323**
High school SAT Mathematics	.0240**	.1285**
Study behavior	.1265**	.0282**
Gender (1=male 2=female)	.2416**	.0251**
White Caucasian	.2923*	.0104*
Extrinsic motivation	.1004*	.0074*
Sum of significant variables		.1446

* $p < .05$. ** $p < .01$.

Table 45

Regression of Variables on Second-Year QCA for College of Arts & Science Students

Variables DF=12 N=380	b	R^2
Intercept	2.4652*	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 -.0123 -.0002 -.0001 -.0001 -.0087 .0023	.0183
Writing ability	.1123**	.0327**
High school rank	-.0010*	.0142*
Help-seeking behavior	.1344**	.0128*
Athletic involvement	-.0817*	.0122*
Age	.1723*	.0115*
High school SAT Verbal	.0096*	.0098*
Sum of significant variables		.1114*

* $p < .05$. ** $p < .01$.

Table 46

Regression of Variables on Third-Year QCA for College of Arts & Science Students

Variables DF=9 N=326	b	R^2
Intercept	.3090	
Institutional variables (by dept.)		.0198
• Selectivity (average SAT Total)	.0119	
• Students per faculty member	-.0039	
• Students per GTA	.0001	
• Average annual allotment	.0001	
• Average classroom enrollment	.0050	
• WSCH per faculty FTE	.0007	
High school SAT Verbal	.0144**	.0342**
Academic involvement	.0828*	.0159*
High school rank	-.0008*	.0126*
Sum of significant variables		.0825

* $p < .05$. ** $p < .01$.

Table 47

Regression of Variables on Fourth-Year QCA for College of Arts & Science Students

Variables DF=9 N=308	b	R^2
Intercept	1.3329	
Institutional variables (by dept.)		.0301
• Selectivity (average SAT Total)	-.0020	
• Students per faculty member	.0180*	
• Students per GTA	.0001	
• Average annual allotment	.0002	
• Average classroom enrollment	-.0097	
• WSCH per faculty FTE	.0018	
White Caucasian	.6257**	.0505**
High school rank	-.0016**	.0363**
Writing ability	.1273**	.0281**
Sum of significant variables		.1451

* $p < .05$. ** $p < .01$.

Table 48

Regression of Variables on First-Year QCA for Humanities Cluster

Variables DF=10 N=210	b	R^2
Intercept	.8222	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .0059 -.0642 .0003 .0001 .0057	.0368
Gender (1=male 2=female)	.3165**	.0685**
White Caucasian	.4278*	.0244*
Study behavior	.1021*	.0233*
Self-efficacy	.2416**	.0197*
Leadership	.2923*	.0171*
Sum of significant variables		.1899

* p < .05. ** p < .01.

Table 49

Regression of Variables on Second-Year QCA for Humanities Cluster

Variables DF=7 N=148	b	R^2
Intercept	3.9089	
Institutional variables (by dept.)		.0942*
• Selectivity (average SAT Total)	-.0080	
• Students per faculty member	-.0274	
• Students per GTA	-.0001	
• Average annual allotment	-.0001	
• Average classroom enrollment	-.0640*	
• WSCH per faculty FTE	.0074**	
Athletic involvement	-.1526**	.0260*
Help-seeking behavior	.1528*	.0291*
Sum of significant variables		.1493

* $p < .05$. ** $p < .01$.

Table 50

Regression of Variables on Third-Year QCA for Humanities Cluster

Variables DF=8 N=103	b	R^2
Intercept	.6085	
Institutional variables (by dept.)		.1330*
• Selectivity (average SAT Total)	.0120	
• Students per faculty member	-.0397	
• Students per GTA	.0002	
• Average annual allotment	-.0001	
• Average classroom enrollment	-.0212	
• WSCH per faculty FTE	.0010	
High school SAT Verbal	.0257**	.0876**
Fraternal involvement	.1365*	.0420*
Sum of significant variables		.2626

* $p < .05$. ** $p < .01$.

Table 51

Regression of Variables on Fourth-Year QCA for Humanities Cluster

Variables DF=9 N=88	b	R^2
Intercept	-29.8858	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment • Average classroom enrollment • WSCH per faculty FTE	 .2446 -.0812 .0005* .0007* -.0102	.1510*
Gender (1=male 2=female)	.5532**	.1038**
White Caucasian	1.6090**	.0989**
High school SAT Mathematics	.0255**	.0440*
Black African American	.9345*	.0333*
Sum of significant variables		.4310

* $p < .05$. ** $p < .01$.

Table 52

Regression of Variables on First-Year QCA for Mathematics Cluster

Variables DF=5 N=102	b	R^2
Intercept	.3035	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 .0046 -.0168 -.0008	.0287
High school SAT Verbal	.0474**	.1398**
High school rank	-.0025**	.0542*
Sum of significant variables		.2227

* $p < .05$. ** $p < .01$.

Table 53

Regression of Variables on Second-Year QCA for Mathematics Cluster

Variables DF=3 N=80	b	R^2
Intercept	4.9696	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 -.0229 -.0108	.0381
Parent income	.0511*	.0597*
Sum of significant variables		.0978

* $p < .05$. ** $p < .01$.

Table 54

Regression of Variables on Third-Year QCA for Mathematics Cluster

Variables DF=3 N=55	b	R^2
Intercept	11.1748	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 -.0909 .0151	.0351
High school SAT Verbal	.0345**	.1544**
Sum of significant variables		.1895

* $p < .05$. ** $p < .01$.

Table 55

Regression of Variables on Fourth-Year QCA for Mathematics Cluster

Variables DF=4 N=55	b	R^2
Intercept	7.9051*	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 -.0621* -.0292*	.1474*
High school SAT Verbal	.0373**	.1233**
Gender (1=male 2=female)	.4512*	.0603*
Sum of significant variables		.3310

* $p < .05$. ** $p < .01$.

Table 56

Regression of Variables on First-Year QCA for Natural Sciences Cluster

Variables DF=8 N=93	b	R^2
Intercept	-8.8566	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 .1001 .1113 -.0239	.0110
Parent education	.1475**	.0593*
High school rank	-.0029*	.0415*
Intrinsic motivation	.2911*	.0467*
Academic involvement	-.2248*	.0407*
Study behavior	.1773*	.0377*
Sum of significant variables		.2368

* $p < .05$. ** $p < .01$.

Table 57

Regression of Variables on Second-Year QCA for Natural Sciences Cluster

Variables DF=4 N=71	b	R^2
Intercept	1.8605	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 .0075 .0046 -.0001	.0020
Writing ability	.3018**	.2129**
Sum of significant variables		.2149

* $p < .05$. ** $p < .01$.

Table 58

Regression of Variables on Third-Year QCA for Natural Sciences Cluster

Variables DF=6 N=79	b	R^2
Intercept	5.4827	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 -.0205 -.0796 .0140	.0260
High school rank	-.0031**	.1123**
Writing ability	.1956**	.0703*
Locus of control	.1602*	.0537*
Sum of significant variables		.2623

* $p < .05$. ** $p < .01$.

Table 59

Regression of Variables on Fourth-Year QCA for Natural Sciences Cluster

Variables DF=5 N=75	b	R^2
Intercept	-1.3146	
Institutional variables (by dept.) • Selectivity (average SAT Total) • Students per faculty member • Students per GTA • Average annual allotment Average classroom enrollment • WSCH per faculty FTE	 .0421 -.0106 -.0001	.0206
High school rank	-.0034**	.1172**
Study behavior	.1825*	.0489*
Sum of significant variables		.1868

* $p < .05$. ** $p < .01$.

Summary

The multivariate regression analysis identified a number of specific institutional and student characteristics that explained about 25 percent of the variance in student grades at Virginia Tech. The relationship was stronger in smaller, more homogeneous groups such as colleges or subject clusters. Institutional characteristics explained about 6 percent of the variance in student grades but, in most cases, they were not a significant factor. Student demographic characteristics, especially high school rank and SAT scores exhibited the strongest relationship to student grades. Together, they explained about 12 percent of the variance in student grades. A few other significant demographic characteristics, including gender, age, parent income and race were present, although not consistently. Student nontraditional characteristics explained about 7 percent of the variance in student grades. Generally, student behaviors exhibited a stronger relationship with grades than did student attitudes, values, and personality traits. Two characteristics, study behavior and writing skills, seemed to be the most prevalent nontraditional characteristics in all academic units.

CHAPTER 4

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

The purpose of this study was to develop and test a model describing the relationships between student achievement and selected student and institutional characteristics at Virginia Tech. A major outcome of the study was the development of a set of student profiles which would identify those student characteristics that most effectively explained differences in achievement in eleven academic units during the undergraduate years. Of special interest to the investigation were those student characteristics that could be manipulated within the context of the institution.

Three data sources were utilized in the study: (a) the 1985 CIRP Freshman Survey, (b) the Virginia Tech Student Longitudinal File, and (c) the Virginia Tech Provost's Fact Book between 1985 and 1989. A total of 1323 students who completed the 1985 CIRP Freshman Survey were included in the study.

The statistical analysis of the data required several different techniques. Descriptive statistics were run by gender, race, and college in order to compare the sample with the population. Two separate principal components factor analyses were undertaken to identify a set of

discrete nontraditional student characteristics to enter the regression analysis. A Pearson correlation analysis was utilized to detect the presence of multicollinearity among the nontraditional student characteristics. Finally, a stepwise regression analysis was undertaken in order to identify those characteristics having a significant relationship with student grades. Institutional characteristics were entered into the regression analysis first, mainly to control for their effects. Demographic and nontraditional characteristics were then allowed to enter the analysis if they met the .05 level of significance criterion. Forty-four separate regression analyses were run; one for each academic unit during each of the four undergraduate years.

Conclusions

The following research questions were investigated in this study:

1. To what extent do institutional characteristics explain the variance in student achievement for undergraduates at Virginia Tech?

2. To what extent do student characteristics explain the variance in student achievement for undergraduates at Virginia Tech?

3. Do student and institutional characteristics explain the variance in student achievement differently in

each of the eleven academic units and during each of the four undergraduate years?

With regard to the first research question, institutional characteristics were found to have a significant relationship with student achievement in sixteen of the forty-four regression analyses, and together they explained about 6 percent of the variance in student grades. With regard to the second research question, at least one significant student characteristic was found in each of the regression analyses that were run. Together they explained about 19 percent of the variance in student grades. With regard to the third research question, it was found that demographic characteristics were almost twice as powerful as nontraditional characteristics in explaining student achievement. Also, some differences were found in the impact of these two types of variables in the various academic units.

General Conclusions

The findings of this study lead to the following general conclusions:

1. The strength of the relationship between student characteristics and student grades was stronger in smaller, more homogeneous groups than it was across the entire university.

2. Institutional characteristics seemed to have a

small, inconsistent relationship with student achievement at Virginia Tech. Of the six characteristics studied, the most prevalent were selectivity and weighted student credit hour (WSCH) productivity.

3. The combination of high school rank, high school SAT mathematics, and high school SAT verbal were the strongest demographic predictors of student achievement. A comparison of the two SAT measures indicates that SAT mathematics was generally a stronger predictor during the early undergraduate years and SAT verbal was generally stronger during the latter undergraduate years. This may reflect the increased importance of reading comprehension and critical thinking during the senior years. Also, the predictive strength of these three variables generally decreased over the four year period.

4. Gender, age, parent income, parent education, and race were each found to have a significant relationship with student achievement in certain instances, but not in a consistent pattern. In general, females attained higher grades than males and older students attained higher grades than younger students.

5. Student behaviors seemed to more effectively explain student achievement than any other type of nontraditional characteristic. The strongest and most consistent student behaviors were study behavior and writing

skills. Students who were strong in these areas generally achieved significantly higher grades.

6. Student interest in athletics and belonging to a fraternity were significant characteristics in a few instances. In those instances, students with a high athletic interest generally attained lower grades, and students with a high interest in belonging to a fraternity attained higher grades.

7. Extrinsic motivation, locus of control, self-efficacy, help-seeking behavior, academic involvement, and intrinsic motivation were found to have a significant relationship with student achievement, but only in isolated instances.

Discussion

This study identified a number of institutional and student characteristics that may explain differences in student grades at Virginia Tech. Many of the results are consistent with previous research on student achievement. Institutional and student characteristics explained about one-quarter of the variance in student grades. The strongest student characteristics were high school rank and SAT scores.

The study, though, did extend the research on student grades in two major ways. First, by breaking down the sample into colleges and subject area clusters, it was

possible to prepare meaningful profiles for each of the eleven academic units, as indicated in tables 16-59. These tables are an important resource because they can be utilized by faculty and administrators at three distinct administrative levels; the subject area, the college, and the university as a whole. For instance, a faculty member in mathematics can identify those student characteristics that explain achievement in mathematics, in the College of Arts & Sciences, and across the university. This knowledge is useful for predicting achievement, for developing intervention programs, and for planning curricular changes.

The following cases illustrate how this information can be applied to specific subject areas. The first case relates to the College of Agriculture. An analysis of Table 20 revealed that those students who exhibited the greatest interest in joining a fraternity also obtained the highest grades in their freshman year. In order to validate this interesting finding, a faculty member and a student in the College of Agriculture were consulted. Both concurred that the AGR fraternity was well-respected at Virginia Tech and across the nation. They stressed that it functioned as a professional rather than a strictly social fraternity. The faculty member stated that students frequently asked him if joining the fraternity would be detrimental to their grades, but he had little information on which to make a judgement.

It was felt that this information would allow him to counsel his students more objectively and knowledgeably in the future.

The second case relates to the mathematics cluster. An analysis of Tables 52-55 revealed that the most potent predictor of grades during three of the four undergraduate years was the SAT verbal score. This was an important finding because it suggested that reading ability was more important that mathematics ability in explaining differences in student mathematics grades. One explanation for this finding is that mathematics students are pre-selected according to their mathematics ability. Consequently, differences in mathematical ability would be less likely to explain differences in grades. This was confirmed upon consultation with a faculty member from the mathematics department. He stated that, although students are selected on the basis of their mathematical ability, their grades often suffer because they lack the reading skills for effective problem-solving. He stressed that this is especially true of many foreign students who do not have an adequate comprehension of the English language. It was felt that the information from this study would assist faculty in more effectively identifying and assisting students with inadequate verbal skills.

A second way in which this study extended the research

on student grades was by identifying a set of nontraditional, manipulable characteristics that may help to explain differences in student grades. The two most important nontraditional variables seem to be self-reported study behavior and writing skills. Both of these behaviors have come under increasing scrutiny at the college level over the past few years. A recent survey that examined these behaviors, among others, was the 1991 College Student Experiences Questionnaire (CSEQ). The CSEQ was initiated by Robert Pace in 1979 and is now used in over 200 institutions across the United States. The 1991 survey was completed by 601 undergraduates of Virginia Tech and comparative results are available from all other institutions included in the study. A recent report of the Virginia Tech Office of Program Review and Outcomes Assessment (Appendix 2) includes the following results from the CSEQ:

1. Students at Virginia Tech scored lower than students in other doctoral universities in each of the six measures of writing experiences. Notably, only 51 percent asked others to proofread their work, 37 percent referred to a book about style of writing, and 21 percent asked an instructor for writing advice.

2. Students at Virginia Tech scored lower than students in other doctoral universities in the number of written assignments. Only 12 percent of Virginia Tech

undergraduates had ten or more essay exams during the current year and 20 percent completed ten or more term papers or reports.

3. Students at Virginia Tech scored lower than students in other doctoral universities in six out of seven measures of course learning (study behaviors). Most notably, only 12 percent made outlines from class notes or readings and 54 percent worked on assignments that required integrating ideas from various sources.

The above report parallels the present study which shows a strong, consistent relationship between student grades and both study behavior and writing skills. This would suggest that students can improve in both of these skills if they are identified early and given specialized training. Identification should take place during the freshman year and training programs should be initiated at both the department and classroom levels. The classroom level has the greatest potential because the teacher has an ongoing relationship with the student. Consequently, the individual faculty member must be made aware of those students who are at risk and become actively involved in their remediation. McKeachie (1986), in describing the college teacher's roles, included that of facilitator. The major goal of a facilitator, he stated, is to help students "overcome obstacles to learning (p.66)". Writing and study

behavior seem to be two of the most important obstacles to learning at Virginia Tech. McKeachie also made the following suggestions for helping students to improve their skills. Writing skills can be improved by:

1. Having students review and critique written assignments for one another.

2. Having students write short papers that can be evaluated in a short time.

3. Having students resubmit written assignments with corrections.

4. Providing students with helpful comments on written assignments.

5. Establishing criteria for evaluation and grading.

Study skills can be improved by:

1. Establishing specific assignments based on course objectives.

2. Assisting students in taking effective notes.

3. Encouraging students to set standards for themselves.

4. Encouraging students to "attribute failure to lack of effort rather than to lack of ability (p. 226)".

5. Utilizing teaching practices that influence student learning strategies. For instance, it has been found that students attain higher scores when they are required to study for an essay question rather than an objective test

(p. 240).

Although other nontraditional characteristics did not consistently explain differences in grades, they did have a significant impact in specific cases. An analysis of the following characteristics provides an interesting profile of undergraduates at Virginia Tech.

Self-Efficacy

Self-efficacy has been defined as "beliefs about one's ability to successfully perform a given task or behavior" (Lent, Larkin, & Brown, 1986, p. 265). In the present study it was measured by student beliefs about their emotional, social, and intellectual strength, as well as their drive to achieve. Self-efficacy was a significant characteristic in the first year for students across the entire university and in the College of Human Resources. This suggests that, especially for freshman students, their beliefs about their own ability may have a significant effect on their subsequent grades. Conversely, it is also true that better students will probably have greater confidence in their ability to succeed. Nonetheless, it is the opinion of this author, after many years of teaching, that many beginning students fail because they lack confidence in themselves. Consequently, one of the most important and rewarding responsibilities in teaching is to identify those students and help them to succeed. Success in their early endeavors

fosters a continued belief that they can succeed in the future.

Help-Seeking Behavior

Help-seeking behavior is the extent to which a student will seek help within the institution. This was a significant variable for second year students across the university and in the College of Arts & Science. Students who were more willing to seek help were more likely to attain higher grades. Conversely, most teachers will concur that the students who have the most academic difficulty are often the least likely to ask for help. This phenomenon was alluded to earlier in the discussion of writing skills. Only 21 percent of undergraduates at Virginia Tech asked a professor for advice on writing. The major implication of this finding is that, at all levels, the university has a responsibility to encourage students to seek help if they are having academic problems.

Extrinsic Motivation

Extrinsic motivation was defined in this study as personal and occupational rewards for academic attainment. Based on this characteristic, it is possible to identify general differences in students attitudes among the various colleges and subject areas. A positive regression coefficient for extrinsic motivation was exhibited for three colleges - Architecture, Education, and Arts & Sciences.

Presumably, students in those colleges who attained the highest grades were extrinsically motivated. Conversely, a negative regression coefficient was exhibited for two colleges - Agriculture and Business. This would suggest that students in those colleges who attained the highest grades were not extrinsically motivated. If this is accurate, it runs counter to many of the present perceptions about student motivations. For instance, Business students are usually perceived to be strongly motivated by extrinsic rewards, especially money. Conversely, both Education and Arts & Sciences students are often perceived as being strongly motivated by intrinsic rewards. This is definitely an area that requires more research.

Intrinsic Motivation

Intrinsic motivation was defined in this study as internal rewards for educational attainment. A positive regression correlation was exhibited during one of the four undergraduate years in the College of Business, the College of Education, and the natural sciences cluster. This suggests that students who attained high grades in these three academic areas also had a high level of intrinsic motivation. It is interesting to note that only in the College of Education did students with high marks exhibit both high extrinsic and high intrinsic motivation. This is consistent with Herzberg's (1968) Two-Factor theory of

motivation, which relates dissatisfaction to extrinsic rewards (hygiene factors) and satisfaction to intrinsic rewards (motivators). Consequently, it is theoretically possible for a student to exhibit high levels of each type of motivation.

Locus of Control

Locus of control is defined as student perceptions about the amount of control they have over their own life. Externals believe that they are strongly controlled by the external environment while internals believe that they have control over their own circumstances. A negative regression coefficient was exhibited during one of the four undergraduate years in the College of Agriculture and the College of Business. This indicates that students who attained higher marks tended to be internals. Conversely, a negative regression coefficient was exhibited in the natural sciences cluster. Students who attained higher marks in this area tended to be externals. This may be explained by the philosophical bent of the natural sciences. Students in the natural sciences may be less likely to accept that any human behavior can be controlled if it cannot be objectively studied.

Leadership

Leadership ability was related to grades during one of the four graduate years in the College of Business, the

College of Education, and the humanities cluster. Interestingly, only in the College of Education was it a negative regression coefficient. In other words, students who attained high marks in the College of Education exhibited a lower level of leadership ability. This finding rings true for the College of Business because most of the students are management oriented. It is also a realistic assessment of students in the College of Education because the undergraduate program is directed toward classroom teaching. The importance of leadership in the humanities cluster, though, is unclear. It is possible that the humanities provide a training ground for future politicians, but further research is necessary in this area.

Although this study did provide a great deal of useful information, three-quarters of the variance in student grades at Virginia Tech remain unexplained. This unexplained variance is the result of three types of error; sampling error, measurement error, and specification error (Fortune, 1990). Sampling error results from non-random selection or assignment of subjects from the population. In this study, the respondents were self-selected and this bias was undoubtedly responsible for a part of the total error. Measurement error is the difference between an individual's response to a question and the true condition that is being measured by that question. Many of the student

characteristics examined in this study were based on student self-reports and were thus vulnerable to measurement error. For instance, most respondents in the sample rated themselves as being high in achievement motivation. This may or may not be a true reflection of the student's actual level of achievement motivation. In an independent analysis of the CIRP survey, though, Boruch (1972) found all of the variables to be "sufficiently reliable for analytic use in statistical research" (p.29). It should be noted, though, that variables from the CIRP survey used in this study were chosen independently and were not scaled on the same basis as those in the survey. For example, locus of control was measured by one question from the CIRP survey, but in the survey it was part of a larger group of questions intended to measure student attitudes. Consequently, this study attempted to maximize reliability by (a) selecting variables that conformed to accepted definitions, and (b) utilizing a factor analysis procedure to group similar variables. Measurement error is also a major problem when grades are used as a criterion measure. Grades are a relative measure and they change from situation to situation and year to year. This study attempted to control for differences in grading practices between departments, but other sources of error such as course difficulty could not be controlled for. The final source of error is specification error which

results from the failure to control for all relevant variables. The present study attempted to minimize these errors by utilizing an accepted model of achievement and basing the selected variables on established literature. The study, though, was unable to include one important institutional variable that is often discussed in the literature; the impact of the individual faculty member on student learning.

Recommendations for Future Research

The results of this study indicate that there is a need to look beyond demographic characteristics to explain student achievement. Consequently, future research should continue to examine both nontraditional and institutional variables to further explain differences in student achievement. One possible direction for study on nontraditional variables is to examine their impact on nontraditional students. Another possibility is to examine other outcomes that may relate more strongly to nontraditional characteristics.

The insignificant relationship between institutional characteristics and grades in this study may be due to the difficulty in collecting effective institutional data. Variables such as faculty/student ratios and budget allocations are relatively simple to measure, but do not necessarily reflect the impact of the institution on the

student. Consequently, two important institutional variables that should be included in future research are faculty-student interaction and teaching effectiveness. Measures for these variables can be found in the CIRP follow-up survey, the Virginia Tech Senior Survey, and the Virginia Tech Alumni Survey, but none of these surveys could be utilized in the present study. The CIRP survey only includes a sample of the freshman population tested four years earlier. The two Virginia Tech surveys are not presently useful for this purpose because they often exclude the student Social Security Number. The SSN is the only link to student census information such as grades. Also, each of the above surveys are given after the fourth year. An earlier survey, possibly after the second year, would provide useful institutional information for this study.

Finally, future research should examine alternative measures of student achievement. One of the most promising of these is the "capstone" course that is being introduced in various colleges. Capstone courses are intended to summarize the knowledge accumulated by the student over the four undergraduate years. As these courses increase in use, it may be possible to include them as alternatives or additions to grades as measures of achievement.

REFERENCES

Alexander, Joanne M. and Stark, Joan S. (1986). Focusing on student academic outcomes: A working paper (Grant No. OERI-86-0010). Ann Arbor, Michigan: University of Michigan.

Astin, Alexander W. & Panos, Robert J. (1969). The educational and vocational development of college students. Washington, D.C.: American Council on Education.

Astin, Alexander W. (1970). The methodology of research on college impact, part one. Sociology of Education, 43(Summer), 223-254.

Astin, Alexander W. (1970). The methodology of research on college impact, part one. Sociology of Education, 43(Fall), 437-450.

Astin, Alexander W. (1971). Predicting academic performance in college. New York: The Free Press.

Astin, Alexander W. & Molm, Linda D. (1973). Personal characteristics and attitude changes of student protesters. Journal of College Student Personnel, 13(3), 239-249.

Astin, Alexander W. (1978). Four critical years. San Francisco, Jossey-Bass.

Astin, Alexander W., Green, Kenneth C., & Korn, William S. (1987). The American freshman: Twenty year trends, 1965-1985. Los Angels: Higher Education Research Institute.

Ayres, Q. Whitfield & Bennett, Ronald W. (1983). University characteristics and student achievement. Journal of Higher Education, 54(5), 516-532.

Bean, John P. (1980). Dropouts and turnover: The syntheses and test of a causal model of student attrition. Research in Higher Education, 12, 155-187.

Bean, John P. (1985). Interaction effects based on class level in an explanatory model of college student dropout syndrome. American Educational Research Journal, 22(1), 35-64.

Bean, John P. & Kuh, George D. (1984). The reciprocity between student-faculty informal contact and academic performance of university undergraduate students. Research in Higher Education, 21(4), 461-477.

Boruch, Robert E. (1972). Measurement error in social and educational survey research. American Council on Education, Washington, D.C.

Cappella, Betty J., Wagner, Marion, & Kusmierz, Julia A. (1982). Relation of study habits and attitudes to academic performance. Psychological Reports, 50, 593-594.

Corlett, Donna. (1974). Library skills, study habits and attitudes, and sex as related to academic achievement. Educational and Psychological Measurement, 34, 967-969.

Cowell, M.D. and Entwistle, N.J. (1971). The relationship between personality, study attitudes, and academic performance in a technical college. British Journal of Educational Psychology, 4, 85-90.

Doughtery, A.M., & Schmidt, T. (1981). Study skills, locus of control, and achievement. Educational and Psychological Research, 1, 11-23.

Edwards, Jack E. and Waters, L.K. (1980). Relationship of academic job involvement to biographical data, personal characteristics, and academic performance. Educational and Psychological Measurement, 40, 547-551.

Edwards, Jack E. and Waters, L.K. (1981). Moderating effects of achievement motivation and locus of control on the relationship between academic ability and academic performance. Educational and Psychological Measurement, 41, 585-587.

Elliott, Rogers & Strenta, Christopher A. (1988). Effects of improving the reliability of the GPA on prediction generally and on comparative predictions for gender and race particularly. Journal of Educational Measurement, 25(4), 333-347.

Finlay, Barbara. (1981). Birth order, sex, and honors students' status in a state university. Psychological Reports, 49, 1000-1002.

Fortune, J. (1990). Class notes presented in behavioral sciences in education class at Virginia Tech, Blacksburg, VA.

Gilmore, Timothy M. and Reid, David W. (1978). Locus of control, prediction, and performance on university examinations. Journal of Consulting and Clinical Psychology, 46(3), 565-566.

Goh, David S. and Moore, Charles M. (1977, April). Personality and academic achievement in three educational levels. Paper presented at the annual meeting of the American Educational Research Association, New York, N.Y.

Gough, Harrison G. & Lanning, Kevin. (1986). Predicting grades in college from the California Psychological Inventory. Educational and Psychological Measurement, 46, 205-213.

Hearn, James C. (1987). Impacts of undergraduate experiences on aspirations and plans for graduate and professional education. Research in Higher Education, 27(2), 119-141.

Herzberg, Frederick. (1968). One more time: How do you motivate employees? Harvard Business Review, 46, 53-62.

Johnson, Lucie R. (1989, March). Ten percent more: What learning process dimensions can add to the prediction of first year college students' academic success. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Kanarek, Ellen Armstrong. (1989, April). Exploring the murky world of admissions predictions. Paper presented at the annual forum of the Association for Institutional Research, Baltimore, MD.

Lemke, E.A., Leicht, K.L., & Miller, L.C. (1974). Role of ability and extroversion in concept attainment of individuals trained in heterogeneous or homogeneous personality groups. Journal of Educational Research, 67, 202-204.

Lenning, Oscar T. and Others. (1974). Nonintellective correlates of grades, persistence, and academic learning in college: The published literature through the decade of the sixties (Monograph No. 14). Iowa City: American College Testing Program.

Lent, Robert W., Brown, Steven D., & Larkin, Kevin C. (1986). Self-efficacy in the prediction of academic performance and perceived career options. Journal of Counseling Psychology, 33(3), 265-269.

Lin, Yi-Guang & McKeachie, Wilbert, J. (1970). Aptitude, anxiety, study habits, and academic achievement. Journal of Counseling Psychology, 17(4), 306-309.

Lunneborg, Clifford E. and Lunneborg, Patricia W. (1986). Beyond prediction: The challenge of minority achievement in higher education. Journal of Multicultural Counseling and Development, 9(2), 77-84.

McCausland, Donald F. & Stewart, Nancy E. (1974). Academic aptitude, study skills, and attitudes. The Journal of Educational Research, 67(8), 354-357.

McKeachie, Wilbert J. (1986). Teaching tips: A guidebook for the beginning college teacher. Lexington: D.C. Heath and Company.

Merante, Joseph A. (1983). Predicting student success in college: What does the research say? NASSP Bulletin, 67(460), 41-45.

Mills, Joan. (1978). Predicting academic achievement of working undergraduate business students. College and University, 53, 335-342.

Pace, Robert C. (1984). Measuring the quality of college student experiences. An account of the development and use of the college student experiences questionnaire. Unpublished report, Higher Education Research Institute Inc., Los Angeles, California.

Pantages, Timothy J. & Creedon, Carol F. (1978). Studies of college attrition: 1950-1975. Review of Educational Research, 48(1), 49-101.

Pascarella, Ernest T. (1985). College environmental influences on learning and cognitive development: A critical review and synthesis. In J. Smart (Ed.), Higher education: Handbook of theory and research (Vol. 1). New York: Agathon.

Pascarella, Ernest T. and Terenzini, Patrick T. (1991). How college effects students: Findings and insights from twenty years of research. San Francisco: Jossey-Bass.

Pauk, W. (1974). How to study in college. Boston: Houghton Mifflin Company.

Prather, James E. and Others. (1978, March). The relationship of undergraduate course grades with student ability levels, programs of study, and longitudinal trends: A multivariate analysis. Paper presented at the annual meeting of the American Educational Research Association, Toronto, Ont., Can.

Prather, James E. & Sturgeon, Joseph S. (1981). The influence of academic performance, demographic background, and discipline on college grades and course withdrawals. Unpublished report, Georgia State University, Office of Institutional Planning.

Prociuk, T. J. and Breen, L. J. (1974). Locus of control, study habits, attitudes, and college academic performance. Journal of Psychology, 88, 91-95.

Provost's fact book. (1985-1989). Blacksburg, VA: Department of Institutional Research, Virginia Polytechnic Institute and State University.

Ritchey, Ferris J. and Lewis, Barbara Lawhon. (1986, November). A statistical interaction model for examining compensatory effects on academic performance. Paper presented at the annual meeting of the Mid-South Educational Research Association, Memphis, TN.

Rummel, R.J. (1970). Applied factor analysis. Evanston: Northwest University Press.

Rutkowski, Kathleen and Domino, George. (1975). Interrelationship of study skills and personality variables in college students. Journal of Educational Psychology, 67(6), 784-789.

Sowa, Claudia J., Thomson, Michelle M., & Bennett, Clofford T. (1989). Prediction and improvement of academic performance for high risk black college students. Journal of Multicultural Counseling and Development, 17(1), 14-22.

Summary of CSEQ results: Virginia Tech and other doctoral universities. (1991). Blacksburg, VA: Program Review and Outcomes Assessment, Virginia Polytechnic Institute and State University.

Thornell, John & Jones, Reid. (1986, November). The college admissions equation: ACT scores versus secondary school grade performance. Paper presented at the annual meeting of the Mid-South Educational Research Association, Memphis, TN.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. Review of Educational Research, 45, 89-125.

Tom, Alice K. (1982). Non-traditional predictors of academic success for special action admissions. Unpublished report, California, Davis, Office of Student Affairs, Research, and Information.

Tracey, Terence J. & Sedlacek, William E. (1987). A comparison of white and black student academic success using noncognitive variables: A lisrel analysis. (Research Report No. 6-87). Maryland University.

Tucker, Samuel J. (1973). Multiple predictors of academic success of the black male college student. Unpublished report, Morehouse College.

Van de Water, Gordon & Augenblick, John. (1987). Working while studying: Does it matter? An examination of the Washington State Work Study Program. Unpublished report, Washington State Higher Education Coordinating Board, Olympia, Washington.

Watkins, David. (1986). Learning processes and background characteristics as predictors of tertiary grades. Educational and Psychological Measurement, 46, 199-203.

Weidman, J. (1989). Undergraduate socialization: A conceptual approach. In J. Smart (Ed.), Higher education: Handbook of theory and research (Vol. 5). New York: Agathon.

Weigel, Richard G. and Weigel, Virginia M. (1967). The relationship of knowledge and usage of study skill techniques to academic performance. The Journal of Educational Research, 61(2), 78-80.

Wilhite, Stephen C. (1989, November). Locus of control, self-assessment of memory ability, and study activities as predictors of college course achievement. Paper presented at the annual meeting of the National Reading Conference, Austin, Texas.

Willingham, Warren W. and Others. (1985). Success in college: The role of personal qualities (Report No. ISBN-0-87447-228-8). New York, NY: College Entrance Examination Board.

(ERIC Document Reproduction Service No. ED 263 837)

Wolfle, L. (1980). The enduring effects of education on verbal skills. Sociology of Education, 53, 104-114.

Wolfle, L. (1991). Multicollinearity. Paper presented in Advanced Statistics class at Virginia Tech, Blacksburg, VA.

APPENDICES

APPENDIX A

CIRP SURVEY

PLEASE PRINT (one letter or number per box)

	FIRST	M I	LAST
NAME			
ADDRESS			
CITY		STATE / ZIP	PHONE:

When were you born? Month (01-12) Day (01-31) Year

1991 STUDENT INFORMATION FORM

DIRECTIONS

Your responses will be read by an optical mark reader. Your careful observance of these few simple rules will be most appreciated.

- [illegible]
- Make heavy black marks [illegible]
- Erase cleanly any answer you wish to change
- Make no stray marks [illegible]

EXAMPLE

Will marks made with ballpoint or felt tip marker be properly read? Yes ◯ No ●

Dear Student:

The information in this form is being collected as part of a continuing study of higher education conducted jointly by the American Council on Education and the University of California at Los Angeles. Your voluntary participation in this research is being solicited in order to achieve a better understanding of how students are affected by their college experiences. Detailed information on the goals and design of this research program are furnished in research reports available from the Higher Education Research Institute at UCLA. Identifying information has been requested in order to make subsequent mail follow-up studies possible. Your response will be held in the strictest professional confidence.

PLEASE USE #2 PENCIL

Sincerely,

Alexander W. Astin, Director
Higher Education Research Institute

PLEASE PROVIDE YOUR SOCIAL SECURITY NO

Mark here if directed: GRP CODE A, GRP CODE B

FORM NO. 178960

(Grid: digits 0–9 in each column)

1 Your sex Male ◯ Female ◯

2 How old will you be on December 31 of this year? (Mark one)

16 or younger	◯	21-24	◯
17	◯	25-29	◯
18	◯	30-39	◯
19	◯	40-54	◯
20	◯	55 or older	◯

3 Are you a twin? (Mark one)

No ◯ Yes, identical ◯ Yes, fraternal ◯

4 In what year did you graduate from high school? (Mark one)

1991	◯	Did not graduate but passed G.E.D. test	◯
1990	◯		
1989	◯	Never completed high school	◯
1988 or earlier	◯		

5 Are you enrolled (or enrolling) as a: (Mark one) Full-time student? ◯ Part-time student? ◯

6 How many miles is this college from your permanent home? (Mark one)

5 or less ◯ 6-10 ◯ 11-50 ◯ 51-100 ◯ 101-500 ◯ Over 500 ◯

7 What was your average grade in high school? (Mark one)

A or A+ ◯ A- ◯ B+ ◯ B ◯ B- ◯ C+ ◯ C ◯ D ◯

8 What were your scores on the SAT and/or ACT?

SAT VERBAL ____

SAT MATH ____

ACT Composite ____

9 Have you had, or do you feel you will need, any special tutoring or remedial work in any of the following subjects?

(Mark all that apply)	Have Had	Will Need
English	◯	◯
Reading	◯	◯
Mathematics	◯	◯
Social studies	◯	◯
Science	◯	◯
Foreign language	◯	◯

10 Prior to this term, have you ever taken courses for credit at this institution?

◯ Yes ◯ No

11 Since leaving high school, have you ever taken courses at any other institution?

(Mark all that apply in each column)	For Credit	Not for Credit
No	◯	◯
Yes, at a junior or comty. college	◯	◯
Yes, at a 4-yr. college or university	◯	◯
Yes, at some other postsecondary school (For example: technical, vocational, business)	◯	◯

12 Where do you plan to live during the fall term? (Mark one)

With parents or relatives	◯
Other private home, apartment or room	◯
College dormitory	◯
Fraternity or sorority house	◯
Other campus student housing	◯
Other	◯

13 Is this college your: (Mark one)

First choice? ◯ Second choice? ◯ Third choice? ◯ Less than third choice? ◯

14. To how many colleges other than this one did you apply for admission this year?

No other ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 or more ◯

15. What is the highest academic degree that you intend to obtain?

(Mark one in each column)

	Highest Planned	Highest Planned at this college
None	◯	◯
Vocational certificate	◯	◯
Associate (A.A. or equivalent)	◯	◯
Bachelor's degree (B.A., B.S., etc.)	◯	◯
Master's degree (M.A., M.S., etc.)	◯	◯
Ph.D. or Ed.D.	◯	◯
M.D., D.O., D.D.S., or D.V.M.	◯	◯
LL.B. or J.D. (Law)	◯	◯
B.D. or M.DIV. (Divinity)	◯	◯
Other	◯	◯

16. Is English your native language?

◯ Yes ◯ No

17. Are you a:

◯ U.S. citizen

◯ Permanent resident (green card)

◯ Neither

18. Are your parents: (Mark one)

Both alive and living with each other?	◯
Both alive, divorced or separated?	◯
One or both deceased?	◯

19. From what kind of secondary school did you graduate? (Mark one)

Public	◯
Private (denominational)	◯
Private (nondenominational)	◯
Other	◯

20 How much of your first year s educational expenses room board tuition and fees) do you expect to cover from each of the sources listed below?

a My Own or Family Resources

b Aid Which Need Not Be Repaid

c Aid Which Must Be Repaid

d Other Than Above

21 Are you

22 Current religious preference

23 Do you consider yourself a born again Christian? Yes No

24 For the activities below, indicate which ones you did during the past year. If you engaged in an activity frequently, mark Ⓕ. If you engaged in an activity one or more times, but not frequently, mark Ⓞ (occasionally). Mark Ⓝ (Not at all) if you have not performed the activity during the past year

	Frequently	Occasionally	Not at all
Attended a religious service	F	O	N
Studied with other students	F	O	N
Was a guest in a teacher's home	F	O	N

25 Rate yourself on each of the following traits as compared with the average person your age. We want the most accurate estimate of how you see yourself

	Highest 10%	Above Average	Average	Below Average	Lowest 10%

26 What is your best estimate of your parents' total income last year? Consider income from all sources before taxes (Mark one)

Less than $6 000	$40 000-49 999
$6 000-9 999	$50 000-59 999
$10 000-14 999	$60 000-74 999
$15 000-19 999	$75 000-99 999
$20 000-24 999	$100 000-149 999
$25 000-29 999	$150 000-199 999
$30 000-39 999	$200 000 or more

27 What is the highest level of formal education obtained by your parents?

	Father	Mother
Grammar school or less		
Some high school		
High school graduate		
Postsecondary school other than college		
Some college		
College degree		
Some graduate school		
Graduate degree		

28 Do you have a disability? (Mark all that apply)

- None
- Hearing
- Speech
- Orthopedic
- Learning disability
- Health related
- Partially sighted or blind
- Other

29 In deciding to go to college, how important to you was each of the following reasons?

	Very Important	Somewhat Important	Not Important
My parents wanted me to go	V	S	N
I could not find a job	V	S	N
Wanted to get away from home	V	S	N
To be able to get a better job	V	S	N
To gain a general education and appreciation of ideas	V	S	N
To improve my reading and study skills	V	S	N
There was nothing better to do	V	S	N
To make me a more cultured person	V	S	N
To be able to make more money	V	S	N
To learn more about things that interest me	V	S	N
To prepare myself for graduate or professional school	V	S	N

30 Mark only three responses, one in each column

Your mother's occupation

Your father's occupation

Your probable career occupation

NOTE: If your father or mother is deceased, please indicate his or her last occupation

[illegible]

31 Mark one in each row

④ Agree Strongly ③ Agree Somewhat ② Disagree Somewhat ① Disagree Strongly

- [illegible] enough to protect [illegible] goods and services
- The Federal government is [illegible] enough to control environmental pollution
- The Federal government should raise taxes to reduce the deficit
- [illegible] in the courts for the rights of criminals
- [illegible] should be increased
- [illegible]
- The death penalty should be abolished
- [illegible] it is all right for them to have sex even if [illegible] a very short time
- [illegible] married women are best confined to home and family
- [illegible]
- [illegible] balance in the schools
- [illegible] homosexual relationships
- [illegible] college education is that it increases one's earning power
- Employers should be allowed to require drug testing of employees or job applicants
- The best way to control AIDS is through widespread, mandatory testing
- [illegible] that a woman has led him on does not entitle [illegible]
- [illegible] the sale of handguns
- [illegible] needed to cover everybody's medical costs
- [illegible]
- [illegible] problem in America
- [illegible] discourage energy consumption
- [illegible] about changes in our society

32 During your last year in high school, how much time did you spend during a typical week doing the following activities?

Hours per week	None	Less than 1 hour	1-2	3-5	6-10	11-15	16-20	Over 20
Studying/homework								
Socializing with friends								
Talking with teachers outside of class								
Exercising/sports								
Partying								
Working (for pay)								
Volunteer work								
Student clubs/groups								
Watching TV								

33 During high school I: (Mark all that apply)

[illegible]

- Took a SAT/ACT preparation course
- [illegible] service projects
- [illegible]

34 How would you characterize your political views?

[illegible]

35 Below are some reasons that might have influenced your decision to attend this particular college. How important was each reason in your decision to come here? (Mark one answer for each possible reason)

Very Important / Somewhat Important / Not Important

- My relatives wanted me to come here
- My teacher advised me
- This college has a very good academic reputation
- This college has a good reputation for its social activities
- I was offered financial assistance
- This college offers special educational programs
- This college has low tuition
- My guidance counselor advised me
- [illegible] near home
- A friend suggested attending
- A college rep. recruited me
- The athletic department recruited me
- This college's graduates gain admission to top graduate/professional schools
- This college's graduates get good jobs
- I was attracted by the religious affiliation/orientation of the college
- I wanted to go to a school about the size of this college
- I was attracted by the racial/ethnic make-up of the student body at this college
- Not accepted anywhere else

36 Below is a list of different undergraduate major fields grouped into general categories. Mark only one oval to indicate your probable field of study.

ARTS AND HUMANITIES
- Art (fine and applied) 37
- English language and literature 2
- History 1
- Language 4
- Literature (except English) 4
- Music 3
- Philosophy 5
- Speech 5
- Theater or Drama 7
- Theology or Religion 10
- Other Arts and Humanities 11

BIOLOGICAL SCIENCE
- Biology, general 12
- Biochemistry or Biophysics 13
- Botany 14
- Marine (Life) Science 15
- Microbiology or Bacteriology 16
- Zoology 17
- Other Biological Science 18

BUSINESS
- Accounting 21
- Business Administration 24
- Finance 23
- Marketing 25
- Management 22
- Secretarial Studies 26
- Other Business 28

EDUCATION
- Business Education 30
- Elementary Education 31
- Music or Art Education 41
- Physical Education (Recreation) 42
- Special Education 32
- Other Education 44

ENGINEERING
- Aeronautical or Aerospace 50
- Civil Engineering 51
- Electrical Engineering 52
- Mechanical Engineering 53
- Other Engineering 57

PHYSICAL SCIENCE
- Astronomy 43
- Atmospheric Science (incl. Meteorology) 45
- Chemistry 46
- Earth Science 47
- Mathematics 48
- Physics 49
- Statistics 39
- Other Physical Science 58

PROFESSIONAL
- Architecture or Urban Planning 67
- Home Economics 70
- Health Technology (incl. Medical Technology) 71
- Pre-Professional (Dentistry, Medicine, Veterinary Medicine) 59
- Nursing 61
- Pharmacy 62
- Physical Therapy 63
- Recreation 65
- Social Welfare 66

SOCIAL SCIENCE
- Anthropology 83
- Economics 82
- Ethnic Studies 77
- Geography 80
- History 81
- Interdisciplinary Social Science 84
- Political Science (Government) 85
- Psychology 86
- Sociology 87

TECHNICAL
- Building Trades 88
- Data Processing 89
- Drafting or Design 90
- Electronics 91
- Mechanics 92
- Other Technical 93

OTHER FIELDS
- Agriculture 3
- Forestry 74
- Home Economics 75
- Industrial Arts 76
- Library Science 78
- Military Science 79
- Physical Fitness, Parks and Recreation 72
- Public Affairs 73
- Other (Any) 01

37 Please indicate the importance to you personally of each of the following. Mark one in each item.

(N) Not Important (S) Somewhat Important (V) Very Important (E) Essential

	E	V	S	N
Becoming accomplished in one of the performing arts (acting, dancing, etc.)	E	V	S	N
Becoming an authority in my field	E	V	S	N
Obtaining recognition from my colleagues for contributions to my special field	E	V	S	N
Influencing the political structure	E	V	S	N
Influencing social values	E	V	S	N
Raising a family	E	V	S	N
Having administrative responsibility for the work of others	E	V	S	N
Being very well off financially	E	V	S	N
Helping others who are in difficulty	E	V	S	N
Making a theoretical contribution to science	E	V	S	N
Writing original works (poems, novels, short stories, etc.)	E	V	S	N
Creating artistic work (painting, sculpture, decorating, etc.)	E	V	S	N
Becoming successful in a business of my own	E	V	S	N
Becoming involved in programs to clean up the environment	E	V	S	N
Developing a meaningful philosophy of life	E	V	S	N
Participating in a community action program	E	V	S	N
Helping to promote racial understanding	E	V	S	N
Keeping up to date with political affairs	E	V	S	N

38 What is your best guess as to the chances that you will

(N) No Chance (L) Very Little Chance (S) Some Chance (V) Very Good Chance

	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N
Graduate with honors?	V	S	L	N

39 The Higher Education Research Institute at UCLA actively encourages the colleges that participate in this survey to conduct local studies of their students. If these studies involve collecting follow-up data, it is necessary for the institution to know the students' ID numbers so that follow-up data can be linked with the data from this survey. If your college asks for a tape copy of the data and signs an agreement to use it only for research purposes, do we have your permission to include your ID number in such a tape? Yes ○ No ○

The remaining ovals are provided for items specifically designed by your college rather than the Higher Education Research Institute. If your college has chosen to use the ovals, please observe carefully the supplemental directions given to you.

40 Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	44. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	48. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
41 Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	45. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	49 Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
42 Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	46. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	
43 Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	47. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	

THANK YOU!

Prepared by the Higher Education Research Institute, University of California, Los Angeles, California 90024

APPENDIX B

SUMMARY OF CSEQ RESULTS

SELECTED ITEMS	Virginia Tech %	Doctoral Univ. %
Campus Residence (Residence hall/Greek housing only)		
Had lively conversations during dinner	84	75
Participated in discussions lasting late into night	64	60
Attended events put on by residence unit	17	43
Studied with other students in residence unit	41	47
Helped plan event in the residence unit	10	24
Worked on community project with other students in residence	9	17
Science		
Memorized formulas, definitions, technical terms	72	67
Tried to express relationships in mathematical terms	51	48
Tested understanding by explaining to another student	35	36
Read articles (not assigned) about scientific theories	19	18
Practiced skills using laboratory equipment	14	17
Showed classmate how to use scientific equipment	14	14
Attempted to explain experimental procedure to classmate	19	18
Went to exhibit of a new scientific device	5	5
Topics of Conversation (with other students)		
Discussed current events in the news	77	56
Discussed major social problems	48	34
Discussed different life styles and customs	40	34
Discussed views and ideas of other people such as writers, philosophers, historians	21	19
Discussed the arts	25	16
Discussed computers and technology	30	25
Discussed social and ethical issues related to science	38	30
Reading/Writing		
Read 10+ textbooks or assigned books	44	45
Read 10+ non-assigned books	14	13
Had 10+ essay exams	12	20
Had 10+ term papers or written reports	20	22
ESTIMATE OF GAINS FROM COLLEGE (The following results are based on the percentage of students who answered "very much" or "quite a bit" for the following items focused on respondents' estimate of what they are gaining from college)		
Acquiring background and specialization for further education	63	60
Gaining broad education about different fields of knowledge	58	64
Gaining a range of information that may be relevant to a career	73	67
Developing and understanding of the arts	22	25
Broadening own enjoyment of literature	26	28
Becoming aware of different ways of life	44	47
Developing own values and ethical standards	66	63
Gaining understanding of oneself	78	74
Writing clearly and effectively	45	52
Acquiring familiarity with computers	59	33
Gaining understanding of other people and the ability to get along with different people	76	75
Becoming aware of consequences of new applications in science and technology	39	32
Gaining ability to think analytically and logically	68	64
Gaining quantitative thinking	49	48
Gaining the ability to put ideas together, to see relationships between ideas	67	69
Gaining ability to learn on one's own	77	78

COMPILED BY VIRGINIA TECH CENTER FOR SURVEY RESEARCH
IN COOPERATION WITH
THE VIRGINIA TECH OFFICE OF OUTCOMES ASSESSMENT

SUMMARY OF CSEQ RESULTS:
VIRGINIA TECH AND OTHER DOCTORAL UNIVERSITIES

SELECTED ITEMS	Virginia Tech %	Doctoral Univ. %
The following results are organized by major categories of activity as provided in the CSEQ. The percentage of students who participated "often" to "very often" in each of the selected activities during the current school year is reported for both Virginia Tech and the CSEQ norm sample of students at other doctoral granting universities.		
Library Experiences		
Used library to study	18	38
Used card catalogue or computer to find materials	39	24
Used library to develop bibliography/references for a paper	24	25
Found interesting material to read by browsing	16	15
Looked for further references that were cited in readings	12	12
Read basic reference authors had referred to	6	5
Experiences with Faculty		
Asked instructor for course related information	42	43
Visited informally with instructor after class	26	28
Discussed an assignment with faculty member	20	21
Asked instructor for comments/criticisms about work	16	15
Course Learning		
Took detailed notes in class	94	94
Underlined major points in the readings	62	76
Tried to see how different facts and ideas fit together	71	82
Thought about practical applications of material	68	76
Worked on assignment that required integrating ideas from various sources	54	56
Summarized major points/information in readings/notes	50	61
Made outlines from class notes or readings	27	40
Art, Music, Theater		
Have gone to an art gallery or exhibit	4	9
Participated in an art activity	13	9
Attended a music event at the college	24	20
Participated in some music activity	10	9
Have seen a ballet or other theater performance at the college	14	12
Participated in a theater production	3	4
Experience in Writing		
Used dictionary/thesaurus to check proper meaning of words	70	75
Wrote a rough draft and revised it before handing it in	76	81
Spent at least five hours writing a paper	61	64
Asked others to read one's written work to see if it was clear	51	54
Referred to a book about style of writing	37	38
Asked an instructor for writing advice	21	25
Personal Experiences		
Sought out a friend to help with a personal problem	56	53
Read articles or books about personal adjustment and personality	19	17
Took a test to measure personal abilities, interests, or attitudes	15	13
Been in a group where each person talked about his/her problems	21	19
Student Acquaintances		
Made friends with students with very different majors	75	68
Made friends with students of another race	47	44
Had serious discussions with students with different philosophies	44	40
Had serious discussions with students from another country	18	21

VITA

I. GENERAL INFORMATION

Name: David G. Rea
Date of Birth: January 18, 1943

II. EDUCATIONAL BACKGROUND

Virginia Polytechnic Institute and State University, Blacksburg, VA, 1992, Ph.D. in Educational Administration

University of Alberta, Edmonton, Alberta, Canada, 1977, M.Ed. in Educational Administration

University of Alberta, Edmonton, Alberta, Canada, 1965, B.Ed. in Secondary English

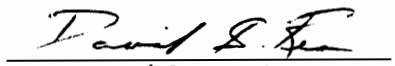
III. PROFESSIONAL EXPERIENCE

Instructor, Management and Marketing Program, Northern Alberta Institute of Technology, Edmonton, Alberta, Canada
1984 - 1989

Principal, Edmonton Public School System, Alberta, Canada
1976 - 1981

Assistant Principal and Teacher, Edmonton Public School System, Alberta, Canada
1973 - 1975

Public School Teacher, Edmonton Public School System, Alberta, Canada
1965 - 1975



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