

Predictors of Performance in an Animal Nutrition Classroom



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Abstract

Animal Nutrition is a required course in animal science curriculums nationwide. Typical of required courses, the class is diverse in previous academic and animal experience. The objective of this research was to gather information about accurate student performance predictors to improve advising and course design. Data from 443 students, representing four semesters (Fall 2007-2010) of Animal Nutrition students, were statistically analyzed to determine predictive relationships between SAT scores, residency, transfer status, animal experience, major, gender, grade in a recommended Cornell general chemistry prerequisite (Cornell Chem) and performance in an introductory animal nutrition course (Animal Nutrition; Cornell University). In addition, an optional survey was administered to the 2010 Animal Nutrition class. In the survey, 27% of students self-identified animal experience level and 48% of transfers identified transfer status as influencers of their grade. Transfer status, residency, SAT scores, gender and grade in Cornell Chem were identified as significant predictors of performance in Animal Nutrition. The highest correlation for a predictor was Cornell Chem grade; completion of Chem was associated with significantly higher Animal Nutrition grades. Gaining information about accurate student performance predictors can assist advisors in making course recommendations as well as instructors in designing the course to best enable corporate learning regardless of the diversity in student preparation.

Introduction

Classroom diversity can manifest itself in a variety of ways. A heightened awareness of multicultural and ethnic diversity influences most university admissions policies as well as scholarship and extra-curricular programs. In animal science departments, the diversity of the undergraduate classroom has evolved considerably over the last century. It has

been characterized by an increase in the proportion of women as undergraduates over the last 50 years, which is now approximately 50 to 75% of animal science majors (Beck and Swanson, 2003). At the same time, increases in racial diversity have been less dramatic, with Blacks and Hispanics still largely unrepresented at all levels of academic degrees conferred (Beck and Swanson, 2003). The focal point of this research, however, was to examine additional discipline-specific aspects of diversity, which have been observed as first emerging, and now growing, trends in animal science departments: lack of animal experience and increase in transfer students (Allen, 1983; Taylor and Kauffman, 1983; Buchanan, 2008).

Diversity in background animal experiences is often the result of increasing proportions of urban students, fewer students coming from or planning to return to family farms, and more students studying animal science with the intention of applying to a college of veterinary medicine (Buchanan, 2008) or other professional program. According to the 1910 U.S. census, when many animal science departments were first created, 33% of the U.S. population was engaged in farming and ranching as opposed to 1% of the U.S. population in the 2000 U.S. census (Britt et al., 2008). Thus, early teacher-scientists in animal science discussed the challenges of how to stimulate students to be 'scholars as well as stockmen' (Taylor and Kauffman, 1983). Now, many students who enroll in animal science have experienced animals solely as companions rather than livestock (Britt et al., 2008). Moreover, the increasing number of students who transfer from a two-year college (Buchanan, 2008) or after any combination of one to three years of post-high school study, has also increased classroom diversity in the form of academic preparation for the course and prerequisites taken. In addition, study skills developed for classroom success and the type of examinations given vary among schools, providing

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yet another area of adjustment for transfer students. Cherney and Bell (2002) also reported that transfer students in their animal nutrition course were less likely to indicate veterinary medicine as a vocational objective. In a degree such as animal science where a large proportion of undergraduates plan to attain a post-graduate degree, this difference in postgraduate plans can further contribute to the diversity of student needs and expectations present in the classroom.

Obtaining information about accurate student performance predictors can assist advisors in making course recommendations; it can also aid instructors in designing the course to best enable corporate learning regardless of the diversity in animal experience and course preparation. Thus, the objective of this research was to discover predictive relationships between SAT scores, residency, transfer status, animal experience, major, gender, grade in a recommended general Cornell chemistry prerequisite (Cornell Chem) and performance in an animal nutrition course.

Materials and Methods

Animal Science Nutrition 2120 (Animal Nutrition) at Cornell University was chosen as a representative required course because the course material is a universal component of animal science curriculums nationwide. Moreover, there was no change in the instructor or the major course material covered in the four years during which data was collected. Students enrolled in the course enter with a wide range of academic and animal experience due in part to the high rate of incoming transfer students. Transfer students made up 30% of the fall 2010 incoming animal science majors. Moreover, the large class size, averaging 110 students, poses a challenge for the instructor in relating information to students according to their personal knowledge level and experience.

This study was deemed exempt by the Cornell Institutional Review Board. Non-identifying information, coded anonymously from the College of Agriculture and Life Sciences (CALS) was collected regarding the following predictors of class performance in Animal Nutrition: transfer status, SAT scores, NY state residency, gender, major and grade in Cornell Chem. Data was analyzed using Proc Mixed of SAS 9.2 (SAS Inst. Inc., Cary, NC). Due to missing SAT information for transfer students, results are displayed as each predictor individually regressed to Animal Nutrition course grade.

To supplement the data analysis and attempt to measure animal experience level of students, an optional survey was administered to the fall semester 2010 Animal Nutrition class with a 90.3% response

rate (Figure 1). Students did not receive an incentive and participation was voluntary.

Results and Discussion

The data collected from the CALS Registrar represented a total of 443 students from four semesters (fall 2007 through fall 2010). The dataset was predominantly made up of sophomores and juniors (89%). Most of the sophomores were four year students (93%) while the majority of the juniors in the course (77%) were transfer students. The high rate of transfer students in the Animal Nutrition dataset (29% overall) is not unlike that of other animal science programs with transfer students making up 19% of incoming animal science majors at the University of Wisconsin-Madison in fall of 2010, 29% at Texas A&M University and 22% at North Carolina State University (personal communication). In the optional survey administered to the fall 2010 Animal Nutrition course, 48% of transfer students self-identified transfer status as an influencer of their grade in the course (Figure 1). In response to the question of how transfer status influenced the respondent's Animal Nutrition grade, one student wrote, "Courses taken at other colleges were not as thorough as Cornell's equivalent classes" while another wrote, "Even though I'm a junior, this semester I feel like a freshman."

The mean grade in Animal Nutrition was 83.7 ± 8.8 . Significant predictors of Animal Nutrition grade include SAT scores, (both math and verbal), grade in the Cornell Chem prerequisite, NY state residency, transfer status and gender. Results are summarized in Table 1. Students performed better in the course if they were non-residents of NY state (84.8 versus 82.5; $P = 0.007$), non-transfers (84.4 versus 81.3; $P = 0.001$), and female (85.0 versus 79.0; $P < 0.001$). Moreover, these three predictors were correlated with each other in that the majority of transfer students were male, NY residents. For each additional point received on the SAT Math score, there was an additional 0.043 point increase in Animal Nutrition grade; likewise a point increase in an SAT Verbal score was associated with a 0.039 point increase in Animal Nutrition grade. In a similar analysis at Oklahoma State University, Vitale et al. (2010) identified cumulative GPA, major, gender and performance in prerequisites to be significant predictors of student performance in an undergraduate agricultural economics classroom while race, residency, transfer status and high school GPA were not.

In a model that included the terms transfer status, NY residency, GPA, gender, SAT scores and major, 70% of the variation in Animal Nutrition grade was

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explained by these predictors. However, only 297 of 443 observations were included because any record with missing data was deleted from the analysis; the majority of deleted records were transfer students missing SAT scores. Although SAT scores were correlated with performance ($P < 0.001$), they were not on record for 87% of transfer students. This prevents definitive conclusions about the strength of the relationship between SAT score as a predictor of Animal Nutrition grade for transfers. Most universities post demographic information in a document called a Common Data Set, published by their Office of Institutional Research. In a survey of U.S. universities with strong animal science programs according to the Chronicle of Higher Education, the Common Data Sets reveal that the majority of universities report the use of standardized test scores for admissions of first year, first time students as “Very Important” or “Important.” However, the same report reveals that few if any of these institutions require standardized test scores for admissions of transfer students.

Moreover, transfer students rarely take the recommended general chemistry prerequisite at Cornell University, despite the fact that Cornell Chem grade had the second highest correlation ($r^2 = 0.409$) with Animal Nutrition grade of any analyzed predictor (Table 1). Students who simply completed the Cornell Chem received a significantly higher grade in Nutrition (86.3 versus 80.6; $P < 0.001$). Animal Nutrition has long been recognized as an applied science in which a background in the fundamental sciences is ideal (Mitchell, 1936; Hoefler, 1968) and a strong foundational knowledge of chemistry appears to continue to significantly impact student performance in Animal Nutrition.

The highest correlation observed with Animal Nutrition grade was that of gender. While the authors are uncertain how gender influenced grade in Animal Nutrition, it was observed that being female was correlated with other predictors that had a positive, significant effect on Animal Nutrition grade. For example, female students were also more likely to be non-transfers and non-residents.

Cumulative GPA exhibited a high correlation but cannot be considered a true predictor of Animal Nutrition grade because GPA values were only present for students who had graduated Cornell by fall 2010; thus grade in Animal Nutrition is a predictor of final cumulative GPA rather than the reverse. High school GPA was not available in the Cornell dataset used for this analysis, but others have observed that high school GPA can explain more of the variance in university degree completion than ACT score, high school rank or learning style (Garton and Kitchel, 2005).

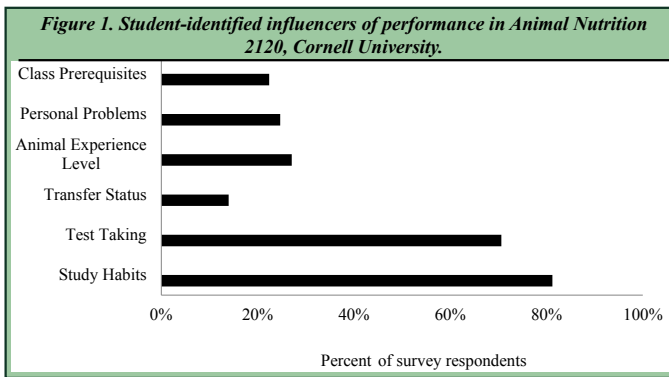
“Test taking” and “study habits” were the top ranking student-identified grade influencers, affecting 71 and 81% of students, respectively; this was considerably higher than animal experience, which affected 27% of students (Figure 1). Additionally, under “Other influencers of your grade in Animal Nutrition this semester” many students listed ‘competing courses’ (Figure 1). The self-identified issues of test taking and study habits were commonly shared among three-quarters of the class, and merit recognition by advisors and instructors. In order to address these student needs, instructors and advisors can utilize and promote local university resources, such as the Learning Strategies Center at Cornell University, and the optional one credit courses that many CALS programs offer to assist new students in adjusting to university life.

Though it is difficult to measure the effect of animal experience level on student performance in Animal Science courses, it has been recognized as an important aspect of diversity in Animal Science undergraduate populations (Buchanan, 2008; Allen, 1983). However, only 27% of students surveyed in the 2010 class felt animal experience level influenced their grade (Figure 1). In addition, the fact that animal science major was not a significant predictor, further negates the idea that animal experience is an important predictor of Animal Nutrition grade. Likely, the lack of significance for animal science major as a predictor of Animal Nutrition grade is influenced by the fact that the vast majority of students in the course (91%) were animal science majors. In one question of the survey, students characterized the type of

Table 1. Predictors of student performance in Animal Nutrition 2120 at Cornell University

Item	N	Grade	SE	P value	r^2	
SAT ¹ Math	299	0.043	0.006	$P < 0.001$	0.144	
SAT ¹ Verbal	299	0.039	0.005	$P < 0.001$	0.152	
Chemistry ¹	227	0.543	0.044	$P < 0.001$	0.409	
Chemistry	Yes	227	86.3	0.567	$P < 0.001$	NA
	No	216	80.6			
Residency	Resident	251	82.5	8.73	$P = 0.007$	NA
	Non-resident	192	84.8			
Transfer Status	Four Year	314	84.4	0.465	$P = 0.001$	NA
	Transfer	129	81.3			
Major	Animal Sci	403	83.5	1.39	$P = 0.854$	NA
	Non-major	40	83.8			
Gender	Male	107	79.0	0.814	$P < 0.001$	NA
	Female	336	85.0			

¹Grade signifies the additional point increase in Nutrition grade a student would expect to receive for each additional predictor point for these continuous variables.



animal experience they held. The majority (87%) had experience with a pet whereas only 55% claimed actual farm experience. It is worthwhile to note that farm experience included horse farms so the number of students with production livestock experience was actually less than 55%. Student comments on the survey included “I felt at a disadvantage because so many other people had so much experience already” and “Owning a pet did not help.”

To assist in alleviating student concern over lack of animal experience, the role of laboratory sections in providing practical animal experience has been and will remain a key component of animal science programs (Horvath and Inskeep, 1968). It is not possible to ascertain from this study whether student concern over their lack of animal experience as an influencer of their Animal Nutrition grade was real or perceived. In the future, pairing students according to their animal experience level in laboratories may be an effective strategy for handling this aspect of classroom diversity. Moreover, to address the needs of students who lack livestock animal experience, curriculum should continue to strive towards including fundamentals of livestock production as well as a variety of directed practical experiences. For example, Bell and Cherney (1999) integrated a semester-long lamb feeding trial into the Animal Nutrition course that allowed students to gain experience in handling and care of farm animals while applying theoretical lecture material.

Summary

Transfer status negatively impacts student performance in Cornell Animal Nutrition 2120. However, this research identified strategies that could be effective in improving the performance of transfers, such as utilizing SAT scores during advising or emphasizing recommended course pre-requisites like Cornell Chemistry. Although it was unclear from this study if student animal experience is influencing performance in Animal Nutrition, it has been recognized as an important aspect of diversity in animal science

undergraduate populations. Pairing students based on animal experiences during laboratories may be an effective strategy at easing student anxiety due to lack of animal experience. Moreover, to address the needs of students who lack livestock animal experience, curriculum should continue to strive towards including fundamentals of livestock production as well as a variety of directed practical experiences. Grade in a recommended Cornell Chemistry course and being female were more important predictors of student performance in Cornell Animal Nutrition 2120.

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