DOCUMENT RESUME

ED 415 279	TM 028 014

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TITLE	Student Achievement in Science and Mathematics General Education Courses: An Assessment of the Effects of Academic Background and Noncognitive Variables.
PUB DATE	1997-11-00
NOTE	31p.; Paper presented at the Annual Meeting of the Illinois Association for Institutional Research (Chicago, IL, November 6-7, 1997).
PUB TYPE	Numerical/Quantitative Data (110) -- Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Achievement; *College Freshmen; Educational Assessment; Educational Background; General Education; Grades (Scholastic); High School Seniors; High Schools; Higher Education; *Mathematics; Predictor Variables; *Sciences; *Self Concept; Self Evaluation (Individuals); Tables (Data)
IDENTIFIERS	*Noncognitive Attributes

ABSTRACT

The purpose of this study was to assess the efficacy of academic background and noncognitive variables as predictors of student achievement in science and mathematics. Participants in this study were 9,802 students who began as new freshmen during 5 consecutive fall semesters and took at least 1 of 14 frequently taken mathematics and science general education courses. Significant relationships between entering academic characteristics, self-appraisals of ability and achievement expectancies, and grade performance were noted. In addition, a number of high school senior-year activities were related to later grade performance. These findings provide direction for future assessments of students' mathematics and science outcomes. An appendix discusses the entering academic characteristics, including American College Testing program scores. (Contains 14 tables and 21 references.) (Author/SLD)

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ED 415 279

Student Achievement in Science and Mathematics General Education Courses: An Assessment of the Effects of Academic Background and Noncognitive Variables

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TM028014

Paper presented at the Illinois Association for Institutional Research
Annual Meeting, November 6-7, 1997, Chicago, IL.

Abstract

The purpose of this study was to assess the efficacy of academic background and noncognitive variables as predictors of student achievement in science and mathematics. The students in this study were 9,802 students who began as new freshmen during five consecutive fall semesters and took at least one of 14 frequently taken mathematics and science general education courses. Significant relationships between entering academic characteristics, self-appraisals of ability and achievement expectancies, and grade performance were noted. Further, a number of senior-year activities were related to later grade performance. These findings provide direction for future assessments of students' mathematics and science outcomes.

An important consideration in higher education assessment is the identification of factors that may predict student progress and graduation from college and the assessment of student outcomes is a critical part of understanding the effects of student preparation and the college environment (Astin, 1995). One recent focus of student assessment has been the examination of factors that are related to achievement in introductory science and mathematics courses; lower achievement levels in these courses can restrict students' choices of majors and limit opportunities for careers in fields such as business, science, engineering, and the health sciences. Consequently, it has been pointed out that there is a need for further assessment of the relationships between students' entering characteristics and their subsequent achievement in several types of mathematics and science courses (House, 1995c).

Previous research has examined students' academic background and noncognitive characteristics as predictors of outcomes such as overall grade performance and persistence. For instance, academic self-concept has been found to significantly predict persistence (Arbona & Novy, 1990; House, 1992, 1993). Similarly, achievement expectancies have been shown to be significant predictors of college retention for eight semesters (House, 1992). Recent findings also suggest that American Indian students' college persistence was significantly influenced by academic preparation and degree aspirations (Brown & Kurpius, 1997; Pavel & Padilla, 1993). With regard to grade performance, achievement expectancies were found to predict exam performance and course grades (Gordon, 1989); further research also indicates that achievement expectancies and academic self-concept were significant predictors of overall grade performance (House, 1997) and of grades in general education courses such as introductory psychology (House, Keeley, & Hurst, 1997) and

English (House & Prion, 1996).

A number of studies have assessed the efficacy of selected noncognitive variables as predictors of achievement in college mathematics and science courses. Academic self-concept and achievement expectancies are significant predictors of performance in a number of courses, such as finite mathematics (House, 1995c), algebra (Wheat, Tunnell, & Munday, 1991), calculus (House, 1995d), and general chemistry (House, 1994, 1995b, 1996). Similarly, Gerardi (1990) reported that academic self-concept was a significant predictor of the overall grade performance of minority engineering students while House (1995a) found that noncognitive variables were related to student persistence in science, engineering, and math disciplines. Finally, several researchers have noted that admissions test scores (SAT and ACT) were significantly correlated with later grade performance in science and mathematics courses (Bridgeman, 1982; Edge & Friedberg, 1984; Keeley, Hurst, & House, 1994). However, there is a need for the comprehensive assessment of the efficacy of a wider variety of noncognitive variables and academic background factors as predictors of achievement in science and mathematics.

The purpose of this study was to extend the findings of previous research on student achievement in science and mathematics courses. First, this study examined the contributions of both academic and noncognitive variables toward the explanation of student outcomes. Second, this study examined a more comprehensive set of science and mathematics courses than has previously been assessed.

Methods

The students included in this study were 9,802 students who began as new freshmen during five consecutive fall semesters and took one of 14 frequently taken mathematics and science general education courses. In this sample, there were 4,475 (45.7%) male students and 5,327 (54.3%) female students; there were 7,482 (76.3%) white students, 2,166 (22.1%) minority students, and 154 (1.6%) students with missing racial/ethnic data. Grade performance data were collected from university records while data on students' entering academic background and noncognitive characteristics were obtained from responses on the American College Testing Program (ACT) Assessment and the Higher Education Research Institute (HERI) Annual Freshmen Survey (Cooperative Institutional Research Program, 1995). Correlation analyses were used to investigate the relationships between student characteristics and subsequent achievement outcomes in science and mathematics general education courses.

Results

Descriptive statistics for the number of students in each course and the grade performance for each course are shown in Table 1 while correlations between academic background variables, noncognitive variables, and grade performance in science and mathematics general education courses are summarized in Table 2 through Table 14. A number of significant findings were obtained from this study. The notable findings included:

1) The general finding of this study was that academic characteristics, self-appraisals, and resources were significantly correlated with grades in general education science and math courses.

2) Academic background variables (ACT scores, number of high school courses, high school achievement, and level of high school preparation) showed significant positive correlations with college course performance.

3) Self-appraisals of ability, achievement expectancies, and the desire for an academically challenging college curriculum were positively correlated with course grades. However, there was a negative correlation between students' unrealistic academic optimism (a higher expected college GPA than their high school GPA) and later course performance.

4) Academic characteristics (Tables 2-5) were most highly correlated with course performance, followed by self-appraisals (Tables 6-8), available resources (Tables 9-12), and certainty of college choices (Tables 13-14).

5) High school class percentile rank showed the strongest correlations with course performance. ACT scores were also significant predictors of subsequent course performance. Further, ACT Math subscores were more significantly correlated with course performance than ACT Composite scores for 9 of the 14 courses included in this study.

6) The analysis of high school curriculum (Table 3) indicates that the number of math courses, years of high school math, and years of natural science were more strongly related to course grades than were other high school curriculum areas.

7) Self-appraisals of academic ability, mathematical ability, and drive to achieve were positively correlated with math and science course grades (Table 6).

8) Variables termed *Party Orientation* meant to assess students' inclination to spend their time in social activities rather than studying math and science (Table 12). Hours spent per week partying during their senior year of high school showed significant negative correlations with grades earned in each course. Other variables (such as staying up all night, frequency of discussion of sex, and being in favor of the legalization of marijuana) were also negatively correlated with course grades.

9) A number of activities during the senior year of high school were related to grade performance in math and science courses (Table 11). For instance, some variables (such as overslept and missed class, turned in homework late, and came to class late) showed negative correlations with later grade performance. Other variables (such as the frequency of tutoring another student and the hours spent studying per week during high school) were positively correlated with later grade performance.

10) A number of family resources and time constraint variables were related to later grade performance (Table 10). Family income and father's education were significantly related to course performance. However, activities that may present time constraints for academic effort (such as planned participation in extracurricular activities and work) were negatively correlated with course grades. Additionally, students who lived in a household with both parents were more likely to earn higher grades in their mathematics and science courses.

11) An assessment of specific goals and abilities (Table 9) indicated that students with certain goals (such as writing original works, being successful in their own business, wanting to influence social values) were less likely to earn high grades in their math and science courses. Similarly, students who indicated that they had certain abilities (such as leadership ability or creativity) were less likely to earn high math and science course grades.

12) Students' indication of a desire for tutoring was negatively correlated with course grades (Table 8) while students who indicated a desire for a more challenging curriculum (such as freshmen honors, advanced mathematics, or advanced science) earned higher course grades.

13) Certainty of college choices (such as the number of colleges applied to and certainty of their choice of major or occupation) were related to grade performance in general education math and science courses (Tables 13-14). For instance, students' class level in high school at the time they take their ACT was related to later course performance while students who were more certain of their choice of major or occupation were less likely to earn higher grades in their math and science courses.

Discussion

The findings from this study indicate that high school curriculum and prior achievement are significantly related to student success in science and mathematics general education courses. These results also identify several noncognitive characteristics that are predictive of student achievement. These findings provide direction for the development of projects for the assessment of student outcomes in mathematics and science courses and highlight a number of factors that should be given consideration when providing academic counseling to students selecting general education courses. For instance, the effects of extracurricular activities and work on course grades might be discussed with students, as well as the importance of hours spent studying for positively influencing course performance. Finally, these results indicate that students should be encouraged to focus their time and energies on studying rather than social activities and other distractions.

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Table 1

Descriptive Statistics

Variable Entered	Number of Enrollments	Mean Grade	Standard Deviation of Grades
Physical Anthropology	485	2.171	1.154
General Biology	2,432	1.996	1.137
Environmental Biology	1,961	2.285	1.121
Chemistry	1,829	1.832	1.158
General Chemistry	2,098	1.377	1.274
Introduction to Computing	986	2.079	1.154
Elements of Electronics	671	2.545	0.954
Physical Geography	631	2.323	1.172
Planetary & Space Science	1,718	2.247	1.104
Introduction to Geology	1,207	2.200	1.026
Human Nutrition	1,130	2.382	0.976
Calculus	2,044	1.873	1.351
Elementary Astronomy	1,423	2.964	1.055
Basic Statistics	1,317	2.171	1.225

Table 2

Correlations between ACT Scores and Grade Performance

Variable Entered	Composite	Math	Science	English	Reading
Physical Anthropology	+.317**	+.223**	+.276**	+.277**	+.234**
General Biology	+.328**	+.316**	+.262**	+.254**	+.232**
Environmental Biology	+.396**	+.334**	+.342**	+.298**	+.320**
Chemistry	+.330**	+.420**	+.232**	+.245**	+.187**
General Chemistry	+.278**	+.356**	+.159**	+.227**	+.141**
Introduction to Computing	+.279**	+.312**	+.196**	+.240**	+.145**
Elements of Electronics	+.241**	+.303**	+.214**	+.179**	+.109**
Physical Geography	+.183**	+.223**	+.098*	+.189**	+.083*
Planetary & Space Science	+.251**	+.242**	+.242**	+.156**	+.151**
Introduction to Geology	+.339**	+.360**	+.287**	+.218**	+.227**
Human Nutrition	+.351**	+.243**	+.253**	+.317**	+.296**
Calculus	+.176**	+.301**	+.074**	+.142**	+.072**
Elementary Astronomy	+.138**	+.185**	+.146**	+.064**	+.050
Basic Statistics	+.299**	+.383**	+.208**	+.230**	+.172**

**P<.01
*P<.05
No asterisk represents P<.10
+ = a non-significant positive correlation
- = a non-significant negative correlation

Table 3

Correlations between High School Curriculum and Grade Performance

Variable Entered	Count of College Prep Math Courses	HS Years of Math, Science, English & Social Studies	Years Taken or Planned in High School for: Math	Natural Science	English	Social Studies
Physical Anthropology	+	+	-	+.141**	-	+
General Biology	+.196**	+.166**	+.146**	+.162**	+.067**	+.044*
Environmental Biology	+.193**	+.161**	+.169**	+.176**	+.061**	+
Chemistry	+.216**	+.215**	+.220**	+.200**	+.103**	+.046*
General Chemistry	+.135**	+.059**	+.073**	+.065**	+.041	-
Introduction to Computing	+.060	+.113**	+.093**	+.102**	+	+
Elements of Electronics	+.162**	+.127**	+.148**	+.167**	+	-
Physical Geography	+.214**	+.083*	+.177**	+.076	-	-
Planetary & Space Science	+.155**	+.151**	+.126**	+.182**	-	+
Introduction to Geology	+.188**	+.146**	+.160**	+.150**	+	+
Human Nutrition	+.157**	+.195**	+.185**	+.217**	+	+
Calculus	+.142**	+.040	+.067**	+	+.044	+
Elementary Astronomy	+.164**	+.130**	+.149**	+.144**	+	+
Basic Statistics	+.222**	+.140**	+.185**	+.113**	+	+

**P<.01
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Table 4

Correlations between High School Achievement and Grade Performance

Variable Entered	HS Rank Percentile	Last Course's Grade				Average of Last Math, Science, English & Social Studies Grades
		Math	Natural Science	English	Social Studies	
Physical Anthropology	+.319**	+.165**	+.196**	+.241**	+.235**	+.306**
General Biology	+.354**	+.214**	+.236**	+.228**	+.243**	+.329**
Environmental Biology	+.344**	+.158**	+.218**	+.244**	+.224**	+.304**
Chemistry	+.319**	+.273**	+.203**	+.166**	+.222**	+.318**
General Chemistry	+.333**	+.254**	+.240**	+.219**	+.173**	+.312**
Introduction to Computing	+.355**	+.244**	+.263**	+.267**	+.268**	+.372**
Elements of Electronics	+.248**	+.207**	+.226**	+.198**	+.185**	+.283**
Physical Geography	+.361**	+.238**	+.200**	+.208**	+.147**	+.293**
Planetary & Space Science	+.275**	+.187**	+.232**	+.146**	+.187**	+.280**
Introduction to Geology	+.327**	+.249**	+.207**	+.185**	+.216**	+.311**
Human Nutrition	+.313**	+.231**	+.198**	+.224**	+.203**	+.312**
Calculus	+.346**	+.226**	+.238**	+.219**	+.214**	+.314**
Elementary Astronomy	+.299**	+.165**	+.194**	+.175**	+.169**	+.253**
Basic Statistics	+.393**	+.312**	+.288**	+.224**	+.159**	+.351**

**P<.01

*P<.05

No asterisk represents P<.10

+ = a non-significant positive correlation

on-significant negative correlation

Table 5

Correlations between High School Preparation and Grade Performance

Variable Entered	Took College Prep Curriculum	While in HS enrolled in advance placement, accelerated, or honors:			
		Math	Natural Science	English	Social Studies
Physical Anthropology	+.132**	+	+.139**	+.090	+
General Biology	+.089**	+.096**	+.124**	+.052*	+.062**
Environmental Biology	+.088**	+.140**	+.130**	+.118**	+.108**
Chemistry	+.092**	+.142**	+.134**	+.072**	+.092**
General Chemistry	+.067**	+.146**	+.112**	+.069**	+
Introduction to Computing	+.069*	+.093**	+.064	+	+.082*
Elements of Electronics	+	+.143**	+.118**	+.081*	-
Physical Geography	+	+.090**	+.090**	+.105*	+.085*
Planetary & Space Science	+.050*	+.063*	+.080**	+	+
Introduction to Geology	+.098**	+.111**	+.061*	+	+
Human Nutrition	+.135**	+.055	+.124**	+.062*	+
Calculus	+.048*	+.166**	+.095**	+.078**	+
Elementary Astronomy	+	+.089**	+.074**	+	+.048
Basic Statistics	+.081**	+.162**	+.146**	+.057*	+.087**

**P<.01
*P<.05
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Table 6

Correlations between Self-Appraisals and Grade Performance

Variable Entered	College GPA - High School GPA	Compared to Others, Same Age: Academic Ability	Mathematical Ability	Drive to Achieve
Physical Anthropology	-.224**	+.239	+	+.147**
General Biology	-.169**	+.251**	+.146**	+.075**
Environmental Biology	-.117**	+.300**	+.170**	+.060*
Chemistry	-.132**	+.283**	+.297**	+.093**
General Chemistry	-.109**	+.229**	+.182**	+.122**
Introduction to Computing	-.185**	+.229**	+.137**	+.115**
Elements of Electronics	-.157**	+.094*	+.233**	+
Physical Geography	-.166**	+.169**	+.147**	+
Planetary & Space Science	-.170**	+.214**	+.177**	+
Introduction to Geology	-.105**	+.217**	+.209**	+
Human Nutrition	-.117**	+.208**	+.132**	+
Calculus	-.132**	+.212**	+.163**	+.058*
Elementary Astronomy	-.192**	+.158**	+.190**	+
Basic Statistics	-.191**	+.271**	+.324**	+.096**

**P<.01
*P<.05
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Table 7

Correlations between Achievement Expectancies and Grade Performance

Variable Entered	Get Bachelors	Graduate with Honors	Be Elected to Honor Society	Anticipated First Year GPA	Make at least a "B" Average	Fail One or More Courses
Physical Anthropology	+.085	+.100*	+.123*	+.174**	+.172**	-.102*
General Biology	+.046*	+.107**	+.102**	+.234**	+.143**	-.086**
Environmental Biology	+.071**	+.152**	+.158**	+.241**	+.191**	-.106**
Chemistry	+.059*	+.115**	+.123**	+.242**	+.105**	-.052*
General Chemistry	+	+.149**	+.160**	+.223**	+.151**	-.107**
Introduction to Computing	+.062	+.119**	+.124**	+.199**	+.073*	-
Elements of Electronics	+.138**	+	+	+.203**	+.134**	-.129**
Physical Geography	+.083	+.130**	+.109*	+.142**	+.120**	+
Planetary & Space Science	+.051	+.099**	+.113**	+.173**	+.140**	-.084**
Introduction to Geology	+	+.113**	+.144**	+.230**	+.108**	-.100**
Human Nutrition	+	+.101**	+.096**	+.250**	+.108**	-.076*
Calculus	+	+.091**	+.127**	+.228**	+.129**	-.095**
Elementary Astronomy	+	+.075**	+.050	+.145**	+.089**	-
Basic Statistics	+.092**	+.131**	+.116**	+.212**	+.139**	-.119**

**P<.01
*P<.05
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- = a non-significant negative correlation

Table 8

Correlations between Desired Academic Challenge and Grade Performance

	Would like to be considered for:					
		Advance Placement and Credit by Exam		Would like special tutoring for:		
Variable Entered	Freshmen Honors	Math	Science	Study Skills	Math	Science
Physical Anthropology	+.128**	+	+.193	-.098*	-	-.134
General Biology	+.058**	+	+.079**	-.146**	-.151**	-.108**
Environmental Biology	+.092**	+.040	+.093**	-.176**	-.170**	-.184**
Chemistry	+.075**	+.164**	+.055*	-.121**	-.255**	-
General Chemistry	+.123**	+.150**	+.091**	-.143**	-.082**	-.063*
Introduction to Computing	+.081*	+	+	-.166**	-.158**	-.090*
Elements of Electronics	+.075	+.097*	+.093	-.131**	-.140*	+
Physical Geography	+	+	+	-.112**	-.095	-
Planetary & Space Science	+.075**	+.055*	+.070**	-.165**	-.131**	-.101**
Introduction to Geology	+	+.107**	+	-.147**	-.206**	-.178**
Human Nutrition	+.062*	+	+.068*	-.149**	-.214**	-
Calculus	+.088**	+.137**	+.050*	-.119**	-.088**	-.100**
Elementary Astronomy	+.072**	+.093**	+.067*	-.098**	-.077	-
Basic Statistics	+.096**	+.158**	+.095**	-.103**	-.233**	-.072

**P<.01
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No asterisk represents P<.10
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- = a non-significant negative correlation

Table 9

Correlations between Specific Goals/Abilities and Grade Performance

		Goal Importance to Student			Self-Appraisal	
Variable Entered	High School Speech Activities.	Write Original Works	Be Successful in Own Business	Influence Social Values	Leadership Ability	Creativity
Physical Anthropology	-.079	-	-	-	-	-
General Biology	-.109**	-.068**	-.094**	-.040	-.054*	-
Environmental Biology	-.054*	-	+.066**	-.056*	-.054*	+
Chemistry	-.105**	-	-.074**	-	-	-.073*
General Chemistry	-.051*	-	-.115**	-.040	-	-.106**
Introduction to Computing	-.068*	-.066	-.118**	-.072*	-	-.102**
Elements of Electronics	-	-.111**	-	-.072	-.077	-
Physical Geography	-.073	-.153**	-	-.084	-	-
Planetary & Space Science	-.054*	-.066*	-.055*	-.116**	-	-.063*
Introduction to Geology	-	-.061*	-.119**	-.083**	-	-
Human Nutrition	-.064*	-.081*	-.235**	-	-.079*	-.086*
Calculus	-.063**	-.051*	-.058*	-	-	-
Elementary Astronomy	-.123**	-.093**	-	-.066*	-	-
Basic Statistics	-.063*	-.065*	-.113**	-	-	-.073*

*P<.01
*P<.05
o asterisk represents P<.10
= a non-significant positive correlation
= a non-significant negative correlation

Table 10

Correlations between Family Resources, Time Constraints, and Grade Performance

	Family Resources			College Extracurricular Plans		
Variable Entered	Parents Together	Father's Education	Family Income	Hours of Work	Number of Clubs	Fraternity or Sorority
Physical Anthropology	+	+	+	-.095*	+	+
General Biology	+.110**	+.085**	+.158**	-.072**	-.117**	-.041
Environmental Biology	+.085**	+.047	+.170**	-	-.094**	-.108**
Chemistry	+.079**	+.091**	+.154**	-.054*	-.075**	-
General Chemistry	+.076**	+.076**	+.107**	-.047*	-.056*	-.068*
Introduction to Computing	+.067	+.088*	+.134**	-.121**	-.095**	-.066
Elements of Electronics	+.132**	+.152**	+.136**	-	-.090*	-
Physical Geography	+.088*	+	+.084	-.082*	-.138**	-
Planetary & Space Science	+.047	+.077**	+.142**	-.097**	-.107**	-.078**
Introduction to Geology	+.077*	+.100**	+.159**	-.145**	-.121**	-
Human Nutrition	+.095**	+	+.160**	-.061*	-.063*	-.073*
Calculus	+.065**	+	+.082**	-.055*	-.079**	-.084**
Elementary Astronomy	+.088**	+	+.058*	-.052	-.080**	-
Basic Statistics	+.150**	+	+.184**	-.132**	-.082**	-

**P<.01
*P<.05
No asterisk represents P<.10
+ = a non-significant positive correlation
- = a non-significant negative correlation

Table 11

Correlations between Senior-Year Activities and Grade Performance

Variable Entered	Homework Late	Late to Class	Overslept & Missed Class	Hours Spent Studying	Tutored Another	Hours Spent Talking to Teacher
Physical Anthropology	-.181**	-.122*	-	+	+	-
General Biology	-.127**	-	-.150*	-.089**	+	-.073**
Environmental Biology	-.111**	-.069**	-.147**	+.072**	+.060*	-.090**
Chemistry	-.071**	-	-.127**	+.093**	+.053*	-.089**
General Chemistry	-.163**	-.077**	-.084**	+.156**	+	-.075**
Introduction to Computing	-.174**	-	-.141**	+.097**	+.106**	-.059
Elements of Electronics	-	-.074	-	+.125**	+.096*	-
Physical Geography	-	-	-.205*	+.117**	+	-.082
Planetary & Space Science	-.091**	-.049	-.179**	+	+	-
Introduction to Geology	-.141**	-.070*	-.110*	+.135**	+	-.071*
Human Nutrition	-.066*	-	-.107*	+.096**	+.060	-.091**
Calculus	-.133**	-.090**	-.114**	+.122**	+	-
Elementary Astronomy	-.122**	-.063*	-.082*	+.052	+	-.061
Basic Statistics	-.165**	-.094**	-.133**	+.145**	+.128**	-.079**

**P<.01
*P<.05
No asterisk represents P<.10
+ = a non-significant positive correlation
- = a non-significant negative correlation

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Table 12

Correlations between Party Orientation and Grade Performance

Variable Entered	Hours Spent Partying	Stayed Up All Night	Discussed Sex	Legalize Marijuana	Socially Self-Confident	Popular
Physical Anthropology	-.169**	-.142**	-	+	-	-.090
General Biology	-.087**	-.136**	-.168**	-.048*	-.080**	-.058**
Environmental Biology	-.150**	-.166**	-.088**	-.059*	-.068**	-
Chemistry	-.124**	-.142**	-.079*	-.060*	-.067**	-.054*
General Chemistry	-.168**	-.136**	-.085**	-.078**	-.084**	-.108**
Introduction to Computing	-.097**	-.138**	-.147**	-.141**	-.073*	-
Elements of Electronics	-.171**	-.164**	-	-.081	-	-
Physical Geography	-.087*	-.171**	-	-.145**	-	-
Planetary & Space Science	-.132**	-.124**	-.090**	-.067*	-.119**	-.079**
Introduction to Geology	-.126**	-.123**	-.081*	-	-.116**	-.103**
Human Nutrition	-.116**	-.206**	-.152**	-	-.083**	-.115**
Calculus	-.116**	-.154**	-.102**	-.095**	-.056*	-.076**
Elementary Astronomy	-.056	-	-	-.057*	-.067*	-
Basic Statistics	-.076*	-.152**	-.122**	-	-.074*	-.070*

**P<.01
*P<.05
No asterisk represents P<.10
+ = a non-significant positive correlation
- = a non-significant negative correlation

Table 13

Correlations between Certainty of College Choice and Grade Performance

			Influence of Others in College Decision To Go To College/Choice of NIU			
Variable Entered	HS Class at ACT Test Time	Time Since Decided	Role Model	Relative	Friend	Number Applied To
Physical Anthropology	-.103*	+	-	+	-	-.091
General Biology	-.163**	+	-.128**	-.107**	-.046*	-.107**
Environmental Biology	-.138**	+.112**	-.100**	-.071**	-.063*	-
Chemistry	-.138**	+	-.051	+	-.049	-.046
General Chemistry	-.097**	+	-	-.039	-.074**	-.048*
Introduction to Computing	-	+	-	-	-.061	-
Elements of Electronics	-.099*	+.104	-.126*	-	-	-
Physical Geography	-.124**	+	-	-.081	-	-
Planetary & Space Science	-.083**	+	-.097**	-.061*	-.064*	-.067*
Introduction to Geology	-.100**	+.073	-	-.062*	-.070*	-.071*
Human Nutrition	-.157**	+.111**	-.079*	-.085**	-.070*	-.074*
Calculus	-.078**	+	-	-	-.064**	-.068**
Elementary Astronomy	-.083**	+	-.063	-	-	+
Basic Statistics	-.161**	+.093*	-.062	-.058	-.091**	-.070*

*P<.01
*P<.05
No asterisk represents P<.10
= a non-significant positive correlation
= a non-significant negative correlation

Table 14

Correlations between Certainty of Major/Occupation and Grade Performance

Variable Entered	Certainty of: Major	Certainty of: Occupation
Physical Anthropology	-	-.089
General Biology	-.069**	-.066*
Environmental Biology	-.089**	-.108**
Chemistry	-.073**	-.090**
General Chemistry	-.054*	-.097**
Introduction to Computing	-.131**	-.136**
Elements of Electronics	-	-
Physical Geography	-	-
Planetary & Space Science	-	-.074**
Introduction to Geology	-.062*	-.065*
Human Nutrition	-.075*	-.064*
Calculus	-.044	-.054*
Elementary Astronomy	-	-.087
Basic Statistics	-.109**	-.136**

**P<.01
*P<.05
No asterisk represents P<.10
+ = a non-significant positive correlation
- = a non-significant negative correlation

Appendix

Appendix:

When students register to take the ACT Assessment, several types of information is requested. For multiple ACT score senders, their last ACT record prior to enrollment at Northern was selected.

ACT test scores are the last scores received prior to their first time freshmen enrollment at Northern.

ACT collects information about 30 high school courses, which includes if they were taken or planned and grades earned for completed courses. These courses are:

English: (English taken during the 9th grade, English taken during 10th grade, English taken during 11th grade, English taken during 12th grade, and Speech);
Mathematics: (First-year Algebra, Second-year Algebra, Geometry, Trigonometry, Calculus, Other Math beyond Algebra, and Computer Math/Computer Science);
Natural Sciences: (General/Physical/Earth Science, Biology, Chemistry, and Physics);
Social Studies: [U.S. History (American History), World History/World Civilization, Other History (European, State, etc.), American Government/Civics, Economics (Consumer Economics), Geography, and Psychology];
Languages: (Spanish, French, German, and Other Languages);
Arts: (Art, Music, and Drama/ Theater)

From the above queried courses ACT provides student's last grade in each area (mathematics, natural science, English, and social studies). Additionally, to their last course grade in mathematics, natural science, English, and social studies, an average is provided by ACT when three or more grades are reported.

A count of college preparatory math courses is the sum of all taken and planned ACT queried math courses (First-year Algebra, Second-year Algebra, Geometry, Trigonometry, Calculus, Other Math beyond Algebra, and Computer Math/Computer Science).

Years certain subjects studied (Grades 9 - 12) concern the number of years you will have studied certain subjects by the time you graduate (or have studied, if you have graduated) from high school. Use responses below to answer all the items in the group.

Did not take any course in the subject = 0
Half-year = 1
One-year = 2
One and a half years = 3
Two years = 4
Two and a half years = 5
Three years = 6
Three and a half years = 7
Four years or more = 8

Mathematics
Natural Sciences (biology, chemistry, physics)
English
Social studies (history, civics, geography, economics)

From the above question a summary variable was computed for the number of years the student has or will have studied in math, natural science (biology, chemistry, physics), English, and social studies (history, civics, geography, economics) by the time they graduate from high school.

The program of high school courses I took can best be described as:

College preparatory = 2
Business or commercial, vocational-occupational, other or general = 1

While in high school, I was enrolled in advanced placement, accelerated, or honors courses in the following areas. Please respond to each item on the list.

No = 1
Yes = 2
Mathematics
Natural sciences
English
Social studies

I estimate my overall grade point average at the end of my first year in college will be:

D- to D (0.5-0.9) = 1
D to C- (1.0-1.4) = 2
C- to C (1.5-1.9) = 3
C to B- (2.0-2.4) = 4
B- to B (2.5-3.9) = 5
B to B+ (3.0-3.4) = 6
A- to A (3.5-4.0) = 7

My overall high school average is (was):

D- to D (0.5-0.9) = 1
D to C- (1.0-1.4) = 2
C- to C (1.5-1.9) = 3
C to B- (2.0-2.4) = 4
B- to B (2.5-3.9) = 5
B to B+ (3.0-3.4) = 6
A- to A (3.5-4.0) = 7

Over optimism in their self assessment was the extent to which the student estimated overall grade point average at the end of their first year of college to be greater than their overall high school average.

The next questions relate to special college programs designed for students who want and are able to pursue academic work of an enriched or accelerated nature. Please respond yes or no to each.

Yes, I am interested and would like to be considered = 1
No, I am not interested = 0
Freshmen honors courses (designed to challenge academically superior students)
Advance placement in mathematics
Advance placement in natural sciences
Credit by examination in mathematics
Credit by examination in natural sciences.

Composite variables for both mathematics and natural science from above queried desires to be considered for advance placement and /or credit by examination were created by summing student's responses.

Neither interest expressed = 0
Interested in only advance placement or credit by examination = 1
Interested in both advance placement and credit by examination = 2

Many colleges offer special assistance for the individual development of students. You may wish to seek such assistance. Please respond yes or no to the following.

Yes, applies to me = 2
No, does not apply to me = 1
I need help in improving my study skills.

ACT queried students about their out of class accomplishments while in high school. An area's level of accomplishment was a count of these items. The following speech activities, which applied to the student, each counted for a point in this summary variable:

1. Placed first, second, or third in a regional or state speech or debate contest
2. Entered a school speech or debate contest
3. Have substantial roles in high school or church-sponsored plays
4. Gave a speech recital
5. Had roles in plays (not high school or church-sponsored)
6. Appeared on radio or TV as a performer
7. Read a part in a high school play

To plan financial aid programs for entering students, colleges need to know the financial background of their students. Please estimate as accurately as possible your family's income. (Indicate total before taxes.)

Less than $6,000 = 0
$6,000 to $11,999 = 1
$12,000 to $17,999 = 2
$18,000 to $23,999 = 3
$24,000 to $29,999 = 4
$30,000 to $35,999 = 5
$36,000 to $41,999 = 6
$42,000 to $49,999 = 7
$50,000 to $59,999 = 8
$60,000 and over = 9

About how many hours per week do you plan to work during your first year of college?

None = 1
1 - 10 = 2
11 - 20 = 3
21 - 30 = 4
31 or more = 5

College extracurricular plans variable was the sum of 16 student activities that ACT asked about planned participation. These activities were:

1. Instrumental music
2. Vocal music
3. Student government
4. Publications (newspaper, yearbook, literary magazine)
5. Debate
6. Departmental clubs
7. Dramatics, theater
8. Religious organizations
9. Racial or ethnic organizations
10. Intramural athletics
11. Varsity athletics
12. Political organizations
13. Radio - TV
14. Fraternity or sorority
15. Special-interest groups (ski club, sailing club, judo club, card section, drill teams, etc.)
16. Campus or community service organizations

Grade Classification at ACT test time:

09 = 9th Grade
10 = 10th Grade

11 = 11th Grade
12 = 12th Grade
13 = H.S. Graduate
14 = College Student

Degree of certainty of current choice of college major?
Not sure = 1
Fairly sure = 2
Very sure = 3

Degree of certainty of first occupational choice?
Not sure = 1
Fairly sure = 2
Very sure = 3

The Higher Education Research Institute at University of California - Los Angeles conducts a continuing study (the Annual Freshmen Survey) on higher education. For falls 1991 - 1995, eighty-four percent of Northern's first-time freshmen responded to this questionnaire and granted Northern permission to access their ID number for local studies. Both Northern's fall 1991 - 1995 entering freshmen and those granting ID use permission were 45 percent male and 55 percent female. Many questions were asked every year, but some were not. For items appearing for only a subset of fall 1991 - 1995, their years of inquiry are indicated.

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.
lowest 10% = 1
below average = 2
average = 3
above average = 4
highest 10 % = 5
Academic ability
Mathematical ability
Drive to achieve
Leadership ability
92 - 95 Creativity
Social self-confidence
Popularity

What is your best guess as to the chances that you will:
No Chance = 1
Very Little Chance = 2
Some Chance = 3
Very Good Chance = 4
Get a bachelor's degree (B.A., B.S., etc.)?
Graduate with honors?
Be elected to an academic honor society?
Make at least a "B" average?
Fail one or more courses?

Do you feel you will need any special tutoring or remedial work in any of the following subjects?
Marked = 2
Not marked = 1
91, 93, 95 Mathematics
91, 93, 95 Science

Please indicate the importance to you personally of each of the following:
Not Important = 1
Somewhat Important = 2
Very Important = 3
Essential = 4
Writing original works (poems, novels, short stories, etc.)
Becoming successful in business of my own
Influencing social values

Are your parents:
Both alive and living with each other? = 3
Both alive, divorced or living apart? = 2
One or both deceased? = 1

What is the highest level of formal education obtained by your father?
Grammar school or less = 1
Some high school = 2
High school = 3
Post secondary school other than college = 4
Some college = 5
College degree = 6
Some graduate school = 7
Graduate degree = 8

For the activities below, indicate which ones you did during the past year.
Not at all = 1
Occasionally = 2
Frequently = 3
Failed to complete a homework assignment on time
Came late to class
Overslept and missed class or appointment
Tutored another student
Stayed up all night
91 Discussed sex
92, 93 Discussed "safe sex"

Marijuana should be legalized.
Disagree Strongly = 1
Disagree Somewhat = 2
Agree Somewhat = 3
Agree Strongly = 4

During your last year in high school, how much time did you spend during a typical week doing the following activities?
None = 1
Less than 1 hour = 2
1 - 2 hours = 3
3 - 5 hours = 4
6 - 10 hours = 5
11 - 15 hours = 6
16 - 20 hours = 7
Over 20 hours = 8
Studying / homework

Talking with teachers outside of class
Partying

91, 92 I made the decision to go to college within the last

3 months	= 1
6 months	= 2
1 year	= 3
2 years	= 4
3 years or more	= 5

In deciding to go to college, how important to you was the following reason?

Not important	= 1
Somewhat important	= 2
Very important	= 3

92 - 95 A mentor/role model encouraged me to go

In your decision to attend Northern, how important to you was each of the following reasons?

Not important	= 1
Somewhat important	= 2
Very important	= 3

My relatives wanted me to come here
A friend suggested attending

To how many colleges other than this one did you apply for admissions this year.

No other	= 1
1	= 2
2	= 3
4	= 5
5	= 6
6 or more	= 7

Northern's registrar provided admission and registration information:

High School percentile ranking is a student's rank divided by the number in their graduating class.

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