Interest and Active Learning Techniques in an Introductory Animal Science Course

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Abstract

Research suggests a link between active, intrinsically-motivated learning and subject-specific curiosity that might be leveraged by teachers to support academic performance. This study investigates relationships between self-reported curiosity in animal science and the perceived impact of seven learning activities. A questionnaire was administered to 238 students in an introduction to animal science course (93.2% response rate; n=222). Likert-scale questions prompted students to rate pre- and post-course levels of curiosity in animal sciences, and to rate the impact of each of the following learning activities on their interest in studying animal science: case studies, think-pair-share, exam review sessions, laboratory stations, laboratory handouts, iClicker questions, and laboratory critical reflections. The majority of the students indicated their pre- and post-course levels of curiosity in animal sciences as very high or extreme (67.1% and 65.3%, respectively). Paired t-tests indicated no change in curiosity in animal sciences over the course of the semester. Pearson correlation coefficients showed a weak positive relationship between end-of-semester curiosity level and the perceived impact of each of the learning activities on student interest. Of the learning activities, case studies and laboratory stations were most related to end-of-semester student curiosity (r=0.373, 0.377). These results indicate that active learning strategies stimulated more interest in students with higher levels of curiosity in animal sciences and suggest that interactive, group-based instructional methods like case studies and laboratory stations are beneficial for this group of students.

Introduction

Stimulating and maintaining student interest to successfully meet learning outcomes is a primary goal of college education. The level of interest in one's chosen area of study can impact both educational performance and well-being outcomes (Schiefele, 2001). Stronger interest has been shown to increase students' motivation to seek knowledge and the number of strategies they employ toward learning (Pressley et al., 1992). In higher education courses, the structure of course activities and the learning environment in which they are administered can greatly influence students' curiosity in a subject. Consequently, administrators and instructors can attempt to improve subject interest by restructuring courses and the classroom environment.

Classroom interventions designed to increase student interest often target introductory courses composed primarily of first-year students, aiming to influence students' entire college career. One frequently used strategy is the addition of active learning elements (Yuretich et al., 2001, Freeman et al., 2014). Previous research has posited a positive feedback loop between subject-specific curiosity and active learning (Stahl and Feigenson, 2015). Implementation of active learning through social, authentic, problem-based activities develops student interest and motivation by supporting needs for autonomy and relatedness (Deci, 1992). Active learning can be implemented through many strategies, each with differing effects on student learning and interest. Relatively little is known about the types of activities and features of learning environments that best support the development of student interest (Rotgans and Schmidt, 2010).

Active learning and student interest have not been studied extensively in agriculture courses. However, there is potential for improving student interest through adding active learning in these courses. Garton's study of learning preferences indicated that agriculture students favored cooperative, interactive learning environments (Garton, 1997). Kansas State University agriculture students described "an enthusiastic and interesting teaching style" and "an interactive classroom environment" as the classroom characteristics that most motivated them to learn, and selected "a long, boring lecture" as the primary factor in reducing motivation (Mankin et al., 2004).

Constructivist learning theory dictates that motivation is key to learning (Palmer, 2005). Interest has been recognized as a component of motivation by many studies on academic motivation and performance (Rotgans and Schmidt, 2011b; Wagner, 2012). Recent work has shown that interest can lead to higher task involvement, improved learning, and increased academic achievement (Harackiewicz et al., 2016).

Interest theories generally characterize interest as consisting of two forms: situational interest and individual interest (Hidi, 1990). Situational interest refers to a transitory psychological state triggered by external factors, whereas individual interest is a more enduring disposition shaped by personal values and experience (Zhu et al., 2009). Increased situational interest in tasks precedes the development of individual interest in subjects.

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Interest and Active Learning

Promoting interest of either form can improve learning by increasing engagement and motivation. Interest is especially important in active learning classrooms, which are characterized by self-initiated, collaborative, and problem-based learning activities (Schmidt, 1993). Classrooms that promote learner autonomy and relatedness among students are beneficial to interest (Deci, 1992). Active learning strategies including authentic, problem-based learning increase perceived meaning and task-value, supporting student interest (Rotgans and Schmidt, 2011b).

To address these student needs, many departments within colleges of agricultures have declared a focus on interactive, experiential, or hands-on learning as core elements of their strategic plan. This research was based on active learning updates implemented in an introductory, required course, traditionally taught through lecture-based techniques.

Purpose and Objectives

The purpose of this study was to explore and describe the relationships between student interest in animal sciences and active learning strategies during an introductory course. The following objectives guided this research:

1. Evaluate students' perceived level of interest in animal sciences at the beginning and end of the semester.
2. Examine students' perceptions of changes to their interest in animal sciences related to seven newly implemented active learning strategies.
3. Investigate relationships between self-rated level of interest in animal sciences and the perceived impact of learning activities on interest.

Materials and Methods

All experimental procedures were approved by the Purdue University Institutional Review Board. This study assessed 238 students enrolled in an introduction to animal agriculture course in the fall 2017 semester. This sixteen-week course consisted of twice weekly 50-minute lectures and a weekly 110-minute laboratory session. Course materials covered the following animal production topics: nutrition, reproduction, global issues, industry trends, welfare, health management, breed identification. Species discussed ranged from livestock to companion animal to zoo animal.

Active learning updates made in fall 2017 included changes to both course lectures and laboratories. For the lecture portion of the course, clicker questions, think-pair-share activities, case studies, and exam review sessions comprised the active learning update. We revised course laboratories to include activity stations, handouts, and critical reflections. Since the course was primarily composed of first-year animal sciences majors, we added these active learning elements with the goal of supporting desired departmental outcomes of increased student performance, retention rates, and improved interest in the subject.

The course held lectures in a traditional lecture hall with front-facing, tiered seating. Two to three clicker questions asked during lecture presentations verified student understanding of the course materials. The instructor periodically asked students to work with a partner for brief, 5-minute Think-Pair-Share activities on questions related to the day's content. For each species unit, students completed 20-minute case studies in groups of 4 to 6 assigned at the beginning of the semester.

Laboratories took place on campus in the university's Animal Sciences Teaching Laboratory, the off-campus Animal Sciences Research and Education Center, and private animal facilities. Laboratories consisted of four to five stations with activities related to the subject matter. Undergraduate laboratory teaching assistants, the class instructor, and subject experts guided students through each station activity. Instructors encouraged students to move around in groups to complete station activities and fill in a lab handout and facilitated rotating student groups once each activity was finished.

Questionnaire Design

We sourced demographic information including gender, major, transfer status, ethnicity, and semester classification from course enrollment records. In addition, we developed a questionnaire to collect additional demographic information related to students' background in agriculture, self-rated curiosity levels, and views toward course learning activities. Items on agricultural background included previous experience with 4-H/FFA, hours of contact with each species, parent involvement in agriculture, and high school agriculture coursework. The post-questionnaire utilized a total of 12 questions including Likert-scale, anchored scale, multiple choice, and open-ended questions. Level of curiosity in animal sciences was converted to numerical form using an anchored scale: not at all–1, slight–2, moderate–3, very much–4, extreme–5. We administered the post-questionnaire electronically via Qualtrics to students during the last week of the course. 222 of 238 students provided responses (93.2%). The questionnaire required completion of each question before advancing.

Statistical Analysis

We used SPSS software for all statistical analyses (SPSS 22.0, SPSS, Chicago, IL) To compare levels of curiosity at the beginning and end of the course, we used paired t-tests. We assessed correlations between curiosity levels and the perceived impact of each of the learning activities on interest through Pearson correlation coefficients. We interpreted correlation absolute values as follows, irrespective of statistical significance: r=0.00 to 0.19, very weak; 0.20 to 0.39, weak; 0.40 to 0.59, moderate; 0.60 to 0.79, strong; 0.80 to 1.0, very strong. For each analysis, we converted verbal Likert and anchored scales to numerical values 1 to 5. We declared statistical significance at $p<0.05$.

Results

Demographics

Table 1 summarizes course demographic information and reflects the 222 survey respondents. The class was composed primarily of females (79.3%, n=176) and was predominantly first-year students (75.7% freshmen, n=168). The majority of students were from majors within the College of Agriculture and were not transfer students. Students enrolled in pre-veterinary medicine degree or concentration made up 62.6% of all respondents (n=139). Of animal science majors, 82.5% identified themselves as pre-veterinary medicine concentration (n=113). Students most frequently selected "companion animal" as their primary species of interest, and many students reported having substantial experience with companion animal species within the past five years. The majority of students (55.9%) had no or minimal recent experience with food animal species (less than twenty hours experience in the last five years). The majority of students came from non-farm backgrounds (64.4%). Students did report having previous agriculture experience through high school coursework (51.9%), 4-H (38.4%), or FFA (25.9%).

Table 1. Demographics of students enrolled in an introductory animal agriculture course during the fall 2017 semester. (n=222)

Gender	#	%
Female	176	79.3
Male	46	20.7
Classification	#	%
Freshman	168	75.7
Sophomore	49	22.1
Junior	4	1.8
Senior	1	0.4
Major	#	%
Animal Sciences	137	61.7
Other agriculture	56	25.2
Non-agriculture	29	13.1
Hometown	#	%
Rural, farm	79	36
Rural, non-farm	61	27
Urban	28	13
Suburban	54	24

Interest in Animal Sciences

Student self-rated curiosity in animal sciences is summarized in Table 2. Students rated themselves highly curious prior to their experience in the course, with 67.1% selecting levels of "extreme (5)" or "very much (4)" to describe their level of curiosity in animal sciences. When rating their level of curiosity at the end of the course, 65.3% of students selected the two highest ratings. Paired t-tests indicated no significant change in self-rated level of curiosity over the course of the semester.

Table 2. Student (n=222) self-rated curiosity in animal sciences during the first and last week of an introductory animal agriculture course during the fall 2017 semester.

	Not at all		*Slight*		*Moderate*		*Very Much*		*Extreme*	
	#	%	#	%	#	%	#	%	#	%
First-Week	2	0.9%	8	3.6%	63	28.4%	93	41.9%	56	25.2%
Last-Week	3	1.4%	12	5.4%	62	27.9%	95	42.8%	50	22.5%

Impact of Learning Activities on Interest

Student ratings of the impact of learning activities on their interest in the course subject are summarized in Table 3. Student viewed learning activities as having predominantly positive impacts on their interest in studying animal sciences. Of the learning activities, students most frequently rated laboratory stations as having "positive" or "strong positive" impacts on interest, with 78.92% of students selecting the above ratings. Students also indicated the use of iClickers in lecture as beneficial to their interest, with 55.16% of students responding "positive" or "strong positive" impact. Case studies and laboratory critical reflections received the least positive ratings from students, with 12.11 and 16.59% (respectively) of students indicating that these activities had a strong negative or negative impact on their interest in studying animal sciences.

Table 3. Student (n=222) self-rated impact of selected learning activities on their interest in animal sciences during an introductory animal agriculture course at the end of the fall 2017 semester.

	Strong Negative Impact		*Negative Impact*		*Neutral*		*Positive Impact*		*Strong Positive Impact*	
Activity	#	%	#	%	#	%	#	%	#	%
Case Studies	3	1.4	24	10.8	111	49.8	73	32.7	12	5.4
Think-Pair-Share	2	0.9	11	4.9	103	46.2	95	42.6	12	5.4
Exam Review Sessions	3	1.4	7	3.1	113	50.7	66	29.6	34	15.3
iClickers	2	0.9	5	2.2	93	41.7	101	45.3	22	9.9
Laboratory Stations	1	0.5	7	3.1	39	17.5	134	60.1	42	18.8
Laboratory Handouts	4	1.8	17	7.6	85	38.1	98	44.0	19	8.5
Laboratory Critical Reflections	10	4.5	27	12.1	102	45.7	66	29.6	18	8.1

Relationships between curiosity level and impact of learning activities on interest

Post-course curiosity levels were positively correlated with all of the activities' impact on interest (Table 4). Of the active learning strategies assessed, case studies, think-pair-share, and laboratory stations were most correlated with student curiosity levels, with Pearson correlation coefficients of 0.373 ($p<0.0001$), 0.329 ($p<0.0001$), and 0.377 ($p<0.0001$) respectively, indicating weak positive relationships.

Table 4. Correlations between last-week student curiosity (n=222) and the impact of each learning activity on interest in studying animal sciences.

Activity	Pearson correlation coefficient	*p*-value
Case Studies	0.37265	<0.0001
Think Pair Share	0.32889	<0.0001
Exam Review Sessions	0.16205	0.0157
Clicker Questions	0.19295	0.0039
Laboratory Stations	0.37725	<0.0001
Laboratory Handouts	0.25573	0.0001
Laboratory Critical Reflections	0.19236	0.0040

Differences in curiosity levels across majors

Students' curiosity in animal sciences did not differ between pre- and post-course ratings for students majoring in animal sciences, other college of agriculture majors, and non-agriculture majors (Table 4). However, for both first-week and last-week ratings, animal science majors had significantly higher levels of curiosity in animal sciences when compared with other college of agriculture majors and non-agriculture majors (Table 5).

Table 5. Mean self-rated curiosity levels (anchored scale, "not at all" – 1, "slight" – 2, "moderate" – 3, "very much" – 4, "extreme" – 5) of students majoring in animal sciences, other college of agriculture (CoA) majors, and non-agriculture (non-CoA) majors, and t-test comparison of means for first-week vs. last-week (n = 222).

Major	*# Students*	*First-Week*	*Last-Week*	*t statistic*	*p-value*
Animal Sciences	137	4.02	3.97	0.76	0.22
Other CoA	57	3.68	3.59	0.90	0.19
Non-CoA	28	3.52	3.37	0.89	0.19
All	222	3.62	3.51	1.26	0.11

Discussion

This study examined interest in students in an introductory animal sciences course and considered self-rated curiosity in the subject as a measure of individual interest. Although a generalized individual interest inventory was recently validated by Rotgans (2015), we chose to operationalize individual interest through self-assessment questionnaires specific to our context, similar to Dotterer et al. (2009) and Kalender and Berberoglu (2009).

All of the active learning strategies assessed (case studies, think-pair-share, exam review sessions, iClicker questions, laboratory stations, laboratory handouts, laboratory critical reflections) had positive impacts on interest in studying animal sciences for the students we assessed. Of these activities, students viewed laboratory stations as the most beneficial to their interest. This is consistent with previous research proposing that students experience greater interest when classrooms incorporate hands-on, social, and problem-based learning to a greater degree (Bergin, 1999).

Laboratory stations incorporated authentic, problem-based, and collaborative learning to a greater degree than other activities, which may be responsible for the larger positive effect on interest compared with other activities. During laboratory stations, students rotated to tables in groups of six to eight and were assisted by experts to complete hands-on activities and fill in laboratory handouts. Activities included simulating management techniques, labeling anatomy, and completing short case studies using information and objects provided.

We found weak correlations between post-course curiosity and the impact of learning activities on interest in studying animal sciences. This would suggest that students with more individual interest in animal sciences benefit more from active learning activities. This is supported by Rotgans (2015) where individual interest was found to be a significant predictor of cognitive engagement in problem-based learning environments. Increased cognitive engagement with learning tasks has the further positive effect of increasing how much is learned from these activities (Rotgans and Schmidt, 2011a).

Students in our study rated themselves as highly interested in studying animal sciences both prior to and following the semester-long course, and no change was observed over the course of the semester. This is corroborated by previous work suggesting individual interest is relatively stable (Rotgans and Schmidt, 2011b).

Table 6. T-test comparisons between mean self-rated curiosity levels (anchored scale, "not at all" – 1, "slight" – 2, "moderate" – 3, "very much" – 4, "extreme" – 5) of students majoring in animal sciences, other college of agriculture (CoA) majors, and non-agriculture (non-CoA) majors (n = 222).

	First-Week			*Last-Week*		
	means	t	*p*-value	means	t	*p*-value
Animal Sciences vs. Other CoA	4.02 vs. 3.68	2.54	<0.01	3.97 vs. 3.59	2.72	<0.01
Animal Sciences vs. Non-CoA	4.02 vs 3.52	2.97	<0.01	3.97 vs. 3.37	3.35	<0.001

Self-rated curiosity in studying animal sciences was significantly higher in animal sciences majors compared with other college of agriculture majors and students from outside the college of agriculture (Table 6). Selection of animal sciences as a major could be assumed to indicate existing interest in the subject or prior knowledge and experience, which Schraw and Lehman conclude is positively related to individual interest (Schraw, 2001).

Understanding student interests may become increasingly relevant to animal sciences departments as student demographics continue to change. In recent decades, animal science courses have tended towards student profiles similar to that observed in the present study: predominantly female, interested in veterinary medicine, from urban or suburban backgrounds, and having relatively little livestock knowledge or experience (Peffer, 2011).

A large proportion of our students had substantial past experience with companion animals, but very few had prior background with food animal species. Companion animals were most frequently selected by students as the primary species of interest. McNamara (2009) suggests animal science students are inclined to be more interested in species more familiar to them. As the number of Americans directly involved with agriculture declines, the number of undergraduates entering animal science programs with prior livestock experience is also decreasing (Buchanan, 2008).

Only a small fraction of students expressed interest in food animal species in our study, and very few had past experience with livestock species. Comparable past studies highlight a trend toward lower interest in food animal species among animal science students (Peffer, 2001; Reiling et al., 2003; Edwards, 1986). Peffer (2001) suggests that this student profile may be problematic because it does not align with workforce needs. Interests are recognized as a primary driver behind career choices and performance (Lent et al., 1994). As McNamara (2009) notes, to remain relevant, academic programs must adapt to employment trends and student needs.

Creating more student interest in food animal species is a realistic goal for introductory animal science courses. Students in Peffer's study (2001) with low initial interest in food animal species selected livestock species as the most beneficial to learn out of all species included in a 10-week introduction to animal sciences course. This could indicate that interest in previously unfamiliar species can be developed through exposure in similar courses. Changes to interest specific to species may be an important topic for future research.

Summary

Overall, students in this introductory course rated themselves as highly interested in studying animal sciences and viewed all the active learning strategies implemented as further increasing their interest. Of the learning strategies evaluated, students favored the collaborative, problem-based laboratory station activities. These results may inform creation of instructional strategies that support the development of student individual interest. In active learning settings, individual interest can lead to greater cognitive engagement and durable learning.

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