Predictors of Success in an Undergraduate Animal Behavior Course

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Abstract

Characteristics of undergraduate students enrolled in a behavior and management of farm animals course were analyzed to determine which influenced student performance on a book quiz, term project, three exams and overall grade. Data were obtained at 4-year intervals from 1982 to 1992, and were based on 267 surveys. The number of science courses completed had a strong positive effect on grades for all measures. Students who had completed more science courses received higher grades. Most of the other 22 student characteristics measured had no effect on performance. Students with no agricultural background earned a higher grade on the term project than students who had an agricultural background. Data regarding experience with six agricultural species were collected, but only cattle experience had an impact on performance. Students having no cattle experience earned a higher grade than students who had cattle experience. The results suggest that students who prioritize earning high grades in an undergraduate farm animal behavior and management course outperform other students, regardless of their experience with a particular species.

Introduction

Academic advisors, guidance counselors, and career counselors need to predict which students will succeed in higher education. Students who lack academic ability may not benefit from the education being offered and their admittance may preclude other more capable students from entering the institution. Similarly, if resources are used on students who do not succeed, the program may not be able to provide resources for to those who would succeed (Lovegreen, 2003).

The prediction of grades, success in college, and long-term career success is also important to students. Higher education is a costly endeavor, in both time and money. It benefits the student to pursue course work that suits their strengths and weaknesses. Unfortunately, predicting academic success in college is difficult because students have varied characteristics and abilities that influence academic outcome (Lovegreen, 2003). Previous studies to determine factors that predict higher education performance have had contradictory results. Some studies suggested that college performance could be predicted (Boyer and Sedlacek, 2001; Edge and Friedberg, 1984; Harrison, 1996; Lam, 1999, McKenzie and Schweitzer, 2001; Troutman, 1978) while others did not (Baron and Norman, 1992; Crouse and Trusheim, 1991; Trusheim and Crouse, 1984; Wainer, 1993).

High school GPA in conjunction with either ACT or SAT scores is used by admission boards to determine admittance and to predict which students will do well in college or university. Students who succeed in their first semester will be more likely to continue their education and graduate with a degree (Lovegreen, 2003). Some studies have shown that performance in high school and higher education is related. For example, Fletcher et al. (1999) found a positive correlation between high school grades and overall college success. When considering performance in a specific program, Lam (1999) found that high school GPA correlated with graduation with an engineering degree. The research also suggested that both high school GPA and ACT scores correlated with the GPA received while working on an engineering degree. Other studies have demonstrated that SAT scores are poor predictors of college success (Baron and Norman, 1992; Crouse and Trusheim, 1991; Trusheim and Crouse, 1984; Wainer, 1993). In fact, research indicates that cognitive measures (e.g. SAT scores) predict only about 25% of college performance and that non-cognitive variables (e.g. first or second generation college student) account for the remaining 75% (Lovegreen, 2003).

Boyer and Sedlacek (2001) found that several student characteristics such as self-confidence, availability of a support person, realistic self-appraisal, an understanding of racism, leadership skills, and a preference for long range goals successfully predicted college GPA. Previous academic performance, integration into the university, and self-efficacy were able to predict first-year college students' grades at an Australian university (McKenzie and Schweitzer, 2001).

In addition to general performance in higher education, researchers have examined the ability to predict success in specific courses. Algebra pretest scores and high school rank predicted grades in a calculus course (Edge and Friedberg, 1984).

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Similarly, Troutman (1978) found that IQ, high school math grades, College Board scores, and high school rank predicted grades in a mathematics course. In a study investigating possible predictors for success in a music course for non-music majors, previous musical performance experience was the only variable to successfully predict grades (Harrison, 1996).

Students with extensive livestock experience often believe that their experience will contribute greatly to their success in a course that emphasizes the behavior and management of livestock (T. Friend, personal communication). The authors of the present research were interested in determining if this belief had merit. It was hypothesized that students who had knowledge in the course topic, such as those who had grown up in a farm setting or those who participated in agricultural activities (e.g. Future Farmers of America) would earn higher grades than students who did not have this background.

Materials and Methods

Description of the Course

The same instructor has taught Animal Science 310 (Behavior and Management of Domestic Animals) at Texas A&M University for over 25 years. The course material, objectives, and projects have changed little over the last 20 years although there was considerable experimentation with the lectures and laboratories before 1982. The number of laboratory sections was reduced from three to two in 1982 and a limit of 16 students per laboratory section was instituted. Course objectives involved developing an understanding of basic ethological principles pertaining to domestic farm animals, learning species-typical behavior of domestic farm animals, learning the factors that can influence animal behavior, developing observational skills, learning how to report behavioral observations, and becoming proficient with some of the methods of ethological research. The course emphasized beef and diary cattle, sheep and goats, horses and swine and poultry, with pet, exotic and other species utilized to illustrate specific points.

Course grade was determined from the percentage of points earned out of the total possible. There were three major exams, each of which covered approximately one-third of the semester's lectures and labs. The last exam contained a comprehensive section that included questions from previous exams. Exams were composed of true/false, multiple choice, short answer, and short essay questions. A quiz on the contents of Konrad Lorenz's (1952) 215-page book, King Solomon's Ring, was given at the end of the second week of each semester and was similar in structure to the exams. Finally, students designed and conducted behavioral research, delivered a 12-minute oral presentation of their project, and wrote a report of the project that followed the Journal of Animal Science format.

Survey Instrument

All students were asked on the first day of class to complete a survey that collected information on student characteristics (Table 1). Information from the class surveys was sampled for two semesters at four-year intervals in Spring-Fall 1982, Fall 1986-Spring 1987, Fall 1996-Spring 1997, and Fall 2001-

Table 1. Information collected from survey (n=267) given to students the first day of an undergraduate course on the behavior and management of farm animals

Category	Variable Name	Variable Categories
Year of Survey	Survey Year	1982, 1986-1987, 1992, 1996-1997, 2001-2002
Student characteristics	Year in School	Freshman, Sophomore, Junior, Senior
	Major	Ag related (Ag. Ed., Animal Science, Dairy Science, Poultry Science, Ag. Journalism, Agriculture, Agronomy, Rangeland Management, Ag. Development), Non-ag (All others)
	High School Honors	Yes/No
	Hours Working/week	0, >0
	Number of sports or extracurricular activities	0-1, 2-3
	Number of science courses completed from chemistry, organic chemistry, biochemistry, and introduction to animal science	0-2, 3-4
	Post-graduation plans	Ag, non-ag, or undecided
Background	Farm Background	Yes/No
Years membership in:	4-H	Yes/No
	FFA	Yes/No
	Scouts	Yes/No
	Total years in clubs	0-1, 2-7, 8-25
Years experience with:		
	Horse	0-2, 3-24
	Dairy	0, >0
	Sheep	0, >0
	Beef	0, >0
	Goats	0, >0
	Swine	0, >0
	Poultry	0, >0
	Lab animal/Pet	0-14, 15-28
	Wildlife	0, >0
	Fish	0, >0
	Total Animal Experience	0-20, 21-40, 41-157

Spring 2002. The exception was Fall 1992, when data were available for only one semester. There was a difference in what was demonstrated during the Fall and Spring laboratories (e.g., lambing in the spring and breeding during the fall), so the survey data for two semesters were pooled for the years when two semesters were available. Data consisted of 267 surveys. More surveys (i.e. 89) were obtained during 1982 than any other year because three laboratory sections were offered in 1982, while only two sections were offered in subsequent years. The least number of surveys (i.e. 26) were obtained for 1992, as data were available for one semester.

Data Analysis

Independent variables were either categorized as yes/no responses or divided into categories (Table 1) such that a similar number of students were represented in each category. A Multivariate General Linear Model analysis was performed to determine if any variables (year of survey plus 22 student characteristics) influenced grades on the Book Quiz, Term Project, Exams 1, 2 and 3, and Overall. An Analysis of Variance with a Bonferroni correction was performed to define significant effects for variables with two levels (e.g. yes/no). Significant variables with more than two levels (e.g. year) were defined with a Bonferroni mean separation post hoc analysis. All data were analyzed using SPSS 12.0.1 For Windows, Chicago, IL.

Results and Discussion

Student Characteristics

Number of specific science courses completed previous to ANSC 310 had a highly significant effect on grades for the Book Quiz ($P=0.003$), Term Project ($P=0.011$), Exam 1 ($P<0.001$), Exam 2 ($P<0.001$), Exam 3 ($P<0.001$), and Overall ($P<0.001$). In every case, students who had taken three to four courses did better than students who had taken zero to two courses (Table 2). This finding is not surprising when the science courses surveyed are considered. Two of the science courses, organic chemistry and biochemistry, are part of the curriculum for students considering graduate programs or advanced professional schools. Since acceptance to advanced educational programs is typically competitive, students who are planning for advanced study need to earn top grades in their course work. Although this study did not measure motivation to obtain high grades directly, when other studies have measured the relationship between motivation and academic achievement, they have found a positive correlation. For example, when Uguroglu and Walberg (1979) performed a meta-analysis of several educational and psychological studies, they found that the mean correlation between achievement motivation and academic achievement measures was 0.338. Likewise, Grabe and Latta (1981) found a positive relationship between motivation and academic performance, especially with male students. Cote and Levine (2000), who measured motivation using survey questions, suggested that motivation was a better predictor of college performance than scores on IQ tests.

In addition, students who had completed several science courses were generally farther along in their education (i.e. juniors or seniors as opposed to freshmen or sophomores). It is expected that students with upper class standing have learned how to study for college course examinations and prepare quality papers and presentations. A study by Grove and Wasserman (2003) supports this supposition. When student GPA was analyzed longitudinally over their academic career, the data revealed a "check mark" pattern. GPAs declined slightly from the first to second semester but then climbed steadily, for an increase of 0.26 points (8.7 percent). Women maintained their scholastic achievement during the second semester of the senior year, while male grades fell slightly. Grove and Wasserman hypothesized that the "check mark" pattern was due to students with upper class status having greater experience with the learning process and an increase in academic maturity and ability to focus. Experienced students also know what subject areas are of greater interest to them and in which subjects they show more aptitude. There was a slight trend in the present research (i.e. year in school was a factor in performance at $P=0.102$) for upper class students to outperform lower class students. Only a slight trend was expected because being a junior or senior does not necessarily predict whether a student gives grades a high priority. Regardless, it is useful for instructors to acknowledge class standing in designing their courses and offer support to newer students who may need guidance in developing study and performance skills.

Few other student characteristics had an impact on grades (Table 2). Student background had a significant effect on the grade received for the Term Project ($P=0.028$). Students with a nonagricultural background earned a better grade when compared with students who came from an agricultural background. Experience with specific agricultural species also had little impact on grades. The one exception was beef cattle experience, with students having no beef cattle experience doing better than those with experience on Exam 1 ($P<0.001$), the Term Project ($P=0.055$) and Overall ($P=0.057$). These results were not consistent with other studies. For example, research in an undergraduate psychology course suggests that when students have extensive prior knowledge, they tend to show a better understanding of new material and perform better in testing situations (Chi and Ceci, as cited by Thompson and Zamboanga, 2004).

One possible explanation for the negative effect of experience could be that prior knowledge can hinder new learning, especially if prior learning is incomplete or inaccurate (Dochy et al., 1999). Such

interference was found in a meta-analysis of reading education and science education research (Guzzetti et al., 1993). Fisher et al. (as cited in Thompson and Zamboanga, 2004) found that when prior learning includes faulty beliefs, they can be difficult to change, even after an extended period of formal coursework. Although the animal behavior course at Texas A&M incorporates practical knowledge, the course also addresses abstract concepts and multiple species. Students with practical knowledge might know, for example, where to stand to most effectively sort cattle, but may not have been exposed to the scientific explanations behind this knowledge, such as flight distance and point of balance. Failure to explain these concepts on examinations would be detrimental to performance in the course.

Table 2. Mean grade earned, standard deviations (SD), F statistics and P values for student characteristics with performance parameters having P < 0.10 in a GLM analysis adjusted for multiple comparisons (Bonferroni)

	Science Courses Completed[1]				
Performance Parameter	0 – 2	3 – 4	SD	F Statistic	P Value
Book Quiz	76	84	2.6	9.0	0.003
Term Project	91	96	2.1	6.6	0.011
Exam 1	81	87	1.4	14.6	0.000
Exam 2	80	86	1.5	13.0	0.000
Exam 3	75	81	1.6	13.1	0.000
Overall	83	88	1.1	22.5	0.000
	Agricultural Background				
Performance Parameter	No	Yes	SD	F Statistic	P Value
Term Project	96	91	2.3	4.9	0.028
Exam 2	85	82	1.6	3.2	0.076
Exam 3	79	76	1.8	2.9	0.088
	Experience Beef Cattle				
Performance Parameter	None	1 + years	SD	F Statistic	P Value
Term Project	96	91	2.2	3.7	0.055
Exam 1	87	81	1.6	13.5	0.000
Overall	87	84	1.2	3.7	0.057

[1] Number of courses (0 - 2 or 3 - 4) completed from the following selection: Introduction to Animal Science, Chemistry, Biochemistry and Organic Chemistry.

In addition, students who came from an agricultural background may not have prioritized high grades in their academic experience. If they planned to work in the agricultural community after their schooling, they may have felt that practical experience was more beneficial to their future than high grades. This emphasis would have favored outside activities, such as showing and judging or part-time work instead of course work. Research indicates that, in terms of post graduation benefits, it may be advantageous for agricultural students to focus on extracurricular activities. When Osmond and Hoover (1995) asked 64 recent graduates of the University of Florida's College of Agriculture what they considered their most valuable experience while attending college, the majority (88%) said the most valuable was their involvement in extracurricular activities and organizations. Cited as specific benefits of these activities were learning to work with people (79%) and developing leadership skills (65%). When asked if they would recommend future students participating in extracurricular activities, 94% responded positively. Perhaps for students interested in having a career in agriculture, trading lower grades for the positive benefits gained from experience is acceptable.

A contributing factor for the negative relationship between experience with beef cattle and performance may have been the multi-species nature of the course. Students with extensive interest and experience with one species may have little interest in learning about other species. The instructor feels that the most important factor influencing the negative association between experience with cattle and grade performance is that within the population of students taking the animal behavior course, the students with extensive beef cattle experience are likely going into the beef cattle industry. Many already have employment waiting for them upon graduation that does not depend on achieving high grades in courses. Such students often glean what is useful to them from the course and merely do passing work otherwise.

Unlike previous research (e.g. Ehrenberg and Sherman, 1987; Stinebrickner and Stinebrickner, 2004) that demonstrated a correlation between working hours in college and lower grades, the present study suggested that outside employment during school had little effect on performance. Stinebrickner and Stinebrickner (as cited in Stinebrickner and Stinebrickner, 2004) found that an additional hour of work per week causes grades to decrease by 0.16 and that compensating by studying for an extra hour did not ameliorate the negative effects. However, they caution that using hours worked as a measure may be misleading because both pre and post work activities (e.g. showering or resting) are not necessarily factored in. The deleterious effect of work is greatest when students work over 20 hours/week and, in the current study, we did not differentiate between students who worked only a few hours and those who had a very demanding work schedule. In addition, the grade suppressing effect Ehrenberg and Sherman (1987) found occurred when employment was off campus as opposed to on campus and we did not differentiate this on the surveys. It remains possible that grade suppression occurred in those students who worked many hours, in particular those who worked off campus.

Year of Survey

There was a strong effect between year of survey and grades on the various assessments (Table 3). How the students did varied depending on the survey year for the Term Project (P=0.003), Exam 1 (P<0.001), Exam 2 (P<0.001), Exam 3 (P<0.001), and Overall (P=0.001). The mean separation post hoc analysis indicated that, although there was year-to-year fluctuation, there was no discernible pattern (Table 3). Consequently, the change in grades as a function of course year is likely a reflection of random variability in students and difficulty of examinations from semester to semester and not an indication of grade inflation. Research has indicated that there is a trend toward grade inflation in higher education and the higher grades are not necessarily associated with an increase in knowledge (Basinger, 1997). The consequences of grade inflation can be serious, for both educational institutions and the student. When the integrity of the educational system is compromised (i.e. degrees can be obtained by anyone), it becomes less valuable as a tool for employers and graduate schools. In addition, by lowering academic standards, students who are less capable of higher learning are kept in the system, increasing class sizes and taking resources away from students who would excel in a more rigorous program.

Table 3. Mean percentage of points earned, out of total available, by survey year, for Book Quiz, Term Project, Exams 1-3 and Overall Grade in an undergraduate course on the behavior and management of farm animals

Year	Book Quiz	Term Project	Exam 1	Exam 2	Exam 3	Overall Grade
1982	82	89	78	77	77[a]	84
1986-1987	81	99[a]	85[ab]	87[a]	86	87[a]
1992	80	93	92[a]	89[a]	78[a]	87[a]
1996-1997	83	96	86[a]	80	76[a]	84[a]
2001-2002	76	90	80[b]	83[a]	72[a]	82[a]
Overall P value	P=0.274	P=0.003	P<0.001	P<0.001	P<0.001	P=0.001

[ab] Means in same column having no superscripts in common differ, P≤ .05 (adjustment for multiple comparisons: Bonferroni).

The good students are not pushed to their upper limit while the poorer students may believe, incorrectly, that they should continue to invest resources in academia when they may be better served by non-academic pursuits (Hesseln and Jackson, 2000). Although grade inflation did not appear to be an issue with this course, the authors suggest that it might be beneficial for instructors, who have taught the same course over several years, to consider periodically reviewing the grades they are assigning students to guard against grade inflation.

Summary

The most significant student characteristic in predicting success in a behavior and management of farm animals course was the number and type of science courses (i.e. introductory animal science, chemistry, organic chemistry and biochemistry) students completed prior to the behavior and management course. Students who had completed advanced science courses, such as biochemistry or organic chemistry, may have been planning to continue their education in competitive programs that require optimal grades. Such students would prioritize earning high grades. Students from agricultural backgrounds and students with beef cattle experience tended to have lower grades in the course, indicating they did not prioritize obtaining a high grade. This likely reflects the students' emphasis on obtaining industry experience, lack of priority in learning about other species covered in the class, or a lack of priority in learning underlying concepts. The average grade awarded to students varied over years in a random pattern that did not indicate grade inflation. These findings suggest that there are many factors underlying the distribution of grades among students enrolled in an undergraduate course on livestock behavior and management, one of the least of which is practical experience with livestock.

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