Demographics of an Undergraduate Animal Sciences Course and the Influence of Gender and Major on Course Performance

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Abstract

Over a period of three 10 week quarters, students enrolled in an introductory animal sciences course were evaluated with the objectives of identifying demographic variables of the student population and their relation to performance, factors associated with enrollment, and interest areas in animal sciences. The findings showed that the majority of participants were female and classified as animal sciences majors. Veterinary medicine was a career objective of 59% of the students, while less than 5% indicated an interest in pursuing a career engaged in food animal production. Companion animals (dogs and cats) represented the species interest of nearly 50% of the students, followed by equine at 24%. Food producing animals (cattle, goats, poultry, sheep, and swine) represented the primary interests of only 20% of students; however, 43% indicated that cattle was the most beneficial species learned and reported lack of prior knowledge (27%) as a primary reason for the selection. Students perceived nutrition as the most valuable discipline learned, followed by reproduction and behavior. There were no differences in overall course performance between male and female students or animal sciences and non-agriculture majors; however, the mean cumulative course grade was lower for agriculture majors excluding animal sciences ($P < 0.05$).

Introduction

While the number of students enrolling in animal sciences departments remains strong, the demography of the student population continues to evolve (Buchanan, 2008). Traditional roles of animal sciences departments in preparing graduates for careers in production agriculture are being replaced by more fundamental missions to educate students for diverse careers in the sciences (Kauffman, 1992). An increasing number of animal sciences students are urban, female, and declare career interests that are dominated by the veterinary profession (Edwards, 1986; Mollett and Leslie, 1986; and Reiling et al., 2003). Furthermore, increased diversity in animal species and scientific discipline interests accompany changes in the student population. Greater percentages of students in animal sciences have interests in companion animals and behavior, topics that were nonexistent in early curricula of animal sciences departments, but are now routinely taught (Buchanan, 2008).

In order for an academic program in animal sciences to remain successful, it must be relevant in a changing society and address the interests and needs of its students. To this end, educators must be knowledgeable of their audience. The overall aim of this study was to characterize students enrolled in an introductory animal sciences course at a land grant university, with the objectives of identifying demographic variables of the student population and their relation to performance, as wells as factors associated with enrollment including student motives for entering the course and career objectives. In addition, student interest areas in animal sciences were documented.

Methods

The cohorts for this study were students enrolled in Introductory Animal Sciences at The Ohio State University between autumn 2007 and autumn 2008. This 10 week course consisted of four 48-minute lectures and one of three 108-minute laboratory sessions each week. Introductory Animal Sciences is a course that utilizes a biological systems based approach to equip a broad range of students with the knowledge and critical thinking skills required to address questions concerning the maintenance, reproduction, and performance of domestic animals utilized for human benefit. The course embodies fundamental concepts in areas of genetics, reproduction, nutrition, behavior, and biotechnology; and students are introduced to the molecular and cellular mechanisms that underscore the function of biological systems and how knowledge in this area is applicable toward advancement of domestic animals. The focus is on traditional agricultural species including: cattle, sheep, swine, poultry, and horses; as well as non-traditional species including: llamas, alpacas, and aquatics. The course is a degree requirement within the animal sciences major and animal production minor.

Pre-course questionnaires were developed to address demographic variables (gender, major classification, and career objectives), motives for course enrollment, and species areas of interests. The

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pre-course questionnaire was provided to students who attended the initial day of the course (n=210). Post-course questionnaires were developed to assess students perceived value of subject matter taught (animal species and disciplines) and was provided to students who attended the final day of the course (n=199). Gender and overall course performance were determined from course enrollment records. Course performance was based on final course grades (n=212) that were determined from examinations, writing composition, laboratory exercises, and participation. Statistical analysis were performed by ANOVA using the general linear model (PROC GLM) procedures of SAS (version 9.1; SAS, Cary, NC) appropriate for a completely randomized design to determine differences in means for cumulative grades. Predictors in the model were gender and major classification (animal sciences; agriculture, excluding animal sciences; or non-agriculture). Data are presented as means ± SEM with $P \leq 0.05$ considered significant. Fisher's Exact Test (PROC FREQ) was used to evaluate the relationship between categorical values (major classification and career objectives on species interests) with $P \leq 0.05$ considered significant.

Results and Discussion

This survey provides a random sample of the student population of an introductory animal sciences course at a land grant university. The majority of participants (Table 1) were female (79%) and classified as animal sciences majors (78%) with the remaining data set consisting of other agricultural (13%), non-agricultural (8%), or undecided (1%) majors. The greater percentage of females enrolled in the course is in agreement with findings of Hoover and Marshall (1998) and Koon et al., (2009) that reported greater enrollments for females versus males in college of agriculture classes, but differs from Mollett and Leslie (1986) and McMillan et al. (2009) that reported nearly equal gender distribution of animal sciences students. Greater female enrollment in the current study may be attributed to the primary career objectives of students, with approximately 59% of total students indicating veterinary medicine as their career objective, increasing to 68% when only animal sciences majors were considered (Table 2). Previous findings of others demonstrated that the percentage of students that declare veterinary medicine as a professional objective closely parallels the gender distribution of introductory animal sciences courses (Edwards, 1986). Female enrollment reflects the drastic change in the ratio of men to

Table 1. Gender and Major Classification of Students Enrolled in an Introductory Animal Sciences Course

Variable	Number	Percent
Gender		
Female	167	78.77
Male	45	21.23
Major classification		
Agribusiness	10	4.81
Agricultural Communication[1]	3	1.44
Agricultural Education[1]	10	4.81
Animal Sciences	158	75.96
Animal Sciences/Veterinary Technology	4	1.92
Biology	8	3.85
Undecided	2	0.96
Zoology	6	2.88
Other[2]	7	3.37

[1] Animal Sciences may be required as a minor course
[2] Food, Agricultural, and Biological Engineering, Crop Science, English, Food Business Management, German, Landscape Architecture, Nutrition

Table 2. Career Objectives of Students Enrolled in an Introductory Animal Sciences Course

Career objectives	Total Students		Animal Sciences Majors[1]	
	Number	Percent	Number	Percent
Animal care[2]	13	6.57	10	6.33
Business	10	5.05	1	0.63
Education	10	5.05	0	-
Food animal production	7	3.54	7	4.43
Uncertain	10	5.05	10	6.33
Veterinary technician	12	6.06	12	7.59
Veterinary medicine	117	59.09	108	68.35
Other[3]	19	9.60	10	6.33

[1] Includes students pursuing the Animal Sciences/Veterinary Technology dual degree.
[2] Approximately 79% of total students and 67% of Animal Sciences majors that listed animal caretaker as a career goal specified desired employment with a zoo, while the remaining areas were equine training and rehabilitation.
[3] Includes postgraduate studies in human medicine, law, or reproduction; athletics; library sciences; journalism; and wildlife conservation.

Table 3. Motives for Students Enrolling in an Introductory Animal Sciences Course

Reason	Number	Percent
Major requirement	95	42.24
Minor requirement	18	8.57
Animal interest	47	22.38
Elective	1	0.48
Exploration[1]	6	2.86
Increase animal experience	2	0.95
Increase animal knowledge	26	12.38
Preparation for veterinary school	15	7.14

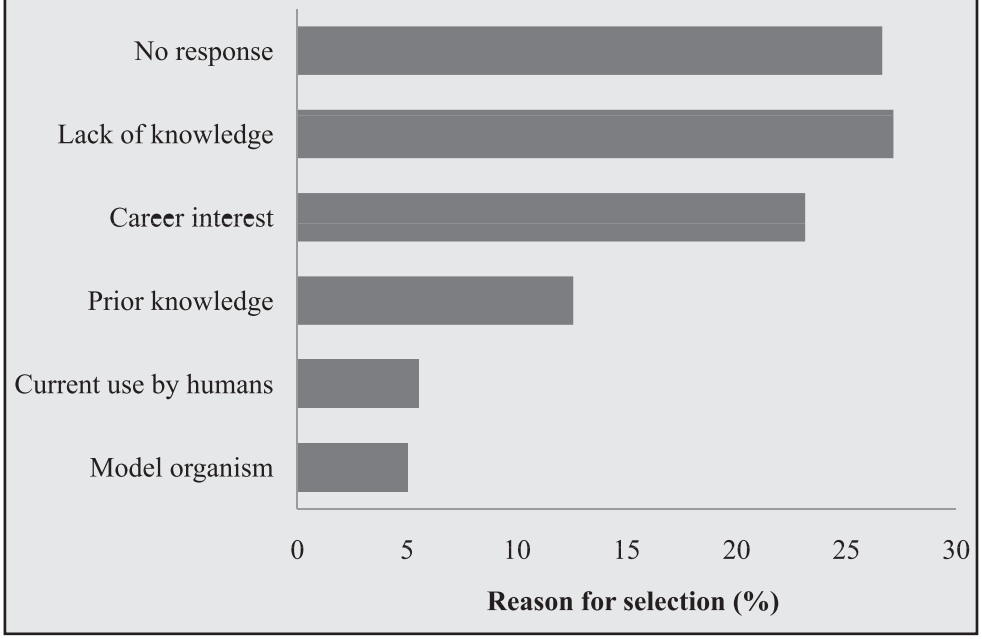
[1] Exploration is a program designed to assist students in deciding on a major or minor through investigation of courses within a degree program

women in veterinary medicine during the last three decades with women now representing greater than 70% of all veterinary students (Brown and Silverman, 1999; Elmore, 2003). The percentage of students classified as animals sciences majors exceeded other reports where 50% or less of student enrollment was ascribed to animal sciences majors (Edwards, 1986; Reiling et. al., 2003). The requirement of the course for additional agricultural majors and select veterinary college admissions is expected to contribute to the percentage of majors and non-majors that enroll in an introductory animal sciences course at different universities. Indeed, a nearly 30% enrollment of biomedical majors was reported by Edwards (1986) and attributed to the pre-professional course requirement of the universities veterinary college. A pre-professional course requirement for introductory animal sciences is not mandated for veterinary admissions at the university of the current study. While the majority of students enrolled in the course were interested in veterinary medicine, only 7% stated preparation for veterinary college as a motive for enrollment with 42% stating the need to satisfy a major requirement as the primary motive (Table 3).

Less than 5% of students indicated an interest in pursuing a career engaged in food animal production. This percentage is considerably less than the 25% reported nearly 25 years ago (Edwards, 1986), but is comparable to the more recent 8% reported by Reiling et al., (2003). An increase in efficiency of production agriculture has been met with a decreased demand for individuals engaged in production practices and is reflective of the U.S. census data (1990) that indicates less than 2% of the U.S. population lives or works on farms. Yet, there remains a requirement for knowledgeable graduates to address the needs of the world's food and agricultural systems and recruitment of qualified students to this end remains a concern (Wildman and Torres, 2001). Findings by Conroy (2000) show that agricultural occupations of interest are established as early as middle school and less than 7% of middle school students report an interest in production agriculture. Factors including reduced exposure to agriculture professions, influences of family and friends, and lack of role models in the profession are known to play a role in selection of an agricultural major (Wildman and Torres, 2001) and are likely to contribute to career decisions. It is expected that the greater percentage of women enrolled in animal sciences also contributes to the lesser reports of career interests in production agriculture as there are fewer numbers of females in agriculture positions to serve as role models and a less inclusive environment in agricultural sciences for females (Beck and Swanson, 2003).

Thirty-seven percent of students responded that information learned regarding nutrition was most valuable toward their academic goals, followed by reproduction and behavior (25 and 17%, respectively; Table 4). Greater percentages of students reported reproduction (36%) and genetics (25%) as the second most valuable discipline topic learned. This is in contrast to Reilings et al., (2003) that reported greater disciplinary interests in behavior relative to subjects of nutrition and reproduction for introductory animal sciences students. Companion animals (dogs and cats) represented the species interest of nearly 50% of the students entering the course (Table 5), followed by equine (23.5%). Food production animals (cattle, goats, poultry, sheep, and swine) represented the primary interests of only 20% of students. With 77% of households reporting animal ownership of dogs or cats and 20% owning horses (AVMA, 2007) the interest in companion animals and equine is not surprising as students in animal sciences are often most interested in animals of familiarity (McNamara, 2009). Upon completion of the course, 43% of students reported that the knowledge of cattle learned was most beneficial toward their academic goals (Table 5). It should be noted that the course focus is food producing animals and equine with discussions of companion animals and exotics restricted to comparative purposes; however, when

Figure 1. Student reasons for most valuable species learned in an introductory animal sciences course



asked if the course should include additional species, 44% of students responded no, whereas 16% and 5% suggested additional information on companion and exotic animals, respectively, should be included. Lack of prior knowledge (27%) was a primary reason provided for the most beneficial species learned (Figure 1). This data suggests that the knowledge and applications of the science of large domestic animals can be used to deliver fundamental biological principles to students regardless of species interests.

The species interests of students were related to major classification and career objectives ($P < 0.001$; Table 6). A greater percentage of students in non-agricultural related majors declared companion animals as their primary species interests (61%) compared to animal sciences (49%) and agricultural majors excluding animal sciences (38%). For animal sciences and non-agricultural majors, equine represented the second most reported species interests, whereas, agricultural majors excluding animal sciences were more likely to report cattle second to companion animals (Table 6). When species interests relative to career objectives were assessed, greater than 80% of students considering a profession in veterinary medicine reported interests in companion animals or equine. The limited interests in food producing animals for students that reported primary career goals in veterinary medicine was most pronounced when poultry and small ruminants were considered. These findings supports recent suggestions that there is a disproportionate number of veterinary students pursuing companion animal and equine medicine, resulting in an increased demand for students interested in food supply medicine to maintain the security of the food

Table 4. Primary and Secondary Discipline Interests of Students Enrolled in an Introductory Animal Sciences Course [1]

Discipline[2]	Primary, %	Secondary, %
Behavior	17.22	18.84
Domestication	9.27	5.80
Genetics	10.60	24.64
Lactation	0.66	0.00
Nutrition	37.09	14.49
Reproduction	25.17	36.23

[1] 151 of 199 students completing the survey question responded with their primary discipline interests; whereas, only 69 students provided their secondary discipline interests.
[2] In addition to the listed disciplines, cell biology is covered, however, was not selected as a primary or secondary interests by students.

Table 5. Primary Species Interests and Most Beneficial Species Learned of Students Enrolled in an Introductory Animal Sciences Course [1]

	Interest		Learned	
Species	Number	Percent	Number	Percent
Cat	17	8.50	-	-
Cattle[2]	30	15.00	78	43.33
Dog	80	40.00	-	-
Horse	47	23.50	43	20.48
Goat	3	1.50	4	2.22
Lamoids	2	1.00	1	0.56
Poultry[3]	3	1.50	10	5.56
Sheep	3	1.50	13	7.22
Swine	11	5.50	31	17.22
Other[4]	4	2.00	-	-

[1] 200 students responded to species interest in the pre-questionnaire, whereas 180 students responded to the most beneficial species learned in the post-questionnaire. The course focus included food animals and equine. Discussions of companion and exotic animals were for comparative purposes primarily.
[2] Includes both beef and dairy cattle
[3] Includes chickens, ducks and turkeys
[4] Includes ferrets and rabbits

Table 6. Effect of Major Classification and Career Objectives on Species Interests of Students Enrolled in an Introductory Animal Sciences Course

Variable		Species Interests, %[1,2]							
		Cattle	Companion animals	Horses	Poultry	Small ruminants[3]	Swine	Other	*P-Value*
	n								
Major classification									< 0.001
Animal Sciences[4]	148	14.19	48.65	25.68	2.70	3.38	0.68	4.73	
Agriculture[5]	32	25.00	37.50	18.75	3.13	9.38	6.25	-	
Non-agriculture[6]	18	5.56	61.11	16.67	-	5.56	6.25	-	
Career objectives									<0.001
Animal care	13	7.69	5	38.46	-	-	-	-	
Business	10	50.00	-	40.00	-	-	-	10.00	
Education	10	20.00	50.00	10.00	-	10.00	10.00	-	
Food animal production	7	71.43	-	14.29	14.29	-	-	-	
Uncertain	10	30.00	30.00	20.00	-	10.00	10.00	-	
Veterinary technician	12	8.33	75.00	8.33	-	8.33	-	-	
Veterinary medicine	117	7.69	55.55	25.64	0.85	2.55	5.13	2.56	
Other	19	21.05	31.58	15.79	5.26	10.52	5.26	5.26	

[1] A dash indicates that no student within the respective major classification or career objectives selected that species.
[2] Association between major classification or career objectives and species interests, Fisher's exact test.
[3] Includes goats, sheep, alpacas, and llamas.
[4] Includes Animal Sciences/Veterinary Technology dual degree students.
[5] Excludes Animal Sciences majors.
[6] Students enrolled in colleges other than the College of Food, Agricultural, and Environmental Sciences.

supply (Leighton, 2004; Prince et al., 2006). Interestingly, of the limited number of students reporting career objectives in food animal production, 71% reported cattle as their species interests and none reported interests in small ruminants or swine (Table 6).

Data regarding the impact of student gender on performance in agricultural courses is conflicting. Although higher-order learning abilities do not appear to differ between gender of students enrolled in the college of agriculture (Torres and Cano, 1995; McMillan et al., 2009) reported that female performance in undergraduate animal sciences courses was greater than males; whereas, Mousel et al., (2006) reported no difference in grade distribution between gender of students enrolled in an introductory forage crops management course. In the current study, there were no differences in overall course performance between male and female students ($P > 0.05$). Class performance also was similar between animal sciences and non-agriculture majors, whereas, the mean cumulative course grade was lower for agriculture majors excluding animal sciences ($P < 0.05$). Mousel et al., (2006) reported differences in grade distributions among agricultural majors enrolled in an introductory forage crop management course and attributed the findings to differences in agricultural background, with students that lacked an agricultural background being disadvantaged. Although information regarding agricultural background was not collected in the current study, this is not anticipated to be a factor underlying current grade differences between majors as it is well established that an increasing number of animal sciences students are classified as urban or suburban (Mollett and Leslie, 1986). It is more likely that the learning styles of students contributed to differences in grade distribution. Cano (1999) and Torres and Cano (1994) determined that students enrolled as animal sciences majors were predominantly field independent (analytical) learners, whereas field dependent (global) learning styles were more frequently reported for students of agribusiness and agricultural communications majors. Furthermore, field independent learners are more likely to report a greater cumulative grade point average than field dependent learners (Cano, 1999). As nearly 50% of the agricultural students excluding animal sciences declaring agricultural communications or agribusiness as their major, it is plausible that differences in learning styles contributed to class performance differences noted in the current study.

Summary

The mission of animal sciences to equip students with the knowledge and abilities to maintain animals for human use remains relevant despite the changing demographics of the student population. As greater percentages of students enroll in animal sciences with interests in companion animals and equine, educators must recognize the greater use of animals by humans that extends beyond agriculture. This study suggests that animal sciences instruction does need to drastically shift away from the teachings of food producing animals to meet the needs and interests of students enrolled in an introductory animal sciences course. Instead, focus should be directed toward student's comprehension of the global nature of the study of animals that encompasses multiple species and disciplines by using large domestic animals as a resource for teaching fundamental knowledge of biological principles. While the majority of students enrolled in the course were female with professional interests in veterinary medicine, success in the course was unrelated to gender. The minor interests in a career involving food animal production was not surprising in light of reports of the number of the U.S. population involved in production agriculture, but causes concern regarding the future availability of knowledgeable graduates to address the needs of food agriculture.

Table 7. Mean Cumulative Course Grade by Gender and Major Field of Study of Students Enrolled in an Introductory Animal Sciences Course

Variable	n	Grade, %[1]
Gender		
Female	167	81.05 ± 1.36
Male	45	80.87 ± 3.06
Major classification		
Animal Sciences[2]	162	82.38 ± 1.52[a]
Agriculture[3]	27	76.09 ± 2.52[b]
Non-agriculture[4]	19	84.42 ± 3.43[a]

[1] Values are means ± SEM. Labeled means within a row with superscripts without a common letter differ within variable, $P<0.05$.
[2] Includes Animal Sciences/Veterinary Technology dual degree students.
[3] Excludes Animal Sciences majors.
[4] Students enrolled in colleges other than the College of Food, Agricultural, and Environmental Sciences.

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