

Predicting First Semester Agricultural College Students' College Performance Using Various Measures of Academic Preparation¹



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Abstract

Incoming freshmen have been observed to have an exaggerated perception of their academic preparation for college. Unfortunately, this perception does not appear to translate into high academic performance. Therefore, the objectives of this study were to survey attitudes, perceptions, and personal characteristics of freshman students and to use these responses to find the significant determinants of first semester grades to identify which students to target for additional attention in orientation. We developed and conducted a survey for students enrolled in all sections of AG1011 (Orientation to Agriculture) in the fall semester of 2004. Regression estimates of determinants of first semester success were run on 45% (n=170) of the total enrollment in the class (n = 381). Survey questions addressed students' perceptions of their college preparation (for example, study and note-taking skills and time commitment to studying). Survey responses were merged with university enrollment data (such as first semester GPA, ACT scores, class rank, and race). Results from this study show that first semester GPA is significantly and positively related to higher ACT scores, relative high school class rankings, perceived note-taking skills, students reporting reading assigned textbooks in high school, and experience with less-analytical high school exam questions. Results also show that students accurately report weaknesses such as note taking and failure to read the text that ultimately results in lower grades. In addition, for some ethnic groups, students may earn lower grades on average. This finding suggests that these factors can be easily targeted in orientation programs to improve expectations, study habits, and educational outcomes.

Introduction

Many incoming university freshmen tend to exhibit overconfidence in their preparation for starting their post-secondary academic career. Although university admissions requirements for most Colleges of Agriculture focus on high school

grade point average (GPA), SAT/ACT scores, and/or class rank, the first semester success also depends on students' experiences, attitudes, and habits they bring from high school. A substantial body of literature exists that shows a positive relationship among these admission requirements and a student's success in college, particularly as they pertain to minority students (Fleming 2002; Fleming and Garcia, 1998; Harackiewicz et al, 2002; Hoffman and Lowitzki 2005; and Kim 2002). We hypothesized that students also bring their high school experiences, such as good study habits, into their college careers in ways that affect their college performance as measured by their GPAs.

Experiences in an introductory plant and soil systems course at Oklahoma State University motivated our interest in students' preparation for college. In this course, we observed incoming students' dissatisfaction and heard consistent complaints about the perceived difficulty of the course, the difficulty level of test questions, and the perceptions of excessive amounts of required study time and too many reading assignments. Students were expected by the professor to have adequate note-taking skills, the ability to read the assigned readings, and adequate study skills. Research by Lange and Byrd (2002) has shown that students' expectations of success are inflated with respect to the actual university grades they receive. They found that those with less maturity and less efficient study skills were most inaccurate in gauging future success. Grimes (2002) found that overconfidence was pervasive in introductory economics courses, but that older students and students with higher GPAs were better able to predict test outcomes. Debacker and Nelson (2001) found that although high school girls perceived themselves to have lower abilities in science; their level of achievement was not statistically different from boys.

An even larger body of literature exists on student attrition from college programs that focuses on college grades and aspects of the student's background. This literature also increasingly acknowledges factors other than GPA and SAT/ACT scores as predictors of dropping out of college (Grimes 2004-

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2005). Woosley (2003) found that dissatisfaction with grades was a significant reason for students to permanently drop out. Kahn and Nauta (2001) show that increasing one point in the first semester GPA made students four times more likely to stay until their sophomore year when controlling for all past performance and their cognitive measures. Underrepresented racial groups have received focused attention in an attempt to reduce disparities in achievement, notably African Americans (Fleming, 2002; and Fleming and Garcia, 1998) and Hispanics (Otero, 2007). Teicher (2006) notes that Native American students have difficulty in adjusting to college and often face problems including prejudice, finances, language, and alcoholism. Therefore, although it is not within the scope of this study to examine retention of students, the question of what determines GPA in our college pertains directly to both retention and future student success.

The objectives of this study were to survey attitudes, perceptions, and personal characteristics of freshman students and to use these responses to find the significant determinants of first semester grades to identify which students to target for additional attention in orientation. Survey questions addressed students' perceptions of their preparation for college (such as study and note-taking skills, interaction with teachers, and time commitment to studying). Individual survey responses were merged with university enrollment data (such as first semester GPA, high school size, GPA, and ACT scores; and class rank) obtained from the registrar. We find that traditional admissions measures work well to predict semester grades, but also discover that students' self-reported high school study habits also prove significant.

Methods

All freshmen enrolled in a first year student orientation course for incoming students into the College of Agricultural Sciences

and Natural Resources (AG 1011Ag Orientation) in the fall of 2005 received an in-class voluntary survey. Of the 381 students enrolled in the six sections of the course, 72% (n=274) completed the survey, (which included high school GPA, class rank, and ACT/SAT

Table 1. Descriptive Statistics of Regressors

VARIABLE		N ^x	MEAN	STD DEV	MIN	MAX	Hypothetical Effect on SEMGPA
GENDER ^y	1=female, 0=male	170	0.59	0.49	0	1.00	-/+
AGE	Age in Years	170	18.55	0.52	18	20.00	+
HSGPA	High School GPA	170	3.71	0.31	2.21	4.00	+
ACTCOMP	ACT comprehensive score (36 total points)	170	24.25	3.68	15.00	33.00	+
HSCENTRANK	High School Centile Rank (0=highest, 100=lowest)	159	17.90	15.65	0.43	75.55	-
WHITE	1=White ; 0 otherwise	170	0.82	0.39	0	1.00	+
BLACK	1=Black; 0 otherwise	170	0.01	0.11	0	1.00	-
ASIAN	1=Asian ; 0 otherwise	170	0.02	0.13	0	1.00	+
HISPANIC	1=Hispanic ; 0 otherwise	170	0.006	0.08	0	1.00	-
NATAMER	1=Native American; 0 otherwise	170	0.13	0.34	0	1.00	-
BIOC ^z	1= Biochemistry major, 0 otherwise.	170	0.28	0.45	0	1.00	+ ^b
ANSCI	1=Animal Science Major, 0 otherwise	170	0.18	0.39	0	1.00	+/-
UNDECL	1=Undeclared Major, 0 otherwise	170	0.03	0.17	0	1.00	+/-
AGEC	1=Agricultural Economics Major, 0 otherwise	170	0.25	0.43	0	1.00	+/-
HORTLA	1=Horticulture and Landscape Architecture Major, 0 otherwise	170	0.03	0.17	0	1.00	+/-
AGCOM	1=Agricultural Communications Major, 0 otherwise	170	0.06	0.25	0	1.00	+/-
AGED	1=Agricultural Economics Major, 0 otherwise	170	0.03	0.17	0	1.00	+/-
AGLEAD	1=Agricultural Leadership Major, 0 otherwise	170	0.02	0.15	0	1.00	+/-
PSS	1=Plant and Soil Sciences Major, 0 otherwise	170	0.01	0.11	0	1.00	+/-
SEMEHRS	Earned Semester Hours	170	13.82	2.77	1	22.00	+
SEMGPA	First Semester GPA (4 point scale)	170	2.99	0.80	0.31	4.00	+
NOTESKLL	Confidence in Note taking skill (5 highest, 1 lowest)	170	3.23	0.79	1	5.00	+
READTXT	0= seldom or never read assigned text in high school 1=rarely read readings 2=sometimes read readings; And, 3=always read text	170	1.87	0.97	0	3.00	+
QUESTYPE	1 = multiple choice or fill in the blank, 0=analytical or essay questions.	170	0.12	0.33	0	1.00	+
STUDLT2	1=Typically studies less than 2 hours before major test in high school. 0 otherwise.	170	0.52	0.50	0	1.00	-
STUD2T5	1=Typically studies between 2 to 5 hours before major test in high school. 0 otherwise.	170	0.33	0.47	0	1.00	+
STUD5T10	1=Typically studies between 5 to 10 hours before major test in h.s., 0 otherwise.	170	0.10	0.31	0	1.00	+
STUDGT10	1=Typically studies greater than 10 hours before major test in h.s., 0 otherwise	170	0.05	0.21	0	1.00	+

^x The number of students in the sample was 170 maximum.

^y Note: the mean of binary (0,1) variables is the percentage in the category coded as 1 when multiplied by 100.

^z We hypothesize that many biochemistry majors are pre-medical students and anecdotally are high achievers.

Predicting First

scores). However for the regression models, 45% of the class (n=170 students) gave us permission to access their first term GPAs and had complete university admission and survey data that could be used for the analysis. Prior to administrating the survey, the instrument was approved by Oklahoma State's Institutional Review Board (Approved Protocol #AG 0602). The traditional admissions

criteria and students' self-reported high school behaviors were regressed on the first semester GPA for each student.

Using a final sample of 170 students, three ordinary least square regressions were run on first semester college grade point averages, the dependent variable using SAS 9.1. The basic modeling theory is as follows:

$$(1) \text{SemGPA}_i = f(D_i, T_i, E_i)$$

The first semester GPA (SemGPA) for each individual *i* is determined as a function of *D_i*, a set of demographic characteristics such as gender, age, and major, *T_i*, a set of traditional admissions measures of college suitability such as ACT scores and high school GPA, and *E_i*, a set of measures of high school experiences such as developed note-taking skills, habitual reading of assigned texts in the past, and past high school test experiences. Three models were run: first Models 1 and 2 show the efficacy of traditional determinants of college GPAs and demographic characteristics. Model 3 includes self-reported measures of high school experiences with study habits and chosen majors.

We hypothesized that traditional measures of success such as high school GPA, class rank, and ACT scores would positively affect first semester GPAs. We also expected to find that students with better study habits such as reading the text and having better note-taking skills would perform better. We expected that we might find that older students or male students would perform better as suggested in the literature. We expected that minority students might earn lower grades in the first semester based on findings in the literature. Miller (2004, p. v) states, "Compared to Whites and Asian Americans, African Americans, Latinos, and Native Americans are severely underrepresented among top students in the United States at all levels of the educational system. This long standing pattern is documented by virtually every traditional measure of academic achievement, including GPA, class rank, and standardized test scores." Our only hypothesis regarding majors was that biochemistry majors, overwhelmingly pre-medical students, might outperform students in other majors. The last column of Table 1 shows our expected positive (+), negative (-) or mixed (+/-) hypothesis about the direction of each variable's effect on first semester GPAs. Results are as shown for Models 1-3 in Table 2 and are discussed in the following section.

Results

Characteristics of Survey Respondents

Descriptive statistics are given in Table 1 and are discussed below. In the initial survey sample, prior to eliminating the students who did not give us permission to follow up on grades (n=274), most of the incoming agricultural college students lived on campus (78%). Eighty nine percent had received some form of scholarship or grant to attend college.

Table 2. Determinants of First College Semester GPA (Dependent variable = First Semester GPaz)

Variable	Model 1	Model 2		Model 3	
		Parameter Estimates ^y (t statistic)			
Intercept	-1.39 (-0.78)	2.48 (1.37)	-2.41 (-1.35)		
ACTCOMP	0.05 (3.16)	*** (2.75)	0.04 (2.89)	*** (2.89)	**
HSGPA	1.03 (6.51)	***		1.06 (6.76)	***
SEMEHRS	0.06 (3.15)	*** (3.18)	0.06 (2.68)	*** (2.68)	***
GENDER	0.03 (0.27)		0.0015 (0.02)	0.02 (0.21)	
AGE	-0.07 (-0.81)	-0.05 (-0.53)		-0.06 (-0.65)	
BLACK	-0.42 (-0.98)	-0.27 (-0.62)	-0.20 (-0.44)		
ASIAN	0.37 (1.06)	0.24 (0.55)	0.25 (0.72)		
HISPANIC	-1.23 (-1.93)	* (-1.81)	-1.16 (-2.30)	* (-2.30)	**
NATAMER	-0.24 (-1.74)	* (-1.94)	-0.27 (-1.77)	** (-1.77)	*
HSCENTRKN		-0.02 (-7.00)	***		
NOTESKLL				0.12 (1.93)	**
READTXT				0.14 (2.82)	***
QUESTYPE				0.29 (2.08)	**
STUDLT2				-0.005 (-0.05)	
STUD5T10				-0.08 (-0.47)	
STUDGT10				-0.07 (-0.28)	
BIOC				-0.02 (-0.16)	
UNDECL				0.03 (0.11)	
AGEC				0.07 (0.57)	
HORTLA				0.30 (1.06)	
AGCOMM				0.38 (1.92)	*
AGED				0.78 (2.82)	**
AGLEAD				0.19 (0.63)	
PSS				0.003 (0.01)	
r ²	0.48	0.50	0.57		
f Value	16.45	16.67	8.53		
df	160	149	146		

^z Due to missing values, 5 OLS regressions were run on 170, 159, and 170.

^y ***, **, * denote significance at 99%, 95%, 90% confidence levels.

Only 49% of the students reported being very active in agricultural activities and classes in high school, and 23% reported no activity in these areas. For the regression analysis to answer our objective of determinants of semester grade, we eliminated those students who did not give us permission to obtain their grades at the end of the first semester. In the regression sample, 59% of the students were female at an average age of 18.55 years.

By traditional admissions measures, the sample of students who gave us permission to obtain first semester grades had above average high school GPAs (See Table 1, $n=170$). Students in the sample earned a high school GPA of 3.71 (4.0 scale), on average, and had an average composite ACT score of 24.25 (perfect score = 36). The high school class rank information and class size were used to compute centile rank and adjust for different high school scales. For example, students in the 1st centile were in the top 1% of their class. On average, students were in the 17.9th centile, with a standard deviation of 15.65. High school size did not prove significant and was not used in the analysis.

The preponderance of students in the modeling sample declared majors in biochemistry (28%), agricultural economics (25%) and animal science (18%). Enrollment in other majors is reported in Table 1. After one semester, students averaged 13.82 hours earned (less than the 15 hours on average required per semester to graduate within four years for a total of 120 hours in a typical degree program). The mean end of first semester GPA was 2.99 (4.0 scale) with a standard deviation of 0.80 points.

We hypothesized that students bring their high school experiences, such as good study habits, into their college careers in ways that affect their college performance as measured by GPA and completed semester hours. Seventy percent of the students in the orientation class reported that they were assigned readings in the text in high school. Only 42% of students reported that taking notes in high school was mandatory; 49% said note taking was optional, and 11% said note taking was not required.

To model whether students brought these habits into the college classroom, we asked students to report on their own note-taking, text reading, and study habits, and high school testing experiences. We hypothesized that students who are more confident at taking notes and more habituated to reading assignments would continue to use those skills and habits in college. As reported in Table 1, students rated their own note-taking skills on a Likert scale of 1 to 5, with 1 being poor, 3 being average, and 5 being excellent. On average, they reported a note-taking skill score of 3.23 with a standard deviation of 0.79. On average, students reported that they "sometimes" read the assigned readings in high school (1.87 was the average for the read text variable, with 1 being rarely read assignments and 2 being sometimes read assignments, on a scale of 0-3). Twelve percent

of students reported that the primary composition of high school testing instruments was predominantly multiple choice or fill in the blank (questype=1). The remainder reported having a combination of exam types including essay (questype=0). Although post-secondary educators ideally would like students to excel at more analytical testing methods, we hypothesized that students used to taking multiple choice questions would fare well in large introductory courses in which such testing methods are prevalent. Finally, we assumed that study habits from high school carry over into college, and thus we asked students how many hours they typically spent studying for a difficult course. The majority of students, 52%, reported studying less than 2 hours before a major test, 33% reported studying between two and five hours, 10% reported studying between five and 10 hours, and only 5% reported studying more than 10 hours.

In the regression sample, the majority of students' reported race was Caucasian or white (82%). The rest of the sample students were Native American (13%), black (1%), Asian (2%), and Hispanic (0.006%, or one person in the sample of 170).

Models 1 to 3

Model 1 shows that the traditional measures of high school achievement significantly predict initial college performance, as measured by first semester GPAs, at a confidence level of greater than 99%. For example, on average, a higher high school GPA and a higher composite ACT score will increase a student's first semester GPA. The number of completed/earned coursework hours in the first semester (SEMEhrs), also positively and significantly increases first semester GPAs. Basic demographic variables were included in Models 1 and 2 to control for gender, age, and race. The gender and age of students did not have a statistically significant effect on first semester GPAs. The lack of the effect of age on first semester GPAs was not surprising; little variation in age in the incoming class occurred (the standard deviation was 0.52 around a mean of 18.55 years). When compared to Caucasian students, neither blacks nor Asian students showed statistically significant differences in first semester GPAs. However, both Hispanic and Native American students had significantly lower first semester GPAs compared to Caucasian students, the comparison group. On average, the Hispanic student, received 1.23 GPA points lower than the Caucasian average at a 95% confidence level. However, this result should be interpreted with caution since only one Hispanic student was in this sample. Native American students earned an average of 0.24 GPA points lower than Caucasian students at a 95% confidence level. Although several factors may affect Native American students' achievement, we believe that lower socio-economic status may be the primary effect on lower achievement. Model 1 has an

Predicting First

R2 value of 0.48 (The coefficient of determination (R2) is measured between zero and one, where zero means that the regression equation fails to explain the values of the dependent variable better than the sample mean, and one means a perfect fit. R2 is loosely defined as the variation percentage of the dependent variable around the average of the dependent variable that is explained by the regression equation. For cross-sectional data such as in this study, an R2 of 0.40 can be considered a good fit. However, theory should be used to guide the inclusion of variables and functional form, rather than using R2 as the sole measure of the appropriateness of an estimated equation (Studenmund 1992)).

Model 2 uses the same traditional measures as Model 1, but high school centile rank is used as the high school achievement measure instead of high school GPAs because these two measures are highly correlated. Any decrease in the centile rank of a student by one percentage point will, on average, decrease first semester college GPAs by 0.02 points and is statistically significant at the 99% confidence level. For example, a student who is ranked lower in the 19th centile of his or her class, will, on average, have 0.02 first semester GPA points less than a student in the 18th centile. However, not all high schools report rank routinely, reducing our sample size to 159, so we recommend using high school GPAs. Model 2 has an R2 value of 0.50.

Model 3 shows the effects of high school study habits and declared majors, respectively, on first semester GPAs. In Model 3, the traditional admissions measures of composite ACT scores and high school GPAs positively and significantly affect first semester GPAs at the 99% confidence level. Demographic characteristics such as gender, age, and race, as shown in the previous models, exert the same positive and negative effects and significance or lack of significance.

Interestingly, students who completed more earned hours also earned statistically higher GPAs for each additional credit hour earned. Although most students are enrolled in the same number of courses, stronger students, on average, tend to complete more course hours. This result may indicate that weaker students will tend to take longer to graduate, thus incurring greater tuition and boarding costs, and potentially spending more hours in a part-time job, which further disables attempts to focus on their studies. This result suggests that orientation programs and advising sessions should focus on the importance of balancing multiple courses with outside work and the need for careful consideration to be given to scheduling so that students are able to manage the coursework scheduled.

The majority of self-reported, non-traditional predictors of first semester GPAs that students reported in orientation were significantly related to first semester success. Interestingly, we find students' self-reported skills at taking notes affects first

semester GPAs. For each one-point increase on a Likert scale of 1-5 for the variable NOTESKLL, a student gains 0.12 GPA points, on average, at a significance level of 95%, holding all else constant. Therefore, students who report strong note-taking skills higher on the scale do better in the first semester. Furthermore, for each point gained on a 0-3 scale, with 3 as the student's self-reported answer that the text was always read in high school and zero as the text never being read, the first semester GPA rises significantly by 0.14 points, on average, at a 99% confidence level. In summary, students who read texts in high school do better in college because we presume this is a proxy for a behavior they carry over into college as freshmen. For the binary variable QUESTYPE, we find that students who reported mostly multiple choice and fill-in-the-blank type questions as predominant in high school earned 0.29 more GPA points, on average, (95% confidence level) than those who were used to answering short essay questions or a combination of question types. We find a significant result that students who were primed in high school to take standardized or multiple choice tests perform better as measured by GPAs in college ostensibly because introductory, large-lecture courses use these same testing methods.

Although we hypothesized that students' study behaviors would carry over to affect college GPAs, we did not find a significant effect for these variables (STUDLT2, STUD5T10, STUDGT10) compared to the comparison group of studying two to five hours before an important test. Potential issues in using a self-reported measure of study habits in high school are the potential for recall bias or the desire to please the researcher. Furthermore, we believe some study habits carry over from high school. Our survey was conducted at the beginning of the semester and therefore, we cannot determine whether students in a new college environment had similar actual study habits as they had when they were in high school.

Finally, Model 3 shows no significant differences in first semester GPAs among majors when controlling for other variables except for agricultural communications and agricultural education majors who earned 0.37 and 0.78 GPA points more than animal science majors (the comparison group) at the 95% and 99% confidence levels, respectively. Ten agricultural communications and five agricultural education students were in the sample. Because we controlled for grades and other factors, we can only speculate that these students may perform better relative to other majors in writing-intensive history and politics courses or they may receive greater support from their advisors.

Summary

The results of this study demonstrate that the traditional admissions measures of college success, past high school study habits and experiences, significantly affect students' success in college, as

measured by first semester GPAs. The significant results of the traditional ACT composite score, high school GPA, and class rank show that these measures are good indicators of the ability to succeed in the College of Agricultural Sciences and Natural Resources at Oklahoma State University. However, the addition of questions such as those regarding students' note-taking skills, past experiences such as reading the assigned materials in high school, or taking standardized tests shows that students are able to self-report their strengths and weaknesses during orientation that affect their success in college.

Orientation programs using such self-reported information on study habits could easily detect and target programs for students at risk of poor performance during the transition from high school to college. Quick and low cost methods such as our survey in a beginning orientation class could be used. For targeted students, short and effective programs to improve students' note-taking skills and to stress expectations about reading and studying should be developed early in their college careers. Furthermore, since Native Americans comprise the highest minority enrollment in the College of Agricultural Sciences and Natural Resources, we suggest that administrators conduct further research into the source of lower academic achievement and perhaps create mentoring programs for students in this group. Wasley (2006) reports that underrepresented students benefit through increased achievement and second year retention rates when they are engaged with faculty and peers outside of class, rather than simply inside of class. This study suggests that designing and empirically testing the efficacy of new teaching methods to improve students' test and note-taking abilities when beginning college is a ripe area for new research.

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