Rapid online teaching: movement of animal science courses online during COVID-19. Case study: pedagogical decisions in transitioning animal science courses online

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ABSTRACT: Traditionally, earning a degree in animal science requires many face-to-face, hands-on courses; however, the COVID-19 pandemic created a situation in which traditional delivery of these courses may not be feasible as they provide a health risk to our students, teaching assistants, and instructors alike. This examination of two pedagogically different courses and how each was transitioned to an online format highlights the types of teaching decisions that are required to effectively teach animal science in an online format. The Farm Animal Production Systems lab was an animal handling and production practices lab, and although the transition to online delivery did not allow for students to participate in traditional hands-on development of skills, various resources were utilized that still achieved the development of animal handling concepts that will prepare students for later courses and work with live animals. In contrast, the Animal Science Laboratory Teaching Methods course remained consistent in format through the transition to online because students were still able to participate in discussion-based activities via Zoom meetings each week due to the small class size, which helped to maintain student engagement. However, the final teaching experience was modified to an alternative assignment. The alternate assignment included self-reflection and course evaluation that will help to improve both the Farm Animal Production Systems laboratory and the Animal Science Teaching Methods course in the future. Although COVID-19 has been a challenge that disrupted traditional courses, it has provided opportunities for a traditionally hands-on discipline, such as animal science, to more effectively engage students via an online platform.

Key words: animal science, emergency remote teaching, hands-on, teaching methods

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INTRODUCTION

Traditionally, undergraduate animal science curriculum requires student's completion of primarily face-to-face courses, many with accompanying animal laboratories. However, the COVID-19 pandemic has created a situation in which conventional delivery of such courses may not be feasible due to increased health risks for students, teaching assistants (**TAs**), and course instructors. A potential solution is the development of blended or fully online courses, which allows for delivery under conditions of possible quarantine and social distancing. Although a valuable means to keep those involved with animal science education safe, it is necessary to recognize that there is an inherent struggle with making a rapid transition to online education, particularly

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if there is minimal departmental precedent for online course offerings. An additional challenge facing animal science courses during the rapid online transition is the range of teaching strategies employed. This variation is expected as the discipline of animal science includes courses with content ranging from molecular biological sciences to application of animal industry practices and economics. Completion of a rapid, midsemester, conversion from face-to-face delivery to an online platform is not a typical approach to course design, and it is understandable that there would likely be concern about lost opportunities for learning. Although it may be difficult to consider utilization of online teaching for specific animal science content, there are strategies to minimize and/or mitigate the learning opportunities lost by going online; however, it is important to note that the strategies will vary depending on the course structure and learning outcomes (Gaytan and McEwen, 2007; Smith et al., 2009; Koskinen, 2010). This article serves to illustrate the course-by-course variation as it presents a case study for the rapid transition of online delivery of both a traditional, large enrollment, introductory-level course with a hands-on laboratory and a small enrollment, discussion-based course, focused on teaching methodology within the department of animal science. This situation provides a novel case study as the courses are connected as the students participating in the small teaching methods class serve as TAs for the large enrollment course with traditional animal handling laboratories.

MATERIALS AND METHODS

Course Descriptions and Characteristics

Farm Animal Production Systems Lab is a conventional animal handling and production practices course, which has a laboratory component that meets weekly for a 2-h lab period. The laboratory course curriculum includes content associated with the production practices, equipment, and handling techniques for five species of livestock (beef cattle, dairy cattle, sheep, swine, and horses). This is a large enrollment course (n = 312) thus requiring the creation of 12 individual lab sections (n = 26 students per lab) in the spring semester of 2020. This course serves as a prerequisite for all upper-level animal science departmental course offerings and is available for second-semester students majoring in Animal Science as a part of their undergraduate degree curriculum.

The Farm Animal Production Systems labs follow a consistent format each week. The labs begin with a low-stakes formative assessment over the previous week's material. This is in the form of a five-question quiz administered in class. Following the completion of the quiz, there is a brief introduction of the current week's labs objectives and discussion of relevant content and instructions for performing the lab activities, all of which is facilitated by a graduate student TA. The course is designed, so that the majority of the 2-h laboratory period is dedicated to the completion of the weekly learning objectives through participation in hands-on activities. These activities were typically presented as three to five workstations for undergraduate students to participate in and progress through in small cohorts. Student assessments included performance on weekly quizzes, laboratory attendance, and an end-of-semester practical in which students are asked to demonstrate proficiency with the physical techniques and/or the conceptual knowledge required to perform fundamental animal science production tasks.

Due to the volume of students enrolled in the course, efforts were taken to minimize animal impact thereby certain activities were developed using creative alternative supplies. As example, students were asked to perform an exercise in lamb tail docking via the application of a band to an appropriately sized piece of rope secured to a board. Additional examples include equipment identification and application demonstrations or accurately drawing syringes with household liquids of varying viscosities to simulate medications and then administering the solutions into fruit with a range of peel or rind thickness to model various injection methods and locations. To complement the simulations, students were also provided opportunities to engage with live animals and asked to perform tasks such as ultrasounding sheep, leading cattle on a halter, and snaring pigs. Content was typically first presented by a graduate TA demonstration and then followed guided practice with the students using shared resources within the smaller lab groups. Content was presented as stations enabled students to work as a group in order to develop strategies for completion of the assigned tasks. These strategies and or student tasks were revised by the TA and students were provided feedback and the opportunity to ask questions and/or continue to practice their skills during the lab time.

To maintain consistency between lab sections, a detailed lesson plan for the weekly laboratory was distributed to the graduate TAs from the lab

coordinator. Utilization of standardized lesson plan for the laboratory activities helped to ensure that each lab presented content and student activities consistently. The lesson plan included the learning objectives for the week, all content to be covered, instructions for each lab activity, and any additional information that would be required to teach the lab. All animals and materials were made available at the lab location and each laboratory was set-up ahead of time by the lab coordinator. As an additional learning opportunity for the TAs, the first lab period of each week was taught by the lab coordinator to demonstrate best practices for completion of the lesson plan and opportunity for contacting TAs if there were any required changes needed prior to instruction of subsequent sections.

The Animal Science Laboratory Teaching Methods course was designed to provide undergraduate students majoring in animal science with the opportunity to develop skills in the application of pedagogical theory within the context of animal sciences. In contrast to the conventionally designed and well-established Farm Animal Production Systems laboratory course, the Animal Science Laboratory Teaching Methods course was developed over the summer and fall semesters of 2019 and then taught for the first time in the spring semester of 2020. This course provides undergraduates a unique opportunity to gain valuable teaching skills and practice these skills in a supervised and supportive environment. This is a small enrollment course consisting of 10 undergraduates, most of whom had completed the Farm Animal Production Systems laboratory course the year prior. As part of the course, the students were expected so assist the Farm Animal Production Systems laboratory through service as an undergraduate TA. To identify the cohort of 10 students, animal science faculty members nominated students to participate based on their excellent performance and willingness to help their instructor and fellow classmates in past courses. An invitation was extended to each nominated undergraduate and those that had an interest in the topic and availability in their schedules enrolled in the Animal Science Laboratory Teaching Methods course.

The Teaching Methods course included a weekly classroom discussion of course materials that was conducted face-to-face on Friday afternoons for 1.5 h. Students also served as an undergraduate TA for one section of the Farm Animal Production Systems lab each week. In the classroom portion of the course, the lecture content was delivered using the Socratic method with a guided discussion allowing students to explore teaching concepts including assessment, group work, teaching techniques, and conflict resolution. Students were then able to apply the content relating to teaching skills via the creation of instructional materials and activities (lab quiz, lab practical station, lesson plan). Each of these assignments had two parts, the activity itself and a rational for the proposed activity. This activity was more heavily weighted in the assignment grade as this is where the instructor could gain insight into the students' understanding of pedagogical decision making. Students also had a real-time opportunity to display these skills in the Farm Animal Productions Systems Lab through their role as the undergraduate TA working to assist the graduate TA assigned to the lab section. The final project for the Animal Science Laboratory Teaching Methods course was intended to be creation of a lesson plan to be used for the facilitation of the Farm Animal Production Systems laboratory semester review. The students were then to be responsible for implementing their lesson plan and presenting it to their respective lab sections. Each student was to be graded on their lesson plan (by the instructor) and on their teaching performance (by their graduate TA supervisor for the semester) via rubrics created for the assessment of each individual component. The lesson plan was to be graded in advance of the student presentation to the Farm Animal Production Systems lab, so that the course instructor could ensure consistency with format and objectives across sections. As this course was taught for the first time in the 2020 spring semester, these components are described as they were intended to be delivered. Due to the COVID-19 pandemic and associated course modifications, the proposed final project required modification, which is addressed in subsequent sections of this manuscript.

RESULTS AND DISCUSSION

Mastery of animal science-associated course content is typically considered to require instruction that is hands-on and includes face-to-face experiences, and yet the events surrounding the COVID-19 pandemic have revealed that it is possible for students to achieve similar course learning objectives when delivery must be rapidly transitioned to an online format as well. Certainly, it is important to note that some courses have a more intuitive and seamless transition to an online format, whereas others require greater creativity and nontraditional approaches. The process of online course transition is influenced by many of the

same factors that guide pedagogical decisions in traditional face-to-face courses such as class size, animal/facilities availability, required course objectives, and expected student background skills or conceptual knowledge. The two courses discussed in this submission provide examples of courses with differing objectives and additional factors influencing pedagogical decisions. This case study provides an example of a large enrollment, multisectioned, introductory-level, skills-based lab with animal engagement as well as a limited enrollment, single-section, advanced-level, highly conceptual, and contextual-driven teaching methods course. These courses pre- and postpandemic-mandated transition to online allowed for the department to explore application of differing pedagogical approaches as they relate to courses within animal science.

Course Transitions to Online Format

A foundational aspect of the Farm Animal Production Systems Lab included assessment of student proficiency in application of skills and abilities associated with animal handling and production practices, which were challenging to rapidly transition to a fully online format as it was not reasonable to expect students to have access to livestock and equipment beyond the university setting. Additionally, the COVID-19 pandemic prevented on-farm visits from being a viable option or alternative for students, we had to opt for material that could be delivered and assessed fully online. The rapid shift to online delivery required that assessment focused more heavily on measuring student proficiency relating to achievement of learning outcomes through their ability to accurate describe and/or evaluate the skills of others that were recorded and presented for review. The ability of students enrolled in the course to accurately assess and critique the demonstration of the practices presented in the Farm Animal Production Systems course requires higher order learning outcomes including critical thinking and evaluation. This also required that they possess the fundamental understanding of the content and associated processes to perform such evaluations. The rapid shift to online delivery required increased effort by the instructor and TAs to develop content in the form of videos of animal handling and/or working facilities, process diagrams, and curation of supplemental readings all of which enabled students to prepare for obtaining the course objectives via indirect means that did not require a hands-on activity with animals or equipment. As Farm Animal Production Systems is a large enrollment course, for which students did not anticipate having to take via online delivery, it was determined to be impractical to require students (who had been required to leave campus) to obtain secure and reliable internet access necessary for synchronous Zoom meetings. At the urging of University administration, course materials were posted online in eCampus, the learning management system version of BlackBoard utilized by Texas A&M University. The decision was made to transition to an asynchronous delivery, so that students could access materials at their discretion and engage with the materials (including all digital content) at the level which they chose to do so. As the rapid online transition occurred midsemester, the topics that were presented in an exclusively online format included cattle handling, cattle production facilities, horse handling, and the semester review.

Using an asynchronous model, laboratory content and resources were posted each Monday at 8:00 am. This enabled all students to have consistent access to the material, irrespective of when their prepandemic, face-to-face laboratory section had been scheduled. The content posted included a lesson plan, providing students an overview of course materials and activity instructions relevant to that week's topic. Also posted were associated videos, pdf attachments of diagrams and/or readings, and practice questions, which allowed for the students to test their own comprehension of the material. On Wednesday of each week, a quiz would be posted at 8:00 am and students were required to complete before 11:59 pm on the following Friday evening. These quizzes were multiple choice and graded by the learning management system, which automatically populated the online gradebook. To ensure that each lab section had matching materials posted at the same time each week, all materials and assessments were posted by the lab coordinator instead of each graduate TA instructor. This shift in responsibilities caused the graduate TAs to assume a larger role in support undergraduate students via serving as a content resources, providing clarification when asked questions, and in some cases even providing a listening ear for students struggling in the post-pandemic educational environment. These were not the topics that the graduate TAs were tasked with in the prepandemic environment, and yet the rapid shift in online course delivery revealed the value in providing a resource for answering generalized questions, not necessarily for delivering topic specific course content.

The Teaching Methods coursed benefitted from having a small class size (n = 10 students); thereby, it was more reasonable to evaluate the student's ability to obtain an internet connection during the original course time. All 10 students were able to participate in weekly Zoom sessions, thereby allowing for a more seamless transition in the rapid shift to online learning. The course continued to meet on Friday afternoons utilizing question-led discussions to engage with course content. Occasionally students did experience connectivity problems that influenced the visual aspect of Zoom participation but utilizing the chat function within Zoom mostly mitigated these issues. Additionally, students could contact the instructor via email or phone to further clarify any missed information.

Although the format of the Animal Science Laboratory Teaching Methods course remained largely intact, the rapid transition to online delivery for the Farm Animal Production Systems Lab class meant that undergraduate TAs were essentially unneeded in their supporting role. Where they had previously assisted the graduate TA by providing additional hands and guidance to undergraduates completing laboratory activities, the transition to rapidly created digital content delivered asynchronously minimized their ability to engage in the course. Resultantly, the original instructional component of the undergraduate TAs, which was to be delivered face-to-face to students in the Farm Animal Production Systems laboratory was canceled and replaced with in-depth course evaluations of both the Farm Animal Production Systems Lab and Teaching Methods courses which included student self-reflections. Additionally, this allowed for students in the Animal Science Laboratory Teaching Methods course to redirect the time that they would have spent assisting in the Farm Animal Production Systems lab to greater exploration of pedagogical practices related to online educational components of STEM instruction.

Pedagogy Outcomes

As the Farm Animal Production Systems Lab is primarily a skills course, a more ideal online scenario would have been similar to online schooling for nursing students or veterinary technicians where students would have to perform skills in a way that could be verified by video stream/recording or by expert verification and signature such as an overseeing doctor or veterinarian (Billings, 2000; Dhein, 2007; Smith et al., 2009). Options such as these may be viable in the future but require extensive planning and organization that was not possible during the rapid online transition that was experienced in the 2020 spring semester.

Recognizing the inherent challenges with a rapid transition from a face-to-face, TA-supported environment to an asynchronous online platform where students could be affected by external factors such as internet availability and/or connectivity and changing schedules, the decision was made to ensure that course materials were available to students with potential accessibility and resource challenges. Videos of people handling animals and working in facilities were the most concrete (least abstract) examples that could be rapidly created and utilized. In addition, the videos were paired with descriptive narrations supplemental texts to provide students increased opportunities to further engage with the content.

The original effort to develop the course in Animal Science Laboratory Teaching Methods was initiated by both the need for more educational career-related opportunities in animal science and the value that undergraduate TAs can provide to the courses they assist with. A review of the literature reveals a gap in content related to training of undergraduate TAs in the discipline of animal science specifically. In contrast, general education literature and general STEM education literature present multiple examples of research relating to and supporting the use of undergraduates as TAs (McKeegan, 1998; Goff and Lahme, 2003; Sana et al., 2011; Weidert et al., 2012; Chapin et al., 2014). In STEM courses, student grades are comparable when either graduate TAs, undergraduate TAs, or both are utilized (Chapin et al., 2014). In some cases, positive student perceptions are actually increased from the perspective of both the undergraduate TA (Weidert et al., 2012) and the students they helped teach during the semester (McKeegan, 1998). When surveyed, students in the courses with undergraduate TAs reported more enjoyment in the course, as measured by student survey Likert scale questions, than the same courses without undergraduate TAs (Goff and Lahme, 2003). Moreover, undergraduate TAs who receive formal teaching training are more well received by the students compared with their peers without formal training (Sana et al., 2011).

Though they were only able to participate as undergraduate TAs for half of the semester (prepandemic), the course instructors received positive feedback from both the undergraduate TAs in this course and the graduate TAs they assisted. Positive comments from the undergraduate TAs were relayed to the professor as part of self-reflections as well as class discussion via Zoom. Some of the graduate

TAs also personally contacted the course instructor to state that it was helpful it was to have the undergraduate TAs to help during hands-on labs early in the semester. Additionally, some graduate TAs commented that the presence of the undergraduate TA in the laboratory increased the efficiency of the lab as opposed to the prior year (2019) when there were no undergraduate TAs available as the Animal Science Teaching Methods course had not yet been launched. In addition to the positive feedback regarding the course, there were also negative comments regarding the semester as presented by students in the Animal Science Teaching Methods course. All centered exclusively on the point that the rapid transition to online did not allow them to have the formal teaching experience as part of the face-to-face Farm Animal Production Systems lab at the end of the semester. Upon reflection, it would have been beneficial to attempt to maintain the connection between the undergraduate TAs and their Farm Animal Production Systems lab sections during and after the rapid online transition. Throughout the semester, the undergraduate TAs primarily served as student mentors and facilitated one-on-one or small group learning sessions, which allowed them to practice teaching on a small scale. The original intent of the course was for the undergraduate TAs to end the semester by presenting an entire laboratory session as the lead TA. Based upon student feedback, this was an eagerly anticipated experience. This would have been the highest impact assignment relating to the demonstration of their teaching skills; although cancelation of that aspect of the final project was unfortunate, it did allow for additional time spent on aspects of teaching methodology not originally planned for the semester. The primary topic added to the class during this transition was online education and how it differs from face-to-face teaching and ways in which it can still be an effective mode of instruction. We asked the students to evaluate the courses from a teacher's perspective and provide feedback on both the Animal Science Laboratory Teaching Methods course and the Farm Animal Production Systems Lab with which they assisted. This method of student feedback provided greater and more course specific course-related content than the general university-provided official survey, and the intent is to use these evaluations to guide future course changes.

CONCLUSION

Although COVID-19 has posed an unprecedented challenge to educational delivery, it has also created opportunities to practice and study animal science education in an online format, which is a growing area of significance. Adapting course delivery methods to serve circumstances caused by the pandemic allowed the continued trial of delivery methods, including various online methods, for a range of courses that are traditionally considered to be hands-on or face-to-face courses. The resulting teaching experiences have and will continue to improve teaching abilities, both via online and face-to-face delivery, and may help to change perceptions about the ability to present animal science content material via online resources, which could allow for increased educational opportunities for a larger audience. Investigation of animal science pedagogy is an ever-expanding area of research, and although a rapid online transition to online delivery is not an ideal situation, it did allow for the creation of interesting case studies that may be of use in shaping future pedagogical decisions.

Conflict of interest statement. None declared.

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