

Experiences in Collaborative Project-Based Study: There's a Heifer in Your Tank

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Abstract

The challenge to move towards a research and inquiry-based model of undergraduate education has faced higher education institutions for a number of years, particularly following the high-profile Boyer Commission (1998) in the United States. This challenge is even more difficult to overcome at the introductory undergraduate level. This paper examines the transition of an introductory University of Alberta Animal Science class from a standard lecture-laboratory class, to one heavily based on students seeking “answers to questions you did not know you had about animal agriculture,” culminating in a unique “There's a Heifer in Your Tank” public forum. The authors discuss project-based learning and the creation of an academic community of practice, explore how they implemented an introductory level project course in Animal Science, examine the challenges and opportunities that this particular hybrid model of inquiry-based undergraduate education presents, and review the impact those changes have had on agricultural education at the University of Alberta.

Introduction

The integration of experiential learning opportunities into senior level capstone courses has been widely evaluated and put into practice (Andreasen, 2004). However, one of the more challenging, and important issues raised by the Boyer Commission (1998) in the United States was to create an inquiry-based first year experience to set the stage for a research-based undergraduate education. The transition from secondary to tertiary education is one that must be handled appropriately by post-secondary institutions to ensure that students are able to succeed in an environment that challenges them to develop critical thinking, inquiry, and other higher order skills necessary for our new knowledge-based society. Many university disciplines struggle to

balance the content that traditional teaching practice dictates is necessary to ground students in any given discipline and the need to make students more engaged in the inquiry process that the educational literature emphasizes as beneficial to students' learning. For the 2004-2005 academic year the teaching team of introductory Animal Science 200 at the University of Alberta decided to introduce a more project-based learning model, as a hybrid-inquiry based learning environment, which focused on the development of those higher order skills. This paper will explore the transition from a standard lecture/laboratory class, to one heavily based on students seeking “answers to questions you did not know you had about animal agriculture,” culminating in a unique “There's a Heifer in Your Tank” public forum.

Much of the discussion in higher education about the implementation of inquiry-based learning opportunities in the first year of undergraduate studies is primarily limited to small enrollment seminar experiences, which are not necessarily feasible in all contexts. For example, in discussing the need to move towards an inquiry-based first year, the Boyer Commission restricted its main recommendations to three broad areas - seminar learning, block scheduling (cohort programming), and remediation before admission (Boyer Commission 1998). They did not, however, make any recommendations about how to move towards an inquiry-based model of education in a larger class environment. In the United States there have been attempts to track the effect that the recommendations of the Boyer Commission have had on research intensive institutions. Results showed that “research universities generally offer freshman seminars; a few provide freshmen limited opportunities to work on research and creative projects; and many use block scheduling” (Boyer Commission, 2002, 12).

There have been several best practices of introductory level inquiry seminars that have been

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successfully implemented in higher education, including the Health Sciences Inquiry program at McMaster University in Ontario (McMaster University, 2006), a freshman soil science course at the University of Nebraska (Sorensen et al., 1992) and an introductory food science course at Texas A&M University (Murano and Knight, 1999). Most of these best practice examples rely on smaller classroom environments conducive to a seminar-based approach. Little discussion has been initiated on what might be achieved in larger class environments. While Animal Science 200 is not a large class by any traditional definition, it consistently has enrollment above 40 or 50 students, which limits the effectiveness of seminar-style teaching strategies. It has been necessary, therefore, to implement projects that have allowed students to participate in an effective inquiry process in a larger class environment.

Another important consideration behind the move to an inquiry model of first year undergraduate education is the potential impact it may have on the creation of a cohesive and integrated department culture, which allows and encourages undergraduate students, graduate students, and faculty to interact and engage with each other. Establishing a sense of community is an important principle in reinventing an undergraduate education that was raised by the Boyer Commission (1998). Brew argues that the effective integration of teaching and research is necessary to move towards a student-centered conceptual change in teaching, and that inquiry models of learning are among the best ways for institutions to proceed towards that goal (Brew, 2003). She maintains that by integrating conceptions of research, scholarship and student learning, we can implement academic communities of practice. Academic departments and disciplines can be seen as networked communities of practice, within an overarching institutional (university-wide) scholarly community (Brew, 2003). It is essential, therefore, in order to successfully move towards the research-based learning environment suggested by the Boyer Commission, that the academic community be inclusive of students at all levels.

This transition was initiated at the University of Alberta to provide students with opportunities to work in small groups in order to develop critical thinking and inquiry skills and to improve oral and written communication skills that will benefit students beyond the class. Within that broader framework, the teaching team established the following objectives:

- Develop problem solving skills early in university to aid in life long learning;
- Create awareness of issues facing livestock and poultry producers;
- Provide a forum to develop skills in team-work, public speaking and electronic media presentation;
- Establish links between students, faculty and industry groups;

- Boost student confidence through positive experiences;
- Introduce non-agriculture students to agricultural issues and to encourage them to think of agricultural education and career paths; and
- Provide consumers with science-based answers to questions relating to agriculture.

These objectives, which could be commonly applied to any agricultural program, shaped the development of a collaborative project-based learning environment, which culminated in a public forum called "There's a Heifer in Your Tank."

Methods

A project-based learning experience was carried out involving groups of two or three students in three different cohorts of Animal Science 200 (Principles of Animal Agriculture) at the University of Alberta, beginning in the fall term of 2004. This course is the entry-level Animal Science course and comprises about 60% Agriculture students with about 40% of the class representing other disciplines (Science, Education, etc.). Approximately four weeks into the semester, students formed groups either randomly (Cohorts 1 and 2), or on the basis of common interest in a particular question (Cohort 3). Each term a list of about 30 potential questions was presented to the students by the teaching team, which comprised an instructor and either two or three graduate teaching assistants. Specific phrasing of each question was undertaken to appeal to a wide range of people, with a particular focus on engaging non-science or non-agriculture students.

Students were advised that while their question may appear to be either overly simple, or in some cases overly complex, the challenge was to answer the question for members of the public in a way that they would convey the science underlying the answer to the question. They were instructed to prepare a three and a half minute PowerPoint presentation relating to their question and answer. It was suggested to limit the presentations to no more than six PowerPoint slides. The slides could contain text, photos or movie clips. Students were advised to prepare their presentation for a diverse audience of agriculture and food personnel, members of the university community and local food consumers (including the students' family members). Students in the second and third cohorts were encouraged to consider incorporating drama, music or other creative media to lighten the delivery so that it would appeal to more members of the audience.

Students were allocated approximately four weeks to research their question, determine the answer and become familiar with the subject area so they could answer questions on the subject. The presentations were e-mailed to the instructor and students were allowed the opportunity for one practice session with their lab group one week prior to grading. This was particularly useful for the

Experiences in

students so that they could compare their output with that of their peers and respond with increased output if necessary. Presentations were assessed by the instructor and teaching assistants during the lab session and marks were assigned by consensus of the teaching team. The percentage grade allocation of this project varied between cohorts (Cohort #1 and #3 at 30%; and Cohort #2 at 20%). Within this overall allocation, the presentations were graded on content of the presentation (two-thirds) and on the quality of the oral presentation (one-third). Students were notified that they would have the opportunity for differential grading between the group members if participation in this project was not considered by the group members to be equal.

The presentation to the lay community took place in an evening forum billed as “There’s a Heifer in Your Tank Science Answers to Questions You Didn’t Know You Had About Animal Agriculture.” A key component of the presentations was a panel of four to eight individuals who questioned the students, offered comments or put students at ease following each presentation in an “American Idol” format. The panel members represented the agriculture industry, primary, secondary, or tertiary educators and local news media personnel. In the latter two cohorts, a pianist doubly entertained and kept the students on time by playing a short musical selection which complimented the presentation subject. To encourage audience participation, people were asked to submit a written question about animal agriculture. These questions were evaluated and the ones considered by the panel to be the best were awarded prizes.

Cohorts #1 and #2 presentations were held on the campus of the University of Alberta. The Cohort #3 Presentation was staged at Northlands Park, as part of the Northlands Fall Fair, which is the regional animal agricultural showcase event. Tickets to the public forum were free with a donation to the local food bank. Sponsorship to cover costs for venue rental, refreshment breaks and volunteer shirts was provided by various agriculture commodity and government agencies.

Results and Discussion

While the participants of the three cohorts, and the members of the community that attended the public forums, would all attest to a more enjoyable learning environment, the key driver for continuing this form of project-based learning is the significant

improvement in the learning objectives established for the course. The questions students examined all have an important scientific component to them, which addresses aspects of the curriculum content that traditionally makes up the core of introductory Animal Science. A sample of the questions previously used is presented in Table 1.

Table 1. Sample Questions Used:

- If a hen lays eggs and defecates out the same opening, why are most eggs laid sparkling clean?
- Is it logical and ethical to euthanize all male egg-type chickens at hatch?
- Why aren't all Hereford cattle used in commercial production polled?
- Do cattle consume hormones in nature?
- Do double-yolked eggs arise when hens are mated twice per day?
- If the manure produced from all pigs in Alberta was put in a space the area of the main campus of the University of Alberta how deep would it be?
- What parts of pigs make what parts of crayons?
- Should you feed beans to your cow to get her to produce more methane?
- In which stomach does a cow get acid indigestion?
- Why do cows smell like cows, but pigs smell like money?
- Why do cattle eat their placenta? Do they like the taste or is it peer pressure?
- Is all offal awful?
- Who's head and who's cheese is in headcheese?

The format chosen by students in the first cohort was a traditional short PowerPoint presentation style. Some groups added humor. For example, the question “why don't sheep shrink in the rain?” was answered (by two young men in very shrunken sweaters) peppered with comedy as well as science. Over time, the use of drama and illustration has developed to a high level. The question “Do hens listen when the rooster crows?” followed a safari scout theme featuring students acting as male and female poultry. The third cohort presentations featured live cattle on stage.

While the students expressed a high level of satisfaction in the revised course, formal evaluation of how these students have embraced the higher order skills emphasized in the Boyer Commission's push for a research-based learning environment and an inquiry-based first year experience (Boyer Commission, 1998) is underway.

The name of the public forum arose from one of the most memorable questions in Cohort 1: “If your car burned methane, how far could you travel on the methane from one cow?” This question, subtitled “There’s a Heifer in Your Tank,” was used to create and maintain a distinct visual identity, which has been highly successful. A logo was developed (see Figure 1), which has been used on shirts, brochures and web material, and has resulted in the acceptance of the acronym HIYT. This distinct visual identity has resulted in an increased awareness of Animal Science across campus, and throughout the broader community. This has helped to increase recruitment of students into the Faculty of Agriculture, Forestry and Home Economics at the University of Alberta, and has also increased the number of students taking Agriculture courses as options within other programs.



Figure 1. Logo used to establish and maintain visual identity of the program.

Student evaluations (quantitative scores and anonymous written comments) provide support that the project has been very well received by students in each of the three cohorts. Further study is underway to understand how this project engaged students and motivated them to do well academically in the class. Mankin et al. (2004) surveyed students in all four years of an agriculture program and reported that the strongest factor to motivate students to learn was a real-life assignment with a high degree of profession relevance. This observation was consistent across all years of students, irrespective of GPA.

Also a strong sense of community has developed around the HIYT initiatives. These student cohorts demonstrated a much stronger sense of identity than the nineteen previous cohorts of this class taught by the same instructor. Evidence of this was apparent in the strong student collaborations across groups and a high degree of participation in class extra-curricular activities. Several students commented on course evaluations that this class was their only class all year where a sense of community was felt. Aligning with the Boyer Commission's recommendation, this identity helped engender a sense of community that many students maintain even as much as two years after completing the course (Boyer Commission, 1998). It is important, however, that this sense of community is within the context of the academic learning environment, or in Brew's terms, within an academic community of practice (Brew, 2003). This learning experience brought diverse students together and new friendships developed which students do value. This has been acknowledged to be a positive outcome of cooperative learning in other freshman experiences as well (Sorenson et al., 1992; Murano and Knight, 1999).

There are several concerns, from a teaching perspective, that must be addressed to make this type of project-based learning successful. The balance between content versus process needed to be monitored continually across the three cohorts. When learning objectives are clearly defined, an effective evaluation of whether or not the course was successful can be undertaken at the end of each term and

appropriate modifications made for subsequent terms. It would be relatively easy to allow the project-based learning process to overwhelm the content, which is still necessary to lay the foundations in Animal Science at the introductory level. This initiative has also been extremely resource intensive both fiscally and in terms of the time invested in the course by the teaching team, particularly because of the scope of the presentation event. External support, in the form of sponsorship, has been critical to the success of "There's a Heifer in Your Tank." While the principles of the course can be implemented in virtually any disciplinary context, access to industry and government organizations willing to contribute to the course has been essential. To manage the course effectively it has also been essential to have a team of people dedicated to its delivery.

From a student perspective, there are also a number of concerns about which the instructor must be aware. Occasionally some student groupings were not as functional as they should have been, due to differences in leadership skills and commitment to group learning. This has been reported earlier in an introductory cooperative learning course in soil science (Sorensen et al., 1992) where some students took extra time to learn how to contribute to group work. Completing the projects within the context of the overall course in a single semester has proven to be challenging. This is particularly true of the time students allocate to this course. The student course evaluations have indicated that they consistently spend too much time on the 'fun' projects, to the detriment of their other course expectations both within Animal Science 200 as well as their additional course load. As well, this extra level of commitment has led to potential grade inflation with many highly-motivated students excelling at these projects that make up a significant portion of their final grade.

Summary

The plans for the fourth HIYT "Community Edition" will feature participation from others in the local community who are impacted by agriculture, including a junior high school jazz band of 50 students, a HIYT Chorale made up of 30 community choir members, and an "Alumni Challenge" featuring a mass presentation by 30 previous Animal Science 200 students who only received their question 24 hours before the presentation. Future HIYT classes may move the public presentations to rural communities, to interact with different members of the food consuming public.

These principles of inquiry and the development of an integrated academic community of practice has motivated the transition to a project-based learning model for introductory Animal Science at the University of Alberta. The restructuring of this class, and the success it has enjoyed among students, faculty and the community-at-large, has seemingly raised the profile of agricultural education offered at

Experiences in

the University of Alberta. The transition has helped by increasing student engagement and student confidence in significant ways, increasing recruitment into the Agriculture program, encouraging more Science and Education students to take the Animal Science course as an option for their programs, and involving both parents and the wider community in Edmonton Alberta to be engaged with the students and faculty in the program. It has also helped the Faculty of Agriculture, Forestry and Home Economics at the University of Alberta move towards an inclusive academic community of practice for students and faculty.

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