Examining How Experiential Learning Impacts Performance in an Introductory Animal Science Course

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Abstract

The use of experiential learning in agricultural courses within postsecondary institutions has become increasingly important as educators seek to provide students with a meaningful education increasing knowledge retention and success. Hands-on, experiential learning activities within animal sciences have previously been used to provide students with experiences that increase performance in courses and overall knowledge and skill development. Therefore, this study aimed to examine the influence that experiential learning laboratory lessons had on students enrolled in an introduction to animal science lecture course at the University of Georgia. Researchers used a quasi-experimental study, placing students in either an experiential learning or review group to determine if students who learned through experiential learning lessons retained more content knowledge than those who did not. Summative assessment scores were used to examine overall and content-related performance between the groups. Although there was no statistical significance between the groups, researchers determined that students in experiential learning activities performed slightly above or equal to those who received only review. Researchers identified recommendations for future studies, which include replicating the study with modifications and repeating the study with two introductory courses simultaneously. Additionally, researchers recommended practitioners use experiential learning to complement traditional lectures and to increase knowledge and practical skills.

Keywords: teaching and learning, animal science, hands-on, undergraduate education, student performance

Over the past two decades, the need to evaluate and identify areas of change to undergraduate education has continued to be a pressing matter for institutions specializing in agricultural sciences (National Research Council, 2009). While many of these changes have centered around the curricula and content delivered to students, research continually indicates that colleges and universities need to consider and change how teaching and learning occurs (Estepp & Roberts, 2011; National Commission on the Future of Higher Education, 2006; National Research Council, 2009). As such, undergraduate education is continually changing and being improved to prepare students for challenges they may face in the classroom or in the workforce. As students complete their undergraduate education and enter into the 21st century professional workforce, the need for content knowledge and technical skills remains important alongside transferable skills that can be used in any field (National Research Council, 2009). While these skills are not restricted to students completing degrees within agricultural fields, institutions with a focus on teaching agricultural sciences (i.e., Land Grant Universities) are primarily responsible to lead the way in preparing the next leaders in the agricultural workforce (National Research Council, 2009). Furthermore, the conditions for teaching and learning within colleges of agriculture and departments of animal science have changed greatly, indicating that these departments need to update their teaching methods to prevent a lack of student development, decreased performance, and student attrition within agricultural and animal sciences from occurring (Buchanan, 2008; Erickson et al., 2020; Thaxton et al., 2003). Therefore, it is important to continually evaluate the impacts of teaching methods on student performance and student development within agricultural sciences.

While these programs typically incorporate problem-based learning and active learning into the classroom due to the unique nature of simulating real-world scenarios, it is important to understand the strategies utilized by instructors that facilitate learning for all students (National Research Council, 2009). Currently, research shows that incorporating experiential-based teaching and learning techniques into introductory courses, typically taught through lecture, may influence student performance and career choices upon graduation (Erickson et al., 2019; Erickson et al., 2020a; Freeman et al., 2014; Hidi & Harackiewicz, 2000; Yuretich et al., 2001). Additionally, research studies and meta-analyses have shown that student learning occurs more when teaching methods are utilized that facilitate active engagement are used, as opposed to traditional lecture sessions (National Research Council, 2009). However, much of the instruction that has been utilized within agricultural sciences has been dependent on traditional lecture (National Research Council, 2009).

In the centennial review of teaching animal science conducted by the American Society of Animal Sciences (ASAS), the call to action was established to re-evaluate teaching and learning outcomes, student experiences in courses, and the assessments utilized to analyze student performance (Buchanan, 2008). A large number of undergraduate students entering animal science programs today come from untraditional backgrounds and have limited experience and knowledge in regard to animal handling and industry skills (Erickson, 2020b; Marshall et al., 1998; Mollet & Leslie, 1986; Reiling et al., 2003). Additionally, colleges and universities are tasked with preparing students for real-world settings in a world where new challenges are presented daily to the field of agriculture and animal science (Deslauriers et al., 2016). In these situations, experiential learning opportunities in the classroom can help improve student performance and prepare students for their careers and demands of the agricultural industry (Deslauriers et al., 2016).

The research behind teaching and learning styles supports the idea that students often have preferred styles of learning (Whittington & Raven, 1995). Active instruction incorporates many different teaching styles into the classroom, including hands-on experiential techniques. Additionally, as active learning is utilized in the classroom, the student begins to take control of their own learning, and the role of the instructor transforms to that of a guide as opposed to a direct instructor of the content (Kirschner et al., 2006; National Research Council, 2009). Further, Erickson et al. (2020b) supported the idea that active learning allows students to develop their own knowledge, in which hands-on, problem-based laboratory stations used in an introductory animal science course had the greatest impact on motivation and interest as opposed to written case studies and video lectures. These activities, alongside the written case studies, were described as being more enjoyable, challenging, and attention-demanding than the video lectures that were utilized in the course, indicating that the use of problem-based active learning instruction, and hands-on learning opportunities foster learning environments in which students are more interested, motivated, and engaged with what is being taught (Erickson et al., 2020b).

While teachers and students tend to focus on overall performance in the classroom, it is also important to understand how students develop and acquire the knowledge and skills required of them to be successful in the course. Erickson et al. (2019) posited that the utilization of active learning strategies in the classroom not only has an impact on student performance, but also supports the development of student knowledge and interest in animal science careers. To ensure that students are developing knowledge and interest in animal science careers, there is an increasing pressure for undergraduate programs to continually evaluate curriculum to adequately prepare graduates for a career in the agricultural workforce (Andelt et al., 1997; Easterly et al., 2017). Necessary learning experiences in agriculture and animal science programs should be continual to allow development and achievement for all students throughout their undergraduate career, encouraging departments and colleges to perform reviews and planning for the integration of active learning and hands-on opportunities (National Research Council, 2009).

Understanding the impacts of teaching methods on student performance and student development in agricultural sciences remains at the forefront of continued research, therefore, researchers sought to examine the impacts of experiential learning on student content acquisition within the animal science curriculum, in an introductory animal science course at the University of Georgia.

Theoretical Framework

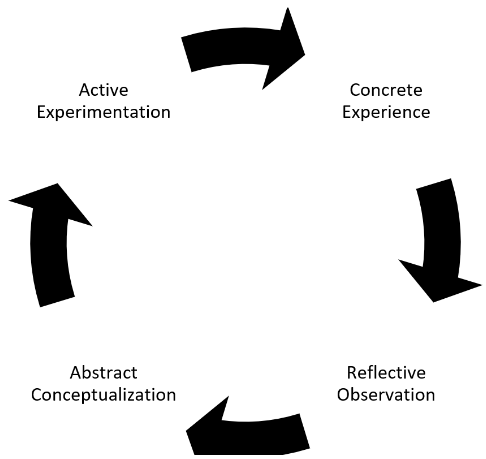
This study was guided by Kolb's (1984) Experiential Learning Theory, which as previously explained, states that a learner constructs their own knowledge and experience through reflection and experimentation. Kolb (1984) best explained this theoretical framework through the experiential learning model, which illustrates the process of learning through four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Figure 1). Through the use of this model and theory, Kolb (1984) indicates that a learner can enter and exit the experiential learning process at any point, but must complete each stage of the cycle to fully develop and acquire the knowledge and skills that are being taught through experiential learning. Once learners have been provided with the opportunity to have a concrete experience, reflect on the initial observation and experience, conceptualize thoughts and ideas to complete the necessary actions, and actively experiment on what was initially taught or experimented, learning fully occurs (Kolb, 1984). Furthermore, active learning and student interest are key aspects within the experiential learning theory and model, as students are provided with the opportunity to learn through hands-on activities and problem-based learning (Erickson et al., 2019; Rotgans & Schmidt, 2011). Within many agricultural classrooms, interactive learning environments are often fostered, in which students have the opportunity to collaborate and work with peers on experiments and activities in experiential and active learning lessons (Garton, 1997; Rotgans & Schmidt, 2011).

Experiential learning is an instructional strategy most commonly associated with David Kolb and John Dewey, two contributors who laid most of the groundwork for education (Roberts, 2006). Dewey's (1938) conception of experiential learning focuses on the ideas of reflection and builds on the student's prior knowledge, with the introduction of hands-on learning. While Dewey was considered to be the first contributor to the idea of experiential learning, Kolb is often most cited when it comes to the current model of experiential learning (Miettinen, 2000). David Kolb developed a comprehensive model of four stages to learning. Grounded in constructivism, Kolb (1984) postulates that a learner constructs their own knowledge and experience through reflection and experimentation.

Within Kolb's (1984) experiential learning model, the four stages can also be divided into two aspects of learning, in which the learner is either grasping information and knowledge or transforming information and knowledge into memory or actions. When the learner is in the concrete experience and reflective observation phases of the model, they are developing knowledge, through an experience and then reflection. As the learner reflects on the experience and begins to transform information, they then move into the abstract conceptualization phase, in which the learner forms conclusions on the experience and reflections that later occurred. It is during this moment in which the learner transforms the information from the experience into applicable knowledge or concepts and then moves into the active experimentation phase (Kolb, 1984).

Figure 1.

Kolb's (1984) Experiential Learning Model



While the principles of experiential learning are not uncommon to undergraduate education today, there are continuous changes occurring in agriculture and more specifically animal science, which must be met and emphasized in the classroom (Deslauriers et al., 2016). In 2009, the National Research Council suggested that undergraduate experiences in agriculture needed a change, particularly through the inclusion of new content and improved teaching methods (Deslauriers et al., 2016). Since then, experiential learning has become more widely used in many colleges of agriculture and departments of animal science. Courses in these disciplines provide students with many hands-on opportunities to learn about animal care and handling. These opportunities may shape a student's perceptions and understanding of specific content and increase their curiosity in areas such as dairy science, beef science, equine science, or extension (Erickson et al., 2019).

Purpose

The purpose of this study was to examine the influence that experiential learning laboratory lessons had on students enrolled in an introduction to animal science lecture course at University of Georgia. The traditional introduction course design was structured with a large lecture component accompanied by a weekly review session. To understand how experiential learning laboratory lessons influenced student performance, the study was guided by the following research objective and hypothesis:

- Examine the effect of experiential learning laboratory lessons on student knowledge acquisition of content taught in an introduction to animal science course.
  - H_O: Students who participate in experiential learning laboratory lessons will have equal content-related scores to students who participated in traditional review sessions.
  - H_α: Students who participate in experiential learning laboratory lessons will have higher content-related scores on summative assessments as compared to students who participated in traditional review sessions.

Methods

This study analyzed student performance in a three-credit-hour, lecture-based introductory animal science course within the Department of Animal and Dairy Science at the University of Georgia. Researchers developed lessons that were implemented throughout the Spring 2022 semester, which were broken down into four content areas. These content areas included topical review and laboratory sessions on reproduction, nutrition and digestion, genetics, and meat science. Lessons included but were not limited to the deconstruction of a hog carcass, examination of breeding animals and genetics-based scenarios, dissection of digestive tracts, and dissection of reproductive tracts. Each of the lessons and content sessions were guided by the teaching assistants who were assigned to the course. These teaching assistants were provided with lesson plans developed by the researchers but were given the opportunity to utilize other materials and teach the material using their own methods. This study was approved by the University of Georgia Institutional Review Board (PROJECT00001692).

Researchers utilized a quasi-experimental design, in which students were placed in one of three sections, two of which were centered around experiential learning laboratories, and one was the traditional classroom section. Prior to the beginning of the course, researchers randomly assigned students to one of the three groups, with an approximately equal number of students in each group. At the beginning of the course, the instructor and researchers distributed consent forms and information regarding the study to students through email in the online learning platform. Students were contacted every other week, for a total of three initial emails (Dillman et al., 2014). One researcher then attended the lecture and collected any remaining consent forms and answered questions from students regarding the study.

Two teaching assistants of the course were assigned to each of the three sections and were instructed to lead the group for the entirety of the semester. The traditional classroom section was designed as a period in which students would review the information taught during lecture and prepare for the course exams. Students who did not wish to participate in the study after the initial assignment of groups were then placed into the traditional review session, and their assessment scores were omitted from the data. The instructor for the course uses a similar exam design each year but changes the style and type of questions asked for the content knowledge being examined. Students who were assigned to either of the two experiential learning groups were provided with the opportunity to attend traditional review sessions with their teaching assistants throughout the semester but were required to attend the laboratory sessions in which the experiential learning lesson was occurring. The researchers and instructor for the course developed similar schedules for each group throughout the semester, in which the only major differences were the nights that one of the experimental groups received experiential learning activities, yet the review sessions were consistent across each schedule. Group One was the control group, Group Two received experiential laboratory lessons in meat science, and nutrition and digestion, and Group Three received experiential laboratory lessons in reproduction and genetics.

Data Collection

Data were collected through four summative assessments throughout the semester. These assessments included three content centered unit exams and one cumulative final exam. Exams were created by animal science faculty, and have been used for this course each year this instructor has taught the course. To ensure the exams were associated with the content material, the instructor and teachings assistants reviewed each exam prior to the exam session for appropriate information from the lecture sessions. Each summative assessment was given during scheduled course assessment periods, which were either two hours in length or three hours in length for the final exam. All assessments presented to students were identical in design to ensure that there were no external influences on student performance or data analysis. Assessments included a variety of true/false, multiple choice, matching, short answer, fill in the blanks, and essay questions including ration calculation, Punnett squares, and various scenarios for students to assess. Additionally, to ensure that student scores were entered appropriately, assessments were given to students in their assigned groups and students were asked to notate which section of the laboratory or review they were assigned. Upon completion of the exams, scores were tabulated and sorted by student and group. Students were assigned numerical codes upon entering scores into the spreadsheet to maintain anonymity. Scores were then entered into a table depending on the total number of content questions that were deemed as correct by content experts.

Study Limitations

Researchers noted several limitations within the study, which included the total number of students who participated in each group and the factor that only descriptive statistics were examined. The researchers attempted to equally distribute 25 students to each group for data analysis, however, there was attrition from the experiential learning groups, as students indicated their intent to remove themselves from the study to receive traditional review. This was due to mostly unknown factors although many students indicated through email that they did not want to have learning impacted by the labs. Additionally, the researcher noted that the differences in teaching assistant teaching styles and content knowledge may have limited the development and knowledge acquisition of students. Thus, researchers were limited in analysis, to only examine mean, standard deviation, and the minimum and maximum questions answered correctly. Additionally, it should be noted that during the summative assessments throughout the semester some students missed the exam period or withdrew from the course, thus variation in group sizes.

Data Analysis

Researchers analyzed data using one-way Analysis of Variance (ANOVA) in SPSS 28.0, with an *a priori* level set at .05. Researchers examined overall group averages for each exam, as well as the total number of content-related questions that were deemed as correct by the instructor and panel of content experts. Scores for each group were compared through ANOVA, depending on whether students received an experiential learning laboratory session or the traditional review session prior to each specific exam.

Results and Discussion

Prior to the study, assessment scores from the first quiz that was given in the course were analyzed by group to determine if a difference was found between the groups. The first quiz was administered online to students a week before the first experiential learning session, and researchers analyzed the data dependent on the initial group assignment. However, prior to the first lab, various numbers of students decided to withdraw from the study from each group, leading to the small and unequal group sizes.

As mentioned, the researcher analyzed the first quiz scores from the course through ANOVA, to determine if there were any significant differences between the groups. The first quiz, which is administered through the online learning platform, examines initial knowledge in the animal science course and includes questions related to breeds and general knowledge. There was a lack in significant differences between the three groups, therefore researchers determined the groups were similar, and mean scores and standard deviations were reported (Table 1).

Summative assessments were collected throughout the semester and analyzed to assess the overall performance and measure group differences through ANOVA. Table 2 displays the mean scores and standard deviation for each

Table 1.

Quiz One Mean and Standard Deviation for All Groups

Quiz	Group	n	Mean	SD
Quiz One	One: Control	24	73.67	16.43
	Two: Experimental (meat science, nutrition and digestion)	11	73.45	18.00
	Three: Experimental (reproduction and genetics)	17	67.06	17.92

Table 2.

Student Assessments Mean and Standard Deviation for All Groups

Exam	Group	n	Mean	SD
Exam One: Meat Science	One (Control)	23	73.04	20.27
	Two (Meat Science & Nutrition)	11	81.73	10.35
	Three (Genetics & Reproduction)	17	70.59	10.32
Exam Two: Genetics, Nutrition & Digestion	One (Control)	24	76.15	20.45
	Two (Meat Science & Nutrition)	11	85.68	16.92
	Three (Genetics & Reproduction)	17	74.32	17.99
Exam Three: Reproduction	One (Control)	23	74.31	20.42
	Two (Meat Science & Nutrition)	11	81.05	8.36
	Three (Genetics & Reproduction)	15	63.76	27.33
Final: Cumulative	One (Control)	24	63.17	15.21
	Two (Meat Science & Nutrition)	11	67.95	12.63
	Three (Genetics & Reproduction)	17	62.37	14.28

Note. Varying group sizes due to students missing exam(s) during the semester

exam based on group assignments. Exam one contained meat science questions and introductory animal science questions, exam two contained both reproduction and nutrition and digestion questions, exam three contained genetics questions, and the final exam was cumulative. Researchers sought to determine if there were significant differences between the three groups, but upon analysis of ANOVA, determined no statistical significance, which led researchers to only examine the differences in mean score. The researchers noted that Group Two had a higher mean score for each exam in comparison to the other two groups. The researchers noted that based on the results of this exam, the performance of students is consistent with previous literature in that the use of experiential-based teaching and learning has the potential to influence student performance in an introductory course (Erickson et al., 2019; Erickson et al., 2020a; Freeman et al., 2014; Hidi & Harackiewicz, 2000; Yuretich et al., 2001).

To further examine the data, researchers analyzed descriptive statistics due to the difference in group sizes and lack of statistical significance between groups. Because each exam contained additional questions that were not included in the experiential learning session, researchers then reviewed each summative assessment and examined the total number of content-related questions that were deemed appropriate to the content that was taught in the experiential learning session and reviewed in the control session. Upon determining the content-specific questions for each exam, researchers then analyzed student exams for correct responses. Upon calculation of correct content questions on each exam, researchers calculated the group means and standard deviations for each group. Table 3 displays the results of these analyses for exam one, in which researchers determined that there were 44 questions that were related to meat science content. Group Two, which received experiential learning lessons related to meat science seemingly performed at a higher level than students in Group One or Group Three. It should be noted that one student from Group One did not participate in this exam.

Table 4 displays the results for exam two, in which researchers examined the total number of questions correct for the entire exam related to both content areas, as well as separating the total correct for genetics and the total correct for nutrition and digestion for further analysis. Students in Group Two received the most correct responses in both content areas, while Group Three and Group One performed similarly in both areas of content-related questions.

Table 5 displays the total questions for reproduction questions that were deemed correct by content experts, and upon analyzing the results, researchers determined that students in Group One and Two performed slightly better than students in Group Three, who received experiential learning lessons in reproduction. However, it should be noted that one student in Group One and two students in

Table 3.

Questions Correct per Group for Meat Science Content

Exam	Group	n	Mean	SD	Min Score	Max Score
	One (Control)	23	31.57	7.24	13	43
Exam One: Meat Science	Two (Meat Science & Nutrition)	11	35.45	7.31	23	43
	Three (Genetics & Reproduction)	17	29.53	5.88	20	44

Note. Varying group sizes due to students missing exam(s) during the semester

Table 4.

Questions Correct per Group for Genetics, and Nutrition and Digestion Content

Exam	Group	n	Mean	SD	Min Score	Max Score
	One (Control)	24	23.92	6.51	7	31
Exam Two: Total Genetics	Two (Meat Science & Nutrition)	11	27.82	5.15	17	32
	Three (Genetics & Reproduction)	17	23.94	4.93	14	30
	One (Control)	24	50.17	15.88	16	70
Exam Two: Total Nutrition and Digestion	Two (Meat Science & Nutrition)	11	56.82	11.94	30	65
	Three (Genetics & Reproduction)	17	49.82	13.64	22	68

Note. Varying group sizes due to students missing exam(s) during the semester

Group Three did not have exam scores reported, which could have skewed the results.

Upon examining the final exam, researchers determined that questions related to each content area should be identified with content experts to analyze knowledge retention throughout the course in relation to the experiential learning laboratory sessions. Table 6 displays these results, and it can be noted that each of the three groups had similar mean scores for the total questions correct in each area. However, the researchers indicated that students who were in Group Two had a lower mean score for meat science content, but higher mean scores for the genetics, nutrition and digestion, and reproduction content.

As mentioned in examining the overall mean scores and standard deviation, the researchers noted that there is seemingly an impact of experiential learning on student performance in the introductory course. However, there are no large differences in the overall content-related performances on each exam when comparing the three groups, and although research has shown that the use of experiential learning often increases student performance, there are other factors that influence performance including student learning styles. Further, as the researchers noted the fact that students chose not to participate in the experiential learning sections, this potentially coincides with the idea that students have varied learning styles and development is dependent on how they construct knowledge.

Summary

Based on the results of the study, the researchers fail to reject the null hypothesis. Researchers noted that while students were actively engaged in the experiential learning lessons, the activities that were utilized as a standalone lesson did not garner a significant increase in the retention of content knowledge across all groups. However, it is evident that Group Two performed seemingly better compared to the other groups, reported by a higher mean of content questions deemed correct on the individual exams, as well

Table 5.

Questions Correct per Group for Reproduction Content

Exam	Group	n	Mean	SD	Min Score	Max Score
Exam Three: Reproduction	One (Control)	23	51.39	9.69	32	70
	Two (Meat Science & Nutrition)	11	51.18	6.98	37	59
	Three (Genetics & Reproduction)	15	49.07	8.66	32	61

Note. Varying group sizes due to students missing exam(s) during the semester

Table 6.

Questions Correct per Group for Final Exam

Exam	Group	n	Mean	SD	Min Score	Max Score
Final Exam: Meat Science Content	One (Control)	24	6.46	2.00	2	10
	Two (Meat Science & Nutrition)	11	5.45	2.34	3	9
	Three (Genetics & Reproduction)	17	6.06	2.11	3	9
Final Exam: Genetics Content	One (Control)	24	14.21	4.49	3	20
	Two (Meat Science & Nutrition)	11	15.27	3.58	9	21
	Three (Genetics & Reproduction)	17	14.94	2.95	10	20
Final Exam: Nutrition and Digestion Content	One (Control)	24	49.00	12.90	19	66
	Two (Meat Science & Nutrition)	11	53.82	10.18	35	67
	Three (Genetics & Reproduction)	17	44.82	12.60	27	66
Final Exam: Reproduction Content	One (Control)	24	18.25	4.32	8	24
	Two (Meat Science & Nutrition)	11	19.00	3.77	13	24
	Three (Genetics & Reproduction)	17	18.35	4.57	10	28

Note. Varying group sizes due to students missing exam(s) during the semester

as a higher minimum and maximum questions correct. Yet, the researchers noted that students in Group Two did not perform as well on meat science-related questions on the final exam, although this was an area in which they received experiential learning. While experiential learning has been known to be an effective teaching method, often, when utilized as a standalone instructional technique, does not lead to an increase in the acquisition of knowledge, as seen among student performance on exams in this introductory animal science course.

As noted in the centennial review of teaching animal science, conducted by ASAS, the need to re-evaluate the instructional techniques, learning outcomes, student performance, and classroom experience was established (Buchanan, 2008), especially as colleges and universities have been tasked to prepare students of diverse and untraditional backgrounds in agriculture and animal science programs (Erickson, 2020b; Deslauriers et al., 2016; Marshall et al., 1998; Mollet & Leslie, 1986; Reiling et al., 2003). Furthermore, additional challenges have emerged in teaching undergraduate students, including that within this study, some students were attending their first in-person class in two and a half years after online and hybrid instruction during the COVID-19 pandemic. Thus, it is important to continually examine and re-evaluate the teaching methods that are currently used, to determine how students are interacting in the classroom and overall engagement with peers, instructors, and the material being taught.

In preparing undergraduate students in the fields of agriculture and animal science, it has been noted that challenges exist in teaching real-world applicable skills and knowledge (Deslauriers et al., 2016). These challenges are often combated with the implementation of new content and use of improved teaching methods, suggested by the National Research Council in 2009 (Deslauriers et al., 2016). This included an increase in the use of experiential learning and active instruction in the classroom, which often influence knowledge acquisition in agriculture and animal science (Deslauriers et al., 2016; Erickson et al., 2020b). Within animal science curricula, hands-on opportunities often influence student perceptions and knowledge of specific content, including specialized areas within dairy science, beef science, and equine science (Erickson et al., 2019). Although researchers sought to determine whether or not experiential learning impacted student performance, it was determined that the group sizes impacted the overall results that were reported, and experiential learning sessions were not implemented appropriately throughout the semester. While researchers were unable to determine the overall significance of implementing experiential learning in an introductory course, researchers noted that assessment questions related to content taught in the experiential learning sessions may reflect a benefit in utilizing hands-on experiences for content in the course.

Recommendations

From the results of the study, researchers identified recommendations for future studies. This includes:

- Replicating the study with modifications, using enforced lessons and guidelines for laboratory activities to minimize external influences on knowledge acquisition and knowledge retention;
- Repeating the study with two introductory courses simultaneously, in which one course entirely utilizes experiential learning lessons and the other course utilizes traditional review sessions; and,
- Examining the implementation of experiential learning in an introductory animal science course, and the impact on student satisfaction and interest within the animal science program and industry.

Researchers also identified recommendations for practitioners in animal science, which included:

- Using required experiential learning activities in laboratory lessons to enhance what is being taught in lecture; and,
- Increasing awareness of the importance of experiential learning and hands-on learning activities in an introductory course.

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