(ISSN 0149-4910)

NACTA

north american colleges and teachers of agriculture

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Vol. 60, No. 3 • September 2016

a publication of the NORTH AMERICAN COLLEGES AND TEACHERS OF AGRICULTURE

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Vol. 60, No. 3 • September 2016

NACTA Journal (ISSN 0149-4910) is published quarterly by the North American Colleges and Teachers of Agriculture (formerly the National Association of Colleges and Teachers of Agriculture). It is directed toward the scholarship of teaching and learning in agricultural, environmental, natural and life sciences by presenting articles covering topics that treat all aspects of teaching such as methods, problems, philosophy, and rewards at the college level. All manuscripts undergo double-blind peer review. An author's guide for manuscript preparation is available on the NACTA web page: http://www.nactateachers.org/ or are available upon request. Page charges of $100.00 per manuscript are waived if one of the authors is a NACTA member at the time of publication.

All manuscripts submitted to the NACTA Journal are submitted and reviewed electronically. To submit a manuscript to the NACTA Journal, go to this website: http://nacta.expressacademic.org/

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The Journal is published electronically/online and quarterly - March, June, September and December. The issues for the current year are available to NACTA members at this website: http://www.nactateachers.org/journal.html, a login and password obtained through membership is required.

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A yearly hard copy of all four issues is printed in December.

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NACTA Journal
the professional journal advancing the scholarship of teaching and learning in agricultural, environmental, natural and life sciences

Contents

A Philosophical Examination of School-based Agricultural Education and NBC's Education Nation

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Abstract

The purpose of this study was to show how school-based agricultural education (SBAE) complements the philosophies and practices of Education Nation and the Common Core State Standards Initiative. Education Nation touts the importance of common core standards, industry ties, college and career preparation and community involvement. Using qualitative content analysis, four researchers reviewed journal articles, meeting proceedings, magazines, texts, agricultural education documents and Education Nation media outlets to conclude that agricultural education espouses the principles put forth by Education Nation. Reviewed literature was classified into four categories representing important parts of the SBAE program: influential philosophers, teaching methods/approaches, FFA and supervised agricultural experience (SAE) programs. After reviewing journal articles, meeting proceedings, magazines, texts, agricultural education documents and Education Nation media outlets, researchers found that agricultural education's use of individualized instruction, innovative teaching methods, community involvement and career and collegiate preparation embodied the beliefs of Education Nation. Agricultural education's use of the three-circle model of classroom instruction, FFA and SAE provides an example for the implementation of Education Nation's principles in real—world classroom settings.

Introduction

In 2010, NBC News created a new initiative, Education Nation, to "explore the challenges and opportunities in education" (NBC News Education Nation, n.d., para. 2). Education Nation has held four summits in order to discuss what organizers believe to be important issues in education. These issues included common core standards, industry support, community engagement and college and career readiness (NBC News Education Nation, n.d.). At the summits teachers, parents and students consult with leaders in politics, technology and business in order to improve education in the United States (NBC News Education Nation, n.d.)

Education Nation has called for common core standards to be used to promote consistency and clarity between teachers, parents and students regarding what the student is expected to learn (Common Core State Standards Initiative, 2012). Common core standards are intended to ensure that students receive a consistently high quality education in order to prepare them for postsecondary education or careers (Common Core State Standards Initiative, 2012). In writing the standards, the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO) sought input from national organizations, teachers, administrators, industry experts

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and postsecondary educators (Common Core State Standards Initiative, 2012).

Today, over 800,000 students participate in School Based Agricultural Education (SBAE) throughout all 50 states and three territories (The Council, 2012). The SBAE mission of "prepare[ing] students for successful careers and a lifetime of informed choices in the global agriculture, food, fiber and natural resources systems" is still producing successful students today (The Council, 2012, para. 3). SBAE has been primarily concerned with preparing students for agricultural careers and advanced education (Newcomb et al., 2004; Phipps et al., 2008), which has been done through the use of the three-circle model of classroom instruction, SAE programs and the National FFA Organization (Newcomb et al., 2004; Phipps et al., 2008). With this being known of agricultural education and Education Nation, it is vital for agricultural education teacher preparation programs to understand the philosophical similarities between these two programs in order to best prepare preservice agricultural education teachers.

Purpose and Objectives

The philosophical underpinnings of SBAE have been prevalent in the literature and resonate throughout SBAE programs. For example, priority five of the National Research Agenda for Agricultural Education (2011) focused on providing effective SBAE programs that offer high quality academic development, as well as career success. Therefore, the purpose of this study was to compare educational practices used within SBAE and educational practices espoused by Education Nation in an effort to show how SBAE complements the educational philosophies and practices set forth by Education Nation.

Methods

This philosophical paper utilized qualitative content analysis to analyze the collected Journal articles texts, agricultural education documents and Education Nation media outlets. Due to the use of historical data, the University of Georgia Institutional Review Board exempted this research from IRB review. According to Bauer (2000), qualitative content analysis may be used to analyze data collected from any source, including media outlets. In accordance with Flick (2006) a theoretical model was used to help derive the categories. Agricultural education's three-circle model was used as the theoretical model and consists of the following three components: classroom/laboratory instruction, supervised agricultural experience (SAE) and FFA (Newcomb et al., 2004; Phipps et al., 2008). Four researchers reviewed each of the collected journal articles, meeting proceedings, magazines, texts, agricultural education documents and Education Nation media outlets to ensure consistency. The following two journals were selected due to their acceptance in the field of agricultural education: (a) Journal of Agricultural Education/ Journal of the American Association of Teacher Educators in Agriculture (18 articles) and (b) Journal of Southern Agricultural Education Research (1 article). Additionally, an Internet search was conducted to locate and review additional documents that would provide insight for the research. Two articles from the Agricultural Education Magazine, one proceeding of the American Association for Agricultural Education, two documents from the National Council of Agricultural Education, one article from The School Review, one Common Core document, eight Textbooks and the Education Nation website were selected as part of the documents used for the content analysis. A total of 35 documents were selected and examined for this study. The documents date from 1938-2012.

The journal articles, meeting proceedings, magazines, texts, agricultural education documents and Education Nation media outlets were compared with one another and were exposed to a procedure that allowed for the reduction of data. The initial reduction of data disregarded data that was deemed irrelevant to the study (Flick, 2006). The second round of data reduction lumped similar findings together and allowed for the summarization of the findings (Flick, 2006). In order to uphold the trustworthiness and rigor of the study, the researchers utilized peer-debriefing, methodological journaling, saturation of the data, triangulation and rich thick descriptions of the data (Lincoln and Guba, 1985).

Results/Findings

Based on the analysis of journal articles, meeting proceedings, magazines, texts, agricultural education documents and Education Nation media outlets research, the results/findings sections were categorized into four sections: influential philosophers, teaching methods/approaches, student organizations/FFA and work based learning/SAE. Each one of the identified categories represents an integral part of the SBAE program and the goals of Education Nation and focuses on providing educational experiences that lead to academic growth and career success.

Influential Philosophers

John Dewey

Dewey (1938) called for an educational environment that moved away from traditional teacher centered classrooms, which required students to regurgitate information, to a progressive approach in which students were submerged in a contextual experience and encouraged to learn based off of the experience. Learning takes place through authentic experiences in which the learner focuses on prior knowledge in order to make sense of the current situation (Dewey, 1938). According to prior literature, Dewey's philosophy has been incorporated in SBAE program's delivery for at least the last 25 years, due to a programmatic change from vocational education to career and technical education (Phipps et al., 2008; Roberts, 2006). Additionally, Education Nation purports that it is imperative to provide students with the opportunity to experience Science, Technology, Engineering and Mathematics (STEM) through

non-traditional means which include: scientific exploration, opportunity and means to invent new technologies and products and the empowerment of solving real world problems (Martin, 2014).

Charles Prosser and David Snedden

During the beginning of the 20th century, Charles Prosser and David Snedden began to promote the need for agricultural education to become more vocational in nature (Gordon, 2008). Prosser and Snedden believed that the purpose of public education was to develop a better-educated workforce to promote the American industrial economy. During the writing of the Smith-Hughes Act of 1917, Prosser was given the opportunity to assist in the development of the purposed bill, allowing for agricultural education to become more vocational in nature (Moore and Gaspard, 1987). The work of Prosser and Snedden has had a lasting impact on the instructional outcomes of agricultural education (Gordon, 2008).

Rufus Stimson

During the early 1900's agricultural teaching methods consisted of lecture and physical skill labor training on the school farm (Stimson, 1915). Rufus W. Stimson believed that these teaching practices were impractical because students were forced to watch others complete the skill due to limited supplies and equipment. Therefore, Stimson believed that students should utilize their home farms to practice and develop skills (Stimson, 1915). This belief is the foundation to Stimson's philosophy of vocational education (Stimson, 1907 as cited in Moore, 1988) and aligns with Education Nation's (2012) push for hands on learning and skill development.

The foundational tenets of the project method, an instructional methodology, were used to develop student skills and competencies (Stimson, 1915). Students were expected to utilize their home farms to conduct projects that would further their learning within agricultural education. Each project was designed to be hands–on and provide a practical real–world application of classroom instruction. Rufus W. Stimson has had a profound impact on Career and Technical Education, especially agricultural education, in the United States. Most prominently, his impact has been seen in the implementation of SAE. Agricultural education would be irreparably different without Rufus W. Stimson's innovation (Moore, 1988).

Teaching Methods/Approaches

SBAE has a tradition of utilizing teaching methods that support problem–based learning (Phipps et al., 2008). Teaching methods/approaches that have been categorized within problem–based learning include problem–solving, inquiry–based learning and experiential learning (Eggen and Kauchak, 2001). Teaching methods within the constructivist theory allow instructors to provide students with educational experiences that allow learners to construct their own knowledge in a way that encourages critical thinking and development of their own thoughts and opinions (Fosnot, 1996). The central tenet of constructivism posited that the learner creates personal knowledge and meaning based on their personal experiences (Steffe and Gale, 1995). Constructivism is divided into a continuum, which includes cognitive constructivism, social constructivism and radical constructivism (Doolittle and Camp, 1999). According to Doolittle and Camp (1999), Career and Technical Education aligns neatly with cognitive constructivism and adheres to the central tenets that knowledge is actively constructed and that cognition is a process that is continually evolving (Von Glasersfeld, 1984, 1998).

Additionally, SBAE has utilized Kolb's (1984) model of experiential learning as a conceptual framework for providing students with an authentic learning experience for many years (Phipps et al., 2008). Kolb's comprehension of experiential learning consists of a concrete experience, reflective observation, abstract conceptualization and active experimentation. The curriculum within SBAE programs allows instructors to provide an experience for the student that aligns with the curriculum (Phipps et al., 2008). According to Phipps et al. (2008), the instructor would focus on personal reflection in order for the student to think about the experience and break the reflection apart in an effort to make sense of the experience. The abstract conceptualization stage would then allow the student to create rules and generalizations regarding the experience and the exemplified concept (Kolb, 1984). The final stage allows for the student to test the generalizations they created (Kolb, 1984). An experiential learning philosophy aligns with the learning theory of constructivism and has been commonly used in the SBAE classroom (Roberts, 2006).

The problem–solving approach has also been used extensively in SBAE (Boone, 1990; Phipps et al., 2008) due to Dewey's (1938) educational philosophy that emphasized the importance of an experience in order to entice students to think critically about the issue at hand. According to Phipps et al. (2008), the problem–solving approach that has been used in SBAE consists of the scientific method and allows the student to develop critical thinking skills that help the student to thrive in a complex society. Boone (1990) posited that the problem–solving approach allows students to utilize the scientific method in a way that allows the student to critically think through a problem, test probable solutions and access results. The researcher found that "the problem solving approach to teaching increases the level of student retention of agricultural knowledge learned during an instructional unit" (p. 25). A study conducted by Dyer and Osborne (1996) found that problem–solving approach is more effective in strengthening the problem solving capabilities of students than the subject matter approach. The problem–solving approach has been widely accepted by SBAE and has been considered one of the best methods of teaching agriculture (Phipps and Osborne, 1988).

SBAE has included science as a part of its curriculum since the advent of agriculture classes in the public school (True, 1929). Agriculture has been shown to be an appropriate context for science integration (Thoron et al., 2011). Increased emphasis on standardized testing has prompted SBAE to focus on science integration in an effort to enhance students' science knowledge, which would be accessed through standardized tests (Ricketts et al., 2006). A study by Ricketts et al. (2006) supported previous research that found students enrolled in agriscience courses scored higher on standardized science tests than students that were not enrolled in agriscience courses (Enderlin and Osborne, 1991; Mabie and Baker, 1996; Conroy and Walker, 1998; Chiasson and Burnett, 2001). Agriscience courses play an important role in increasing students' scientific ability by providing a context for scientific concepts and application (Ricketts et al., 2006). SBAE currently has teachers that believe it is important to continue adding science concepts into the agriscience curriculum (Thoron and Myers, 2009). However, the need for continued science integration is inherent with in–service and pre–service teachers (Thoron and Myers, 2009). According to Thoron and Myers (2009) SBAE is currently at a unique point in its evolution. The current generations of pre–service teachers have experienced the push for science integration when they were secondary students (Thoron and Myers, 2009). This experience has helped to create agriscience teachers that understand the importance and significance of continued science integration into SBAE (Thoron and Myers, 2009).

Myers et al. (2009) found that the majority of the members of the National Agriscience Teacher Ambassadors Academy (NATAA) surveyed used inquiry–based techniques at least two times per week. In addition, 68% of the NATAA instructors surveyed provided time for students to design and conduct experiments at least once a week. Thoron et al. (2011) found that professional development focused on inquiry–based learning helped to increase in-service teachers' knowledge of inquiry–based instruction and to "maintain positive perceptions of their teaching and school environment" (p. 103). Similarly, NBC News Education Nation (2011) highlighted a science teacher's classroom in which the students were learning about physics by using hands on learning that included designing and conducting experiments.

In addition to SBAE's focus on academic integration, SBAE fulfills a vocational role that provides technical skills to students that may be applied to the agricultural workplace (Dailey et al., 2001). By providing a plethora of agricultural courses, SBAE has been able to provide students with the opportunity to learn and enhance many workplace skills that may be transferred to different types of careers (Dailey et al., 2001). According to Education Nation (2012b), schools should provide students with a solid education in STEM, which will allow the student to be equipped with the appropriate knowledge and skills to obtain employment, apprenticeships and admittance into community colleges, vocational schools, or four-year degree programs.

FFA

As a member of FFA, students have the opportunity to participate in a number of events and activities, including Career Development Events (CDEs), officer positions and chapter–level activities. Studies have shown that students who were FFA members had more leadership and personal development abilities than non-members (Stewart et al., 1985, as cited in Rutherford, Townsend et al., 2002).

The FFA mission states *"The National FFA Organization is dedicated to making a positive difference in the lives of students by developing their potential for premier leadership, personal growth and career success through agricultural education"* (The National FFA Organization, 2012). Additionally, agricultural education is often recognized as educating the whole person and providing life knowledge, characteristics of many CTE classes. Career Development Events are designed to encourage to students develop abilities that will help them in a competitive job market, such as critical thinking and communication (National FFA Organization, 2012). Career Development Events such as Prepared Public Speaking, Livestock Evaluation and Parliamentary Procedure help FFA accomplish its mission. In order to keep CDEs up to date and relevant, the materials are often selected and organized by colleges, universities and industry leaders. At the national level, there are 24 CDEs (National FFA Organization, 2012). Depending on the event, students may compete individually, or as teams (National FFA Organization, 2012).

Membership and participation in the FFA has been shown to have many benefits to students. Talbert and Balschweid (2004) found that FFA members statistically rated agricultural education and history and social studies as more important than non–members. The significantly higher rankings of these topics may contribute to the students' personal growth and subsequent career success. In another study, students and graduates who had FFA membership or were in high school agriculture education classes rated higher in the cooperative/helpful and pleasant/friendly/cheerful categories on the Affective Work Competencies Inventory than non–members or those who were not in agriculture classes (Benson, 1982). This study demonstrates the affect that FFA has had on these members' career success and leadership qualities. Not only do supervisors see the benefits, FFA members do too. Carter and Neason (1984) compared the self–perceptions of personal development of FFA members who had high and low participation using the Personal Development Index. Members with high levels of participation rated themselves statistically higher than low participation members on leadership, orientation to agricultural occupations, citizenship and cooperation (Carter and Neason, 1984). Members who were categorized as having high involvement also had overall higher self–perceptions of personal development

(Carter and Neason, 1984). Carter and Neason (1984) demonstrated that high FFA participation could be linked to feelings of self–efficacy in leadership and traits connected to development of the whole person.

As part of being an officer at any level, an FFA member is expected to take a leadership role, grow from the experience and improve the chapter (National FFA Organization, 2012). Several studies have been conducted on FFA officers in an attempt to determine how serving as an officer has affected them. In 1979, Owings and Nelson attempted to determine the personality traits of FFA officers who attended the 1976 leadership conferences at the National FFA Center and to compare the traits of state and chapter officers. The Myers–Briggs Type Indicator was used to determine traits. After analysis, it was found that 72.1% of the sample was extroverted rather introverted, 68% were sensing rather than intuitive, 62.6% were feeling rather than thinking and 59.9% were judging rather than perceptive (Owings and Nelson, 1979). Chapter and state officers differently significantly only on the sensing/intuitive measure, with more state officers classified as intuitive than chapter officers (Owings and Nelson, 1979). Owings and Nelson summarized by describing the typical chapter officer at this conferences as, "outgoing, good with detail and routine, people–oriented and working well under structured situations" (Owings and Nelson, 1979, p. 43). This study again shows the importance of FFA when describing those who would likely be successful, demonstrating the addition to the officers' life knowledge.

Rutherford et al. (2002) assessed FFA members attending the Washington Leadership Conference (WLC) in 1997 regarding their self–perceived leadership skills using the Leadership Skills Inventory. Statistically significant relationships were found between level of involvement in FFA and working with groups, understanding self, communicating, decision making and leadership (Rutherford et al., 2002). Additionally, participants who were officers at any level had significantly higher leadership scores than non–officers (Rutherford et al., 2002). A study conducted by Wingenbach and Kahler in 1997 used the Youth Leadership and Life Skill Development Scale (YLLSDS) to determine that significant positive relationships existed between participation in FFA leadership activities and membership in FFA and YLLSDS scores. Both of the above studies indicate the positive affect that FFA has on self–perceived and independent measures of leadership qualities.

Not only do FFA members excel in leadership in high school, they continue to see success into their collegiate and working lives (Ricketts and Rudd, 2004; Park and Dyer, 2005). In 2004, Ricketts and Rudd concluded that former FFA Florida state officers considered their agricultural education program the most influential construct for development of their leadership ability, while the FFA construct was rated as the second most influential. Park and Dyer (2005) investigated the relationship between positions of leadership in a college of agriculture and prior high school FFA and 4–H experience. The results showed that FFA and 4–H members held more offices and were members of more organizations on average than those who were not FFA or 4–H members (Park and Dyer, 2005). Additionally, almost half of the college of agriculture's ambassadors were FFA members, while over a quarter were in 4–H (Park and Dyer, 2005).

Overall, FFA has a long track record of living up to its mission of "premier leadership, personal growth and career success" (National FFA Organization, 2012). FFA has also been shown to help educate the whole person and facilitate gains in characteristics that could be considered life knowledge. In conjunction with the three circle model of classroom teaching, SAE and FFA, FFA provides the opportunity to use classroom and individualized learning into a leadership environment.

Alumni and Community Involvement

The FFA Alumni Association is meant to help garner community support and assist agriculture teachers with recruitment, fundraising and personal development programs (National FFA Organization, 2012). Those interested in becoming an FFA Alumni member need not have been in FFA; membership is open to anyone interested in supporting FFA (Jewell, 1981). Jewell (1981) found that the presence of an FFA Alumni had a significant positive relationship with the percentage of agriculture students who were also FFA members and the number of advisory committee meetings. The presence of an alumni affiliate also somewhat positively affected teacher perception of administrative support, job satisfaction and familiarity with FFA activities (Jewell, 1981). FFA Alumni affiliates benefit the teacher and the FFA program through these positive relationships.

Though FFA has a long history of alignment with leadership, few studies have been done explicitly addressing how FFA affects community leaders (Brannon et al., 1989). Brannon et al. (1989) formulated an instrument to determine community leaders' level of participation in and perceptions of vocational agriculture. The leaders indicated that vocational agriculture/FFA had a great impact on their success as community leaders (Brannon et al., 1989). Additionally, 44% of all community leaders and 49% of male community leaders were involved in vocational agriculture programs (Brannon et al., 1989). It was also reported that leaders who had participated in vocational agriculture had a higher degree of involvement in community activities than non–participants (Brannon et al., 1989).

SAE

SBAE has embraced the project method since Stimson first utilized the method in his classroom in 1908 (Roberts and Harlin, 2007). Today, the agricultural education profession uses the term SAE as the term for Stimson's project method (Phipps et al., 2008). Over the past 100 years, there have been several changes to the purpose of SAE in agricultural education. The focus on skill–based projects has shifted to a professional devel-

opment focus that enhances the students' knowledge of the agricultural industry (Roberts and Harlin, 2007).

Historically, SAE has been a form of individualized application for students to apply the knowledge gained from classroom instruction to a real–world setting (Newcomb et al., 2004; Phipps et al., 2008). When developing an SAE program, agricultural students individually select a project area that is tied to a career interest within the agricultural industry (Barrick et al., 1992; Newcomb et al. and Phipps et al., 2008). In turn, students are able to strengthen and develop workforce and societal skills necessary to be successful in their careers and life (Barrick et al., 1992). In addition, Roberts and Ball (2009) argued that industry relevant skills and knowledge must be incorporated in the agricultural education curriculum; SAE programs provide students the opportunity to develop these skills. Further, agricultural education programs must develop lasting relationships with industry representatives to ensure that students learn the necessary skills to be a productive member of the workforce (Phipps et al., 2008 and Roberts and Ball, 2009). Similarly, NBC News Education Nation (2012c) posited that a charter school in Miami, Florida, has successfully partnered with industry and developed programs in which students spend part of the day learning a skill that will prepare them for the workforce as well as post-secondary education. Partnerships with industry have created a strong relationship between the school district, industry and the community and have allowed students to have real life experiences that allow them to learn by doing (NBC News Education, 2012c).

According to the American Management Association's Critical Skills Survey (2010), U.S. employers reported that the future workforce must be equipped with skills beyond reading, writing and arithmetic, with skills such as problem solving and critical thinking. Phipps et al. (2008) stated that student involvement in SAE programs further promotes the acquisition of problem–solving and critical thinking skills. Students who complete an SAE program are required to make decisions that affect the program's economic productivity and overall success (Newcomb et al., 2004). Finally, the development of these vital skills will assist students in becoming successful members of society and well-prepared employees for the workforce (Barrick et al., 1993).

To ensure that SAE programs are properly implemented, teachers are expected to supervise the student's developed program (Newcomb et al., 2004; Phipps et al., 2008). Traditionally, supervision has occurred through annual home visits to the students' SAE programs. During the home visit, teachers are, in many cases, presented with an opportunity to interact with the student's parents. This opportunity is used to provide parents with an understanding of SAE programs as well as a set time that the teacher can garner support for the agricultural education program (Newcomb et al., 2004; Phipps et al., 2008). Similarly, teacher visits to industry partners and work-based placements for high school students allows the teacher to build relationships with both industry partners and the student (NBC News Education Nation, 2012c). Based on this interaction, a lasting impression can be made on parents that will further benefit the students' education (Phipps et al., 2008). Finally, parent, community members and employers can conduct more informal supervision (Newcomb et al. and Phipps et al., 2008). Further, support for the agricultural education program can be promoted through the interactions that community members and employers have with students' SAE programs (Phipps et al., 2008).

Conclusion/Discussion

Based upon the research and literature analyzed, agricultural education has embraced and embodied the principles presented and discussed by NBC's Education Nation. Through the use of classroom/laboratory instruction, the National FFA Organization and SAE, agricultural education provides examples for implementation of Education Nation's initiatives (Phipps et al., 2008). Since the passage of the Smith–Hughes Act of 1917, agricultural education has promoted individualized instruction, utilized innovative and proven teaching methods, promoted community support, conducted home visits and prepared students for the workforce or post–secondary education (Hillison, 1987; Moore, 1987; Phipps et al., 2008).

A variety of teaching methods are utilized within SBAE that promotes the overall goals of Education Nation. Some of the innovative teaching methods utilized in SBAE include: problem–based learning, experiential learning and inquiry–based learning (Boone, 1990; Myers et al., 2009; Phipps et al., 2008; Roberts, 2006; Thoron et al., 2011). The use of these teaching methods promotes student learning and knowledge retention through agricultural education (Phipps et al., 2008; Ricketts et al., 2006).

Members of the agricultural education profession must stand together and be recognized as an integral component to the educational profession/society. This requires agricultural education to adopt and implement the Common Core Standards and the initiatives of NBC's Education Nation. The need for preparing students for the workforce and postsecondary education is evident in SBAE (Newcomb et al., 2004; Phipps et al., 2008). Further, agricultural education promotes skill and career training through the curriculum that is taught in agricultural education programs (Newcomb et al., 2004; Phipps et al., 2008), supporting the needs presented by Education Nation (2012). To enhance students' preparation for the workforce and post–secondary education, students in agricultural education are presented with the opportunity to experience and apply their knowledge to real–world situations through the National FFA Organization and SAE programs. Through each component of the total agricultural education program, students are adequately provided with the resources to be successful in the workplace and post–secondary classroom (Newcomb et al., 2004; Phipps et al., 2008).

SBAE is firmly rooted in community support and need (Phipps et al., 2008), supporting Education Nation (n.d.) that encouraged parents and community members to have an interest in ensuring that student receive a high–quality education. The SBAE program promotes parental and community involvement through the integral components of FFA and SAE (Newcomb et al., 2004; Phipps et al., 2008). Through SAE programs, agricultural education continues to meet the call of Education Nation by conducting home visits to promote the agricultural education curriculum and student involvement in SAE programs (individualized learning).

Implications

This study provides findings that elicit three overarching implications for local SBAE programs, agricultural education organizations and agriculture teacher education programs. First, based on the findings that SBAE prepares students to enter the workforce or post–secondary classroom (Hillison, 1987; Moore, 1987; Newcomb et al., 2004; Phipps et al., 2008), secondary agricultural educators and agricultural education organizations (National FFA Organization, The Council, Team Ag Ed, etc.) should promote the achievements of their students on the local and state level. This could promote the need for SBAE in every public school, state and federal funding and local support for appropriate agricultural teaching facilities. Second, because students have been found to increase knowledge gain due to proven teaching methods (Phipps et al., 2008; Ricketts et al., 2006), secondary agricultural educators should continue to utilize innovative and proven teaching methods. This will assist students in developing problem–solving, critical–thinking and personal development skills. Further, teacher education programs should continue to prepare preservice teachers to implement proven and innovative instructional strategies and teaching methods. Third, because SBAE has historically demonstrated the goals and innovations of Education Nation and the Common Core State Standards (Phipps et al., 2008; Ricketts et al., 2006), teacher educators and secondary teachers must continue to promote preservice teacher education programs to high school and undergraduate students. Fourth, agricultural education teacher preparation programs must continue to rejuvenate curriculum to incorporate new and innovative strategies that enhance the overall education experience of high school and middle school students.

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Motivations and Barriers of Undergraduate Nontraditional Students in the College of Agricultural Sciences and Natural Resources at Texas Tech University[1]

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Abstract

The purpose of this study was to determine the motivations and perceived barriers of nontraditional undergraduate students in the College of Agricultural Sciences and Natural Resources (CASNR) at Texas Tech University. The nontraditional students in this study perceived intrinsic motivation, task value, self-efficacy and internal locus of control as their largest motivations to continue their education. Furthermore, the findings of this study indicated intrinsic motivation served as the greatest motivational force. Conversely, the participants perceived extrinsic motivation and test anxiety as smaller sources of motivation in their educational pursuits. The nontraditional students in this study perceived institutional barriers (i.e., barriers pertaining to instruction and educational planning), to be the greatest barriers to continuing their education. More specifically, the participants perceived the lack of a nontraditional student office on campus, mentoring program and nontraditional student support group as the largest barriers to continuing their education. The implementation of a stronger support system for nontraditional students at the university level, could potentially mitigate the barriers faced by these students. With that in mind, future research should be conducted to examine the benefits of various nontraditional student resources. This information could aid CASNR in selecting programs to benefit their nontraditional students.

Introduction

The latest report from the U.S. Department of Labor, Bureau of Labor and Statistics (2015) indicated an unemployment rate of 5% in the United States. The consequences of working or searching for a job, under the current economic pressures, have driven adult learners to remain "marketable and competitive" (Milheim, 2005, p. 120). The transformation in the job market has led many adults to return to school. While this could account for a major portion of adult students entering higher education, there are other factors. Some factors to consider include: value in continuing education, advancement for career, retirement plans and job losses (Kenner and Weinerman, 2011).

First, it is imperative to define the meaning of an adult learner or nontraditional student. This can be a definition that varies from campus to campus. However, a review of the literature indicated many nontraditional students are categorized by age, 25 years or older, delayed enrollment into higher education, military service, employment status, enrollment status at the university and number of dependents other than a spouse (Bye et al., 2007; Senter and Senter, 1998; Scott and Lewis, 2012; Wyatt, 2011). By this definition, nontraditional students now make up approximately 74% of the student population (Radford et al., 2015). Within the student population, nontraditional students have the highest increase in enrollment since the 1980's (Compton et al., 2006).

With the increase in enrollment patterns, from nontraditional students, research related to this student population continues to grow. Although limited, past research indicated that nontraditional students are a very diverse population. Donaldson and Graham (1999) concluded that nontraditional students learn differently. Previous studies on nontraditional students indicated they are motivated differently to attend college, in comparison to their younger classmates (Kasworm, 2008); identify different support systems (Bean and Metzner, 1985; Donaldson and Graham; 1999); and experience institutional, informational, situational, or psychological barriers (Darkenwald and Merriam, 1982).

[1]The Texas Tech University Institutional Review Board approved the study protocol and consent was obtained from all participants prior to their involvement in this study.

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Institutions of higher education must acknowledge the shift in student populations (Scott and Lewis, 2012) and begin to serve this "increasing segment of college students" (Wyatt, 2011, p. 11).

The study of nontraditional students is a fairly new area of research; therefore, it is important to note that there are limited studies and theories associated with adult learners (Jinkens, 2009). Furthermore, research pertaining to nontraditional undergraduate students enrolled in agriculture courses is even more limited. It is evident though that nontraditional students have a variety of experiences that "adds academic validity" to the classroom (Scott and Lewis, 2012, p. 2). Aside from adding more real world experiences to the undergraduate environment, adult learners make sense of their life experiences through transformational learning (Mezirow, 2000). In the lens of transformational learning, learning is defined as *"the process of using a prior interpretation to construe a new or a revised interpretation of the mearing of one's experience in order to guide future action"* (Merriam et al., 2007, p. 132).

Inside the classroom, nontraditional students not only bring experience, but also differences in motivation and barriers, when compared to traditional college students. Kasworm (2003) indicted that intrinsic and extrinsic motivation for learning is high in adult students. Additionally, Murphy and Roopchand (2003) discovered that between traditional and nontraditional students, nontraditional students reported higher levels of intrinsic motivation. While these studies provide some insight to the motivations of nontraditional students, Justice and Dornan (2001) found that *"few studies have examined nontraditional students' motivation to achieve once enrolled in college"* (p. 237).

While nontraditional students are motivated, what challenges and barriers do they face while pursuing a degree? Darkenwald and Merriam (1982) propose that barriers can be categorized into institutional, informational, situational, or physiological. Institutional barriers focus around instruction and educational planning. Situational barriers pertain to issues such as transportation and childcare (Brassett-Grundy, 2002). Wyatt (2011) indicated universities need to focus on the various factors and attributes of this population of students, to better understand the barriers they face and to serve their unique needs. Furthermore, if institutions of higher education are still focusing on the traditional student and the number of nontraditional students continues to rise, the gap for what adult learners need will continue to widen.

Prior to the 1970's, adult educators assumed that all members of a classroom learned the same. Since then, there has been a great deal of effort by researchers to identify how adult learners interact in the classroom and how they should be instructed. While there is no single theory that fully explains adult learning, there are many models that build a solid foundation for educators. The most notable theory on adult learning was proposed by Malcolm Knowles. Knowles coined the term andragogy, which is the science and art of helping adults learn. Knowles' theory of Andragogy was comprised of four original assumptions (as cited in Merriam et al., 2007): (a) as a person matures his or her self-concept moves from that of a dependent personality toward one of a self-directing human being, (b) an adult accumulates a growing reservoir of experience, which is a rich resource for learning, (c) the readiness of an adult to learn is closely related to the developmental tasks of his or her social role and (d) there is a change in time perspective as people mature from future application of knowledge to immediacy of application; thus, an adult is more problem centered than subject centered in learning (Merriam et al., 2007). Two additional assumptions are as follows: (e) the most potent motivations are internal rather than external (Knowles, 1984) and (f) adults need to know why they need to learn something (Knowles, 1984). While some of these assumptions often mirror the process of learning for early learners, experience coincides better with adult learners (Merriam and Cafarella, 1999).

Adult Learner Motivation

Kasworm (2003) analyzed adult learners' comprehension of their learning experiences in higher education and found that older adult students show higher degrees of intrinsic and extrinsic motivation. Intrinsic motivation is defined as the "doing of an activity for its inherent satisfactions rather than for some separable consequence" (Ryan and Deci, 2000, p. 56). Bye et al. (2007) indicated that a student who is intrinsically motivated will show characteristics of "autonomy and employ self-initiated exploratory strategies" (p.144). Ryan and Deci (2000) believe that intrinsic motivation occurs between the person and certain activities.

Justice and Dornan (2001), focusing on metacognition and motivation of nontraditional and traditional students, found "only older female students reported higher levels of intrinsic motivation" (p. 245). Bye et al. (2007) concluded that nontraditional students reported higher levels of intrinsic motivation than their younger classmates.

Ryan and Deci (2000) stated that *"extrinsic motivation is a construct that pertains whenever an activity is done in order to attain some separable outcome"* (p. 60). This area of motivation can become more ambiguous in nature. For example, students who are completing assignments for a grade or to avoid certain undesirable consequences are extrinsically motivated. These students are completing the assigned task for reasons that are not associated with internal factors. Students who are extrinsically motivated often want answers to procedural questions and not questions based off class content (Sansone and Smith, 2000). With the concept of extrinsic and intrinsic motivation, Deci et al. (1999) indicated extrinsic motivation can in fact change an individuals' intrinsic motivation. Knowing the impact of these motivational constructs on adult learners can provide faculty members with tools to utilize in the classroom.

Adult Learner Barriers

The transition to college can be difficult for many students, but for nontraditional students there are additional barriers to overcome. Senter and Senter (1998) recognized the needs of nontraditional students have not been reviewed. After determining that adult learners are more intrinsically motivated and want more control over their learning activities than their younger classmates, it was suggested that institutions of higher education are hesitant to meet the needs of the growing nontraditional student population. This hesitation could be related to administration's fear of the cost associated with meeting the needs of these students (Senter and Senter, 1998). Thon (1984) determined many institutions of higher education were not adapting programs to meet the needs of nontraditional students, but expected students to modify their behaviors to fit into the more traditional programs. Family relationships have been identified as a critical barrier for nontraditional students returning to higher education (Donaldson and Graham, 1999). More specifically, it can be difficult for nontraditional students to plan their class schedule to coincide with their spouses' schedule and child care demands.

In addition to balancing their home and school lives, financial concerns can also serve as a barrier. Often, adult learners are returning to school to increase income, gain a certification, obtain a higher degree, or for self-satisfaction (Milheim, 2005). Family can influence the decision to return to school, continue education, or drop out. Financial stresses are usually subsided with part-time or full-time employment (Donaldson and Graham, 1999).

Similar to traditional students, adult learners are attending class and are employed on or off campus. Planning academic schedules that will work with family obligations and work can be challenging. Nontraditional students have difficulty enrolling in classes that are offered during regular times (Daniel, 2000). Offering evening classes and distance education classes (Vangen, 1998) can alleviate the stress that nontraditional students face when preparing semester schedules. Providing students with flexibility in educational planning can assist nontraditional students through their educational pursuit.

Within the classroom setting nontraditional students often face anxiety and many emotions that traditional students do not. According to Bishop-Clark and Lynch (1992), nontraditional students have a discomfort with younger and older classmates and find it hard to connect to faculty members. The classroom environment plays a major role in adult learners' collegiate experience. This idea is parallel with Donaldson and Graham Model of College Outcomes (1999) that indicated the classroom is the center point of nontraditional students' collegiate experience. If nontraditional students feel comfortable in the classroom environment they can add to the classroom by offering their experiences and real world approaches (Scott and Lewis 2012).

The transition to college can be difficult for students of all ages and backgrounds; however, adult learners face numerous challenges from family obligations, financial resources, educational planning and classroom interaction.

Purpose and Objectives

The purpose of this study was to determine the motivations and barriers of nontraditional undergraduate students in the College of Agricultural Sciences and Natural Resources (CASNR) at Texas Tech University. The following research objectives were used to guide the study:

- Determine undergraduate nontraditional student motivations in CASNR at Texas Tech University.
- Determine the perceived barriers faced by undergraduate nontraditional students in CASNR at Texas Tech University.

Methods

Population

The accessible population consisted of 139 undergraduate nontraditional students enrolled in CASNR at Texas Tech University, during the fall semester of 2012. The sampling frame was obtained from the Student Success Center within CASNR. Texas Tech University defines a nontraditional student based solely on age. The frame for nontraditional students in this study was constructed based upon age (i.e., 25 years or older). Utilizing an online survey platform and incurring no additional monetary cost to study the entire population, a census was attempted in this study of CASNR nontraditional students. Participation in this study was completely voluntary and no incentives were given to complete the research study.

Forty-two students responded to the survey for a response rate of 30.2%. The gender breakdown of nontraditional students in this study consisted of 25 (59.5%) females and 17 (40.5%) male students. Thirty-five (83.3%) of the participants were Caucasian, four were Hispanic/Latino (9.5%) and two identified their ethnicity as multiracial (n = 2, 4.8%). In regard to marital status, 21 (50.0%) were married, 16 (38.1%) were single and a total of five students were currently divorced (11.9%). When asked to select their age based off the categories provided, participants most frequently selected 25-27 age range (n = 19, 45.2%), followed by 28-30 age range (n = 8, 19.0%), 31-33 age range (n = 3, 7.1%), 37-39 age range (n = 2, 4.8%), 40-42 age range (n = 1, 2.4%), 43-45 age range (n = 1, 2.4%), 46-48 age range (n = 3, 7.1%), 49-51 age range (n = 2, 4.8%) and 52-54 age range (n = 3, 7.1%). Over 40 % (n = 17) of the nontraditional students indicated they were employed part-time, 28.6 % (n = 12) held full-time employment and 16.7% (n = 7) were unemployed.

When questioned about income, the greatest frequency of students identified with the $10,000- $19,999 income range (n = 9, 21.4%), whereas the lowest frequency of nontraditional students indicated their salary was in the $125,000-$149,999 income range (n = 1,

2.4%). Participants were also questioned about their proximity of work in relation to campus. A total of 18 (42.9%) worked on campus, 17 (40.5%) had a 30-minute commute to work and one participant (2.4%) indicated they traveled over an hour to get to work. A majority of the nontraditional students in this study indicated they were enrolled full time, whereas 11 (26.2%) students were enrolled part-time. In regard to CASNR department the students were enrolled in, 18 (42.9%) were enrolled in the Department of Plant and Soil Science, followed by eight (19.0%) in the Department of Resources Management, six (14.3%) in the Department of Animal and Food Sciences, four (9.5%) in Department of Agricultural and Applied Economics, three (7.1%) in Department of Agricultural Education and Communications and three (7.1%) in the Department of Landscape Architecture.

Of the 42 participants, 11 (26.2%) nontraditional students indicated they had served in the military. When asked about their decision to continue education, participants were asked to select all that apply. Thirty-three (78.6%) were continuing their education to obtain a higher degree, 31 (73.8%) for personal satisfaction, 25 (59.5%) to improve their income, 18 (42.9%) to learn a new occupation, 12 (28.6%) to improve job skills, 11 (26.2%) to meet job requirements and four (9.5%) to obtain or maintain certification.

Design

A descriptive explanatory design was used in this quantitative study on the motivations and perceived barriers of nontraditional undergraduate students in CASNR at Texas Tech University. This study sought to determine the nontraditional students' motivations and perceived barriers in completing their undergraduate degree. A 59 item instrument was distributed amongst the nontraditional students enrolled in CASNR at Texas Tech University. Utilizing the Qualtrics Survey Platform, an online survey instrument was created and distributed to the participants to collect descriptive data for this study. All nontraditional students who participated in this study received the same survey instrument.

Instrumentation

The 59 item instrument utilized in this study of nontraditional college students sought to describe the students' demographics, motivation strategies for learning and perceived barriers to continuing their education. The demographic questions inquired about the participants' gender, age, marital status, ethnicity, employment status, income, enrollment within department, decision to continue education, current enrollment status, work hours per week, proximity to work and military service.

The Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991) was utilized in this study to determine the nontraditional students' motivation strategies. The first 31 items of the Motivated Strategies for Learning Questionnaire were used and no significant changes were made to the original instrument. The nontraditional students rated themselves on a seven-point Likert-type scale, ranging from "not at all true of me" (1) to "very true of me" (7). The remaining 11 questions focused on the barriers nontraditionals face in their education. The barriers included, financial aid for students, planning academic schedules, preparation for college, graduation requirements, family support and university support. The items addressing barriers were comprised of seven-point Likert-type scales, ranging from "not at all true of me" (1) to "very true of me" (7).

The three-part instrument was originally developed online using Qualtrics, due to licensing requirements with Texas Tech University, Qualtrics was replaced as a source for data collection requiring the instrument to be placed on Survey Monkey. Participation was voluntary and anonymous. Participants could skip questions or stop at any time during the process.

Reliability and Validity

To establish reliability for the instrument utilized in this study, a pilot study was conducted. The pilot study was administered to 23 undergraduate nontraditional agricultural students at a four-year institution in the Midwest. The potential participants in the pilot study were sent an email which included the purpose of the study, clause of confidentiality and a link to access the instrument. A total of 13 participants completed the pilot study instrument.

At the conclusion of the pilot study, a reliability analysis was conducted using the IBM Statistical Package for the Social Sciences (SPSS) version 18.0 for windows. The overall Cronbach's alpha coefficient for items that were modified from the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991) was 0.89. Cronbach's alpha coefficient was also conducted on the subscales: intrinsic motivation was 0.85, extrinsic motivation was 0.62, task value was 0.86, control of learning beliefs was 0.35, self-efficacy for learning was 0.68 and test anxiety was 0.83. In comparison to previously reported Cronbach alpha levels all subscales were close or parallel to results (Pintrich et al., 1991). While extrinsic motivation, control of learning beliefs and self-efficacy were not in the acceptable range for reliability subsequent changes were made to increase reliability. Additionally, reliability was tested on the barriers of nontraditional students that were developed from the review of literature. The Cronbach alpha coefficient was 0.70 which is in the acceptable range for reliability. Overall, the instrument was found to be reliable. To establish face and content validity, the instrument was sent to a panel of experts at Texas Tech University and Murray State University. The professors at both universities found the instrument to be valid.

Data Collection

Data was collected for this study from October through November of 2012. All undergraduate nontraditional students in CASNR during the fall of 2012, received a recruitment email. The recruitment email included a description of the study, clause of confiden-

tiality and a link to access the online instrument. The initial recruitment email was sent on October 12, 2012, followed by subsequent reminder emails on October 22 and November 2, 2012. The distribution schedule, developed by Ary et al. (2010), was utilized in this study.

To account for non-response error in this study, the early respondents were compared to the late respondents. Extrapolation methods in this method of controlling for non-response error are based on the concept that late respondents are similar to non-respondents (Armstrong and Overton, 1977; Pace, 1939). Linder et al. (2001) recommended that late respondents be defined as *"those who respond in the last wave of respondents in successive follow-ups to a questionnaire, that is, in response to the last stimulus"* (p. 52). Based on Linder et al.'s (2001) recommendations, the late respondents in this study were operationalized as the respondents who responded after the last reminder email (i.e., November 2, 2012). No differences were found between the early and late respondents to primary variables of interest; therefore, non-response error was not found to be a threat to the external validity of the study. After removal of partially completed instruments (n = 2), a total of 44 students responded, accounting for a response rate of 32%. Dillman et al. (2009) stated 25% response rate is acceptable with online survey research.

Although the aforementioned noted steps were taken to guarantee a methodologically sound approach, limitations and assumptions existed. To assess the nontraditional students' characteristics, it was assumed that respondents identified with the nontraditional student characteristics included in the instrument. Previous studies have rendered various definitions of nontraditional students (Brock, 2010; Choy, 2002; Horn, 1996; Kim, 2002; Taniguchi and Kaufman, 2005); the lack of a universally accepted definition of a nontraditional student was a limitation in this research study. In addition, the lack of a probabilistic sampling technique served as a limitation and caution should be taken when making generalizations from this data.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 18.0. Demographic information and descriptive statistics were reported for measures of central tendency and variability. Scores were summated for the 31 items under the motivation construct, as well as the subscales (i.e., intrinsic motivation, extrinsic motivation, task value, learning beliefs, self-efficacy and test anxiety). Frequencies and percentages as well as the overall means and standard deviations were reported for each.

Results and Discussion

Objective one sought to determine undergraduate nontraditional student motivations in CASNR at Texas Tech University. Means, standard deviations, frequency counts and percentages were calculated to report on this objective. The motivations of nontraditional students were determined utilizing the Motivated for Learning Strategies Questionnaire (Pintrich et al., 1991). The first 31 questions were used, that include six subscales; intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy and test anxiety. Questions were based on a seven-point Likert-type scale, ranging from not at all true of me to very true of me. For clarity on the findings the researcher categorized the averages and will be reported as follows: 1–2.49 = not true of me, 2.50–3.49 = hardly ever true of me, 3.50–4.49 = occasionally true of me, 4.50–5.49 = sometimes true of me, 5.50–6.49 = almost always true of me and 6.50–7 = very true of me.

Four statements were asked that pertained to the area of intrinsic motivation. All four statements had an average that fell in the category of almost always true of me. Participants reported the highest average (M = 6.12, SD = 0.94) on the statement *"the most satisfying thing for me, in my major, is trying to understand the content as thoroughly as possible"*, followed by *"in my classes I prefer course material that arouses my curiosity, even if it is difficult to learn"* (M = 6.10, SD = 1.09). Also reported, *"in my major, I prefer course material that really challenges me, so I can learn new things"* (M = 5.86, SD = 1.22) and concluded with *"when I have the opportunity I choose course assignments that I can learn from even if they do not guarantee a good grade"* (M = 5.60, SD = 1.36). The summated average was 5.94 with a standard deviation of 0.91 (see Table 1). The subscale of intrinsic motivation had the greatest summated average of all subscales in this study.

Six statements were asked that pertained to the area of task value. The first five statements had an average that fell in the category of almost always true of me. Participants reported the greatest average (M = 6.24, SD = 1.12) on the statement *"it is important for me to learn the course material in each class." "I like the subject matter of all my major courses"* (M = 5.26, SD = 1.61), which identified with the category of sometimes true of me, was the only task value subscale statement which was not identified to be almost always true of me.

Table 1. Summated Averages for Motivation Subscales

Subscale	M	SD
Intrinsic Motivation	5.94	0.91
Task Value	5.79	0.94
Self-Efficacy	5.61	1.10
Control of Learning Belief	5.57	1.08
Extrinsic Motivation	5.45	1.20
Test Anxiety	4.53	1.70

Table 2. Subscale of Intrinsic Motivation (n = 42)

Statement	M	SD
The most satisfying thing for me, in my major, is trying to understand the content as thoroughly as possible.	6.12	0.94
In my classes I prefer course material that arouses my curiosity even if it is difficult to learn.	6.10	1.09
In my major, I prefer course material that really challenges me so I can learn new things.	5.86	1.22
When I have the opportunity, I choose course assignments that I can learn from, even if they do not guarantee a good grade.	5.60	1.36
Summated score for subscale	5.94	0.91

Note. 1 = Not at all true of me, 7 = Very true of me.

Table 3. Subscale of Task Value

Statement	M	SD
I am very interested in the content area of my classes, in my major. (*n* = 42)	6.24	1.30
It is important for me to learn the course material in each class. (*n* = 42)	6.24	1.12
I think course material in my classes, in my major, is useful for me to learn. (*n* = 41)	5.90	1.28
Understanding the subject matter in each course is very important to me. (*n* = 40)	5.83	1.13
When I think about my classes, in my major, I will be able to use what I learn in other classes. (*n* = 41)	5.80	1.12
I like the subject matter of all my major courses. (*n* = 42)	5.26	1.61
Summated score for subscale	5.79	0.94

Note. 1 = Not at all true of me, 7 = Very true of me.

Table 4. Subscale of Self-Efficacy

Statement	M	SD
I'm confident I can learn the basic concepts taught in each class, in my major. (*n* = 42)	6.38	0.91
I expect to do well in my classes. (*n* = 42)	5.83	1.40
I'm certain I can master the skills being taught in my classes, in my major. (*n* = 42)	5.64	1.14
I'm confident I can understand the most complex material presented by my instructors, in my major. (*n* = 41)	5.59	1.22
I'm confident I can do an excellent job on assignments and tests in each class. (*n* = 41)	5.44	1.48
I am certain I can understand the most difficult material presented in the readings, in my major. (*n* = 42)	5.33	1.30
Considering the difficulty of classes, the teachers, and my skills, I think I will do well this semester (*n* = 42)	5.31	1.47
I believe I will receive excellent grades in my classes. (*n* = 42).	5.17	1.49
Summated score for subscale	5.61	1.10

Note. 1 = Not at all true of me, 7 = Very true of me.

Task values' summated average was 5.79 (SD = 0.94), which was considered to be almost always true of me.

Eight statements were asked that pertained to the area of self-efficacy. The first four statements had an average that fell in the category of almost always true of me. Participants reported the highest average (M = 6.38, SD = 0.91) on the statement *"I'm confident I can learn the basic concepts taught in each class, in my major,"* followed by *"I expect to do well in my classes"* (M = 5.38, SD = 1.40). Also reported, *"I am certain I can master the skills being taught in my classes, in my major"* (M = 5.64, SD = 1.14), *"I'm confident I can understand the most complex material, presented by my instructors, in my major"* (M = 5.59, SD = 1.22). The final four statements fell into the category sometimes true of me, *"I'm confident I can do an excellent job on assignments and tests in each class"* (M = 5.44, SD = 1.48), *"I am certain I can understand the most difficult material presented in the readings, in my major"* (M = 5.33, SD = 1.30), *"considering the difficulty of classes, the teachers and my skills, I think I will do well this semester"* (M = 5.31, SD = 1.47) and concluded with *"I believe I will receive excellent grades in my classes"* (M = 5.17, SD = 1.49). The summated average was 5.61 with a standard deviation of 1.10. The summated average for self-efficacy fell into the category almost always true of me.

For this subscale four questions were asked that related to control of learning beliefs. All four statements fell into the category of almost always true of me. The highest average (M = 6.24, SD = 1.12) was reported with the statement *"it is my own fault if I do not learn the material in each class,"* followed by *"if I try hard enough then I will understand the material in each class"* (M = 6.24, SD = 1.30). The third rated statement was *"if I do not understand the course material in a class, it is because I did not try hard enough"* (M = 5.90, SD = 1.28), concluding with *"if I study in appropriate ways, I will be able to learn the material in all my classes"* (M = 5.80, SD = 1.12). On the subscale for control of learning beliefs the summated values were (M = 5.57, SD = 1.08). The summated average for control of learning beliefs fell into the category of almost always true of me.

Four questions were asked that related to the extrinsic motivation subscale. The two statements with the highest average reported fell into the category of almost always true of me. The highest average was reported with the statement *"if I can, I want to receive better grades than most of the students in my class"* (M = 5.74, SD = 1.59), followed by *"receiving good grades is the most satisfying thing for me right now"* (M = 5.52, SD = 1.37). The final two statements fell into the category of sometimes true of me. When asked *"I want to do well in my classes because it is important to show my ability to my family, friends, or others"* (M = 5.37, SD = 1.98), concluding with *"the most important thing for me right now is improving my overall GPA, so my main concern is getting a good grade in each class"* (M = 5.24, SD = 1.75). On the subscale of extrinsic motivation, the summated values were (M = 5.24, SD = 1.20). The summated average for extrinsic motivation fell into the category of sometimes true of me.

For this subscale five questions were asked that related to test anxiety. The first four statements fell into the category of sometimes true of me. Participants reported, (M = 4.95, SD = 2.12), on the statement, *"when I take tests I think of the consequences of failing"* followed by *"I become very anxious when I take an exam"* (M = 4.95, SD = 2.26). The final statement fell

Table 5. Subscale of Control of Learning Beliefs

Statement	M	SD
If I try hard enough, then I will understand material in each class. (*n* = 42)	6.24	1.30
It is my own fault if I do not learn the material in my classes. (*n* = 42)	6.24	1.12
If I do not understand the course material in a class, it is because I didn't try hard enough. (*n* = 42)	5.90	1.28
If I study in appropriate ways, I will be able to learn the material in all my classes. (*n* = 41)	5.80	1.12
Summated score for subscale	5.57	1.08

Note. 1 = Not at all true of me, 7 = Very true of me.

Table 6. Subscale of Extrinsic Motivation

Statement	M	SD
If I can, I want to receive better grades than most of the other students, in my classes. (*n* = 42)	5.74	1.59
Receiving good grades is the most satisfying thing for me right now. (*n* = 42)	5.52	1.37
I want to do well in all my classes because it is important to show my ability to my family, friends, or others. (*n* = 41)	5.37	1.98
The most important thing for me right now is improving my overall GPA, so my main concern is getting a good grade in each class. (*n* = 42).	5.24	1.75
Summated score for subscale	5.45	1.20

Note. 1 = Not at all true of me, 7 = Very true of me.

into the category occasionally true of me, "when I take a test I think about how poorly I am doing compared to other students" (M = 3.55, SD = 2.07). On the subscale for test anxiety the summated values were (M = 4.53, SD = 1.70). The summated average for test anxiety fell into the category sometimes true of me.

Objective two sought to determine undergraduate nontraditional student barriers in CASNR at Texas Tech University. Questions were based on a seven-point Likert-type scale, ranging from not at all true of me to very true of me. For clarity on the findings the researcher categorized the averages and will be reported as follows: 1–2.49 = not true of me, 2.50–3.49 = hardly ever true of me, 3.50–4.49 = occasionally true of me, 4.50–5.49 = sometimes true of me, 5.50–6.49 = almost always true of me and 6.50–7 = very true of me.

Eleven statements were asked that pertained to barriers. The nontraditional students identified the lack of a nontraditional student office on campus (M = 4.78, SD = 2.19), lack of mentoring/tutoring program in CASNR (M = 4.24, SD = 2.36) and lack of nontraditional support groups (M = 3.93, SD = 2.40) as the largest perceived barriers to continuing their education (see Table 2). Conversely, the statement which the nontraditional students perceived to be the smallest barrier was "my family and friends support my decision to further my education (M = 6.60, SD = 0.73).

Summary and Recommendations

The nontraditional undergraduate students in this study reported the greatest summated mean score for intrinsic motivation, in comparison to the other motivation subscales. This finding coincides with previous research (Bye et al., 2007; Murphy and Roopchand, 2003) which indicated nontraditional students have high levels of intrinsic motivation, especially in comparison to traditional students. The high levels of intrinsic motivation indicated by the nontraditional students may imply their motivation to continue their education is for inherent satisfaction. The students with high levels of intrinsic motivation might also show characteristics of autonomy and employ self-initiated exploratory strategies (Bye et al., 2007).

When the nontraditional students were questioned about the task value they associated with their education, the respondents indicated high levels of task values (M = 5.79, SD = 0.94). The high levels of task value scores imply that the students associate their post-secondary education with positive task value. Previous research indicated that individuals tend to carry out task they positively value and avoid negatively valued task (Atkinson, 1957, 1966; Eccles et al., 1983; Feather, 1982). Furthermore, positive task value is associated with task which provide enjoyment and allow the individual to achieve long and short range goals (Wigfield and Eccles, 1992).

In regard to self-efficacy, the nontraditional students indicated the statement "I am confident I can learn the basic concepts taught in each class, in my major" was most true of them. The perceived self-efficacy of the students varied on the eight items of the instrument and "I believe I will receive excellent grades in my classes" was the statement nontraditional students indicated the lowest level of agreement with. These findings coincided with Bandura's (1982) research, which indicated self-efficacy is task-specific, as opposed to a general sense of self-esteem. Furthermore, Bandura (1982) emphasized self-efficacy is concerned with courses of action, rather than merely the outcome. It can be implied that the nontraditional students in this study associate greater levels of self-efficacy with specific task related to their major.

The nontraditional undergraduate students in this study reported high levels of internal locus of control (LOC). Britt et al. (2013) indicated individuals who are internally driven believe that future events are determined by their own behavior. Individuals with internal locus of control (ILOC) are more likely to be more alert in their environment, are concerned with their ability, take steps to improve their environment and are more resistant to subtle attempts to influence them (Rotter, 1966; Speck, 1996). An implication can be made that the nontraditional students in this study, with high levels of ILOC, hold themselves accountable for their educational success. To enhance the education of students with higher levels of ILOC, it is recommended the learner has the opportunity to provide input and have some control over the learning method, learning environment, materials and evaluation of learning effectiveness. According to Speck (1996), individuals with higher levels of ILOC are more likely to engage in self-directed learning (SDL).

Table 7. Subscale of Test Anxiety

Statement	M	SD
When I take tests I think of the consequences of failing. (*n* = 41)	4.95	2.12
I become very anxious when I take an exam. (*n* = 42)	4.95	2.26
While taking a test, I think about items on other parts of the test I can't answer. (*n* = 42)	4.69	1.94
I have an uneasy, upset feeling when I take an exam. (*n* = 42)	4.57	2.30
When I take a test I think about how poorly I am doing compared with other students. (*n* = 42)	3.55	2.07
Summated score for subscale	4.53	1.70

Note. 1 = Not at all true of me, 7 = Very true of me.

Table 8. Frequency and Variability of Participants Perceived Barriers

Statement	Barrier Rank	M	SD
An office for nontraditional students at the University would be beneficial. (*n* = 41)	1	4.78	2.19
I would benefit from a mentoring/tutoring program in my major. (*n* = 42)	2	4.24	2.36
Having a nontraditional support group on campus would assist in my educational experience. (*n* = 41)	3	3.39	2.40
I need more guidance about financial aid for students my age. (*n* = 41)	4	3.88	2.28
I need help learning about graduation requirements. (*n* = 42)	5	3.29	2.11
I need help when planning classes around my work schedule. (*n* = 41)	6	3.85	1.89
I need assistance with learning how to transfer prior credits. (*n* = 42)	7	2.62	2.00
I am able to meet with Professors when needed. (*n* = 41) [z]	8	4.92	2.11
I attended orientation and was prepared for college. (*n* = 41) z	9	5.22	2.09
I would benefit from childcare services. (*n* = 42)	10	1.90	1.89
My family and friends support my decision to further my education. (*n* = 42) [z]	11	6.60	0.73

Note. [z] Statement is written as higher number equals lower barrier.

In regard to motivation, the nontraditional students perceived their intrinsic motivation to be greater than extrinsic motivation. This finding is consistent with other studies (Anderson, 2013; Bye et al., 2007) and coincides with Knowles' (1984) assumption of andragogy which states *"the most potent motivations are internal rather than external"* (p. 12). The students identifying closer with aspects of intrinsic motivation might imply that their reasons to continue their education are lined to personal satisfaction. Although the students indicated higher levels of intrinsic motivation, the students perceived the extrinsic motivation statements to be sometimes true about themselves. Previous studies on motivation have indicated that external motivators are sometimes necessary to begin an action (Deci et al., 1994; Deci and Ryan, 1985). Furthermore, other studies have concluded that extrinsic motivation can alter an individual's intrinsic motivation (Deci et al., 1999). Therefore, the moderate levels of extrinsic motivation, indicated by the nontraditional students, may serve as a catalyst to enhancing their levels of intrinsic motivation. It is recommended that professors, who instruct nontraditional students, consider the source of their students' motivation, when planning and implementing lessons. Motivating the students with feedback and constructive criticism might be more valuable to the intrinsically motivated students, as opposed to grades (i.e., extrinsic motivator). To identify other motivational factors of nontraditional students, not included in this study, a qualitative study should be conducted on nontraditional students' motivations to continue their education.

Objective two sought to determine the perceived barriers of undergraduate nontraditional students in continuing their education. The nontraditional students in this study perceived institutional barriers (i.e., barriers pertaining to instruction and educational planning), to be the greatest barriers to continuing their education. More specifically, the students perceived the lack of a nontraditional student office on campus, mentoring program and support group for nontraditional students as the largest barriers to continuing their education. This may imply the nontraditional students need more structured support systems in order to thrive in a traditional setting. Thon (1984) suggested this problem might be attributed to the institutions of higher education who are reluctant to adapt to the needs of nontraditional students and expect nontraditional students to modify their behaviors to fit into the more traditional programs.

It is recommended that post-secondary institutions implement programs to lend support to the nontraditional students enrolled in their programs. Universities should provide nontraditional students with library and online resources which are available to students at all hours—to accommodate their various schedules. Furthermore, a nontraditional student center should be established on campus in order to provide mentoring programs and host social activities. Previous research has indicated that students with higher levels of social integration are more likely to continue enrollment (Community College Survey of Student Engagement, 2005; Muench, 1987). The social activities should cater toward older students and their families; it is important that campus administrators and faculty effectively communicate with nontraditional students about student services and academic programs available to them (Benshoff and Lewis, 1992; Thorn, 1984). Before taking action to accommodate adult learners, universities should conduct an assessment to identify perceived barriers of nontraditional students. Klein-Collins (2011) recommended the use of the Institutional Self-Assessment Survey (ISAS) and the Adult Learner Inventory (ALI). The use of these two instruments would allow the comparison of faculty and administration views of current adult programs with the perceptions of the adult learners (Klein-Collins, 2011).

With that in mind, further research should be conducted to examine the benefits of various nontraditional student support systems and resources. Information from this study could potentially aid colleges of agriculture in selecting and implementing programs to benefit their nontraditional students. Conversely, the nontraditional students perceived the support from friends and family as the smallest barrier to continuing their education. With the support of family and friends being the smallest perceived barrier, it can be implied that this aspect of the nontraditional student's life might serve as a form of assistance. Findings from previous studies also indicate the support from friends and family is an important resource to nontraditional students (Compton and Schock, 2000; Donaldson and Graham, 1999; Justice and Dornan, 2001). Nontraditional students should seek support from their friends and family when deciding to continue their education.

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Undergraduate Students Self-Efficacy Related to the Performance of Animal Handling and Management Techniques: Implications for Pre-service Teachers

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Abstract

This study examined a census of students enrolled in a junior level undergraduate animal science course at Oklahoma State University during the spring of 2013. This course was designed to address the "skill gap" of pre-vet and pre-service agricultural education majors in the area of animal handling and management. The course focuses on the identification and acquisition of basic animal handling and management techniques in the context of beef, dairy, sheep, goat, horse, swine and poultry. Data were collected at two points during the semester, the initial data collection occurred on the first day of the course. All (n = 39) students completed the instrument resulting in a 100% response rate. The second data collection occurred on the last day of the course. Thirty-six (three students dropped the course during the semester) of the 39 students completed the instrument resulting in a response rate of 92%. Findings from this study revealed an increased self-efficacy for undergraduate students after taking the undergraduate Animal Science course. Findings also revealed undergraduate students believe identifying proper injection sites and overall animal health are important. These results indicate student performance and acquisition of technical skills should inform curriculum development in Colleges of Agriculture.

Introduction

Animal agriculture and the skills needed to facilitate experiential learning opportunities in the context of Supervised Agricultural Experience (SAE) programs continues to be an important component of the agricultural education teacher's job (Retallick, 2010; Walker et al., 2004). Historically, students have embraced the opportunity to raise and exhibit livestock projects (Nash, 2007). A positive livestock experience can serve as a context for the development of employability skills as well as the technical skills needed for the animal industry (Boleman et al., 2004; Ramsey and Edwards, 2011). In addition, students involved with animal agriculture SAEs are exposed to opportunities to receive awards and recognition through FFA and earn scholarships. Such awards can assist with post-secondary education that may lead to careers in the agricultural industry (Talbert and Balschweid, 2004).

In school-based agricultural education programs across Oklahoma, one of the primary career pathways is Animal Science (Oklahoma Department of Career and Technology Education, 2013). As teachers representing the Baby Boomer generation retire, new teachers will be needed to lead these programs. These new teachers must be competent to teach the animal science curriculum, and also facilitate SAE programs focused on animal agriculture.

Skill development of pre-service agricultural education teachers is important for college curriculum committees to consider when developing new courses. According to Irving et al. (1999), *"the need to improve teachers' content knowledge in the sciences and their ability to communicate that knowledge to students must be moved to the forefront of the national educational agenda"* (p. 410). In addition, researchers have reported *"teachers who do not have a strong content knowledge base tend to teach didactically, relying on 'expert' sources such as textbooks and content lectures to transmit information to their students"* (Stofflett and Stoddart, 1994, p. 34).

In the context of animal science, Slusher (2009) reported the third most important entry-level technical skill needed in the animal science sector was to "understand animal needs" in the context of animal handling/husbandry (p. 4). Industry professionals reported administering medications, livestock selection and disease identification (animal) as the three most important entry-level technical skills for students (Ramsey and Edwards, 2011). Training the next generation of teachers to have the requisite skills needed to facilitate these programs is the focus of a collaborative effort between two depart-

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ments in the College of Agricultural Science and Natural Resources at Oklahoma State University. The undergraduate Animal Science course provides an overview of animal management and handling techniques used with beef, dairy, sheep, goat, horse, swine and poultry. The primary objective of the course is to aid students in the acquisition of basic skills associated with livestock production and handling.

Theoretical Framework

This study is framed in Bandura's associated theory of self-efficacy (Bandura, 1997). Bandura (1997) described self-efficacy as *"the belief in one's capabilities to organize and execute courses of action required to produce given attainments"* (p.3). Individual self–efficacy is derived from four main sources: mastery experiences, physiological and emotional states, vicarious experiences and social persuasion (Bandura, 1994). Mastery experiences are considered to be "the most effective way of creating a strong sense of efficacy" (Bandura, 1995, p. 3). Physiological and emotional arousal also affects the sense of self–efficacy. A person's sense of self-efficacy increases when they can reduce their stress reactions and alter negative tendencies in the face of adversity. Vicarious experiences are the "second influential way of creating and strengthening efficacy beliefs" (Bandura, 1995, p. 3). Seeing people similar to themselves succeed by perseverant effort raises observers' beliefs that they, too, possess the capabilities to master comparable activities (Bandura, 1986; Schunk 1987). Social persuasion is the final main source with which individuals derive self-efficacy. People who are persuaded verbally that they possess the capabilities to master given activities are likely to mobilize greater effort and sustain it than if they harbor self-doubts and dwell on personal deficiencies when problems arise (Litt, 1988; Schunk, 1989). The animal science course meets twice a week, one meeting is a 50-minute lecture and the second meeting is a four-hour lab, adequate time for demonstration and practice to occur. One lab is designated for pre-service agricultural education students, this allows for multiple opportunities for practice and observation providing potential for impacting students' self-efficacy (Bandura, 1994).

Purpose and Objectives of the Study

The purpose of this study was to determine the self-efficacy of undergraduate students enrolled in an animal management course at Oklahoma State University. Specifically, their ability to identify and perform selected skills associated with livestock handling and management. In addition, the undergraduate students' perceived level of importance of animal management techniques was of interest to the researchers. The following research objectives guided the study:

1. Describe the perceived level of undergraduate students' self-efficacy to perform animal management techniques.
2. Describe the level of importance of animal management techniques as perceived by students enrolled in an Animal Management course at Oklahoma State University.
3. Describe changes in students' self-efficacy to perform animal management techniques, as measured at the beginning and end of the spring semester 2013.
4. Describe changes in the level of importance of animal management techniques, as measured at the beginning and end of the spring semester 2013.

Research Design and Methods

The design of this study was descriptive in nature. This study focused on a census of students enrolled in a junior level undergraduate animal science course at Oklahoma State University during the spring of 2013. This new course was designed to address the "skill gap" of pre-vet and pre-service agricultural education majors. The course focuses on the identification and acquisition of basic animal handling and management techniques in the context of beef, dairy, sheep, goat, horse, swine and poultry. Data were collected at two points during the semester, the initial data collection occurred on the first day of the course. All (n = 39) students completed the instrument resulting in a 100% response rate. The second data collection occurred on the last day of the course. Thirty-six (three students dropped the course during the semester) of the 39 students completed the instrument resulting in a response rate of 92%.

A modified version of the instrument utilized by Hartfield (2011) was used for this study. The instrument gauged students' capability (ability to perform the skill) and perceived degree of importance on 42 items identified from the course syllabus designed by the instructor. The 42 items reflected the skills identified as objectives for the course. A panel of experts consisting of five Oklahoma State University professors and four graduate students were consulted to determine the face and content validity of the instrument. Cronbach's alpha was calculated to identify the reliability of the capability ($\alpha = 0.98$) and importance ($\alpha = 0.95$) scales. The 42 items on the instrument were arranged on two Likert-type scales. For self-efficacy, a nine-point scale was employed where 1 indicated No Capability, and 9 indicated A Great Deal of Capability. For importance, a nine-point scale was used where 1 indicated No Importance and 9 indicated A Great Deal of Importance. So, these scales measured students' perceptions of capability along with their perceptions of importance.

Data were analyzed using PASW Statistics Student Version 18.0 (SPSS). According to Creswell (2012), for a census survey, "researchers simply report descriptive statistics about the entire population" (p. 382). The mean and standard deviation were calculated to determine the perceived self-efficacy related to the capability and importance of each item at the beginning and end of the spring semester 2013.

Findings/Results

Objective #1

All 42 skills related to livestock handling and management were perceived by students as capable of performing in the animal science course (see Table 1). According to posttest scores, the skill or competency students' perceived to be most competent at was injection site selection (Post-M = 8.35, Post-SD = 1.07). Other skills and competencies students' perceived themselves to be competent at included animal identification (Post-M = 8.33, Post-SD = 1.05), livestock transportation (Post-M = 8.18, Post-SD = 1.06), movement of livestock (Post-M = 8.15, Post- SD = 1.35), handling of livestock (Post-M = 8.15, Post-SD = 1.21), administering health care products (Post-M = 8.15, Post-SD = 1.13), and animal reproduction techniques (Post-M = 8.15, Post-SD = 1.02). The students considered themselves to be the least competent at ovine breed knowledge (Post-M = 6.35, Post-SD = 2.14), ovine breed identification (Post-M = 6.41, Post-SD = 2.27), identifying caprine breeds (Post-M = 6.44, Post-SD = 2.25) and caprine breed knowledge (Post-M = 6.44, Post-SD = 2.20) (Table 1).

Table 1. Students Perceived Level of Self-efficacy Regarding Animal Handling and Management Skill or Competency as Reported by a Pre and Post Test

Item	Pre-*M*	Pre-*SD*	Post-*M*	Post-*SD*
Injection Site Selection	6.84	1.87	**8.35**	1.07
Animal I.D.	6.45	1.69	**8.33**	1.05
Livestock Transportation	6.73	1.73	**8.18**	1.06
Movement of Livestock	7.03	1.64	**8.15**	1.35
Handling of Livestock	7.13	1.61	**8.15**	1.21
Administering a Health Mgt Plan	6.26	2.00	8.15	1.13
Animal Reproduction Techniques	6.39	2.01	8.15	1.02
Unloading Livestock	6.82	1.81	8.12	1.09
Processing Pig Litters	5.24	2.54	8.03	1.40
Loading Livestock	6.87	1.74	8.03	1.27
Symptoms of Illness	6.89	2.00	8.03	1.06
Castration	6.11	1.90	8.00	1.10
Vision of Livestock	6.24	1.55	7.99	1.24
Flight Zones of Livestock	6.74	1.35	7.97	1.36
Health Management	6.18	2.19	7.88	1.17
Record Keeping	6.58	1.88	7.85	1.21
Bovine Breed I.D.	7.33	1.58	7.79	1.32
Hearing of Livestock	6.08	1.55	7.79	1.27
Milking Cows	5.32	2.22	7.74	1.60
Administering a Bolus	5.47	2.72	7.74	1.31
Bovine Breed Knowledge	7.41	1.48	7.68	1.65
Restraint Sizes/Species	5.89	1.61	7.58	1.28
Dairy Mgt. Production	4.37	2.15	7.56	1.48
Anatomy of Livestock	6.13	1.74	7.53	1.60
Obtaining Blood Samples	5.92	2.12	7.47	1.56
Processing Lambs	4.34	2.30	7.41	1.71
Restraining Animals by Species	5.76	1.53	7.39	1.46
Porcine Breed I.D.	6.03	2.51	7.35	2.10
Dehorning	5.26	2.13	7.29	1.43
Porcine Breed Knowledge	6.21	2.35	7.21	2.11
Use of Ropes	5.47	2.14	7.12	1.72
Storage of Health Care Products	6.21	2.23	7.12	1.11
Tying Knots	5.16	2.03	6.97	1.98
Tie Ropes	5.26	2.09	6.85	1.97
Using Knots	5.03	1.82	6.82	1.85
Equine Breed I.D.	5.67	2.44	6.68	2.38
Equine Breed Knowledge	5.69	2.23	6.53	2.51
Caprine Breed I.D.	4.62	2.31	6.44	2.25
Caprine Breed Knowledge	4.59	2.12	6.44	2.20
Ovine Breed I.D.	4.82	2.10	6.41	2.27
Ovine Breed Knowledge	5.10	2.05	6.35	2.14

Note. A nine point scale was used to measure self-efficacy *1 = No Capability, 3 = Very Little Capability, 5 = Some Capability, 7 = Quite a Bit of Capability, 9 = A Great Deal of Capability*.

Objective #2

Students perceived all 42 competencies to be important to livestock handling and management as identified in the animal science course. According to students' posttest scores, the most important competency was movement of livestock (Post-M = 8.65, Post-SD = 0.65), followed by management of health care products (Post-M = 8.62, Post-SD = 0.74), handling of livestock (Post-M = 8.59, Post-SD = 0.70) and administering a bolus (Post-M = 8.56, Post-SD = 0.66). Storage of health care products (Post-M = 8.56, Post-SD = 0.79) completes the top five most important competencies perceived by students' (Table 2).

Objective #3

Regarding the change in students' self-efficacy from the beginning to the end of the semester, the top ten items are identified (Table 3). Change in students' self-

Table 2. Students Perceived Level of Importance of Animal Handling and Management Skill or Competency as Reported by a Pre and Post Test

Item	Pre-*M*	Pre-*SD*	Post-*M*	Post-*SD*
Movement of Livestock	8.38	1.14	**8.65**	0.65
Mgt of Health Care Products	8.36	1.18	**8.62**	0.74
Handling of Livestock	8.44	1.10	**8.59**	0.70
Administering a Bolus	8.05	1.26	**8.56**	0.66
Storage of Health Care Products	8.31	1.15	**8.56**	0.79
Castration	8.28	1.21	8.53	0.93
Unloading Livestock	8.33	0.98	8.53	0.75
Livestock Transportation	8.41	0.82	8.53	0.71
Symptoms of Illness	8.63	0.71	8.53	0.66
Record Keeping	8.26	1.29	8.50	0.99
Animal Reproduction Techniques	8.26	1.04	8.50	0.71
Handling of Health Care Products	8.36	1.16	8.50	0.86
Injection Site Selection	8.56	0.68	8.47	0.86
Obtaining Blood Samples	8.31	0.86	8.44	0.79
Administering a Health Mgt Plan	8.49	1.10	8.44	1.02
Animal ID	8.15	0.99	8.41	0.96
Dehorning	8.00	1.32	8.38	0.92
Flight Zones of Livestock	8.10	1.31	8.38	1.01
Vision of Livestock	7.56	1.67	8.35	1.07
Hearing of Livestock	7.62	1.63	8.24	1.09
Processing Pig Litters	7.69	1.72	8.21	1.34
Bovine Breed Knowledge	8.05	1.09	8.20	0.88
Loading Livestock	8.42	0.89	8.20	0.95
Processing Lambs	7.46	1.82	8.18	1.37
Restraining Animals by Specie	7.87	1.55	8.18	1.17
Restraint Sizes/Specie	7.95	1.36	8.18	1.18
Anatomy of Livestock	8.15	1.01	8.12	1.17
Dairy Management Production	7.26	2.71	8.00	1.35
Bovine Breed I.D.	8.11	1.13	7.94	1.15
Milking Cows	7.31	1.91	7.82	1.59
Porcine Breed I.D.	7.24	1.91	7.74	1.42
Using Knots	7.13	1.72	7.68	1.51
Tying Knots	7.05	1.62	7.65	1.63
Caprine Breed Knowledge	6.76	2.02	7.62	1.52
Use of Ropes	7.31	1.67	7.59	1.52
Equine Breed Knowledge	7.16	2.06	7.55	1.37
Ovine Breed Knowledge	6.79	2.11	7.53	1.42
Porcine Breed Knowledge	7.16	1.82	7.52	1.72
Equine Breed I.D.	7.29	2.09	7.47	1.58
Tie Ropes	7.18	1.54	7.44	1.58
Ovine Breed I.D.	6.97	2.06	7.41	1.58
Caprine Breed I.D.	6.87	2.16	7.36	1.67

Note. A nine point scale was used to measure perceived level of importance *1 = No Importance, 3 = Very Little Importance, 5 = Some Importance, 7 = Quite a Bit of Importance, 9 = A Great Deal of Importance*.

efficacy is reported by using the difference between the pre and posttest scores. The greatest difference in students perceived level of self-efficacy was on the item dairy management production (3.19). Processing lambs and processing litters of pigs showed positive gains in students' self-efficacy (3.07; 2.79) respectively. Milking cows (2.42) and administering a bolus (2.27) completed the top five items that saw a positive change in students' self-efficacy of performing livestock handling and management techniques as identified in the animal science course. The tenth item that received the greatest change was caprine breed knowledge, an item students' identified as being the least efficacious (posttest 6.44) was an item that saw a positive gain at the end of the semester (Table 3).

Objective #4

As indicated in Table 4, livestock handling and management skills and competencies increased from the beginning to the end of the semester. Change in students' perceived level of importance was reported by using the difference between the pre and posttest scores. The item caprine breed knowledge showed a gain of 0.86 from the beginning of the semester, an increase of almost one full point on the posttest. Vision of livestock gained over three fourths of a point at 0.79 and ovine breed knowledge increased at the same level.

Students reported an increase in self-efficacy and importance on the following items, dairy management production (3.19; 0.74), caprine breed knowledge (1.85; 0.86), administering a bolus (2.27; 0.51), processing pig litters (2.79; 0.52) and processing lambs (3.07; 0.72). Other items students perceived level of importance increased during the course of the semester included, livestock hearing (0.62), tying knots (0.60) and using knots (0.55) (Table 4).

Conclusions and Implications

Students considered all 42 skills related to livestock handling and management identified for the undergraduate animal science course that they were capable of performing. The skills students' considered themselves to have the most capability included selecting proper injection sites. Injection site selection and the skill of administering injections is a common skill that is highlighted in many programs focused on quality care standards for livestock. The personal characteristics of the students in the class were not an objective for this study, determining students' prior exposure to livestock handling and management skills would be valuable information to. Skills students reported as having the least capability of performing included ovine breed knowledge, identifying ovine breeds, caprine breed knowledge, and caprine breed identification. This finding is representative of school-based agricultural education programs and the animal agriculture industry in Oklahoma. As of January 1, 2011 Oklahoma sheep and goat producers had 75,000 head of sheep on hand and 91,000 head of goats as compared to 5.10 million head of cattle (Oklahoma Agriculture Blog, 2011, January 1). These numbers highlight the importance of beef cattle in Oklahoma. This emphasis is transferred to the curriculum school-based agricultural education programs utilize and the number of livestock oriented SAE's exhibited by Oklahoma FFA members. The lack of emphasis on sheep and goat SAEs may contribute to the limited exposure or vicarious experiences needed for students to have a high degree of self-efficacy in the livestock handling and management techniques associated with ovine and caprine.

Students became more efficacious after completing a sixteen-week animal science course. Ten selected items that the mean difference between the pre and posttest scores showed a positive increase included; dairy management production, processing lambs, processing pig litters, milking cows, administering a bolus, dehorning, administering a health plan, castration, animal identification and caprine breed knowledge. These livestock handling and management skills can be identified as units of instruction in the Introduction to Animal Science Curriculum found in Oklahoma's school-based agricultural programs i.e., Dairy Industry, Goat Industry and Animal Health and Management (Oklahoma Department of Career and Technology Education, 2013). These foundational units are introduced to all students so it is important for teachers to have a degree of confidence when preparing to plan and deliver lessons focused on these topics. The increase in students' efficacy to perform these skills suggest a sixteen-week

Table 3. Top Ten Animal Handling and Management Skills or Competencies Reporting a Gain in Student Self-efficacy from Beginning to End of the Spring 2013 Semester

Animal Husbandry Item	Pre-*M*	Pre-*SD*	Post-*M*	Post-*SD*	Mean Difference Post-Pre
Dairy Management Production	4.37	2.15	7.56	1.48	**3.19**
Processing Lambs	4.34	2.30	7.41	1.71	**3.07**
Processing Pig Litters	5.24	2.54	8.03	1.40	**2.79**
Milking Cows	5.32	2.22	7.74	1.60	**2.42**
Administering a Bolus	5.47	2.72	7.74	1.31	**2.27**
Dehorning	5.26	2.13	7.29	1.43	**2.03**
Administering a Health Mgt Plan	6.26	2.00	8.15	1.13	**1.89**
Castration	6.11	1.90	8.00	1.10	**1.89**
Animal I.D.	6.45	1.69	8.33	1.05	**1.88**
Caprine Breed Knowledge	4.59	2.12	6.44	2.20	**1.85**

Table 4. Top Ten Animal Handling and Management Skills or Competencies Perceived Level of Importance as Reported from Beginning to End of the Spring 2013 Semester

Animal Husbandry Item	Pre- *M*	Pre- *SD*	Post- *M*	Post-*SD*	Mean Difference Post-Pre
Caprine Breed Knowledge	6.76	2.02	7.62	1.52	**0.86**
Vision of Livestock	7.56	1.67	8.35	1.07	**0.79**
Ovine Breed Knowledge	6.79	2.11	7.53	1.42	**0.74**
Dairy Management Production	7.26	2.71	8.00	1.35	**0.74**
Processing Lambs	7.46	1.82	8.18	1.37	**0.72**
Hearing of Livestock	7.62	1.63	8.24	1.09	**0.62**
Tying Knots	7.05	1.62	7.65	1.63	**0.60**
Using Knots	7.13	1.72	7.68	1.51	**0.55**
Processing Pig Litters	7.69	1.72	8.21	1.34	**0.52**
Administering a Bolus	8.05	1.26	8.56	0.66	**0.51**

course focused on the identification and acquisition of livestock handling and management skills can be an effective way to prepare pre-service teachers to deliver the animal science curriculum in Oklahoma.

Quite a bit of importance was placed on the movement of livestock, management of health products, handling of livestock, storage of health care products and administering a bolus. All 42 skills were perceived to have some importance by participants, which is encouraging given the potential for these students to be in positions of influence as school-based agriculture education teachers. Agriculture teachers must be content experts in a variety of disciplines. In the context of animal science, these livestock handling and management skills represent "technical" knowledge needed to deliver the curriculum associated with the animal science pathway (Ramsey and Edwards, 2011; Slusher, 2009).

The importance of selected skills increased over the course of a sixteen-week semester. Of particular interest is the reported increase in self-efficacy and importance on the following items; dairy management production, caprine breed knowledge, administering a bolus, processing pig litters and processing lambs. Items reflecting students perceived level of importance increased during the course of the semester were also included; livestock hearing, tying knots and using knots (see Table 4). These skills or competencies were impacted the most by the course. The scope of this study did not include an examination of the pedagogical practices of the instructor, however, the cohort nature of the lab sections implies that a communities of practice approach may be developing within the labs. According to Lave and Wenger (1991), communities of practice are everywhere and students are generally involved in a number of them, this involvement could lead to social persuasion. Social persuasion is the final main source with which individuals derive self-efficacy. People who are persuaded verbally that they possess the capabilities to master given activities are likely to mobilize greater effort and sustain it than if they harbor self-doubts and dwell on personal deficiencies when problems arise (Litt, 1988; Schunk, 1989).

Recommendations for Research and Additional Practice

Research

Future research should identify the experiences students had with each of the 42 skills, along with the demographics of students enrolled in the course. Research should also address whether students had the knowledge of how to work 'real-world' problems related to each skill. Longitudinal research should be conducted to determine the impact of a series of courses and experiences and how they impact students' ability to identify and perform the requisite skills needed for animal science professionals and school-based agricultural education teachers in the 21st Century. An examination of the professional development needs for in-service school-based agricultural education teachers within the first five years of service should be conducted to inform departments of animal science, faculty and state program leaders of agricultural education of the "skill gaps" that may need to be addressed.

Much has been reported concerning agricultural literacy and the reality that undergraduate students enrolled in colleges of agriculture represent families that have not had direct ties to agricultural production for multiple generations (Frick et al., 1991; Leising et al., 1998; Powell and Agnew, 2011). Research focused on student's actual ability to perform animal management skills versus their perceived ability to perform said skills could inform faculty charged with developing curriculum for "post agrarian society" students. This "beginning with the end in mind" approach supports Talbert et al., (2007) assertion that teachers must "stay current in the technical content of the profession i.e., the agricultural industry" (p. 57).

Practice

Industry professionals should validate skills and objectives for courses designed to provide technical skills needed for successful entry and performance in an industry. To that end, department chairs, faculty and instructors should form industry based advisory committees that can provide insight into the technical needs required in the industry. The relationship formed between post-secondary institutions and industry professionals can extend beyond the classroom.

The pre-service teachers enrolled in the course could enhance their competence through a lesson-planning requirement. A microteaching requirement designed to allow students to not only practice the technical skill but also practice the planning, delivery and implementation of the skill could reflect the type of mastery experience described by Bandura (1995).

Colleges of Agriculture should consider developing similar courses in each of the disciplines reflecting the food, fiber and natural resource industries. School-based agriculture educators are required to have a broad set of skills representing a very diverse agricultural industry. Courses like this support the National Research Agenda for Agricultural Education Priority Area #4 Meaningful, Engaged Learning in All Environment

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Applying the Lesson Study Method in a Graduate Teaching Methods Course: Implications for Improving College Teaching

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Abstract

The lesson study method is a community of practice approach to professional development designed to assist educators in increasing their content knowledge and pedagogical skills. This study focused on how lesson study was implemented in a graduate teaching methods course for students who had career interests in education and extension with varying levels of former teaching experience. Students were grouped into educational teams and charged with applying the lesson study method to plan and teach an agricultural lesson to a select group of students. As a result of the lesson study method, students' teaching self-efficacy scores increased substantially throughout the semester, for both experienced and novice teachers. However, the most growth was realized for novice teachers. It is recommended that the lesson study method be used with graduate teaching assistants as a professional development tool to improve their teaching effectiveness.

Introduction

Students need a forum in which they can actively solve problems, make decisions, communicate in both oral and written form, and work in teams (Evers et al., 1998; Robinson et al., 2007). Assistance in acquiring these skills is perhaps even more pertinent for students who are preparing to become educators in either formal or non-formal settings. According to Lieberman and Mace (2010), *"there is a worldwide concern that schools must change to meet the demands of rapidly changing demographics, the globalization of the economy, as well as the technological and cultural changes that are happening around us"* (p. 77). To that end, pedagogical professional development is important and necessary (Lieberman and Mace, 2010).

Numerous European countries have begun altering the way they conduct professional development for teachers (Organisation for Economic Co-Operation and Development, 2005). However, the United States has yet to realize the effect that critical self-reflections can have on teachers' effectiveness in the classroom (Darling-Hammond et al., 2009). Teaching students how to reflect and develop metacognitive skills is a difficult but worthy task (Tanner, 2012).

New teachers need to be inducted into the teaching profession with mentors who can help them with pedagogy and content (Fieman-Nemser, 2003; Greiman, 2010; Robinson, 2010), especially those who have little teaching experience and are considered novices. Research suggests that when compared to experts, novice teachers *"showed more time-consuming, less efficient planning, encountered problems when attempts to be responsive to students led them away from scripted lesson plans, and reported more varied, less selective post lesson reflections"* (Borko and Livingston, 1989, p. 473). Lieberman and Mace (2010) argued that professional development opportunities should exist *"that use professional learning communities, center on the study of practice, and incorporate the use of technology"* (p. 77). One approach for potentially rich and impactful professional development for teachers is the use of the lesson study method (LSM) (Fernandez, 2002; Lewis et al., 2006).

LSM *"brings together groups of teachers to discuss lessons that they have first jointly planned in great detail and then observed as they unfolded in actual classrooms"* (Fernandez, 2002, p. 393). LSM assists teachers in learning from their own practice through reflection (Fernandez, 2002). The purpose of LSM is to allow teachers within a particular discipline to collaborate in identifying a common problem that students struggle to solve and develop a unified lesson that addresses the problem. Once developed, teachers critique each other on the delivery of the lesson to students. At the end of each lesson, teachers reunite to reflect and modify the lesson plan to improve its effectiveness before re-teaching the material to a different group of students. Each teacher gets a turn at teaching the lesson to a similar age group of students. The hope is to improve

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the lesson's content and the teachers' pedagogical skills each time the lesson is taught. Lewis et al., (2006) stated that LSM assists teachers in learning new knowledge, improving their commitment to the art of teaching, and increasing necessary resources for lessons, thus creating an excellent mechanism for professional development (Fernandez, 2002).

Because LSM requires modeling and observation among all teachers who participate, it has implications for increasing efficacy levels regarding their teaching ability (Bandura, 1977; 1993). Therefore, this study was based on Bandura's (1977) self-efficacy theory prior to and at the end of the semester.

Self-efficacy is needed to help people achieve at performing tasks (Bandura, 1993). Self-efficacy is based on allowing people to observe a model demonstrate aspects of a task or skill and then apply that task or skill in a real life setting (Bandura, 1977). Experience in a particular domain is a key factor that impacts a person's level of self-efficacy. Weidert et al. (2012) found that university graduate teaching assistants (GTAs) who had previous teaching experience rated themselves as more engaging in the classroom than did those with no previous teaching experience. However, additional research is needed that compares experienced teachers with their novice counterparts "before, during, and after teaching" (Westerman, 2000, p. 292) experiences.

Purpose and Objectives

The purpose of this pilot study was to determine the total amount of change in self-efficacy of students who participated in a semester-long advanced teaching methods course in the Department of Agricultural Education, Communications and Leadership (AECL) at Oklahoma State University (OSU), using lesson study. The overarching objective for this study was to compare the total change in self-efficacy scores of students who had formal teaching experience prior to enrolling in the course with those who did not.

Materials and Methods

A variety of students enroll in the advanced teaching methods course at OSU each spring semester. According to the Oklahoma State University Catalog (2014-2015), AGED 5823 – Advanced Teaching Methods is described as, *"Advanced concepts and methods relevant for both formal and informal presentations. Effects methods may have on individuals involved in the learning experience. Demonstrations of proficiency in use of various advanced methodologies, technologies and concepts"* (p. 201).

The course attracts students from an array of academic majors. Each cohort includes a wide variety of diversity ranging in teaching experience, the type of graduate degree being sought, whether the students are domestic or international, and the departments in which the students are enrolled (i.e., the course is a requirement in AECL and an elective in all other departments in the College of Agricultural Sciences and Natural Resources [CASNR] at OSU). Specifically, the demographic makeup of the students used in this study (N=11) consisted of seven males and four females (see Table 1). Of the eleven students enrolled, five had formal teaching experience (i.e., these individuals had either taught in formal settings or participated in a semester-long student teaching internship) and six had no formal teaching experiences. Three were international students and eight were domestic students. Six were working on Master's degrees and five were working toward doctoral degrees. Four students were enrolled in the department of agricultural education and seven students were enrolled as general agriculture majors.

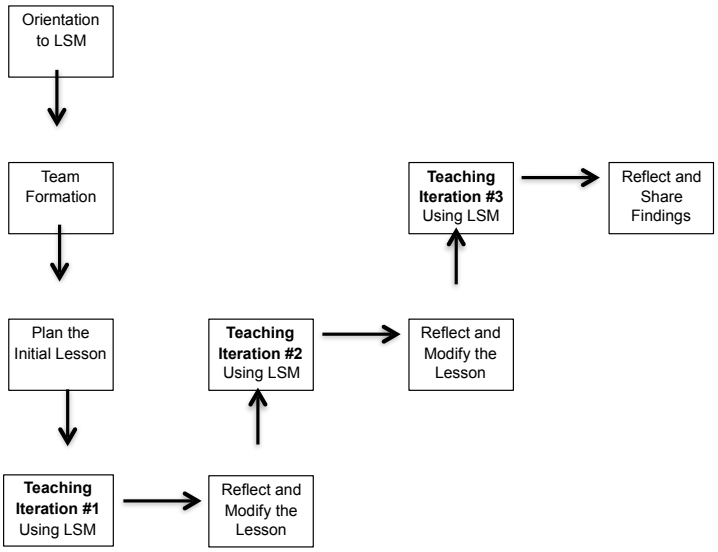
Due to the rich diversity of the class, a need existed to provide a learning experience that would be fruitful for both novice and experienced teachers. The lead instructor wanted to allow students to work in teams, reflect and use their metacognitive skills and develop rich experiences by teaching in real-life settings. Because LSM assumes students teach and reflect on a lesson multiple times, implications exist for such metacognitive skills to improve self-efficacy (Tanner, 2012).

At the beginning of the 16-week semester, the instructor of record allowed multiple opportunities for information building in which students shared aloud and oriented each other to their academic backgrounds and experiences, the problems in agriculture they were interested in highlighting and ultimately addressing, and the age group of students they would like most to interact with in relation to the assignment (see Figure 1). Once completed, students were allowed to select their own groups, consisting of no fewer than two and no more than three members, for the purpose of completing the lesson study assignment. In each group, students self-selected partners, or teams of individuals, who aligned with their own interests as it related to completing the project. In all, four groups were formed. These groups were similar regarding their academic major, future career plans and agricultural interests. Per the guidelines of the assignment (Robinson, 2011), each team determined who, what, when, how and in some cases, where they would teach their lessons. Specifically, the course syllabus stated that students were to

Table 1. Demographics of Participants (N=11)

Characteristic	f	%
Gender		
Male	7	63.6
Female	4	36.4
Teaching Experience		
Yes	5	45.5
No	6	54.5
Degree Being Sought		
PhD	5	45.5
Master's	6	54.5
Geographical Location of Students		
Domestic	8	72.7
International	3	27.3
Department of Enrollees		
Agricultural Education	4	36.4
General Agriculture	7	63.6

Figure 1. A Conceptual Model of LSM in Action



contact the lead instructor to determine a possible date and specific topic (related to the problem you identified) in which you will teach. Ideally, you should plan to teach the lesson at least twice to the same age group of students (Robinson, 2011, p. 4).

The LSM was introduced to students in week five of the 16-week semester. Students were charged to determine the age demographic of students they would like to prepare their lessons and teach (e.g., elementary, high school, college, 4-H youth) and make their own arrangements to teach the multiple iterations of their lessons per the LSM guidelines (Fernandez, 1999). Beginning in week five, the instructor of record allowed students roughly 30 minutes to one-hour at the back end of the three-hour class session for LSM team planning and preparation. During this time, the instructor facilitated and answered questions, cleared up any confusion, helped make contacts for the teaching experiences, and guided the students to a sharper focus regarding the assignment's guidelines and the instructor's expectations. Students conducted their teaching assignments based on their own schedules outside of class time and reflected on them, via an oral poster presentation to the class, as part of their final assignment in week 16.

The essence of this study was to determine if LSM could improve students' levels of self-efficacy related to teaching. Because of its solid reputation and reliability estimates, the questionnaire used for the study was the long version of the Teachers' Sense of Efficacy Scale (TSES), developed by Tschannen-Moran and Woolfolk Hoy (2001). The TSES is a 24-item questionnaire that measures participants' self-efficacies across three constructs – student engagement, instructional practices, and classroom management. Each construct consists of eight items. Essentially, teachers are asked to respond to their ability to perform specific tasks in the classroom related to the three constructs. Because of the small sample size, only basic descriptive statistics (i.e., modes of central tendency) were employed to analyze the data. A mean difference score was calculated as a form of assessing the practical significance of LSM on students' self-efficacy to teach.

Results and Discussion

The objective of this study was to determine the total change in teacher self-efficacy scores among graduate students who had teaching experience versus those who did not. It was found that students with formal teaching experiences had the greatest amount of teacher self-efficacy in the area of classroom management prior to (M = 6.73, SD = 0.84) and at the end of (M = 7.68, SD = 0.76) instruction. Those without teaching experience had the greatest amount of teacher self-efficacy in the area of classroom management (M = 5.98, SD = 1.22) prior to instruction and instructional practices (M = 8.02, SD = 0.95) at the end of instruction.

The greatest amount of growth for both groups was in the area of instructional practices (Mean Differences = 1.38 and 2.71), respectively (see Table 2). Those with teaching experience were least efficacious with student engagement (M = 6.10, SD = 0.78 prior to instruction; M = 7.33, SD = 0.49 end of instruction). Those without previous teaching experiences had the least amount of efficacy in the area of instructional practices (M = 5.31, SD = 1.03) prior to instruction and classroom management (M = 7.71, SD = 1.09) at the end of instruction.

Table 2. Self-Efficacy Measures at the Beginning of the Semester between those with Teaching Experience and those without Teaching Experience (N=11)

	Prior to Instruction		End of Instruction		
Variables	M	SD	M	SD	Mean Differences
Teaching Experience (n = 5)					
Student Engagement	6.10	.78	7.33	.49	1.23
Instructional Practices	6.25	1.24	7.63	.69	1.38
Classroom Management	6.73	.84	7.68	.76	.95
No Teaching Experience (n = 6)					
Student Engagement	5.96	1.47	7.79	1.15	1.83
Instructional Practices	5.31	1.03	8.02	.95	2.71
Classroom Management	5.98	1.22	7.71	1.09	1.73

Note. Scale: "1" = "Nothing," "3" = "Very Little," "5" = "Some Influence," "7" = "Quite A Bit," and "9" = "A Great Deal"

Summary

It appeared that the semester-long, lesson study assignment impacted teacher self-efficacy positively for all students in the course. Students with former teaching experience had the highest perceived self-efficacy scores on all three constructs (i.e., student engagement, instructional practices, and classroom management) prior to instruction. This finding is consistent with work from Prieto and Altmaier (1994) and Tanner (2012) who found that GTAs who had previous teaching experiences also had higher levels of self-efficacy. In contrast, students who had no prior teaching experience had the highest perceived self-efficacy scores on all three constructs at the end of instruction.

The greatest amount of growth in teacher self-efficacy for both groups was noticed in the area of instructional practices. This is somewhat expected since the class students were enrolled was advanced teaching methods and focused almost solely on instructional practices. The least amount of growth for both groups was in the area of classroom management. This could be explained in two ways: 1) the course did not address classroom management specifically; and 2) perhaps the students being taught in the respective locations were on their best behavior and posed no real classroom management issues. Thus, perhaps students in the course did not have to develop or use any classroom management skills.

In contrast, individuals with no former teaching experience had the highest mean scores in all areas at the end of the semester. Further, students with no teaching experience prior to enrolling in the course had the highest gains in Mean Differences scores when compared to their counterparts who had teaching experience. A potential explanation for this finding is that these students had more room for improvement regarding their efficacy and pedagogical understanding (Roberts and Dyer, 2004). Further, since the content and experiences were likely new and novel to them, perhaps they underestimated their sense of efficacy prior to instruction and overestimated their sense of efficacy at the end of instruction when compared to their counterparts who have been entrenched longer as formal educators.

Recommendations

Viewed as a pilot study, the results favored the use of LSM to improve self-efficacy related to teaching practices. The study suffered from a small sample size and should be replicated with larger groups to determine the impact that LSM has on teacher self-efficacy. Replicating the study across multiple departments, colleges and states would help determine its utility in preparing graduate students for teaching obligations and future careers.

A question that remains is, did the LSM assignment or the course, writ large, make a lasting impact for these students? Future studies should assess this phenomenon in a more experimental way. For example, the lead teacher and researcher offers two sections of the advanced teaching methods course each spring, simultaneously a face-to-face section and an online section. Students in the face-to-face section are exposed to the LSM. However, students in the online section, who receive course information asynchronously, are not. This is due largely because students in the online course typically span multiple time zones across various geographic regions of the United States, thus, making the use of lesson study (i.e., team building and planning) ineffective. As such, comparisons should be made between these two groups to understand better how the intervention of LSM affects students' self-efficacy toward teaching.

Discussion

Although LSM is a method that has been used primarily at the primary and secondary levels (Fernandez, 2002), it has implications for improving the teaching self-efficacy of current and aspiring college instructors, which is an important phenomenon to consider (Prieto and Altmaier, 1994). Because universities across America rely on GTAs to help deliver important content to undergraduate students in classroom and laboratory settings, it is important for them to receive proper training and preparation (Prieto and Altmaier, 1994). Numerous institutions have teaching excellence centers that offer training workshops for improving the teaching repertoire and competence of GTAs as instructors. Therefore, college administrators should consider utilizing their centers for teaching excellence, when possible, to help fulfill the preparation necessary for their GTAs, where pedagogies such as LSM can be emphasized.

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Motivation of Undergraduate Animal Sciences Students[1]

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Abstract

The purpose of this study was two-fold: 1) identify motivational constructs in animal sciences students and the association with demographic variables; and 2) consider self-reported satisfaction within the major and decisions to persist. Motivational constructs included themes of affect, self-efficacy, academic and career outcomes. Findings indicated strong positive academic affect and intrinsic career motivation (4.39 ± 0.03 and 4.56 ± 0.02, respectively on a 5-point scale), which did not differ among rank, cumulative point-hour ratio (CPHR), transfer status, or community association. Both intrinsic and extrinsic measures were important to achieve positive academic outcomes. Self-efficacy emerged as the leading construct associated with demographic variables and CPHR. Rank 1 students, out-of-state and regional, agricultural technical transfer students and students with CPHR less than 3.00 reported reduced values for self-efficacy ($P < 0.01$). Seventy-nine percent of respondents reported with certainty that they would graduate within the Animal Sciences major, but 23.7% of students reported that they were too far along in the degree to change majors. Collectively, measurements of motivational constructs and decisions to persist reported herein provide a framework for understanding student attitudes and orientation to the academic environment. A basis for future research to strengthen academic achievement and major persistence through academic approaches that foster self-efficacy is established.

Introduction

Learning success is reliant on motivation (Donker et al., 2014). However, factors that influence motivation are complex. When one perceives confidence in their skills and a positive ability to accomplish a task, greater achievement occurs as a result of increased effort and persistence (Lent et al., 1984, 2008). Greater self-efficacy as a motivating factor can predict positive outcomes across unrelated events, including cognitive learning abilities (Sherer et al.,1982). Greatest success is achieved when individuals demonstrate self-efficacy and underlying intrinsic motivation toward the task.

In learning, intrinsic motivation reflects a desire to learn due to curiosity, a need to be challenged, or a need to master a concept. Intrinsic motivation reflects self-improvement (Bye at. al., 2007). In contrast, extrinsic motivation is reflected by seeking of approval or external signs of worth. In the classroom, students driven by extrinsic motivation are more inclined to ask procedural questions instead of content enhancing questions (Bye et al.,2007). Grades or other rewards of performance have greater value than the knowledge itself.

While intrinsic motivation promotes learning from interest, not all learning activities will be inherently interesting and extrinsic motivation becomes of greater value. Indeed, intrinsic motivation decreases with advancing education, which promotes breadth across disciplines (Ryan and Deci, 2000). It is well established that intrinsic and extrinsic motivation are interactive, with each contributing to overall learning (Lin et al., 2001). Extrinsic motivation progresses from dimensions of external regulation to self-integration, which reflects decisions made on the basis of compliance toward autonomous commitment to personal accomplishment (Ryan and Deci, 2000). Each dimension is underscored by reward, but students driven predominantly by external regulation are less likely to persist in academic activities (Vallerand and Bissonnette,1992); thus, dominance of this form of extrinsic motivation may undermine career success (Benabou and Tirole, 2003) and contribute to long-term, negative outcomes. Both intrinsic and extrinsic motivation are fostered through positive affect, which promotes self-regulated behaviors in the extrinsically motivated (Reeve and Cole, 1987; Isen and Reeves (2005). Indeed, persons that demonstrate positive affect are more likely to complete tasks even when not intrinsically motivated to do so.

Studies of motivational factors in undergraduate education are not new, but information concerning motivation of animal sciences students is lacking. The study herein provides evidence of motivational factors among this population of students and considers decisions to persist in the major. A greater understanding of motivat-

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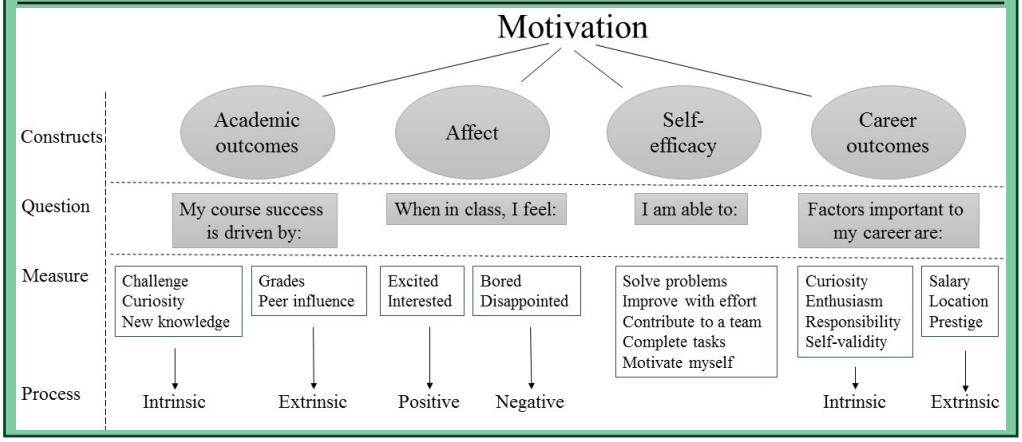
ing factors shapes pedagogical strategies to move students toward more successful learners with long-term positive outcomes.

Figure 1. Conceptual framework for assessing motivational constructs. Multiple measures were queried for each construct and associated processes using Likert-scale, multiple-choice, multiple-select, and dichotomous type questions.



Methods

Instrument

A self-report survey instrument was developed to collect demographic variables (gender, academic rank, enrollment status, cumulative points-hour ratio (CPHR), race/ethnicity, domestic data, and work/education commitments), determine self-regulated learning activities, assess constructs of motivation and examine the likelihood to persist to graduation. Motivational constructs were defined according to the social-cognitive theory of motivation (Pintrich and Schunk, 1996) and included the constructs of outcome (academic and career), affect and academic self-efficacy. Outcome included the subscales of intrinsic and extrinsic and affect included the subscales of positive and negative (Figure 1). Multiple measures were queried for each construct and associated processes. The instrument was modeled according to motivational scales reported in the literature (Pintrich et al., 1993; Sherer and Maddux, 1982), but with questions applicative to the target student population. Questions were mixed-format requiring Likert-scale (n=46), multiple-choice (n=17), multiple-select (n=4), and dichotomous (n=4) responses. Non-response options were included when appropriate. Likert scale response questions were on a fixed 5-point scale, and scales were defined progressing from negative to positive statements of agreement.

Participants

The survey was administered spring term 2014 following review and exemption by The Ohio State University Institutional Review Board. Online survey software and questionnaire applications (SurveyMonkey) were used to deliver the survey. Students with a declared program in Animal Sciences according to enrollment census data (n=697) were invited to participate in the survey using email notification. The survey invite included the targeted audience, the purpose of the survey, an estimate of the length of time needed to complete the survey, incentives offered in completing the survey, the beginning and end dates for completion of the survey, and a direct link to the on-line survey through a SSL encrypted URL. The survey was open for three weeks and a reminder email including the original survey invite information was sent weekly. Participation in the survey was voluntary. Participants accessing the URL were required to provide consent prior to beginning the survey and were entered into a drawing to receive

Table 1: Profile of survey respondents.

Variable	Number	Percent
Gender (n=235)		
Female	200	85.1
Male	33	14.0
Not Reported	2	0.85
Program of study (n=235)[x]		
Animal Biosciences	144	61.3
Animal Industries	71	30.2
Animal Nutrition	14	5.96
Veterinary Technology	6	2.55
Academic rank (n=235)[y]		
Rank 1	30	12.8
Rank 2	51	21.7
Rank 3	65	27.7
Rank 4	87	37.0
Degree holding	2	0.85
Transfer status (n=228)		
Not applicable	145	63.6
Interdepartmental	4	1.75
OSU affiliated institution	43	18.9
Agricultural Technical Institute	(12)	(5.26)
OSU regional campus	(31)	(13.4)
In-state	22	9.65
Out-of-state	14	6.14
Enrollment status (n=235)[z]		
Full-time	223	94.9
¾-time	5	2.13
½-time	4	1.70
Part-time	3	1.28
Cumulative points hour ratio (n=236)		
Less than 2.00	4	1.69
2.00 to 2.49	14	5.93
2.50 to 2.99	45	19.07
3.00 to 3.49	87	36.86
3.50 to 4.00	81	34.32
Not determined	5	2.12

[x]Animal Sciences programs of study include: Animal Biosciences and Animal Industries that lead to a B.S. in Agriculture, Animal Nutrition that leads to a B.S. in Nutrition, and Veterinary Technology that is a joint program with Columbus State Community College and leads to an A.A.S. in Veterinary Technology and B.S. in Agriculture.

[y]Academic rank in accordance with university policy is defined as 30 credits or less for Rank 1, 30.5 to 60 credits for Rank 2, 60.5 to 90 credits for Rank 3, and 90.5 or above credits for Rank 4. Definitions based on

[z]Full-time enrollment status in accordance with university policy is defined as a minimum of 12 credits, 9 to 11 credits define ¾-time enrollment, 6 to 8 credits defines ½-time enrollment, and 5 or less credits defines part-time enrollment.

a reward as incentive for participation. Survey participation was kept confidential and confidentiality of survey response was maintained by collecting, retrieving and storing data without any personal identifiers (personal names, ID, email and IP addresses).

Figure 2. Post-secondary financial sources. Participants were directed to select all options that applied, and data is presented as a percent of total respondents (n=235).

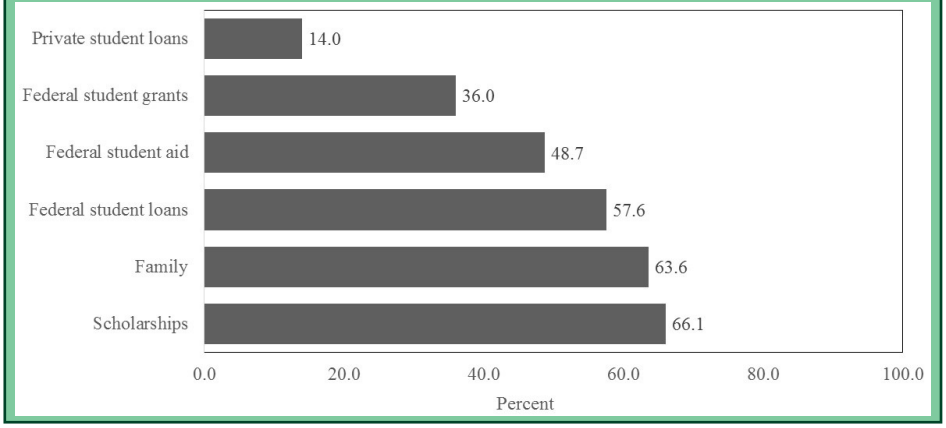
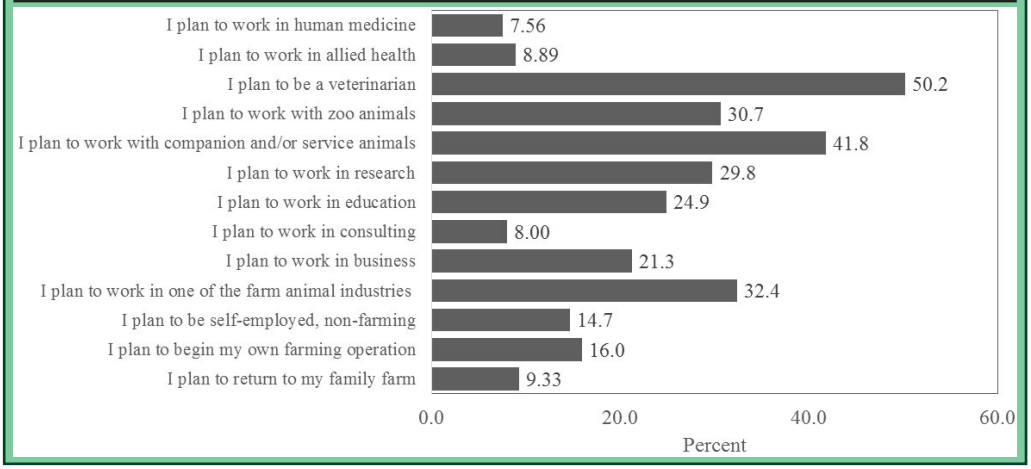


Figure 3. Post-secondary financial sources. Participants were directed to select all options that applied, and data is presented as a percent of total respondents (n=235).



Data Analyses

Statistical analyses were performed using SAS (version 9.3; SAS, Cary, NC). The Cochran-Mantel-Haenszel test was used to control for student and report demographic data using the PROC FREQ procedures. Factorial analysis (PROC FACTOR) was used to examine the latent factor structure of surveyed elements of motivation. The minimum data for factor analysis was satisfied (Santos, 1998). Examination of scree plots identified five factors with varimax rotation. Eigenvalues showed that the five factors explained 54.2, 19.1, 11.3, 8.81 and 6.59% of the proportional variance. Variables within a factor shared commonality with the targeted motivational themes: positive affect, negative affect, academic self-efficacy, intrinsic career motivation and extrinsic career motivation. Internal consistency among the set of variables for a given construct or subscale was calculated using Cronbach's alpha. Composite scores were calculated for each of the five factors from the variables loaded onto each factor. Measures of intrinsic and extrinsic academic values did not load onto a factor and were analyzed individually. Additional items that did not load onto a factor and did not increase Cronbach's alpha for a given construct or subscale were removed from analysis. Descriptive statistics were calculated using PROC MEANS and mean responses compared by ANOVA and confirmed by Tukey's post-hoc analysis. Multiple response survey data were analyzed as dichotomous variables using PROC FREQ procedures. Data are presented as means ± SEM with $P \leq 0.05$ considered significant.

Results

Demographics

Survey response rate was 33.7%. The majority of responses, 34.7, 12.7 and 16.9%, occurred within 24 hours of the original survey invite, the first reminder, or the second reminder, respectively. Respondents were primarily female with a declared Animal Biosciences program (Table 1). Race/ethnicity of respondents was 86.0% white, 2.97% Asian, Asian American, or Pacific Islander, 2.12% Black or African American, 2.12% Hispanic or Latin American, 1.69% Multiracial, 1.27% Mexican or Mexican American, 0.85% Puerto Rican, 0.42% American Indian or other Native American and 2.45% other. Ninety-three percent of respondents identified as traditional students, defined as continuous education from secondary or high-school to post-secondary or university. The majority of respondents were non-transfer students (63.6%) and enrolled full-time (94.9%). Scholarships (66.1%), family (63.6%) and federal loans (57.6%) were the primary financial resources for funding ones education (Figure 2). Veterinary medicine (50.2%) and careers in the companion and/or service animal industries (41.8%) were the two leading long-term career objectives of respondents (Figure 3). Respondents were distributed among all ranks (Table 1) and 71.1% reported a CPHR of 3.00 or above on a 4.00 scale (Table 1). Students of rank 1 status and transfer students from the regional, agricultural technical institute were more likely to report CPHR below 3.00 when compared to rank 4 and non-transfer students (73.3% of rank 1 students and 81.9% of transfer students, compared to 30.4% of rank 4 students and 14.0% of non-transfer students). Due to limited sample size, respondents with a CPHR of less than 2.00 were omitted from further data analysis and reporting.

Approximately 33% of respondents were first-generation college students as defined by neither parent having received a degree from a four-year institution. Of first generation students, 45.6% of parents were associate degree holders and 54.4% percent held high-school degrees only (Figure 4). The majority of students identified as suburban (42.7%) followed by rural farming association (18.8%). While urban identified students represented the smallest population of respondents, 48.1% of these students were first-generation (Figure 4). The choice of major was determined during ones early child education for 37.0% of respondents, whereas 21.6% of respondents did not decide on a major in animal sciences until college. Personal experience (98.2%) and family (62.8%) were the primary factors influencing the choice of an animal sciences major (Figure 5). When asked about certainty in choosing the major, 83.9% of respondents reported that they were certain or very certain that the degree in animal sciences was the best fit major. Major courses, courses in natural sciences and math, and professional experiences contributed to certainty in major selection (Table 2).

The majority of students participated in co-curricular (56.2%), extra-curricular (79.2%), or volunteer (63.3%) activities, with most students committing less than 5 hours per week to these activities (Figure 6). Nearly 40% of students worked 5 hours or less weekly for pay (Figure 7A). There was no association between the number of hours committed to co-curricular, extra-curricular, or volunteer activities or hours worked for pay and the time committed to preparing for class. However, hours worked for pay and time committed to preparing for class were associated with CPHR. Overall, students with greater CPHR spent less time working for pay. Whereas only 30.9% students with a 3.50 or greater CPHR worked 15 hours or more per week, this value increased to 71.5% for students with less than a 2.50 CPHR (Figure 7B). The majority of students (46.6%) spent 10 hours or less preparing for class weekly (Figure 8A); however, there was a tendency (P=0.07) for students with a 3.00 CPHR or greater to dedicate more time preparing for class and 9.62% of these students spent more than 25 hours per week preparing for class each week (Figure 8B). When asked about class preparation, only 22.8% of students reported that they always prepare for class by completing readings, assignments, or review of notes prior to attendance. However, 87.4 and 90.9% of respondents agreed or strongly agreed to statements of taking detailed notes during class and using notes to prepare for graded course assessments, respectively.

Table 2. Confidence in fit of major and contribution of academic fields to fit of major.

	Response, %					
Variable	1	2	3	4	5	Mean ± SE[x]
Confidence[z]	1.79	4.02	10.3	26.8	57.1	4.33 ± 0.06
Academic fields[y]						
Humanities	29.3	25.8	28.0	13.3	3.56	2.35 ±0.08[a]
Social Sciences	11.6	20.0	36.0	22.7	9.78	2.98 ± 0.08[b]
Natural Sciences and Math	1.33	3.56	14.7	31.6	48.9	4.22 ±0.06[c]
Major Courses	0.44	0.0	1.78	16.0	81.8	4.79 ±0.03[d]
Professional Experiences	1.33	0.89	7.56	18.2	72.0	4.60 ±0.05[e]

[z]Respondents (n=) used a five-point response scale rating system progressing from not at all certain (1) to very certain (5).

[y]Respondents (n=) used a five-point response scale rating system progressing from not important (1) to very important (5).

[x]Values are means ± SE, n = 231. Labeled means within a column with super-scripts without a common letter differ, *P < 0.01.*

Figure 4. The percent of students identifying as a first-generation college student (A) and community association prior to entering university (B). Community association is presented as total respondents for each classification (n=231) and summation of first- and non first-generation students as a percentage for each classification. For the purpose of this study, urban was defined as a population dense area, i.e. city, and suburban was defined as an urban outlying residential area.

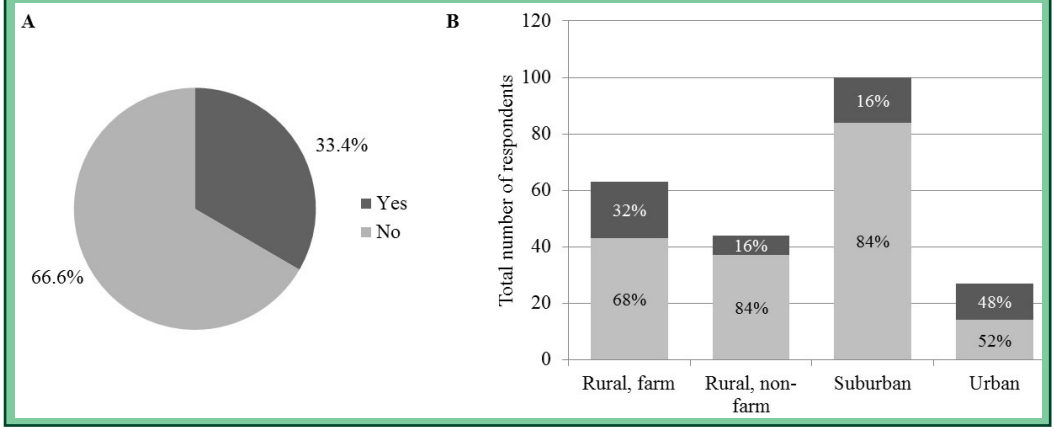


Figure 5. The percent of students by time decision was made to pursue animal sciences degree (A) and the factors influencing the choice to study animal sciences (B). Data is presented as a percent of total respondents (n=231). For individuals influencing the choice of study, participants were directed to select all options that applied.

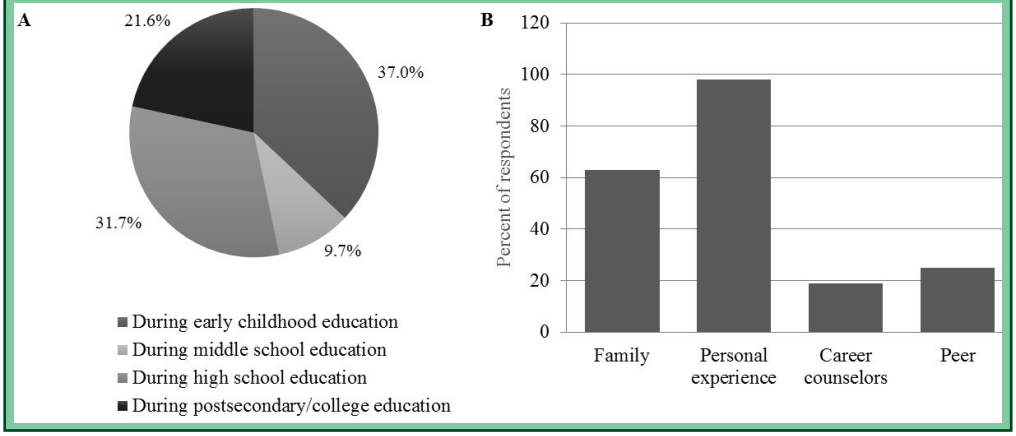


Figure 6. Distribution of students by weekly commitment to co-curricular (A), extra-curricular (B), and volunteer (C) activities. Data is presented as a percent of total respondents (n=231). Co-curricular activities were defined as mentoring, student teaching, judging teams, and research. Extra-curricular activities were defined as student organizations, athletics, band, vocals, orchestra, and similar.

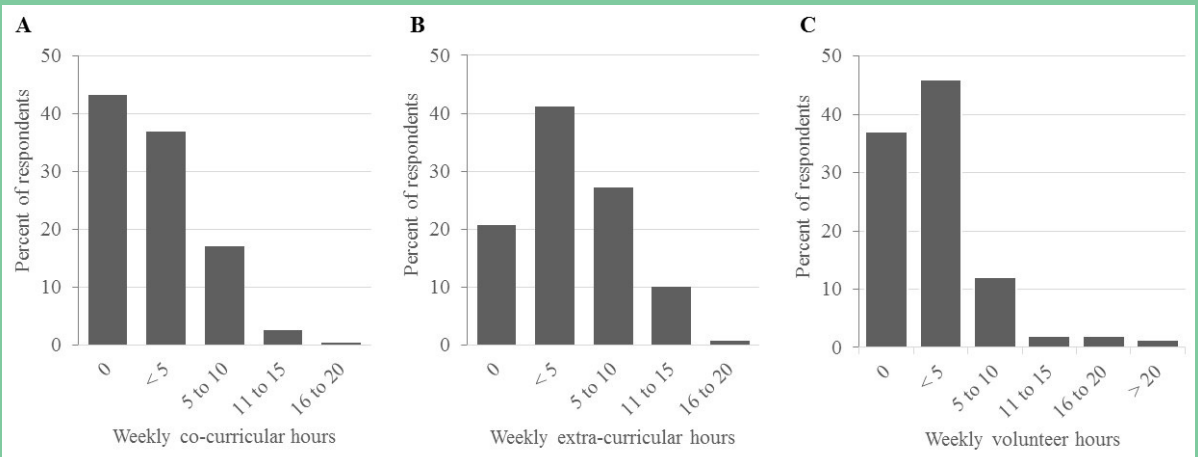


Table 3: Scale reliability and mean composite scores of motivational factors.

Variable	Cronbach's alpha	Mean[z]	SE
Affect			
Positive affect	0.80	4.39[a]	0.03
Negative affect	0.72	4.07[b]	0.06
Academic self-efficacy	0.73	3.84[c]	0.03
Career outcomes			
Intrinsic factors	0.75	4.56[d]	0.02
Extrinsic factors	0.69	3.89[c]	0.02

[z]Values are means ± SE, n = 231. Labeled means within a column with superscripts without a common letter differ, *P < 0.01*.

Figure 7. Percent of student respondents (n=231) by the number of weekly hours worked for pay (A), and by weekly hours worked for pay and CPHR (B). Cochran-Mantel–Haenszel analysis for distribution of weekly hours worked for pay by CPHR P =0.02.

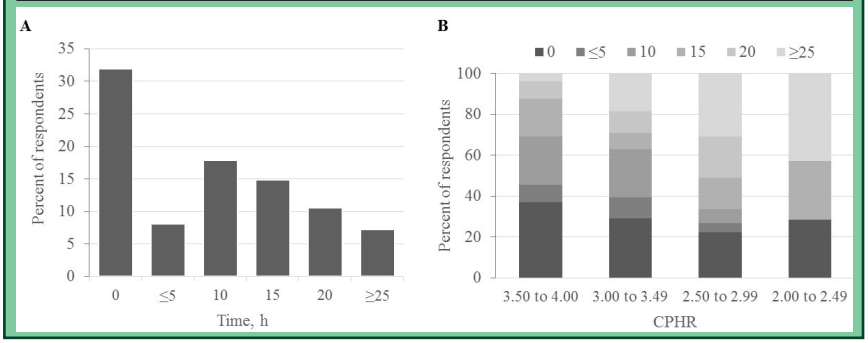
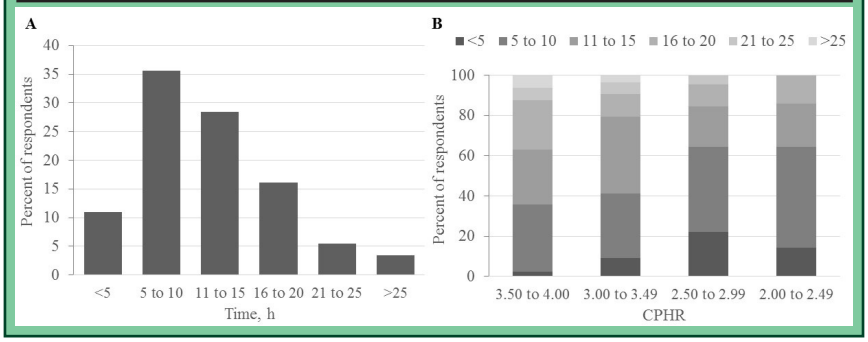


Figure 8. Percent of student respondents (n=231) by the number of hours spent preparing for class weekly (A), and by total hours spent preparing for class and earned CPHR and (B). Cochran-Mantel–Haenszel analysis for distribution of weekly hours worked for pay by CPHR P =0.07.



Motivation

Reliability of motivational constructs and subscales for items of affect, academic self-efficacy and career outcomes ranged from 0.80 to 0.69 (Table 3). Mean Likert-scale composite scores showed that respondents perceived greater positive academic affect compared to negative affect, 4.39 ± 0.02 versus 4.07 ± 0.06, respectively (P< 0.01; Table 3). Students perceived only moderate self-efficacy (3.84 ± 0.03) in their academic abilities. When asked which factors were important toward their intended career, mean scores were greater for intrinsic career factors compared to extrinsic career factors, 4.56 ± 0.02 versus 3.89 ± 0.02, respectively (P< 0.01; Table 3). There were no differences among rank, CPHR, transfer status, or community association for measures of affect or career outcomes; however, differences were noted among these variables for self-efficacy. Mean composite scores for self-efficacy were least in rank 1 students and students with CPHR less than 2.50 (Table 4). Non-transfer students and students who transferred to OSU from a non-OSU affiliated school within Ohio reported greater self-efficacy than the regional, agricultural technical students and out-of-state transfer students (Table 4). Lastly, students of suburban community association reported greater self-efficacy than urban and non-farm, rural students. There were no differences in self-efficacy between suburban and farm, rural students (Table 4).

The intrinsic motivator with the greatest influence on academic outcomes was curiosity (4.56 ± 0.04; P < 0.01), followed by gain in new knowledge (4.25 ± 0.05; P < 0.01; Table 5). Peer comparison was the greatest extrinsic motivator of academic outcomes (4.15 ± 0.06; P < 0.01); Table 5). Academic outcomes were further influenced by rank and CPHR. The need to be challenged was greatest in rank 4 students and least in rank 1 students (3.71 ± 0.11 and 3.33 ± 0.18, P < 0.01), whereas, extra-credit was a more important motivator in rank 1 relative to rank 4 students (4.20 ± 0.18 and 3.76 ± 0.12, P

Table 4: Distribution of responses and composite mean scores for self-efficacy by rank, CPHR, transfer and community status.

	Response, %[z]					Mean ± SE[y]
	1	2	3	4	5	
Rank						
Rank 1	4.67	12.0	30.7	34.7	18.0	3.59 ± 0.09[a]
Rank 2	4.18	12.6	15.5	39.3	28.5	3.89 ±0.06[b]
Rank 3	2.49	7.48	24.0	34.3	31.8	3.94 ±0.05[b]
Rank 4	4.72	7.78	19.1	38.7	29.7	3.83 ±0.05[b]
CPHR						
2.00 to 2.49	5.71	8.57	28.6	38.6	18.6	3.44 ±0.12[a]
2.50 to 2.99	6.22	12.9	32.4	32.0	16.4	3.40±0.07[a]
3.00 to 3.49	1.71	8.56	19.6	39.4	30.8	3.97 ±0.05[b]
3.50 to 4.00	3.29	5.82	15.2	38.0	37.7	4.11 ±0.04[b]
Transfer						
None	3.57	8.43	20.0	39.1	28.9	3.91 ±0.04[a]
Interdepartmental	6.67	0	20.0	46.7	26.7	3.73 ±0.30[ab]
ATI	13.3	6.67	21.7	21.7	36.7	3.50 ±0.18[b]
OSU Regional	1.94	10.3	23.2	40.0	24.5	3.73 ± 0.08[ab]
Ohio	3.08	9.23	15.4	30.8	41.5	4.01 ± 0.13[a]
Out-of-state	5.08	20.34	32.2	27.1	15.3	3.40 ± 0.15[b]
Community						
Farm, rural	1.43	7.14	24.3	41.1	26.1	3.85 ±0.05[ab]
Nonfarm, rural	8.42	8.95	21.6	34.2	26.8	3.67 ±0.08[a]
Suburban	2.42	9.47	18.5	35.2	34.4	3.94 ±0.05[b]
Urban	9.47	10.5	15.8	40.0	24.2	3.70 ±0.10[a]

[z]Respondents (n=231) used a five-point response scale rating system progressing from not at all confident (1) to very confident (5).

[y]Values are means ± SE. Labeled means within a column with superscripts without a common letter differ, *P < 0.01.*

Table 5: Intrinsic and extrinsic measures contributing to academic outcomes.

Variable	Mean[z]	SE
Intrinsic measures		
Challenge	3.51[a]	0.07
Curiosity	4.56[b]	0.04
New knowledge	4.25[c]	0.05
Extrinsic measures		
Grade earned	3.48[a]	0.07
Extra-credit	3.98[d]	0.07
Peer comparison	4.15[c]	0.06

[z]Values are means ± SE, n = 231. Labeled means within a column with superscripts without a common letter differ, *P < 0.01.*

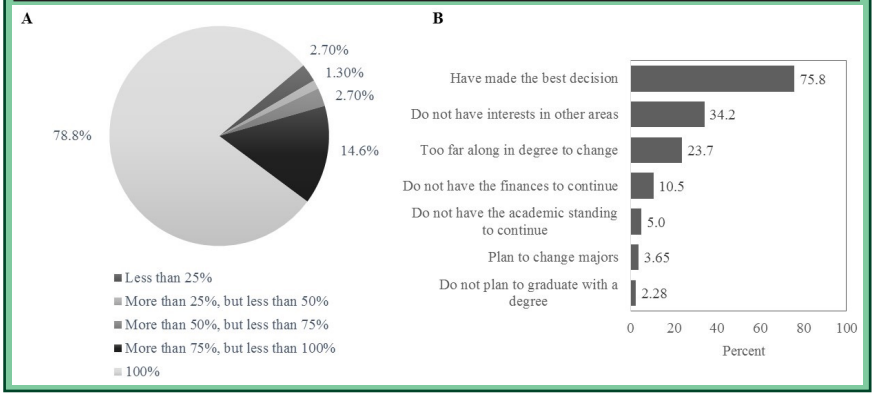
Table 6: Distribution of responses and composite mean scores for intrinsic and extrinsic measures of academic outcome by CPHR.

	Response, %[z]					Mean ± SE[y]
Variable	1	2	3	4	5	
Curiosity						
2.00 to 2.49	0.00	0.00	0.00	35.7	64.3	4.64 ± 0.13[ab]
2.50 to 2.99	0.00	0.00	8.89	37.8	53.3	4.44 ± 0.10[a]
3.00 to 3.49	0.00	2.47	4.94	27.2	65.4	4.56 ± 0.08[ab]
3.50 to 4.00	0.00	2.56	1.28	19.2	76.9	4.71 ± 0.07[b]
Challenge						
2.00 to 2.49	0.0	7.14	42.9	21.4	28.6	3.71 ± 0.27
2.50 to 2.99	4.26	12.8	36.2	34.0	12.8	3.36 ± 0.15
3.00 to 3.49	3.80	10.1	25.3	44.3	16.5	3.59 ± 0.11
3.50 to 4.00	6.41	15.4	16.7	37.2	24.4	3.58 ± 0.14
Knowledge						
2.00 to 2.49	0.0	7.14	21.4	42.9	28.6	3.93 ± 0.25[a]
2.50 to 2.99	2.22	2.22	22.2	37.8	35.6	4.02 ± 0.14[ab]
3.00 to 3.49	0.00	1.23	14.8	39.5	44.4	4.27 ± 0.08[b]
3.50 to 4.00	0.00	1.27	8.86	30.4	59.5	4.50 ± 0.08[c]
Grade earned						
2.00 to 2.49	0.00	21.4	35.7	14.3	28.6	3.50 ± 0.31[ab]
2.50 to 2.99	2.22	13.3	37.8	33.3	13.3	3.42 ± 0.14[ab]
3.00 to 3.49	4.94	19.8	27.2	34.6	13.6	3.32 ± 0.12[a]
3.50 to 4.00	1.25	12.8	29.5	30.8	25.6	3.67 ± 0.11[b]
Extra-credit						
2.00 to 2.49	7.14	0.00	14.3	21.4	57.1	4.21 ± 0.31
2.50 to 2.99	0.00	4.44	17.8	28.9	48.9	4.22 ± 0.13
3.00 to 3.49	1.23	8.64	24.7	30.9	34.6	3.89 ± 0.11
3.50 to 4.00	3.90	7.79	26.0	23.4	39.0	3.83 ± 0.13
Peer comparison						
2.00 to 2.49	7.14	0.0	0.0	50.0	42.9	4.21 ± 0.28
2.50 to 2.99	2.22	2.22	17.8	44.4	33.3	4.04 ± 0.13
3.00 to 3.49	2.47	3.70	18.5	32.1	43.2	4.10 ± 0.11
3.50 to 4.00	1.28	2.56	11.5	32.1	52.6	4.33 ± 0.10

[z]Respondents (n=231) used a five-point response scale rating system progressing from this is not at all me (1) to this is exactly me (5).

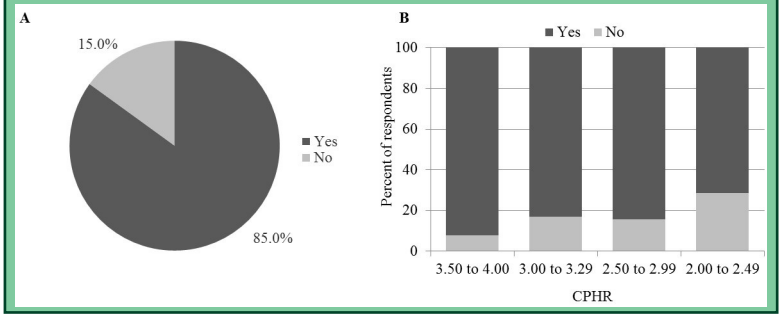
[y]Values are means ± SE. Labeled means for a given variable within a column with superscripts without a common letter differ, *P < 0.05.*

Figure 9. Distribution of students by likelihood to persist in major (A) and factors contributing to the decision to persist or not persist with the Animal Sciences major (B). For decisions to persist, participants were directed to select all options that applied. Data is presented as a percent of total respondents (n=226).



<0.01). Students reporting a 3.50 or above CPHR reported numerically greater mean scores for the intrinsic factors of curiosity and new knowledge (Table 6). Nearly 77% of students with a 3.50 CPHR or above were in strong agreement that curiosity was an important course factor, and as the desire to gain new knowledge increased, CPHR increased and was greatest among students with a 3.50 or above CPHR (4.50 ± 0.08; P< 0.05). Differences were also noted with the value of grade earned between the two highest CPHR categories (Table 6). Accordingly, students reporting a CPHR of 3.50 or above reported greater value of grade earned (3.67 ± 0.11) when compared to students reporting a CPHR of 3.00 to 3.49 (3.32 ± 0.12; P< 0.05).

Figure 10. Student response (n=226) to the question "If you could start over, would you pursue the same major?" (A) and student response by CPHR (B). Cochran-Mantel–Haenszel analysis for distribution of choice to pursue the same major by CPHR P =0.04.



Persistence

Three percent of respondents reported that the decision to earn a college education was the decision of their parents or legal guardian. When asked of the likelihood to persist to graduation,

78.8% of respondents reported 100% certainty that they would graduate with a B.S. degree with the Animal Sciences major (Figure 9A). For decisions to persist in the degree, 23.7% of students reported that they were too far along in the degree to change majors. Factors contributing to the decision to not persist in the degree included financial limitations (10.5%), academic standing (5%), plans to change majors (3.7%) and intent to not complete a four-year degree (2.3%) (Figure 9B). Eighty-five percent of students indicated that they would choose the same major again if given the choice (Figure 10A). The choice of selecting the same degree was associated with CPHR (P = 0.04) and 28.6% of students with less than a 2.50 CPHR indicated they would not choose the same degree whereas only 7.79% of students with 3.50 CPHR or above indicated they would not choose the same degree (Figure 10B).

Discussion

Motivation is a predictor of postsecondary success (Allen and Robbins, 2010). The theories of motivation in learning are complex and there are many constructs postulated to underscore motivational learning processes. Ryan and Deci (2000) classify motivation through regulatory styles, including extrinsic and intrinsic motivation. Intrinsic motivation is driven by the inherent satisfaction that occurs with completion of a task, whereas extrinsic motivation occurs by reward (Ryan and Deci, 2000). Both forms of motivation play a role in student achievement and persistence to degree attainment. In the postsecondary learning environment, these motivating realms are influenced by self-regulation, whereby an individual assumes control of his or her learning strategies (Bembenutty, 2011). Self-regulation, in turn, is subject to self-efficacy or confidence, which is promoted through positive affect (Bandura, 1997). Due to the influence of these interconnected factors on academic performance, numerous conceptual models have been proposed to understand the processes crucial to student success. Current literature is based primarily in social science disciplines and often is confined to single-course populations (Bye at al., 2007). To this end, the conceptual framework of the current study (Figure 1) examined academic and career outcomes and underlying intrinsic and extrinsic motivating factors, self-efficacy and affect in animal sciences majors and captured influences of sociodemographics as well.

It is well documented that a shift in traditional animal sciences student demographics has occurred, where an increased number of students are female and classify as non-rural with career interests in companion animals and/or veterinary medicine (Edwards, 1986; Reiling, 2003; Reese et al., 1987). The current population under study was representative of this shift. The lack of racial and ethnic diversity is in agreement with previous studies and suggests limited growth in diversity, which has persisted for the field for nearly two-decades (Beck and Swanson, 2003). The majority of respondents were female. While this study only captured one-third of the students enrolled in the major, enrollment census data is in agreement and confirms the female gender bias of the major, which closely parallels gender distribution in veterinary medical colleges (Brown and Silverman, 1999). This study further suggested increased interests in zoo professions when compared to course enrollment data of others (Reiling, 2003). Career interests were not surprising. Only 26.9% of students identified as farm rural, thus the majority of students would likely not have farm animal experience. Students with minimal to no farm animal experience are more likely to indicate study interests in companion and zoo animals (Reiling, 2003). Interests support career choice goals (Lent et al.,1994), which are strengthened by interest-major congruence (Allen and Robbins, 2010). Indeed, 86.0% of students reported that the major was mostly or exactly the best fit for enhancing their career values. Furthermore, students reported greater intrinsic career motivation. Thus, while a demographic shift as occurred in animal sciences students and their career intentions, data of the current study supports the value of the major toward continuing to meet the educational and career objectives of its students.

The majority of students reported that the decision to major in animal sciences occurred prior to high-school entrance. Prior experiences are considered one of the most influential factors in major selection (Wildman and Torres, 2001) and was true of students in the current study. Reese and colleagues (1987) further identified parents as a primary determinant of major selection. In the current study, 62.8 % of students identified family as a factor influencing major selection. While this study did not differentiate among family associations, the data suggests that the influence of family is less than that reported nearly three decades ago (Reese et al.,1987). The finding is surprising considering generational shifts in the parent-child relationship in which parents today are considered more active in the educational decisions of their offspring (Elam et al., 2007).

Engagement in academic, extra-curricular, and volunteer activities are reflective of the current generation of college students who are defined with the ability to multi-task and prioritize schedules toward appropriate academic achievement (Elam et al., 2007). The number of students working for pay is in agreement with national data (Pike et al., 2008). An association between hours working for pay and hours spent preparing for class was not found. Others have reported a negative association between work load and forms of academic engagement (Furr and Elling, 2000; Pike et al., 2008). Of students who worked for pay, 48.1% reported moderate work load hours, ranging from 10 to 15 hours per week. An association between hours working for pay and academic outcome is suggested, but a consistent relationship between the two has yet to be defined (Furr and Elling, 2000; Pike et al., 2008). While employment which promotes work place skills is considered a positive affector to academic success, there is a non-linear relationship whereby working more than 20 hours per week reduces

students' academic efforts and decreases CPHR (Pike et al., 2008). Indeed, students who worked substantially (> 25 hours per week) were more likely to report a lower CPHR. Students with substantial workloads are more likely to report greater financial stress, negative impacts of work on academic performance and are at greater risk for not persisting in their education (Furr and Elling, 2000; Pike et al., 2008). In the current study, 10.5% of students reported finances as a reason for not persisting in the major.

Only 22.8% of students reported attending class prepared, which is in agreement with student data from like fields reported by the National Survey of Student Engagement (NSSE, 2014). However, students in the current study reported spending less time preparing for class weekly when compared to the national average (NSSE, 2014). Whereas nearly 49% of students in Biology, Agriculture and Natural Resource fields spent 15 or more hours preparing for class weekly, only 25.0% of students from the current study reported spending more than 15 hours per week preparing for class. While course expectations and rigor are expected to increase study time, self-reported hours spent preparing for class are situational and may not be a valid predictor of academic performance (Devadoss and Foltz, 1996; Dollinger et al., 2008). Alternatively, study time is negatively associated with deliberate practice, or engagement with explicit study goals (Plant et al., 2005). Deliberate practice is also argued to underscore the association of study time and grade outcomes. Specifically, it is the quality of study, not time, that has greatest value in academic achievement. In the current study, there was a tendency for students with greater CPHR to report greater time devoted to preparing for class. Deliberate practice requires active planning and time management and is supported by self-regulated learning. Thus the lesser time spent preparing for class and the albeit weak association between class preparation time and CPHR may reflect improved quality study practices of the current student population relative to national findings.

Intrinsic and extrinsic motivation is underscored by multiple constructs that differentiate into defined realms of motivation (Pelletier et al., 1995; Ryan and Deci, 2000). Thus, single scales of intrinsic motivation in learning are unlikely to produce satisfactory factor models, as occurred with this study. Accordingly, individual scales of academic motivation were analyzed. Self-reported measures of new knowledge were equivalently weighted to measures of peer comparison, reflecting value in intrinsic and extrinsic motivators, respectively. It was not surprising that one's academic values were influenced by both intrinsic and extrinsic motivators. Orientation to the environment determines the motivator, and intrinsic motivation can only occur in light of intrinsic interests. For the student that holds no intrinsic interests to a specific task, the replacement with extrinsic interests provides another means to achieve the outcome. (Ryan and Deci, 2000). In an academic setting where not all experiences will be inherently interesting to all persons, the ability to respond to extrinsic motivation is a successful learning strategy toward academic achievement. However, it is unknown if peer comparison altered learning behaviors to this end.

Positive affect has been shown to increase interest and enjoyment of an activity. Persons in positive affect experience increased intrinsic motivation, surprisingly, persons of positive affect also respond to extrinsic motivation (Isen and Reeve, 2005). Thus, positive affect can influence outcome regardless of the motivation type. Despite positive affect being greater than negative affect, the interval estimate of negative affect was relatively strong. Kort et al. (2001) proposed a four dimensions model of learning that involves both positive and negative affect. Both behavioral dimensions occur with constructive learning, and both behavioral dimensions can occur during the process of unlearning in which knowledge is challenged and misconceptions dispelled. The states of effect on the model are cyclical and students move between the behavioral dimensions as a natural state of the learning process (Kort et al., 2001).

Surprisingly, reports of self-efficacy were moderate. While studies suggest a relationship between self-efficacy, positive affect and intrinsic value, the nature of the relationship remains uncertain (Bye et al., 2007; Komarraju et al., 2013; Lent et al., 2008). Thus, self-efficacy does not always predicate other motivational factors, or vice-versa. Indeed, self-efficacy was less for rank 1 students, out-of-state transfer students, and transfer students from the regional, agricultural technical institute; yet positive affect and career intrinsic value did not differ among these populations. Self-efficacy is cultivated through the experience of success, positive encouragement and feedback, appropriate role models and ability to manage emotions (Bandura 1997). Lack of awareness for the educational expectations and requirements of the program may contribute to depressed self-efficacy views, and rank 1 students may further lack the social maturity to promote self-efficacy within. Students from the regional, agricultural technical institute were anticipated to report greater views of self-efficacy. Although a limited number of respondents, these students would have prior program success to meet the requirements for transfer. Further, as these students originate from an agricultural program they are likely to encounter like role models. The lack of self-efficacy noted may reflect external stressors associated with the transition to an urban campus with larger class sizes. Hackett and colleagues (1992) concluded that perceived self-efficacy is reduced among students in a stressed state. Studies show that self-efficacy is a positive determinant of CPHR, with increased self-efficacy predicting increased CPHR. This was true of the current study as well. Both rank 4 and non-transfer students were more likely to report greater CPHR and overall, students reporting CPHR in the upper two brackets reported better views of self-efficacy.

Summary

The present study considered motivational constructs across animal sciences students who differed in academic rank, CPHR, transfer status and community association. The influence of academic and external commitments was considered and the intent to persist in the major examined. Both intrinsic and extrinsic motivators are of operational value to achieving successful academic outcomes; however, academic self-efficacy may be the greatest factor contributing to academic performance. Further studies are needed to determine the factors or experiences that foster self-efficacy in animal sciences students. In light of the associations of self-efficacy and CPHR, and the impact of CPHR on major satisfaction, the findings herein provide context for future academic strategies to improve student success.

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Incorporating Writing-to-Learn Strategies into an Animal Reproduction Course[1,2]

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Abstract

The objectives of this project were to determine whether incorporating writing-to-learn (WTL) strategies into an animal reproduction course affected student performance. Mean scores for papers, exams and quizzes were similar (P > 0.05) for students who participated in WTL (80.6 ± 2.06%, 72.1 ± 1.59% and 68.9 ± 1.76%, respectively) to those that did not (control (CON); 79.7 ± 2.00%, 71.8 ± 1.55% and 68.7 ± 1.72%, respectively). Enrollment in a CON or WTL course did not affect (P > 0.05) the final percentage of total points acquired or final letter grade in the course. Of students enrolled in a WTL course, those with a score above the average mean score on the daily writing assignments achieved a higher (P < 0.0001) percentage (83.3 ± 1.59%) and final grade (2.9 ± 0.16 [A=4 to F=0]) compared to those with a score below the average mean score (68.5 ± 1.81% and 1.5 ± 0.18 for final percentage and grade, respectively). In conclusion, student performance did not differ between students enrolled in a WTL course compared to those that were not; however, students in a WTL course who performed above the average mean score on daily writing assignments had better final grades in the course compared to those who performed below average. Therefore, students who did well on WTL assignments also did better on overall course performance.

Introduction

In the classroom of a science course, instructors often struggle to balance two over-arching objectives for student learning: to learn basic facts about the subject matter and to learn how to critically think and solve problems. Writing-to-learn (WTL) is a group of practices and strategies that are designed to use informal writing to facilitate learning in any particular subject area (Connaly, 1989; Rivard, 1994); WTL may address both of these objectives. Although communication is often thought of as being the primary purpose of writing, the writing process may also be used to learn course material and clarify ideas for the student. Writing may enhance learning in science courses (Emig, 1977; Gere, 1985; Langer, 1986).

Hurd (1991) suggested that discrete knowledge should not be learned for its own sake. Instead, students fare better when they are asked to use that discrete knowledge to problem-solve (Resnick and Kopfer, 1989). Aaron (1996) reported that the incorporation of writing assignments into an animal science class gave students increased opportunities to practice communication skills the students will need in their futures. Aaron (1996) further asserted that "writing to learn" was perhaps even more intriguing to those in the animal science field than "learning to write". Therefore, the objectives of this project were to determine whether incorporating WTL strategies into an animal reproduction course affected student performance as measured by scores on assessments and final course grades and to determine whether performance on WTL activities was correlated with final course grades. The hypothesis was that incorporating WTL strategies during the course would improve overall learning of subject matter which would be reflected in assessments.

Methods

Physiology of Reproduction (ADS 4613) is a required course for all students in the Animal and Dairy Sciences major and is predominantly taken during their junior year, although a few sophomores and several seniors take it each semester. This course has been taught by the same instructor every semester since Fall 2009, including all semesters in this experiment. Although this course is a lecture-based course, there is a corresponding but separately-graded laboratory course: Practices in Physiology of Reproduction (ADS 4611). This laboratory course is also required of all Animal and Dairy Science majors and students are advised to take it concurrently with ADS 4613. Both of these courses are also cross-listed as 6000-level graduate courses. There are, on average, 1 to 2 graduate students enrolled each semester although they are predominantly non-Animal and Dairy Science majors (i.e., biological science, biochemistry, and poultry science majors). Both courses

[1]This study was deemed exempt by the Mississippi State University Institutional Review Board under federal regulation 45 CFR 46.101(b)(4).

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are open to non-majors. With approximately 350 undergraduate students in the Department of Animal and Dairy Sciences, there are typically 42 students enrolled each fall semester (two laboratory sections of corresponding ADS 4611 offered) and 24 students enrolled each spring semester (one laboratory section of corresponding ADS 4611 offered). There was only one section of ADS 4613 taught each semester and thus students did not have a choice in instructor, type of course (regarding treatment), or were not aware that writing was going to be incorporated into the course.

In an effort to meet the objectives, two semesters of ADS 4613 were taught as conventional without (CON; Spring 2013 and Fall 2013; n = 67) and two semesters were taught with WTL strategies (WTL; Spring 2014 and Fall 2014; n = 64). During the CON semesters, students were required to write 2 formal scientific papers. For each paper, they were allowed to choose 1 of 4 topics to write about, papers must have been at least 1,000 words and have included at least 3 peer-reviewed journal articles as sources. Students were encouraged to participate in the instructor-facilitated peer exchange of papers for editing (up to 6% of final grade (3 of 45 points) given for successfully completing this portion). These formal writing assignments were the only writing assignments graded in the course (excluding long-answer type questions on exams) and the one-time peer review was the only option for feedback prior to students' receiving the final assignment grade.

During the WTL semesters, students were also required to write 2 formal scientific papers that followed the same assignment requirements, choice of topics, and grading rubric. However, students were asked to participate in a pre-writing process. The same 6% of final grade (3 of 45 points) was allocated to the following: 1) turning in a paragraph describing why they were choosing the topic they were and how this may affect them in their future, 2) completing an outline of their papers in which the instructor gave feedback about content, 3) turning in a draft of the body of the paper in which the instructor gave feedback about content, and 4) an in-class peer exchange with 3 classmates. Classmates were tasked with making suggestions on content as well as editorial-type corrections.

In addition to participating in this writing process for the 2 formal writing assignments, students during the WTL semesters also completed daily short writing assignments. These were called tickets to class because they were due at the start of each class period as the students entered the classroom (18 total were due) and the topics were related to what was being discussed in class that day. During the first approximately two thirds of the semester, the topics were directly related to the book chapter to be discussed and were designed to encourage students to read and think about the chapter before class. During the last one third of the semester, the topics were more introspective and required more critical thinking. The following are examples of tickets to class: draw, label and list functions of the components of the male reproduction system, create an outline of the next chapter, write a paragraph summarizing the process of ovulation, discuss how artificial insemination may impact global food security, and describe 10 management factors that may improve reproductive efficiency.

Tickets to class were graded using a simple 2-point system: if it was not turned in a 0 was given, if it was not typed and/or did not address all that was asked and/or lacked detail a 1 was given, and a 2 was given if all points were addressed and students included sufficient detail. They were not graded on quality of writing but instead, exclusively on content. In most cases, the instructor skimmed the assignment and assigned the points. To make this daily assignment feasible, additional feedback was not routinely provided and only monthly summation of scores were posted using the online course management system.

As with all aspects of the course, students were welcome to schedule appointments to discuss grades or progress. Tickets to class were required to be typed to reduce the temptation to quickly write something just before class just to complete the assignment. This was important because the purpose of these tickets was not really the ticket itself, it was to encourage students to read and think about the material before class so they could understand the discussion and come prepared with questions. The assignments were to facilitate learning of the material and thus fell into the category of WTL processes.

Final grades were calculated slightly different due to the additional writing requirements of the WTL semesters. However, all semesters had 3 exams, 10 or 11 quizzes, 1 presentation (with a partner) and writing assignments made up 15 to 25% of the final grade. The grading scale followed the following format: A = 90 to 100%, B = 80 to 89%, C = 70 to 79%, D = 60 to 69%, and F < 60%. During all semesters, similar questions and consistent format were followed for quizzes and exams.

Data were analyzed using the GLM procedure of SAS (SAS software version 9.3, SAS Institute Inc., Cary, NC). Means were separated using the PDIFF option of the LSMEANS statement. For a portion of the analysis, those students in the WTL semesters were categorized into either below or above the mean score for the tickets to class. This category was used to assess quality (essentially effort and completeness) of the tickets to class and whether it impacted overall performance in the course. Student letter grades were transformed to a number system for analysis (A = 4, B = 3, C = 2, D = 1, and F = 0). Pearson correlation coefficients were determined using the CORR procedure of SAS. Least-square means and standard errors are reported. Statistical significance was declared at $P < 0.05$.

Results and Discussion

Contrary to the hypothesis, incorporating WTL strategies did not improve mean scores on individual course assessments. Mean scores for formal scientific papers,

exams, and quizzes did not differ between students enrolled in a CON semester and those enrolled in a WTL semester (Table 1). In addition, overall percentage of points available in the course did not differ between students enrolled in a CON semester and those enrolled in a WTL semester (Table 1). Overall letter grade for the course did not differ between students enrolled in a CON semester and those enrolled in a WTL semester (Table 1). It has been noted that science teachers tend to use writing as a means of evaluation compared to social studies teachers who tend to use writing to extend the learning of their students (Langer and Applebee, 1987). This coupled with the observation that students put less emphasis on writing when the product of writing is determined to be more important than the process of writing (Marshall, 1984), may indicate that students majoring in the sciences in college have received many years of unintentional training to de-emphasize writing as a mechanism to learn. Rivard (2000) evaluated secondary education students in comprehension of science after assigning talking, writing, or a combination of both into classroom activities. Authors stated that talking was social, divergent, and generative while writing was personal, convergent, and reflective. Although they determined that writing appeared to enhance retention of co-constructed knowledge over time, students who discussed or talked and then wrote outperformed students who only wrote or did neither when evaluated with a delayed post-test. It may be that the initial talking activity to gain understanding was a necessary component to then realize the benefits of writing to learn. Regarding the current study, we speculate that the assignments may not have been the most ideal to improve learning or perhaps only ideal for some students depending on learning styles. But these results may also indicate that a few assignments in one class during their college career may not be enough for them to switch learning gears and benefit from WTL strategies.

Students submitted WTL assignments that were variable in content, quality, and completeness (or amount of detail). So, although WTL strategies were assigned to all students in the WTL-semester, not all students completed every assignment and among those that did, some exerted more effort compared to others. To further understand how doing complete work on WTL assignments may impact overall course grades, a subsection (only students enrolled in WTL semesters) were analyzed separately. Of these students, those with an above average mean score on the daily writing assignments achieved a higher percentage and final grade compared to those with a below average mean score (Table 2). The scores on the tickets to class were also correlated ($P < 0.0001$) with the final percentage ($R = 0.615$) and final letter grade ($R = 0.588$). Some educators suggest that WTL strategies may improve student learning because these assignments do not have a primary purpose of communication, and instead promote thinking (Howard, 1988). The incorporation of WTL strategies can only have an effect if students put forth some amount of time and thought into completing them, and thus have a chance of increasing learning of the subject matter. If students do not take these assignments seriously, it makes sense that they would not see the potential improvements in learning. These data support this explanation and lead to the question, "How do we increase student participation in these writing-to-learn strategies?" In other words, students must see the value in these types of assignments before they will readily participate.

Table 1. Percentages of points available on course assessments between students enrolled in a conventional (CON) animal reproduction course or one with writing-to-learn (WTL) strategies.

Assessment	CON	WTL	*P*-value[1]
Scientific papers, %	79.7 ± 2.00	80.6 ± 2.06	0.98
Exams, %	71.8 ± 1.55	72.1 ± 1.59	0.88
Quizzes, %	68.7 ± 1.72	68.9 ± 1.76	0.96
Overall points, %	75.4 ± 1.42	76.8 ± 1.45	0.51
Final letter grade[2]	2.2 ± 0.29	2.7 ± 0.24	0.30

[1] *P*-value determined by the GLM procedure of SAS (SAS Inst., Inc., Cary, NC) and when appropriate, means were separated using the PDIFF option of the LSMeans statement.

[2] Final letter grade was transformed to a numerical value for analysis (A = 4.0, B = 3.0, C = 2.0, D = 1.0, F = 0.0).

Table 2. Percentage of points available and final letter grade between students scoring above the average mean score on daily writing assignments and those scoring below the average mean score.

	Above average	Below average	*P*-value[1]
Overall points, %	83.3 ± 1.59	68.5 ± 1.81	< 0.0001
Final letter grade[2]	2.9 ± 0.16	1.5 ± 0.18	< 0.0001

[1] *P*-value determined by the GLM procedure of SAS (SAS Inst., Inc., Cary, NC) and when appropriate, means were separated using the PDIFF option of the LSMeans statement.

[2] Final letter grade was transformed to a numerical value for analysis (A = 4.0, B = 3.0, C = 2.0, D = 1.0, F = 0.0).

Summary

In conclusion, student performance did not differ between students enrolled in a course with WTL strategies compared to those that did not; however, students who performed above average on daily writing assignments had improved final grades in the course compared to those who performed below average. Therefore, students who did well on writing-to-learn strategies also did better on overall course performance.

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The Critical Need for Merging Educational Learning Theories with Experiential Learning Programs in Animal Agriculture: A Literature Review

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Abstract

Many colleges and universities have responded to the National Research Council's (1984) call for educational reform by turning to experiential learning environments. Due to its heightened importance from this perspective, this study reviewed literature pertaining to experiential learning programs in animal agriculture. While Kolb's (1984) model of Experiential Learning is often acknowledged in the literature, it fails to recognize the importance of social interactions and its importance in program development and evaluation is often underplayed. Consequently, a perspective of experiential education is proposed to better support the experiential and social aspects of these valuable programs. Since a great deal of research on experiential learning programs neglects to make ties between program outcomes and educational theory, there is a gap in knowledge regarding how students experience a program. It is equally important to understand how they have learned, so that programs can be modified and strengthened accordingly. As time passes, the demographics of students in agriculture will continue changing, as will the needs of the agricultural industry. By maintaining an understanding of the educational, experiential, and social facets of a program, as well as programmatic outcomes, educators can more successfully prepare undergraduates in agriculture for the challenging futures that await them.

Introduction

Academic institutions must adapt and face challenges presented by a changing society and the agricultural industry. In 2009, the National Research Council called for reform to undergraduate agricultural curricula. The council discussed numerous arguments supporting this reform, including changing student demographics and needs of the agricultural industry.

Over the past century the demographics of youth entering agricultural fields have changed significantly. Today, less than 5% of the United States' population lives on farms and only 20% live in rural areas (Dimitri et al., 2005; NRC, 2009). Unfortunately, a large proportion of the U.S. population has become so distanced from agriculture that they are unfamiliar with how foods are grown and produced (NRC, 2009). Youth entering agricultural fields today are faced with a different set of challenges than those faced by youth a century ago (Splan et al., 2009). They must not only overcome agricultural unfamiliarity and outdated positions (NRC, 2009) but also gain the knowledge and experience necessary to solve complex challenges, from feeding the world to developing efficient and effective fuel sources. Undergraduate agricultural curriculum must be updated in order to adequately prepare these students. Specifically, the NRC (2009) calls for educational reform resulting in an increase of transferrable skills and additional use of problem-based learning and critical thinking strategies (Estepp and Roberts, 2011).

The agricultural industry has also seen substantial changes in the past century, presenting additional challenges that educational reform must recognize. As the baby boomer generation approaches retirement, the agricultural industry is left seeking qualified individuals to continue supporting its mission (NRC, 2009). Additionally, the agricultural industry's foci have shifted away from traditional interests to areas such as energy production and natural resource management (NRC, 2009, pg. 32). There has been a substantial increase in international operations, consequently introducing more complex logistics, heightened regulations, and a need for bridging social and cultural differences (NRC, 2009). Today's agricultural industry needs a talented new generation of employees possessing a strong knowledge

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base and a myriad of social and technical skills (Splan et al., 2009). Without these abilities, students may find themselves entering a complex workforce without the tools necessary to be successful.

The National Research Council (2009) suggests that undergraduate experiences in agriculture are in need of a change, stating that *"The changes include new curricula and content, but it will also be vital to improve how teaching and learning occur"* (pg. 35). The NRC (2009) highlights a number of steps that can be taken to help achieve this goal: skills development, teamwork, working across disciplines, communication, critical thinking and problem-based learning, just to name a few. Each of which contribute to producing more prepared, knowledgeable and well-rounded undergraduate students.

Many colleges and universities have responded to this call for reform by turning to experiential learning programs. By helping students connect crucial classroom knowledge with invaluable hands-on experiences in real-world settings, experiential learning opportunities can help answer the demands of the modern agricultural industry.

Methods

Experiential learning programs are not new in higher education and there is a great deal of research that has been done in this general area. Green et al. (2006) define narrative literature reviews, stating that *"They are helpful in presenting a broad perspective on a topic and often describe the history or development of a problem or its management"* (Day, 1998; Slavin, 1995). Consequently, a narrative literature review of experiential learning programs to summarize and draw conclusions from pre-existing theories and research studies was conducted. This review of literature primarily utilized the Virginia Tech Library, Google Scholar, ProQuest database, Journal of Extension, Journal of Agricultural Education, NACTA Journal and the EBSCOhost database to establish the literature review.

Discussion

Experiential learning is an educational model that views learning as the result of an interaction between discovery and experience. This model is based on immersing students in an environment with relevant, "real-world" experiences that allow students to build upon prior knowledge and learn in a more meaningful fashion. While this model is not ideal in every context, it often provides students with a unique realization of how their knowledge is relevant and useful.

Dewey's Perspective

Experiential learning is rooted in Dewey's (1938) work, Experience and Education. In this work, he presents two views of education: traditional and progressive. Traditional education is depicted as the structured, didactic environment that most students are familiar with, whereas progressive education is described as a comparatively unstructured, student-centered environment. Dewey proposed that neither of these educational paradigms present a solution and that educators must begin to understand human experiences in order to resolve conflict between these two paradigms.

Consequently, he proposed a need for a theory of experience and emphasized that while students in traditional settings do not have a lack of experiences, those they do have can lack quality and connection with other knowledge and experiences (Dewey, 1938). Ord and Leather (2011) cited a very specific definition of experience: *"An experience is always what it is because of a transaction taking place between an individual and what, at the time, constitutes his environment"* (Dewey, 1938, p.43). Dewey continues to explain, *"The environment, in other words, is whatever conditions interact with personal needs, desires, purposes and capacities to create the experience which is had"* (1938, p. 44).

Dewey (1938) does not simply consider experience to be an outward act, but rather the process of considering a notion, acting upon it, observing results and consequences, and ultimately applying that knowledge towards future situations. This perspective on experience presents a process far more complex than simply "doing" (Ord and Leather, 2011). This understanding is also integrally linked to meaning, as individuals must conceptualize that specific acts lead to certain consequences. Ord and Leather (2011) cite a specific example of the link between experience and meaning:

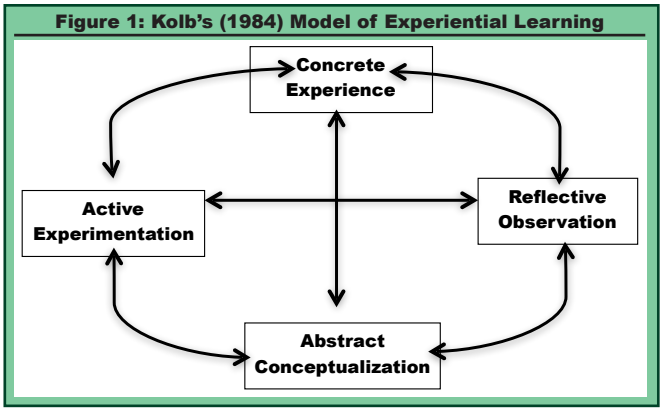
It is not experience when a child sticks his finger into the flame; it is experience when the movement is connected with the pain that he undergoes in consequence. Henceforth, the sticking of the finger into the flames means a burn (Dewey, 1916, p. 104).

This also emphasizes Dewey's (1938) argument that learning is not solely accomplished by introspective behavior, but rather requires individuals to change during and as a result of their experiences (Ord and Leather, 2011). These elements must come together in order for meaningful learning to occur, as "No experience having a meaning is possible without having some element of thought" (Dewey, 1916, p. 107; Ord and Leather, 2011). Schunk (2012) further supports this in stating: *"Learning is an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience."*

Ultimately, Dewey (1938) proposes that educators might use his theory of experience to structure learning around the prior experiences of students, consequently providing more meaningful and beneficial learning environments. He stipulates that educators must accept the role of a learning facilitator rather than dictator, creating a learner-centered classroom environment. It is off of these principles that Kolb (1984) partially bases his model of experiential learning.

Kolb's Perspective

Kolb's (1984) model provides a structure for meaningful learning environments in which students



can apply prior knowledge within a real-world hands-on setting. Based on fundamental constructivist theory, Kolb's model proposes that knowledge and experience are shaped through reflection into concepts, which are then used as a basis of experimentation. Kolb (1984) presents an ongoing cycle of concrete experience, reflective observation, abstract conceptualization and active experimentation (Figure 1). Through this process, students can participate in meaningful learning and higher-order thinking while gaining invaluable skills and life experiences.

The four stages of Kolb's (1984) model represent two continuums proposed in his work: perception and processing. The perception continuum is learning through thinking or feeling, and is stimulated by the learner's intellectual or emotional response. This continuum includes the first and third stages of Kolb's model – concrete experience and abstract conceptualization. The processing continuum, however, references a learner's approach to a task, where learning is stimulated by doing. This continuum involves the second and fourth stages of the model – reflective observation and active experimentation. It is essential to consider these two continuums when considering Kolb's (1984) model, as they begin to provide the "bigger picture."

It is important to recognize that Kolb does not present a straightforward, sequential cycle through which learning occurs. On the contrary, he proposes that learning is sparked by an observation, leading to continued consideration and ultimately beginning the process that encompasses all four of Kolb's (1984) key principles. There is not, however, a starting or ending point to Kolb's proposed model – learning can begin at any phase of the model, and does not terminate after an individual has actively experimented with generalizations of a concept. Not unlike his theoretical predecessors, Kolb (1984) proposes that learning is a lifelong process, rooted in personal experiences.

Kolb's (1984) model is, in many ways, cut from the same cloth as Dewey's (1938) theory of experience. Both Kolb and Dewey agree that learner-centered environments can facilitate meaningful learning spawned by facilitated experiences in a real-world setting. If higher education is to meet the NRC's (2009) call for reform, it is essential that undergraduates be provided this type of learner-centered environment, where classroom knowledge and hands-on experience are undoubtedly connected. What Dewey and Kolb neglect to address, however, is the pervasive social influence present within modern society and programs in higher education.

Social Cognitive Theory

Social cognitive theory lends further explanation and insight into the importance of social factors when designing educational programs. This theory posits that individuals will learn by doing, sensing and observing the actions of others (Bandura, 1986; Ormrod, 2008; Schunk, 2008). By making observations within their environment, individuals acquire knowledge that can then influence future behaviors. Albert Bandura challenged behaviorism with this comprehensive theory of observational learning, where reciprocal interactions occur among individuals, their behaviors and their surrounding environments (Bandura 1982, 1986, 2001; Schunk, 2008).

Social cognitive theory views learning as the processing of information from behaviors and environmental factors which ultimately serve as a guide for action (Bandura, 1986, p. 51). Learning can occur in one of two ways: enactively or vicariously. Enactive learning, not unlike the theory of experience proposed by Dewey (1938), involves learning by doing, whereas vicarious learning occurs primarily through observation in some form. A majority of human learning occurs vicariously, allowing individuals to learn more rapidly than would be possible if humans only learned from behavior (Schunk, 2008). Complex skills and theories are typically learned through a combination of vicarious and enactive learning – students can learn some components of a skill through observation and continue learning via practice, which models can then be used to provide corrective feedback.

Humans learn a great deal through observation, and models of all shapes and sizes play an important role in learning. Schunk (2008) defines modeling as "…behavioral, cognitive, and affective changes deriving from observing one or more models" (Rosenthal and Bandura, 1978; Schunk, 1987, 1998; Zimmerman, 1977). Models provide valuable data points to process, which individuals can then translate into behavior. In a classroom setting, teachers and peers can all serve as models, providing multiple perspectives for an individual to consider. Bandura (1977, 1986) noted four necessary conditions for an individual to model the behaviors of another person: attention, retention, motor reproduction, and motivation. Prior to successfully modeling another individual's behavior, one must attentively watch and observe the behavior being performed. The individual must also remember the behavior that he/she has observed, and then be able to replicate the demonstrated behavior. Lastly, an individual must be motivated to model the learned behavior. If any of these four conditions are not met, the likelihood of exhibiting the behavior decreases (Ormrod, 2008).

Social cognitive theory further expands on the concept of motivation, as its presence is often key to an

individual's learning. Self-efficacy, or an individual's belief regarding whether or not they are capable of executing a behavior correctly, is a significant component of motivation (Ormrod, 2008; Schunk, 2008). For instance, if an individual believes that they won't perform well on an upcoming test, he or she has low self-efficacy regarding that task and may not be motivated to study, as they may already feel it is hopeless. Self-efficacy is largely developed as a result of successes and failures and can have a powerful effect on an individual's behavior, including goal setting, activity choices, persistence and ultimately learning (Bandura, 1997, 2000; Ormrod, 2008; Schunk and Pajares, 2004; Zimmerman, 1998).

Bandura (1997, pg. 1) stated that *"A key assumption of social cognitive theory is that people desire 'to control the events that affect their lives' and perceive themselves as agents."* Individuals with higher overall self-efficacy also exhibit an increased sense of agency. Self-regulation, or the process through which individuals perform specific behaviors oriented towards achieving goals, is key to this agentic perspective. According to Ormrod (2008), the social cognitive perspective of self-regulation involves at least four key components: goals, self-observation, self-evaluation and self-reaction (Bandura, 1986; Schunk, 1989c, 1998; Zimmerman and Schunk, 2004). Individuals set goals for themselves based on peer or model observations and personal self-efficacies regarding a task. Individuals then observe themselves in action and evaluate whether their behaviors were adequate based on the standards they have set. Finally, an individual will react to their self-evaluation, typically by exhibiting pride for accomplishing a goal, or punishing themselves for not having met their expectations.

As a whole, social cognitive theory provides a framework to support the numerous social interactions that occur in any educational environment, and how those interactions impact an individual's learning. Social cognitive theory supports the notion that students who succeed in a given environment may ultimately exhibit indicators of increased self-efficacy or even perhaps self-regulation. These lifelong learning traits feed into the NRC's (2009) call for more prepared young professionals, capable of tacking the complex quandaries that inevitably lay ahead of them.

A Perspective of Experiential Education

As we have previously discussed, Kolb's (1984) model of experiential learning provides an outlined structure to consider when designing experiential learning programs. While the four key principles of Kolb's (1984) model are a good starting point and certainly hit on key components of experiential learning, they also leave a great deal to be desired when considered on their own. For instance, Kolb (1984) neglects to address the social interactions present in educational environments.

Consequently, one might propose adopting a modified version of Kolb's (1984) model of experiential learning. So as not to confuse the two, let this updated perspective be referred to as experiential education. Beginning with Bandura's (1986) concept of reciprocal causation, the interactions between an individual, their environment, and resulting behaviors creates knowledge that is later used as a guide for action (Bandura, 1986, 2006; Ormrod, 2008; Schunk and Pajares, 2004; Zimmerman and Schunk, 2004).

In essence, these reciprocal interactions create an experience – the first key tenant of Kolb's (1984) model. When an experience occurs, it often draws attention from participating or observing individuals, the first key component in Bandura's (1977) modeling process. Focused attention can lead to goal-setting behaviors, the first component of Bandura's (1986) concept of self-regulated learning. From there, individuals oftentimes proceed to a period of reflection, the second tenant in Kolb's (1984) model. This aids in an individual's retention of an experience, the second key process in Bandura's (1977) modeling process. Furthermore, this provides individuals with an opportunity for self-observation, the second component of self-regulated learning (Bandura, 1986).

From this reflective period, individuals naturally move to conceptualizations of their experience, the third key tenant of Kolb's (1984) experiential model. These conceptualizations can be a motivating factor for students, addressing the third key component of Bandura's (1977) modeling process. This can also stimulate self-evaluation, the third component of self-regulated learning (Bandura, 1986), where an individual can evaluate behaviors or conceptualizations resulting from their experience. The last tenant of Kolb's (1984) model posits that an individual will proceed to actively experiment with new conceptualizations of their experience, which creates a type of reproduction, the final component of Bandura's (1977) modeling process. Results of this experimentation or reproduction lead an individual to self-reaction, the last component of Bandura's (1986) concept of self-regulation.

These models and concepts may not always occur simultaneously. However, this perspective provides a logical way to help educators recognize the importance of social interactions in learning environments. Furthermore, facilitating personal experiences and social interactions in a learning environment works to answer the calls for educational reform by providing students with strengthened processing, observation, and self-regulatory abilities.

Experiential Learning Programs in Agriculture

Despite an extraordinary amount of research making mention of experiential learning's importance in agricultural education (Anderson, 2009; Andreason, 2004; Marshall et al., 1998; Parr and Trexler, 2011; Roberts, 2006), there is a surprising lack of literature discussing program ties to educational theory. Reiling et al. (2003) published a study where researchers collected demographic and experience information from cohorts in an introductory animal science course over a three-year

period. Having assessed student backgrounds, it was determined that students needed hands-on experience with livestock. Consequently, a multispecies large-animal management and production practicum course was designed and implemented. Reiling et al. (2003) concluded that a program *"that primarily involves experiential learning activities to teach basic applications of animal science principles and animal husbandry skills has proven successful."* However, the study made no mention of underlying educational theories, or how the program can continue to be improved. In similar fashion, other studies have acknowledged educational theories and models in support of experiential learning programs without drawing conclusions regarding how theoretical applications have affected program outcomes (Anderson, 2009; Guay and Oshel-Shultz, 2009; Marshall et al., 1998), much less how applications of teaching and learning theory can be used to further strengthen student learning experiences.

Another surprising gap in current literature is the lack of discussion regarding the evaluation of experiential learning programs. It is not uncommon to solely evaluate an experiential learning opportunity by providing a survey to participants. Reiling et al. (2003) utilized the University of Florida's standard course and faculty evaluation form as the sole method of evaluation for the program. Although the information collected from this method was informative and useful, it could be greatly strengthened with an explanation of how the program currently applies theory, and how altered or additional applications could further strengthen program outcomes. Parr and Trexler (2011) utilized a focus-group method to evaluate student farm experiences in higher education. Due to the in-depth data collected, the researchers were able to connect reported program outcomes with applications of educational theory. Knowledge of how educational theory is being applied in a program is crucial, as it provides insight as to how those applications can be modified to further strengthen experiential programs.

Summary

While Kolb's (1984) model of Experiential Learning is often acknowledged in the literature, its importance in program development and evaluation is often underplayed, if recognized at all. Furthermore, Kolb's (1984) model does not consider the significance of social interactions in regards to learning (Seibel et al., 2012). Consequently, a perspective of experiential education is proposed to better support both the experiential and social aspects of these valuable programs in higher education. Since a great deal of research on experiential learning programs neglects to make ties between program outcomes and educational theory, there is a gap in knowledge regarding how participating students truly experience a program. While it is undoubtedly important to assess what students gain from participating in a program, it is equally important to know how they have learned, so that programs can be modified and strengthened where needed. As time passes, the demographics of students in agriculture will continue changing, as will the needs of the modern agricultural industry. To ensure that programs continue successfully preparing students for their futures, experiential education programs must be periodically evaluated. By acknowledging the educational, experiential, and social facets of a program, as well as the outcomes produced by those facets, educators can more successfully prepare undergraduates in agriculture for the challenging futures that await them.

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Changes in Student Perception of Food Animal Agriculture Following Discussion of Controversial Topics

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Abstract

Discussions on controversial issues in food animal agriculture were incorporated into NC State University's Introduction to Animal Science Lab. Student (n=136) perceptions were evaluated through pre- and post-lab surveys collected over two years with responses on a Likert scale ranging from "not at all" (score 1) to "very much" (score 5). Three topics increased in score ($P<0.01$): "How aware are you of the current issues facing animal agriculture?" (3.06 pre to 4.17 post), "Can you describe the difference between animal rights and animal welfare?" (3.58 to 4.55), "Do you consider the US food supply to be safe, wholesome and nutritious" (3.41 to 3.87). Following the discussion, students indicated their understanding of what constitutes poor animal husbandry changed (3.75, SEM=0.09) and they had a better understanding of how animal agriculture interacts within the environment (4.22, SEM= 0.07), antibiotic usage in animal agriculture (4.29, SEM=0.08), and hormone usage in animal agriculture (4.27, SEM= 0.08). Some responses differed by gender (understanding of animal rights vs. welfare) and by college in which the students were enrolled. Based on student responses, this discussion format was determined to be an effective and worthwhile addition to this introductory level course.

Introduction

Student attitudes toward animal agriculture can vary depending on many factors, including gender (Bennett-Wimbush et al., 2015; Herzog, 2007; Taylor and Signal, 2005; Paul and Podberscek, 2000), residence (Kelbert and Berry, 1980), ethnicity (Davey, 2006), companion animal ownership (Taylor and Signal, 2005) and other demographic characteristics (Bennett-Wimbush et al., 2015; Signal and Taylor, 2006). Attitudes can also depend on species in question (e.g., horses vs. cattle) and experience working with livestock (Adams et al., 2015). Student demographics and backgrounds vary over time in a university setting, and more students with little to no experience with livestock are now interested in studying animal science at land grant universities (Britt et al., 2008). These students lacking experience and knowledge about animal agriculture may share similar misconceptions about livestock as the general public (as reviewed in Terry et al., 1992).

Adams et al. (2015) documented the demographics of introductory animal science courses and wanted to determine if student background experiences correlated with student perceptions of livestock production. Student agricultural background did have an effect on how animal agriculture was perceived, specifically regarding media portrayal and animal welfare (Adams et al., 2015). Smith et al. (2009) found that high school students who had lived on a farm were more positive about farming than those students who had not lived on a farm. Similarly, in the study conducted by Walter and Reisner (1994), urban students were more critical of livestock agriculture than students from rural areas. This may be a result of opinions formed based on media coverage of livestock agriculture as opposed to first-hand experience and suggests that covering controversial topics in an animal science curriculum is essential in order to produce well-rounded and well-informed students preparing for careers related to livestock agriculture. Controversial topics in livestock agriculture are numerous and complex and preparing future animal scientists to handle such issues in professional settings is important. The objective of this study was to investigate how students perceive food animal agriculture and how an informative, discussion-based presentation focused on controversial topics could influence student perceptions and understanding.

Materials and Methods

The Introduction to Animal Science Laboratory at North Carolina State University was chosen as a representative course because the material is a universal component of animal science curricula nationwide (Britt et al., 2008). Students enrolled in the course represented a wide range of academic and animal experience. This investigation was a descriptive census (all members of the class) study (Patton, 2002). Due to the restrictions of a census study, participants were not selected randomly but were considered representative of undergraduates at North Carolina State University who had previously or will enroll in this course.

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Figure 1: Comparison of pre- and post-survey responses from all students (n = 136). Student responses varied from 1 = Not at all to 5 = Very Much identified along bottom axis. Error bars represent the Standard Error of the Mean. Letters (a,b) indicate statistically significant differences for (P<0.05)

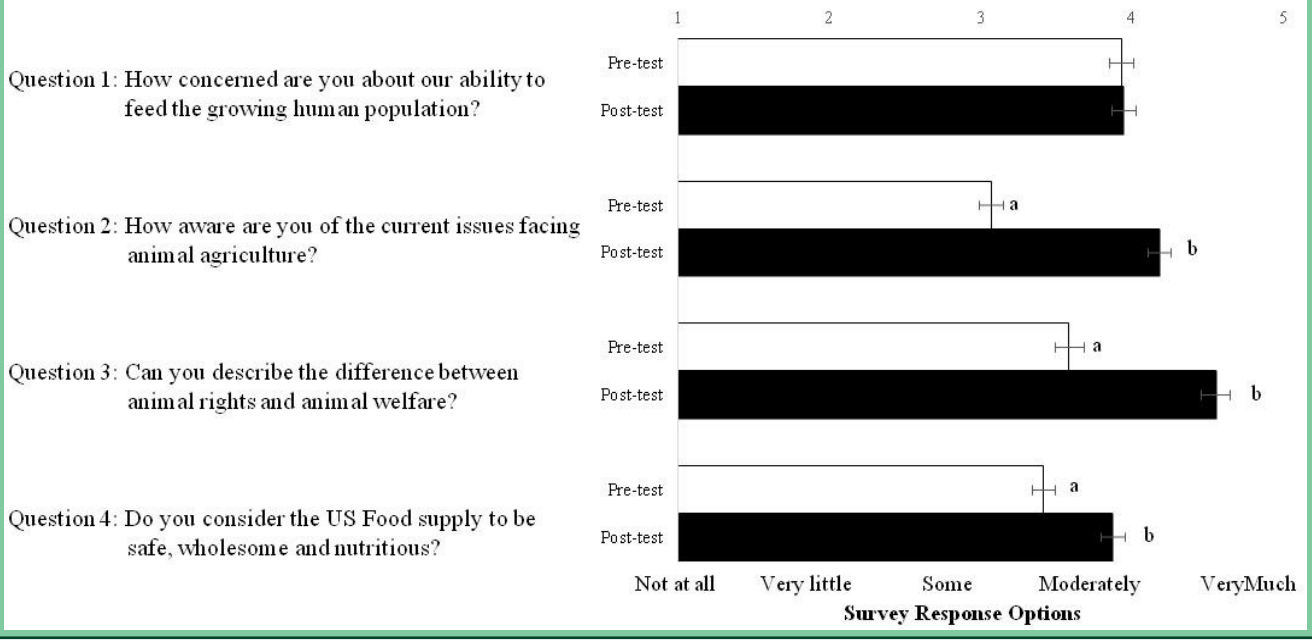
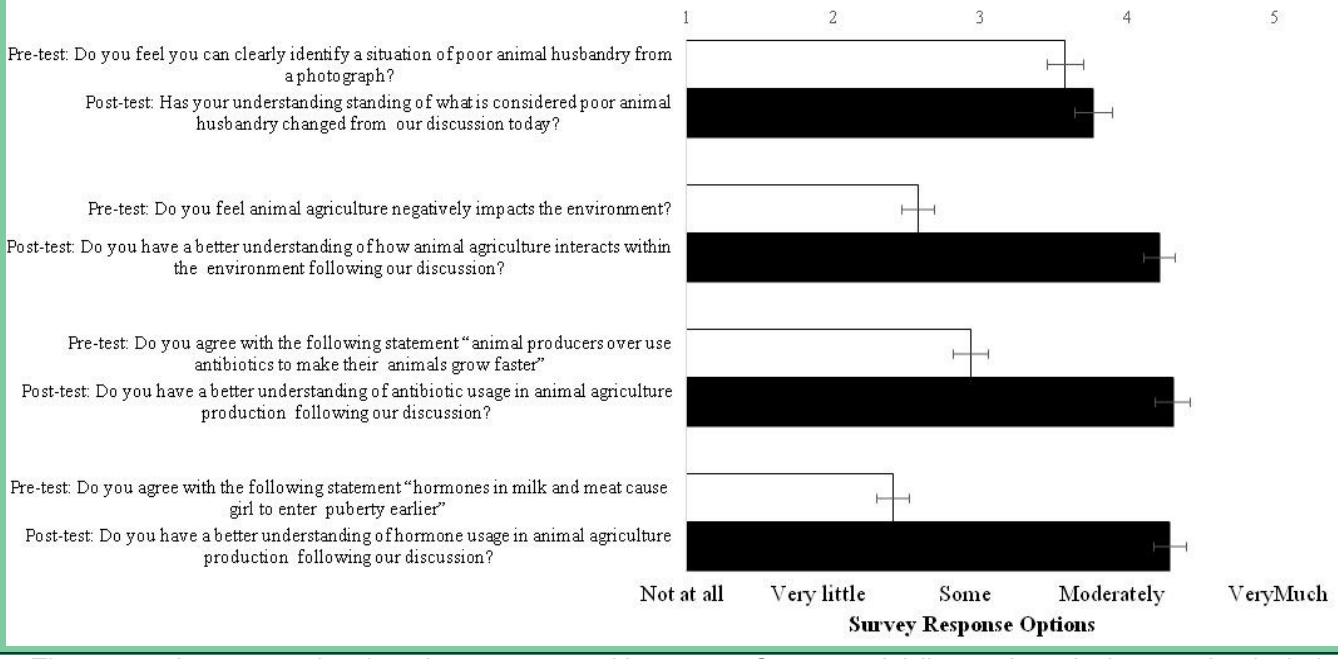


Figure 2: Responses to pre- and post-survey questions that varied in format but covered similar concepts. Statistical comparison was not conducted because these questions on the pre-and post-surveys were not identical. Student responses varied from 1 = Not at all to 5 = Very Much identified along bottom axis. Error bars represent the Standard Error of the Mean.



The course instructors developed two surveys with a range of questions regarding livestock agriculture. Students from the Introduction to Animal Science Laboratory in the spring semesters of 2014 and 2015 were included in the survey (n = 136). Surveys were administered at the beginning and end of the lab period. The pre- and post-lab surveys consisted of 10 and 9 questions, respectively. The first four questions on the pre- and post-lab surveys were identical (Figure 1), whereas the remaining questions on the pre- lab survey varied slightly from the post-lab survey (Figure 2). Responses included a 1 to 5 Likert scale using descriptors such as "not at all" to "very much."

Controversial livestock agriculture topics included: concern about feeding the growing population, awareness of issues facing animal agriculture, the safety of food and welfare of animals in agriculture, tools used in animal agriculture such as hormones and antibiotics and the use of social media to discuss these topics. In year two, an interactive audience response polling system (Turning Point Technologies©) was included in the lecture PowerPoint®. Questions included in the poll asked students for their opinions concerning food security and safety as well as asking students to recognize various classifications of livestock agriculture based on photos (e.g., organic, cage-free). This provided a visual

representation of responses in bar graph form on the screen that assisted in student discussion between topics. Within the various lab sections, students were presented information accompanied with a series of pictures or video pertaining to a controversial issue. Students were asked to discuss and respond to the information provided. In year two, students were asked to respond to questions using the audience response polling system following the provided information; open discussion occurred after this point. No demographic questions were included in the surveys, poll or analyses. The goal of this study involved efforts to improve instruction and thus was deemed exempt by the North Carolina State University Institutional Review Board. Student responses were anonymous and no identifying information was used in the data analysis.

Data were entered into an Excel® spreadsheet. Data were analyzed numerically ("not at all" received a 1, "very much" received a 5) and means were calculated for survey questions 1-9. Identical questions from pre- and post-lab surveys were compared for significant changes in responses, and change in response was also compared between years to determine if there was an effect of the in-class poll. Differences in pre and post-test data were analyzed using Paired T-Test model in SAS 9.2 (SAS Inst. Inc., Cary, NC). Correlation analysis (Pearson) was performed between demographic main effects (gender, college, major, academic rank, transfer status and semesters enrolled at the university) and composite score using least square means. Major, academic rank, transfer status and semesters enrolled at the university did not influence the student response and was subsequently removed from the model. These data were analyzed using Proc Mixed of SAS 9.2 (SAS Inst. Inc., Cary, NC). Significance was reported at $P < 0.05$ and trends were reported at $0.05 < P < 0.10$ level.

Results and Discussion

The target population consisted of 136 undergraduate students (17% male and 83% female) from the Introduction to Animal Science Laboratory during the Spring semesters of 2014 and 2015. Of the 136 students, 78% were enrolled in the Colleges of Agriculture and Life Sciences, 9% in the Colleges of Sciences and 13% were undeclared university students or students with majors in the College of Humanities and Social Sciences. Eighteen different majors were represented within this student population, with 57% of the students pursuing a degree in Animal Science. Additionally, students in the course were distributed into the following academic ranks: seniors (13%), juniors (32%), sophomores (35%) and freshmen (20%). These data were collected in the spring semester and the course is restricted to Animal Science freshmen in fall semester, so it is not surprising that 68% of the students transferred into the university after completing coursework at another college or university. With this large percentage of students transferring into the university, the number of semesters enrolled at the university ranged from 1 to 7 semesters.

All four questions included on the pre- and post-survey increased in score following the course activity ($P < 0.05$) except for one (Q1; Figure 1). Student concern about feeding the growing population was high and did not change ($P > 0.10$) following the lab period. However, after the class presentation and discussions, students indicated that they had a greater awareness of current issues facing animal agriculture and had an increased ability to differentiate between animal rights and animal welfare ($P < 0.05$). Because there is growing concern in the general public about practices in livestock agriculture, especially concerning animal welfare (Poletto and Hotzel, 2012; Verbeke and Viaene, 2000), it is important

Table 1. Pre- and post-survey responses by gender[1,2]

		Pre-test	Post-test	Pvalue
Question 1: How concerned are you about our ability to feed the growing human population?	Male	3.4	3.7	0.48
	Female	3.8	3.7	0.88
Question 2: How aware are you of the current issues facing animal agriculture?	Male	2.8	4.1	<.0001
	Female	3.1	4.2	<.0001
Question 3: Can you describe the difference between animal rights and animal welfare?	Male	2.9	4.5	<.0001
	Female	3.6	4.6	<.0001
Question 4: Do you consider the US Food supply to be safe, wholesome and nutritious?	Male	3.3	3.9	0.04
	Female	3.3	3.8	0.05

[1]Pre- and post-survey responses varied by gender (male, n – 23; female, n = 113).
[2]Student responses varied from: 1 = Not at all; 2 = Very little; 3 = Some; 4 = Moderately; 5 = Very Much. *P*-values within gender are considered statistically difference at ($P < 0.05$).

Table 2. Comparison of survey responses by college in which the students were enrolled[1,2]

		Colleges			P value	P value
		CALS	COS	UN	CALS-COS	CALS-UN
Question 1: How concerned are you about our ability to feed the growing human population?	Pre-test	4.0	3.3	3.5	0.009	0.040
	Post-test	4.1	3.3	3.7	0.002	0.099
Question 2: How aware are you of the current issues facing animal agriculture?	Pre-test	3.3	2.6	3.0	0.003	0.089
	Post-test	4.3	4.0	4.2	0.271	0.735
Question 3: Can you describe the difference between animal rights and animal welfare?	Pre-test	3.6	3.1	2.9	0.123	0.016
	Post-test	4.6	4.5	4.6	0.689	0.993
Question 4: Do you consider the US Food supply to be safe, wholesome and nutritious?	Pre-test	3.6	3.3	3.0	0.273	0.040
	Post-test	3.9	3.8	3.8	0.781	0.761

[1]Pre- and post-survey responses varied by college in which the student were enrolled CALS = College of Agriculture and Life Sciences (n = 106); COS = College of Sciences (n = 12); UN = University undeclared majors plus students from the College of Humanities and Social Sciences (n = 18).
[2]Student responses varied from: 1 = Not at all; 2 = Very little; 3 = Some; 4 = Moderately; 5 = Very Much. P-values for main effects of college were considered statistically difference at ($P < 0.05$).

Table 3. Responses by college the students were enrolled in to questions about hormone and antibiotic use in animal agriculture[1,2]

	CALS	COS	UN	P value CALS-COS	P value CALS-UN
Pre-test: Do you agree with the following statement "animal producers over use antibiotics to make their animals grow faster"	2.8	3.6	3.4	0.025	0.001
Post-test: Do you have a better understaning of hormone usage in animal agriculture production following our discussion?	4.4	3.8	4.3	0.00	0.659

[1]Pre- and post-survey responses varied by college in which the student were enrolled CALS = College of Agriculture and Life Sciences (n = 106); COS = College of Sciences (n = 12); UN = University undeclared majors plus students from the College of Humanities and Social Sciences (n = 18).
[2]Student responses varied from: 1 = Not at all; 2 = Very little; 3 = Some; 4 = Moderately; 5 = Very Much. P-values for main effects of college were considered statistically difference at ($P < 0.05$).

for students who will obtain careers involving animals to be aware of societal views of food animal agriculture, the current practices of livestock operations and the regulations governing management practices

Student perception of whether the US food system is safe, wholesome, and nutritious had a positive change following the activity ($P < 0.05$, Figure 1). The positive change in response to this question is likely associated with the increase in student understanding of how animal agriculture interacts with the environment, antibiotic and hormone usage in animal agriculture (Figure 2).

Females indicated they were better able describe the difference between animal rights and animal welfare on the pre-survey compared to males. This is in agreement with recent finding by Bennett-Wimbush et al. (2015) which also reported that more females (88%) indicated they could distinguish between animal rights and animal welfare than males (75%). However, responses were similar for animal right versus animal welfare on the post-survey for males and females and both genders were confident they distinguish between animal rights and animal welfare follow the laboratory discussion.

Terry and Lawver (1995) reported that College of Agricultural Science students had more favorable perceptions of similar issues when compared to students in the College of Arts and Sciences. Therefore, student responses to the survey questions were further analyzed by comparing students with majors in the College of Agriculture and Life Sciences (CALS; mostly Animal Science and Ag Education) to those in the College of Sciences (COS; mostly Zoology and Biology) or to students in non-science majors (UN; mostly undeclared university students or students with majors in the College of Humanities and Social Sciences); see Tables 2 and 3. Students in CALS were more concerned pre- and post-survey about our ability to feed the growing human population than were students in COS or in UN (Table 2). The survey administered prior to the discussions showed a difference between CALS and COS and a tendency for a difference between CALS and UN for the question about awareness of issues facing animal agriculture, but those differences disappeared after the in-class presentations and discussions. Furthermore, the pre-survey showed a difference between CALS and UN pertaining to questions about animal rights/welfare and safety of the US food supply, whereas no difference was observed between life science oriented students (CALS and COS; Table 2). Differences on questions about animal rights/welfare and safety of the US food supply disappeared after the in-class presentations and discussions. Interestingly, there was not a difference between CALS and COS on the pre- and post- questions about animal rights/welfare and safety of the US food supply.

Table 3 shows differences in CALS students compared to either COS or UN students when asked in the pre-test about over-use of antibiotics in livestock, indicating that CALS students were more knowledgeable about livestock practices in the industry. The CALS and UN students indicated a better understanding of hormone usage in animal agriculture following the in-class presentations and discussions when compared to students in COS. Terry and Lawver (1995) found that university students in the College of Agricultural Science at Texas Tech had more favorable perceptions of farming/ranching practices and animal medications when compared to students in the College of Arts and Sciences.

Another interest was to see if using the in-class polling ("clickers") in the second year would alter the discussion results. While the in-class polls encouraged student discussion, there was no difference in changes in perception following the lab with the addition of the poll ($P > 0.10$). This suggests that even without the use of advanced classroom tools and technologies, in-class presentations and student discussions about controversial topics in agriculture can be beneficial for students in the field. The presentation of controversial topics with visuals followed by class discussion may have given those students with very little exposure to animal agriculture a more sophisticated foundation upon which to form opinions about the controversial issues. According to Walter and Reisner (1994), animal science students who had encountered issues in livestock agriculture in the classroom were better able to offer and articulate their opinions on a similar, short-answer survey than those who had not, regardless of farm experience. Based on the survey results included in this study as well as observed student engagement and interest, the activity was determined to be an adequate introduction to the complex issues in food animal agriculture and a worthwhile addition to the course.

Summary

As the demographics of students seeking degrees at Land Grant Universities continues to change, so do their attitudes toward the various production systems utilized in animal agriculture. Because there is growing concern in the general public about practices involved in livestock agriculture, it is important for students who will obtain careers involving animal agriculture to be aware of societal views of food animals, the current practices of livestock operations, and the regulations governing management practices. Initial student knowledge of controversial issues, such as differences between animal rights and animal welfare, hormone and antibiotic usage, and factors that influence the U.S. food supply, was somewhat limited despite many of them seeking a degree in Animal Science. This learning activity engaged students in discussion about these animal agriculture issues, which increased their perception and knowledge of consumer attitudes and misconceptions about labeling of products. In addition, methods to stimulate discussions to educate individuals not familiar with these agricultural practices were explored. Results of this study indicate a student's gender and college which they are enrolled in influence the student's perceptions of animal care, use and treatment by society. Providing students the opportunity to discuss these issues in

animal agriculture sparked student engagement and interest and was successful at introducing students to the complex issues in food animal agriculture.

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Relationship between Academic Engagement, Self-Reported Grades, and Student Satisfaction[1]

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Abstract

The purpose of this study was to describe self-reported grades, scores on 10 academic engagement indicators and satisfaction of senior Agricultural, Food and Life Sciences (AFLS) students (n = 144) at a mid-south land grant university and to determine the relationship between grades, academic engagement and student satisfaction. Students were satisfied with their experiences at the university. They reported being often engaged in 8 of the 10 indicators, but only sometimes engaged in indicators measuring Quantitative Reasoning and Student-Faculty Interactions. All engagement indicators except Reflective and Integrative Learning and Quantitative Reasoning were significantly ($p < 0.05$) related to student satisfaction; there was no significant correlation between self-reported grades and satisfaction. Two faculty-related engagement indicators, Student-Faculty Interaction and Effective Teaching, had low positive correlations ($r = 0.25$) with satisfaction. A linear combination of three engagement indicators, Quality of Interactions, Supportive Environment, and Learning Strategies, explained a significant ($p < 0.05$) percentage (30.0%) of the variance in student satisfaction. These results confirmed the importance of positive interpersonal relationships, quality study habits, and student support services to student satisfaction. Further research is needed to examine the relationship between financial stability, family and work responsibilities, and academic and career goals and student satisfaction.

Introduction

Student satisfaction has been defined as a subjective attitude based on the student's evaluation of his or her educational experiences (Athiyaman, 1997; Elliott, 2002; Elliott and Shin, 2002). Satisfaction results when educational experiences meet or exceed the student's expectations, while dissatisfaction results when experiences do not meet expectations (Elliott, 2002; Hom, 2000). According to Elliott (2002), student centeredness and instructional effectiveness are primary contributors to enhanced levels of student satisfaction. Strahan and Crede (2015) found only a weak, positive correlation between grades and student satisfaction. Moreover, Mark (2013) asserted that students are satisfied when their academic needs are fulfilled and they receive a quality education that is valued in the job market. Student satisfaction is positively related to student retention, motivation, recruiting, and fundraising (Elliott and Shinn, 2002). Additionally, institutions with satisfied graduates also tend to have higher levels of public and political support (Weerts et al., 2008). Therefore, it is beneficial for colleges and universities to focus on improving student satisfaction (Saunders, 2014).

Academic engagement is defined as the time and energy that students devote to educationally productive activities (Carini et al., 2006). Kuh (2003) stated that the premise of academic engagement is deceptively simple and even self-evident: When students study a subject more, they learn more about it. Academic engagement is one of the best predictors of learning and personal development (Carini et al., 2006). One

[1]Acknowledgements: This work was supported by the USDA National Institute of Food and Agriculture, Hatch project 1007996, and the University of Arkansas, Division of Agriculture.

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of the most commonly used methods of measuring academic engagement is the National Survey of Student Engagement (NSSE). Since 2000, NSSE has been completed by students at over 1500 U.S. and Canadian colleges and universities (McCormick et al., 2013). NSSE measures student engagement using 10 engagement indicators: (1) Higher-Order Learning, (2) Reflective and Integrative Learning, (3) Learning Strategies, (4) Quantitative Reasoning, (5) Collaborative Learning, (6) Discussions with Diverse Others, (7) Student-Faculty Interaction, (8) Effective Teaching Practices, (9) Quality of Interactions, and (10) Supportive Environment. Pascarella et al. (2010) found each of these engagement indicators, except Student-Faculty Interaction, to be significantly related to important academic and/or personal development outcomes. Pascarella et al. (2010) posited that the lack of a significant relationship between Student-Faculty Interaction and any outcome variable was likely because of greater faculty interaction with both students who excel and with those who struggle.

Johnson et al. (2009) used NSSE data to compare agriculture and non-agriculture students and found that both freshmen and senior agriculture students had significantly higher scores on the Student-Faculty Interaction engagement indicator. However, the researchers found no significant difference in satisfaction between agriculture and non-agriculture students. In the Johnson et al. (2009) study no attempt was made to explore the relationship between academic engagement and student satisfaction.

The purpose of this study was to examine the relationship between 10 behavioral measures of student engagement, self-reported academic achievement, and student satisfaction among senior Agricultural, Food and Life Sciences (AFLS) students attending a mid-South land grant university. Specific objectives were to: (1) describe the academic engagement, self-reported grades, and satisfaction of senior AFLS students; (2) determine the relationships between academic engagement indicators, self-reported grades, and satisfaction among senior AFLS students; and (3) determine if a single or linear combination of engagement indicators and/or self-reported grades could explain a significant portion of the variance in the satisfaction of senior AFLS students.

Methods

The population for this study included all AFLS seniors (N = 588) enrolled during the spring 2013 semester at the University of Arkansas (Office of Institutional Research, 2013a). For the spring 2013 NSSE administration, a random sample of 370 AFLS seniors received email messages inviting them to complete the NSSE; a link embedded in the email allowed participants to access the on-line survey. Data were collected from 144 seniors for a 38.9% response rate; this response rate was higher than the overall university response rate of 33.5% (Office of Institutional Research, 2013b). The percentage of AFLS seniors (10.3%) included in the university sample (n = 3,586) closely approximated the percentage of AFLS students (9.9%) in the senior class (N = 5,966) (Office of Institutional Research, 2013a).

To test for non-response bias, respondents were compared to the population of AFLS seniors on the available demographic variables of gender and ethnicity (Miller and Smith, 1983) using demographic data obtained from the university Office of Institutional Research (2013a). Chi square analyses found no statistically significant ($p < 0.05$) differences in gender or ethnicity between the respondents and the population. Kuh (2003) compared a national sample of NSSE non-respondents (via telephone interviews) with NSSE respondents and concluded that "few meaningful differences exist between respondents and non-respondents in terms of their academic engagement" (p. 13). Thus, based on the demographic analysis and the findings of Kuh (2003), the researchers judged these findings as generalizable to the population.

The 2013 NSSE contained 10 multi-item engagement indicators (NSSE, 2013a): (1) Higher-Order Learning (4 items), (2) Reflective and Integrative Learning (7 items), (3) Learning Strategies (3 items), (4) Quantitative Reasoning (3 items), (5) Collaborative Learning (4 items), (6) Discussions with Diverse Others (4 items), (7) Student-Faculty Interaction (4 items), (8) Effective Teaching Practices (5 items), (9) Quality of Interactions (5 items), and (10) Supportive Environment (8 items). For items in 9 of the 10 indicators, students rated the frequency (or extent) which they engaged in a specific behavior during the current academic year using a 1 - 4 scale [1 = Never (or Very Little); 2 = Sometimes (or Some); 3 = Often (or Quite a Bit); and 4 = Very Often (or Very Much)]. Students rated items in the Quality of Interactions indicator using a 1 - 7 anchored scale (1 = Poor and 7 = Excellent).

After administration, each engagement item was converted to a 0 to 60 scale and the rescaled items for each engagement indicator were averaged. An engagement indicator score of 0 represented an individual answering at the bottom of the scale for each item in the indicator, while a score of 60 represented an individual responding at the top of the scale for each item in the engagement indicator (NSSE 2013b). These scale conversions were made by NSSE staff and included in the data set provided to the researchers.

NSSE (2015) reported coefficient alpha engagement indicator reliabilities ranging from 0.77 (Learning Strategies) to 0.90 (Discussions with Diverse Others) for the 2013 NSSE. For 2013 University of Arkansas senior AFLS respondents, coefficient alpha reliability estimates ranged from 0.70 (Learning Strategies) to 0.92 (Discussions with Diverse Others). Extensive testing (NSSE, 2015) has shown that NSSE possess construct, content, known groups, and concurrent validity.

Student satisfaction was measured by responses to two NSSE items. The first item asked students to evaluate their entire educational experience at the University

of Arkansas on a 1 - 4 scale (1 = Poor; 2 = Fair; 3 = Good; and 4 = Excellent). The second item asked students if they could start over again would they choose to attend the University of Arkansas; this item was also assessed on a 1 - 4 scale (1 = Definitely No; 2 = Probably No; 3 = Probably Yes; and 4 = Definitely Yes). Responses to these two items were averaged for each respondent and used as a measure of satisfaction. In interpreting the mean satisfaction score, the following real limits and descriptors were used: 1.0 to 1.75 = Dissatisfied; 1.76 to 2.50 = Somewhat Dissatisfied; 2.51 to 3.25 = Somewhat Satisfied; and 3.26 - 4.0 = Satisfied. For 2013 University of Arkansas respondents, the coefficient alpha reliability estimate for student satisfaction was 0.79.

Respondents self-reported their grades in response to the question, "What have been most of your grades up to now at this institution?" Eight response options were provided, ranging from "A" to "C- or below." Cole et al. (2012) evaluated the validity of NSSE self-reported grade data by comparing them to institutionally-reported GPAs for 12,650 undergraduates participating in the 2011 NSSE and found "A" students were very accurate in their reporting (91.3% match), "B" students were fairly accurate (70.0% match), and "C" students were least accurate (42.5% match). Kuncel et al. (2005) concluded self-reported grades can be useful, but caution must be exercised in interpreting results.

After institutional IRB protocol approval, the university Office of Institutional Research provided the researchers with the raw data file that included AFLS senior student responses (n = 144) to the spring 2013 administration of NSSE. To preserve respondent anonymity, the data file did not contain any information allowing researchers to match responses to specific individuals.

Data were analyzed (in SAS® 9.3) using descriptive statistics, bivariate correlations and linear multiple regression. The 0.05 level of significance was set a priori for correlation analysis and for the overall significance test in multiple regression; however, the 0.10 level of significance was set, also a priori, for testing significance of individual predictor variables (Hair et al., 1998). The descriptors suggested by Davis (1973) were used to describe the magnitude of bivariate correlations; 0.00 to 0.09 = negligible, 0.10 to 0.29 = low, 0.30 to 0.49 = moderate, 0.50 to 0.69 = substantial, and 0.70 to 1.00 - very strong.

Table 1. Means and Standard Deviations for Academic Engagement Variables and Student Satisfaction

Variable	*n*	*M*	*SD*	Descriptor[x]
Higher-Order Learning	135	37.03[z]	14.72	Quite a Bit
Reflective / Integrative Learning	137	36.34[z]	11.46	Often
Learning Strategies	119	38.15[z]	13.67	Often
Quantitative Reasoning	134	29.80[z]	16.55	Sometimes
Collaborative Learning	135	34.74[z]	14.29	Often
Discussions with Diverse Others	121	41.69[z]	16.31	Often
Student-Faculty Interaction	136	26.95[z]	17.72	Sometimes
Effective Teaching Practices	136	40.59[z]	13.99	Often
Quality of Interactions	119	44.08[z]	10.34	Good
Supportive Environment	116	33.31[z]	12.43	Quite a Bit
Student Satisfaction	114	3.39[y]	0.63	Satisfied

[z]Converted to a 0 to 60 scale where higher scores represented higher levels of engagement.

[y]Measured on a 1 to 4 scale where 1 = low satisfaction and 4 = high satisfaction.

[x]Based on descriptors supplied by NSSE (2013b).

Results

Of the 144 senior AFLS students responding to the 2013 NSSE, a majority were female (72.2%) and of non-minority (83.3%) ethnicity. Approximately 9 in 10 seniors reported earning mostly grades of B or higher (87.4%) while 42.3% reported earning mostly A's (27.0%) or A-'s (15.3%).

Objective 1

Senior AFLS students rated Quality of Interactions, Discussions with Diverse Others, and Effective Teaching Practices as the most frequently occurring engagement indicators (Table 1). Eight of the 10 engagement indicators were rated as occurring "often" (or "quite a bit" or "good") while two indicators (Quantitative Reasoning and Student-Faculty Interaction) were rated as occurring "sometimes." There was a large degree of variability associated with each engagement indicator with coefficients of variation ranging from 23.4% (Quality of Interactions) to 65.8% (Student-Faculty Interaction).

Overall, students were "satisfied" with their college experiences as indicated by a mean of 3.39 (SD = 0.63) on the two-item satisfaction variable (Table 1). With a coefficient of variation of 18.6%, there was less relative variation in student responses to the satisfaction variable compared to the engagement indicators.

Objective 2

Eight of 10 engagement indicators had significant ($p < 0.05$) positive correlations with student satisfaction (Table 2). Using descriptors suggested by Davis (1973),

Table 2. Intercorrelations and Cronbach's Alpha Reliability Estimates for Predictor and Criterion Variables

Variable	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
Higher-Order Learn. (X1)	(0.85)											
Reflect./Integ. Learn. (X2)	0.45***	(0.85)										
Learning Strategies (X3)	0.27**	0.25**	(0.70)									
Quant. Reasoning (X4)	0.51***	0.43***	0.19[NS]	(0.89)								
Collaborative Learn. (X5)	0.33***	0.34***	0.14[NS]	0.43***	(0.83)							
Discuss./Div. Others (X6)	0.35***	0.33***	0.46***	0.20*	0.28**	(0.92)						
Student-Fac. Interact. (X7)	0.40***	0.32***	0.19*	0.35***	0.46***	0.30**	(0.87)					
Eff. Teaching Prac. (X8)	0.35***	0.11[NS]	0.17[NS]	0.38***	0.16[NS]	0.10[NS]	0.32***	(0.87)				
Quality of Interact. (X9)	0.16[NS]	0.12[NS]	0.24*	0.12[NS]	0.11[NS]	0.29**	0.26**	0.40***	(0.75)			
Supportive Env. (X10)	0.30**	0.28**	0.26**	0.23*	0.19*	0.32***	0.25**	0.23*	0.32***	(0.87)		
Self-Report. Grades (X11)	0.12[NS]	0.04[NS]	0.21*	0.05[NS]	-0.04	0.17[NS]	0.25**	0.12[NS]	0.15[NS]	0.01[NS]	(*na*)	
Student Satis. (X12)	0.31***	0.09[NS]	0.29**	0.15[NS]	0.26**	0.25**	0.25**	0.25**	0.43***	0.37***	-0.01[NS]	(0.79)

Note. Reliability estimates (Cronbach's alpha) appear on the diagonal above correlation coefficients.

[NS]Not significant; *$p < .05$; **$p < .01$; ***$p < .001$.

these correlations ranged from small to moderate. Supportive Environment (r = 0.37), Quality of Interactions (r = 0.43), and Higher-Order Learning (r = 0.30) were moderately correlated with student satisfaction (Davis, 1973). Two faculty-related engagement indicators, Student-Faculty Interaction and Effective Teaching, had low (Davis, 1973) positive correlations with student satisfaction. The Reflective and Integrative Learning and the Quantitative Reasoning engagement indicators and self-reported student grades were not significantly related to student satisfaction.

The inter-correlations between the 11 potential predictor variables (10 engagement indicators and self-reported grades) ranged from non-significant to moderate (Davis, 1973). Of particular interest, only two engagement indicators, Quantitative Reasoning and Student-Faculty Interaction, were significantly related to self-reported grades and these correlations were low (Davis, 1973).

Objective 3

Prior to regression analysis, data were evaluated for outliers; regression diagnostics were used to determine if data met the assumptions of linearity, homoscedasticity, and normality of the error term distribution; and predictor variables were examined for multicollinearity (Hair et al., 1998).

Examination of the plot of residuals revealed four outliers; these outliers were removed and the data were reanalyzed. Linearity was assessed through visual evaluation of each potential predictor variable plotted against the dependent variable. All predictor variables exhibited linearity with student satisfaction. Homoscedasticity of residuals was assessed graphically and because no pattern of increasing or decreasing residuals was found, this assumption was determined to have been met (Hair et al., 1998). The results of the Shapiro-Wilk test (W = 0.98, p = 0.42) indicated the assumption of normality of residuals was met. Finally, the variance inflation factors (VIF) ranged from 1.24 to 1.57, well below the VIF of 10.0 suggested by Hair et al. (1998) as indicating a potential multicollinearity problem.

Student satisfaction was regressed on a linear combination of the eight statistically significant predictor variables. The resulting regression equation was significant [F (8, 88) = 4.63, p < 0.0001] and explained 30% of the variance in student satisfaction. According to Cohen (1988), the R^2 of 0.30 (adjusted R^2 = 0.23) represents a large effect. As shown in Table 3, Quality of Interactions, Supportive Environment, and Learning Strategies were all statistically significant (p < 0.10) in predicting student satisfaction. The remaining five engagement indicators did not explain statistically significant increments of variance in student satisfaction. Examination of the Beta weights (β) and squared semi partial correlations (sr^2) indicated Quality of Interactions was the best predictor of student satisfaction (explaining 6.0% of unique variance), followed by Supportive Environment (2.8%), and Learning Strategies (2.4%).

Table 3. Beta Weights and Squared Semipartial Correlations Obtained in Multiple Regression Analyses Predicting Student Satisfaction

Predictor	*B*	*SE B*	β	*t*	sr^2
Quality of Interactions	0.016	0.006	0.293	2.73***	0.060***
Supportive Environment	0.008	0.004	0.186	1.87*	0.028*
Learning Strategies	0.007	0.004	0.173	1.74*	0.024*
Collaborative Learning	0.005	0.004	0.133	1.26NS	0.013NS
Higher-Order Learning	0.004	0.004	0.102	0.95NS	0.007NS
Discussions w/Diverse Others	-0.001	0.004	-0.041	-0.39NS	0.001NS
Effective Teaching Practices	0.000	0.004	0.010	0.09NS	0.000NS
Student-Faculty Interaction	0.000	0.003	0.004	0.03NS	0.000NS

Note. R^2 = 0.30; adjusted R^2 = 0.23.
NSNot significant. *p < 0.10. **p < 0.05. ***p < 0.01.

Summary and Discussion

This study sought to describe and determine the relationships between 10 academic engagement indicators, self-reported grades, and student satisfaction among 144 senior AFLS students at a mid-south land grant university. On the 0 - 60 scale, seniors rated the Quality of Interactions engagement indicator highest and Student-Faculty Interactions lowest. Students reported fairly high levels (often, quite a bit, or good) of engagement in 8 of the 10 indicators, but reported lower levels (sometimes) of engagement in Student-Faculty Interaction and Quantitative Reasoning. There was a high degree of variability within each academic engagement indicator suggesting that students in the same college can have very different academic experiences, likely depending on their own specific majors and particular interests and motivations.

Senior AFLS students were satisfied with their experiences at the University of Arkansas as indicated by a mean satisfaction score of 3.39 (SD = 0.63) on a four-point scale. Apparently, AFLS seniors' experiences at the University of Arkansas largely met their expectations (Mark, 2013) and, consequently, the university and college can expect these future alumni to be potential sources of financial (Elliott and Shin, 2002) and personal (Weerts et al., 2008) support.

Self-reported grades were not significantly correlated with student satisfaction or with any engagement indicator other than Learning Strategies and Student-Faculty Interaction, where only low positive correlations were found. The finding of no relationship between grades and satisfaction is largely consistent with Strahan and Crede (2015) who found only a weak correlation between grades and student satisfaction. The lack of any significant relationship between grades and 8 of the 10 engagement indicators is surprising, given the link between student engagement and academic achievement reported by Carini et al. (2006). However, because self-reported grades of unknown validity (Kuncel et al., 2005) were used in this analysis, no substantive conclusion can be reached; further research examining the relationships between university-reported official grade point averages and each of the 10 engagement indicators and student satisfaction is warranted.

Eight of the 10 engagement indicators had significant positive correlations with student satisfaction, with magnitudes ranging from low to moderate (Davis, 1971).

Reflective and Integrative Learning and Quantitative Reasoning were not significantly related to student satisfaction. Student-Faculty Interaction had a low positive correlation with both student satisfaction and student grades while Effective Teaching had a low positive correlation only with student satisfaction. Further research should be conducted to more fully understand the relationship between these two faculty-related engagement indicators and student grades and satisfaction.

A linear regression equation containing three engagement indicators (Quality of Interactions, Supportive Environment and Learning Strategies) was statistically significant and explained 30% of the variance in student satisfaction. Quality of Interactions was the most important predictor explaining approximately 6.0% of the unique variance, followed by Supportive Environment (2.8%) and Learning Strategies (2.4%). These findings are consistent with Elliott (2002), who reported institutional student-centeredness is a primary contributor to student satisfaction. However, Elliott's (2002) contention that instructional effectiveness is related to student satisfaction is supported only to the extent that effective instruction contributed to the use of good learning and study practices.

The Quality of Interactions engagement indicator asked students about their relationships with other students, their academic advisors, faculty, student services staff, and other administrative staff and offices. The Supportive Environment indicator asked students about the university's emphasis on academics and academic support services, support for non-academic responsibilities (work and family) and providing social, cultural and recreational opportunities. Finally, the Learning Strategies indicator asked students how often they identified key information in readings, reviewed notes after class, and summarized class material. Thus, in plain language, the best predictors of satisfaction for AFLS seniors were quality student-faculty-staff relationships, a stimulating and supportive campus environment and the extent to which the student practiced good learning habits. AFLS faculty and administrators, as well as campus administrators, should place special emphasis on enhancing each of these in order to improve student satisfaction.

While this study confirmed the relationship of positive interpersonal relationships, quality student support services, and effective learning and study practices to higher levels of student satisfaction, these three factors combined explained only 30% of the variance in the satisfaction of senior AFLS students. Further research is recommended to identify how additional factors, such as financial stability, family and work responsibilities and academic and career goals, contribute to student satisfaction.

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Developing Autonomy Through Laboratory Experience: A Case Study in Meat Science Curriculum

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Abstract

The absence of autonomous learning models within food animal science curriculum prompted this research linking food quality theory to consumer selection. Sixty-two food animal science students participated in this study to determine if laboratory experience enhances academic performance, comprehension and aids in development of learner autonomy. Students were randomly selected to participate in either a lecture (control; n = 31) or a lecture and laboratory exercise (treatment; n = 31) involving both subjective and objective analysis of pork loin chops. Eight correlations were found ($P < 0.05$) associating student analyses to objective measurements. Preference questionnaires indicated color was identified by students as a key meat quality cue, and is utilized during meat purchasing. Correlations between preference frequency and L*, a*, b* values for samples chosen based on color were -0.30, 0.06 and 0.05, respectively ($P < 0.05$). As lightness decreased sample preference increased, supporting lecture materials. Laboratory participation did not affect pre-test/post-test score differences ($P = 0.34$). Although academic performance was not enhanced through participation in the laboratory exercise, correlation analysis of students' subjective measurement of meat quality and objective instrument measurements suggested enhanced retention of lecture materials into the lab. These results support practical application of this model exposing students to self-education methods employable beyond the scholastic setting. Based on this, further research into the effect of laboratory experiences on academic performance and comprehension beyond the classroom is warranted.

Introduction

Developing autonomy in students and employees is often the focus of instructional development as departments of education as well as governments continue to focus on the quality of teaching and training (Cranton, 1994). According to Holec (1980), autonomous learning can be described as the process of taking charge of one's learning. Hiemstra (1994) considered the idea of learner autonomy to be self-directed learning, or where the learner takes primary responsibility for learning decisions. Although these definitions are similar, multiple variations of the definition of learner autonomy may be found. This variety associated with the numerous definitions of autonomous learning leaves room for much diversity between explanations and reasoning in developing the idea of independent learners. In specific fields of education, curriculum design becomes important in order to foster autonomous learning while adequately teaching the necessary content. The methods by which this is accomplished may vary by discipline. For example, English as Second Language (ESL) teachers may utilize different methods of developing learner autonomy when compared to math instructors with the same goal of promoting independent learning techniques beyond the academic setting.

Food animal science courses within agricultural science curricula are designed to enhance comprehension of the technical aspects of food products with animal origins. These courses provide students insight into the processes of harvesting, cooking and consumption, and include coursework related to quality measurements for food safety and consumer perception. In many cases the overall goal of food animal science courses is

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two-fold; prepare students for employment in the food animal industry as well prepare them to be knowledgeable lifelong consumers of food animal products. Laboratory activities within these courses often require students to apply subject material received during lecture to complete hands-on activities (Parr and Edwards, 2004).

The overall goal(s) of food animal science courses may provide opportunities to develop and foster autonomous learning via laboratory experience. According to Schwienhorst (1998), autonomy is the capacity that the learner will acquire a psychological connection with the learning process that can be utilized into extensive situations. Based on this perspective, laboratory exercises in food animal curriculum may be beneficial in developing autonomy in that they can assist in bridging the gap between scientific information presented in lecture and the practical application of that information outside of the traditional classroom setting. One example of this may be found in meat quality evaluation. Meat quality is the result of a multitude of factors having relevance in both industry and purchasing habits of consumers of meat products (Aberle et al., 2012). This subject provides a unique opportunity for course instructors to attach "real-world relevance" to scientific information. As adults are exposed to information emphasizing the importance of the learning process, each individual is taking more responsibility for personal decisions, thus life planning also becomes a necessity (Edwards et al., 1998).

Agriculture as an industry would benefit from autonomous learners. Based on that, the following study was performed to evaluate the effectiveness of a laboratory exercise in enhancing students' knowledge and subject matter retention when compared to a traditional lecture-only setting.

Methods

Experimental Design

Research was conducted according to the Illinois State University (ISU) Institutional Review Board Guidelines following protocol approval. Undergraduate students enrolled in two courses; AGR 271: Foods of Animal Origin and AGR 285: Introduction to Meat Science, voluntarily participated in an experiment involving the visual appraisal of fresh pork loins treated with natural antioxidants. A total of 62 students from one AGR 271 class and two AGR 285 classes were chosen as the sample population for this study. Upon receiving written informed consent, each class was randomly divided into two groups participating in either a lecture (control) or a lecture and laboratory exercise (treatment), with 31 students in each group. Both treatment and control groups completed a demographic survey and a pre-test prior to a meat quality unit. The control group received only in-class lecture experience. In addition to lecture, the treatment group completed a laboratory exercise involving the subjective analysis of fresh pork loins treated with natural antioxidants at specified days of refrigerated shelf storage. It is important to note that the students completed the laboratory without direct instruction for the use of these cues, being advised and exposed to this information only during lectures within the meat quality unit. The treatment group also completed open-ended response questionnaires to determine which sample(s) each evaluator would purchase and the students' quality justification for that choice on each day of evaluation. Both the control and treatment groups completed a post-test following the meat quality unit. Pre-tests and Post-tests consisted of the same questions, which included information related to development, measurement, and evaluation of meat quality. Following the completion of this process, answers and explanations for test questions were discussed to both groups during lecture.

Treatment Group Laboratory Exercise

Nine fresh pork loins, three per class, were used during the laboratory. The loins for each class were randomly chosen, measured and cut into twelve chops, 3.81 centimeters thick. The chops were treated with water (control), 5% rosemary, or 5% basil solutions of pure, edible extract oil and distilled water. A total of four chops within each loin were randomly selected for each treatment. The chop treatments have been found to conserve product color and increase shelf stability, maintaining the visual parameters of fresh pork loin chops (Sebranek et al., 2005). This allowed students to "judge" the full visual parameters of the chops for the duration of the study. Each treated chop was placed in a foam tray, wrapped with polyvinyl chloride (PVC) film, and assigned a sampling number according to the loin, chop treatment and chop placement within the loin. On days one, three and seven of refrigerated shelf storage, the chops were removed from a lighted retail meat cooler and evaluated by the treatment group of students. The schedule for one AGR 285 class required evaluations on days one, five and seven.

On selected days, the treatment group subjectively measured each sample for color, firmness and marbling. The student's subjective analysis was recorded based on anchored-line Likert scales for lightness, redness, marbling and firmness for each sample. Following student evaluations, a reflectance measurement device was used to calculate light intensity in order to quantify muscle color changes in the chops during storage. Objective readings on each sample were recorded based on light reflectance from a Hunter colorimeter to measure CIE L* (lightness), a* (redness) and b* (yellowness) values, calibrated against black and white reference tiles covered with the same packaging materials as used for the sample (Hunter Associates Laboratory Inc.) (Brewer et al., 2006; Hunt et al., 1991). These objective readings were taken to provide a point of comparison against the students' subjective analyses. The treatment group completed the open-ended questionnaires following each evaluation.

Statistical Analysis

Quantitative data was analyzed using SAS/STAT® software Version 9.1.3 of the SAS System for Illinois State University Copyright 2010. A one-way analysis of variance model with fixed effects was used to determine if the fixed effect of student treatment (lecture/lab vs. lecture) influenced the mean difference between the pre-test and post-test scores as a measure of academic performance. A multiple comparisons follow-up test using least significant difference was used to compare the mean test score differences for the two groups. In order to evaluate comprehension and retention of lecture materials into the laboratory setting, students in the laboratory treatment group subjectively evaluated pork loin chops for multiple indicators of meat quality through the use of anchored-line Likert scale evaluations. Subjective evaluations were compared with objective instrument evaluations performed by the course instructor. Correlation analysis using PROC CORR was performed between each objective value and each subjective value to determine the degree of accuracy for the student evaluators. Pearson correlation coefficients were estimated for linear relationships between the student's subjective evaluations and the objective instrument evaluations from the laboratory.

Qualitative Analysis

Qualitative analysis of the data was performed using responses from the open-ended questionnaires completed by the treatment group to determine if consumer preference could be linked to physical quality characteristics. Following each subjective evaluation, students completed questionnaires requesting they identify which pork chop sample(s) they would prefer to purchase as a retail meat consumer. The students were asked to justify the choice. Color was the key meat quality term used to perform the analysis. Visual color appraisals are in close relation to evaluations made by consumer, and are used to set the benchmark for many instrumental measurement comparisons (AMSA, 2012). Preferred samples were tallied for each class. For each preferred sample, the preference frequency was calculated based on the number of times chosen and the number of participants in each class. The preference frequency and the L*, a*, b* values were quantitatively compared using correlations to determine if consumer preference could be linked to physical quality measurements, thus promoting the use of techniques received through an autonomous laboratory and lecture into consumer scenarios.

The student demographic survey was used to establish background on the type of students involved in this study. Survey data was analyzed to determine the distribution of gender, age, grade level, and experience with food animal science classes in and outside of Illinois State University. The survey also assessed the average meat purchasing experience of the class by figuring the overall mean monthly meat purchases, as well as the mean monthly purchases of beef, pork, poultry, lamb and seafood.

Table 1. Demographic survey results for grade level for all treatment and control groups.

Grade Level	Treatment	Control	Total
Freshman	0	0	0
Sophomore	6	3	9
Junior	6	9	15
Senior	19	18	37
Graduate	0	1	1

Results and Discussion

Tables 1-3 present the results from the demographic survey and represent an overall grouping of treatment and control participants from all three classes. Results of the demographic survey follow characteristics of the Department of Agriculture at Illinois State University. Forty-seven percent of the sampling population was female and 53% was male. Within the treatment group, 61% of the students were males, compared to the control group with 45% males. Seniors represented the majority of the sampling population and also accounted for the majority in both the treatment and control groups (Table 1). Agriculture business majors/sequences represented the majority of the students in the sampling population and in both treatment groups, followed by agriculture industry management and food industry management (Table 2). Only seven students total, three in the treatment group and four in the control group, had taken the corresponding food animal science class (AGR 285 if in AGR 271, or AGR 271 if in AGR 285) at ISU, or had taken a similar class at another institution.

The sampling population had an average of 3.6 total monthly retail meat purchases, with beef representing the most purchased meat category. Poultry was the next highest, followed by pork, seafood and lamb. Both treatment and control groups followed similar patterns. The control group averaged 3.9 overall monthly meat purchases, with 2.1 average monthly pork purchases. The treatment group averaged 3.3 monthly meat purchases, with a monthly average 1.9 pork purchases (Table 3). These results are in contrast with information reported by the United States Department of Agriculture, which has shown downward trends in beef consumption as per capita consumption of poultry has risen over the last few decades. More poultry is consumed per person than any other meat (AMI, 2015). Often, consumption of certain types of meat is largely dependent upon geographic

Table 2. Demographic survey results for majors/sequences for all treatment and control groups.

Major / Sequence	Treatment	Control	Total
Agriculture Business	10	8	18
Agriculture Industry Management	8	6	14
Food Industry Management	4	5	9
Agriculture Education	3	3	6
General Agriculture	3	1	4
Animal Science	1	3	4
Agriculture Science	1	1	2
Family and Consumer Science	0	1	1
Business Administration	0	1	1
Public Relations	1	0	1
Construction Management	0	1	1
Horticulture	0	1	1

Table 3. Demographic survey results for overall average monthly retail meat purchases and by categories for all treatment and control groups.

Categories (# of purchases)	Treatment	Control	Total
Overall Monthly Purchases (avg.)	3.30	3.90	3.60
Beef	3.38	3.60	3.49
Poultry	3.00	3.30	3.15
Pork	1.89	2.05	1.97
Seafood	0.62	1.22	0.92
Lamb	0.07	0.13	0.10

region. Purchasing trends exhibited in this study could be related to relatively high consumption patterns of red meat within the geographic regional location of the participants.

Pearson correlation coefficients indicated eight significant linear relationships between the subjective student analysis and the objective instrument analysis ($P < 0.05$) (Table 4). These results suggest that students in the laboratory were able to accurately evaluate the pork loin chops based on multiple meat quality indicators. Qualitatively, color was the most frequent cue identified and used by the students for consumer preference which is similar to results reported by Grunert et al. (2003) and AMSA, (2001) stating that color is the main justification consumers use to purchase meat products. Using the frequency of samples preferred because of color, correlations between the preference frequency and the L*, a*, b* color values were -0.30, 0.06 and 0.05, respectively ($P < 0.05$). As the degree of lightness decreased, preference for the samples increased, indicating darker samples had higher preference. As a* and b* increased, preference increased slightly. Given the weak correlation for preference and a*, b* the degree of redness or yellowness had very little effect on preference. According to Frederick et al. (2003), low L* values demonstrate higher consumer preference. The students were able to distinguish the quality of the samples based on quality information presented during lecture within the semester. These results concur with Grunert et al. (2003) advising that as individuals are continually exposed to applicable quality information and the product selection process, they will develop the required quality cues used during the selection process for the desired characteristics.

Analysis of variance results indicated no significant test score differences (post-test score minus pre-test score) ($P = 0.34$). Student treatment did not affect test scores to indicate enhanced academic performance of evaluators in the laboratory when compared to the lecture-only control. Laboratory exercises have been cited as playing a role in developing not only students' conceptual understanding of science, but also in developing students' interests (Wu, 2013). However, in the current study, these parameters were not directly measured. Efforts to foster development of autonomous learning, such as the one presented within the food animal science curriculum, are designed to aid the growth of learners into valuable and practical supervisors of personal learning (Sherman, 1985). The students demonstrated comprehension of quality characteristics through a process fostered by repeated exposure to the information, which is in agreement with Grunert et al. (2003). Adoption of this theory becomes apparent in meat product consumers where quality measurements are developed through a "learning by doing" experiential process. The majority of the students' learning in science actually takes place outside the classroom (Ramsey and Edwards, 2004). Qualitative analysis completed by Rhykerd et al. (2006) concluded that participation in a crop production and marketing contest suggested greater comprehension of principal agronomy, commodity marketing, and mechanization concepts. The authors proposed participation in the contest encouraged experiential learning requiring the students to make actual decisions and observe the direct outcomes for those decisions. Findings of the current research suggest that this curriculum model may be used to connect gaps between instructor and student.

Summary

The expected annual per capita consumption of red meat and poultry by the end of 2008 approximates to 22 pounds of retail weight, roughly $573 per person, per year. Projections for 2016 indicate the per capita consumption will increase to $656 per person (USDA, 2007). Increasing trends in meat consumption indicate the need for food animal science curriculum that will prepare both future food animal industry stakeholders as well as future consumers of meat products. Food animal science courses present an opportunity to utilize laboratory exercises to provide "real-world" scenarios relating science to everyday experiences such as meat purchasing.

Similar to discussion provided by Clark et al. (2010) in which the authors state experiential learning in tech-

Table 4. Results for Pearson Correlation coefficients between the objective[z] instrument analyses and subjective[y] student analyses for all three classes.

Variables	L*[z]	a*[z]	b*[z]	Light to Dark[y]	Pink to Red[y]	Firmness[y]	Marbling[y]
L*[z]	———						
a*[z]	0.19**	———					
b*[z]	0.30***	0.54***	———				
Light to Dark[y]	0.39***	0.15*	0.08	———			
Pink to Red[y]	0.37***	0.13*	0.06	0.97***	———		
Firmness[y]	0.06	-0.05	0.19**	0.06	0.07	———	
Marbling[y]	0.26***	-0.12*	0.15**	0.19***	0.22***	0.09	———

[1]Pearson's Correlation Coefficients test on objective and subjective analysis

[2]*, **, ***,significance at the p<0.05, p<0.01, or p<0.0001, respectively using Pearson's correlation coefficients

[z]Objective instrument readings based on Hunter Color Scale Values

L*: ranges from dark (0) to white (100)

a*: positive numbers red; negative numbers green

b*: positive numbers yellow; negative numbers blue

[y]Subjective analysis using Likert scale values completed by students

Color: degree of light to dark

Color: degree of light pink to dark red

Firmness: degree of soft to very firm

Marbling: practically devoid to abundant

nical education programs may differ from true experiential learning, it may be difficult in food animal curriculum to provide true autonomous learning experiences. Although the laboratory exercise reported in this study may not have been definitively autonomous in nature, these exercises may assist in the development of autonomous learners. In this study, associations between the subjective and objective analyses indicated students were able to evaluate pork quality using information presented within lectures during the semester and possible from past experiences involving pork product selection. Students successfully identified and utilized the main meat quality cue of color. This suggests that quality cues can be developed and applied to real-life scenarios in food animal curriculum utilizing laboratory exercises.

In accordance with Hiemstra (1994), a more qualitative approach was used during this project to support the theoretical aspects of autonomous research. The process by which the students were able to take materials obtained in class lecture and apply them to laboratory activities suggests autonomous learning skills, as recommended by Sherman (1985). Exposing students to this process allowed students to become equipped with a method of self-education employable beyond the scholastic setting. However, further research into the benefit of laboratory exercises in food animal curriculum is warranted.

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Do Students Really Learn from Online Experiments? – Evidence from Introductory Microeconomics Class[1,2]

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Abstract

Online experiments are frequently used to engage students and improve pedagogy in introductory microeconomics classrooms. This paper compared student scores on homework problem sets to evaluate whether the experiments helped improve student understanding of economic concepts. Two composite scores were created for each student: one based on the homework problem sets that involved an online experiment component and another for the problem sets that did not have any associated online experiments. The results showed an increase in student scores, ranging from 1% to 5%, when online experiments were conducted prior to the related homework. Two statistical tests – paired t-tests conducted on the mean score and Wilcoxon signed rank test on the median scores – showed that the increase in student scores are statistically significant. The variances in student scores were also found to be reduced with the use of online experiments. The descriptive answers given by students were able to recall the experimental setup and use it to explain related economic concepts.

Introduction

Agribusiness classrooms have long employed modern technologies such as newer presentation software, audio-visual tracks, online assessments and online experiments that simulate market and business settings and changed how students participate, engage and learn (Alston et al., 2003; Litzenberg, 1995; Litzenberg, 1982). New pedagogical models such as the Technological, Pedagogical, and Content Knowledge (TPACK) suggest that technology has become an essential component of classroom pedagogy and an integral part of subject content (Koehler and Mishra, 2009). Particularly, in undergraduate economics classrooms, technological resources are becoming more common than ever (Kennelly and Duffy, 2007; O'Dea and Ring, 2008).

The basic economic concepts can be taught with or without the use of technology such as experiments (Becker and Watts, 1995; Carter and Emerson, 2012; Emerson, 2014; Joseph, 1970; Wells, 1991). Nguyen and Trimarchi (2010) reported student performance improved slightly but significantly, showing a marginal (two percentage point) increase in student grades with the use of homework software packages (such as Aplia or MyEconLab). The software packages help organize and provide easy access to course content; can it also help improve students' economic knowledge? The existing studies find mixed evidence with the use of technology in teaching economics through synchronous online experiments (O'Dea and Ring, 2008; Lee et al., 2010; Perez-Sebastian, 2010). Technology has the advantages of increasing enthusiastic participation of students and highlight the nuances of economic concepts through quick implementation of multiple rounds with slight variations and immediate summarization of results (Ball and Eckel, 2004; Janssen et al., 2014; Palan, 2014; Shor, 2003). But, the question of whether students become savvy in the economic content due to online experiments is yet to be investigated. This study tries to find evidence for any discernible improvements in student performance (grades) when technological tools (such as online experiments) are used to teach key introductory economic concepts.

The students in introductory microeconomics class need to know the impact of demand and supply forces and how they determine the outcome in these issues: (i) laissez faire market experiments show what the market equilibrium would look like (quantity and price) under free market conditions, (ii) government intervention measures that can have negatively implications such as surplus or shortage and deadweight loss, (iii) government intervention that is necessary to manage of common pool resources, (iv) how monopoly profits and deadweight loss can be controlled by the government and (v) how information asymmetry problems can be addressed with rules and requirements mandated by the government or markets. Each of these issues builds upon each other to provide a broader economic

[1]This study was deemed exempt by the Ohio State University Institutional Review Board.

[2]The homework problem sets show a slightly higher score due to the availability of three attempts for each question.

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understanding for the students. These concepts can be taught with the use of online experiments, as explained below.

While using online experiments, the class is divided into two sections – buyers and sellers. The buyer group will be provided with a buyers' value signifying their willingness to pay; the seller group will be provided with sellers' costs signifying their willingness to accept. The buyers and sellers are given with decide how much to sell for or bid on the product. The technological component makes it convenient to implement various rounds with slight variations. One of the primary benefits of using online experiments is that it can provide students with additional time to think and reflect upon the economic concepts and understand the economic implications better. The online experiments used for this study comes from multiple sources such as Aplia, MobLab, MyEconLab, GameTheory.net and VEconLab.

This study hypothesizes that when online experiments are used, they can reinforce the economic concepts in students and help them score better in their assessments. The hypothesis can be established by comparing two scores: (i) the students' performance in homework problem sets that are completed after online experiments and (ii) the students' performance in homework problem sets that did not include any prior online experiment component (Bostian and Holt, 2013; Holt, 2009; Nguyen and Trimarchi, 2010; Shor, 2001). The results discussed below show that there is a marginal improvement in students' scores, which can be considered as a proxy of gain in students' economic knowledge and understanding. The improvement in student scores is statistically significant. The following sections provide an overview and nature of data, methods and the results and implications.

Data

The data for this analysis were derived from an introductory microeconomics course (*titled Principles of Food and Resource Economics*) in the Ohio State University ATI, Wooster, OH over four semesters – spring 2013-fall 2014. The delivery format of all four course offerings remained the same: lectures supplemented with audio-visual aids and experiments. The assessments included weekly homework problems and exams. Each offering of the course contained 12 problem sets. On an average, students completed four homework problem sets after participating in a related online experiment that reinforced learning; other eight problem sets did not have any underlying experiment. The class sizes ranged from 59-97 (table 1); the students' mean and median scores for the entire course grade (including exams) ranged from 77 to 82%. The mean and median of homework problem set scores ranged from 82-88% and 93-97% respectively (see footnote 2).

Table 1: Summary statistics for the introductory microeconomics course

		Overall course grade		Problem set grade	
Term	Number of students	Mean (%)	Median (%)	Mean (%)	Median (%)
Fall 2014	97	80	82	82	93
Spring 2014	83	77	81	85	97
Fall 2013	59	78	81	88	97
Spring 2013	69	78	81	83	97

The online experiments, implemented primarily through Aplia software, included basic economic concepts such as finding market equilibrium, evaluating the role of the government (price controls, impact of taxes), managing common resources (tragedy of the commons) and making decisions in the presence of information asymmetry. The classroom attendance rate, which is an indicator of students' effort level, was similar irrespective of the presence or absence of experiments: the attendance rate ranged from 86-93% when experiments were conducted and 85-94% for general lectures. Given that each student's effort level remained the same, any difference in student problem set scores would reflect the knowledge gained from the online experiment and how that knowledge got translated into better grades in the homework problem sets.

The composite data created for each student is paired in nature. That is, for each student, the factors such as effort, interest level and preliminary knowledge remain the same. The two composite scores for each student differed primarily in that whether the problem set was completed with or without prior online experiment component. Hence, comparing the changes in problem set score for each student individually is a reliable way to evaluate if the students gained knowledge from participating in online experiments. Such a paired nature of data also eliminates the need to control for other variables such as students' knowledge level (measured by GPA, SAT scores), status or year in the college (freshmen, sophomore), gender, race, age and prior economics courses completed, effort level (attendance) and other factors as reported in Carter and Emerson (2012). These are some of the factors that can possibly explain student scores – but the paired data eliminates the need to control these factors. Hence, analyzing the composite scores for each student, across four semesters, presents a reliable way to evaluate the pedagogical effectiveness of online experiments.

Methods

For each student, two composite homework scores were created: y_i denotes the composite score for student i with underlying online experiments and w_i denotes the composite score for the problem sets that did not have any underlying experiments. The difference in scores for each student be represented by $x_i = y_i - w_i$. The data for each student y_i and w_i would be independently distributed; that is, the composite scores derived for a student depend only the effort and knowledge level of that particular student and independent of other students. If students did not benefit from experiments, then the expected value of x_i, denoted as would be zero. That serves as the null hypothesis for testing, = 0. The alternative hypothesis is ≠ 0; it allows for both > 0 where the online experiments have a positive impact on student

knowledge and < 0 where the online experiments have a negative impact on student knowledge.

The descriptive statistics for the mean and median scores in table 1 displayed skewness in student score distribution. To correct for the skewness, the data was given a monotonic log-transformation. The sample size for each class ranged from 59 to 97 students, sufficient enough for the variable xi to be t-distributed. To evaluate whether the mean value of variable x_i, , was zero or not, t-statistic was computed as t = (- μ)/ SD where was the average difference in the scores with and without online experiments; μ was the mean difference assumed to be zero under the null hypothesis and SD was the standard deviation of the differences in student scores. The computed value of t-statistic could be compared against the t-critical value for a two-tailed distribution to allow for both possibilities > 0 and < 0.

A non-parametric test known as Wilcoxon signed rank test for paired samples was also conducted. The key idea behind this test was to test whether more than half of the class improved their homework problem set scores with the use of online experiments. Hence, it was a test on the median score of the students' problem sets. Both the required criteria for the use of Wilcoxon signed rank test were satisfied by this data set: (i) x_i values were independent of each other and (ii) y_i and w_i were interval data (to enable ranking of student scores based on the difference of y_i and w_i). The steps to conduct the Wilcoxon signed rank test were as following: First the differences in the student scores $x_i = y_i - w_i$ was calculated. Second, a rank score was assigned to each student in the class based on the absolute value for x_i. Third, two groups of students were created based on the sign of x_i (that is $x_i > 0$ and $x_i < 0$). Finally, the rank values were summed up for both groups. To test for statistical significance, the lower value of the two sums (called as the z-score) was compared against the critical value available from the table for Wilcoxon signed rank tests. More details and a ready-to-implement spreadsheet tool were available with Zaiontz (2014).

Results and Implications

Table 2 shows that the mean score from problem sets increased in all four semesters. The online experiments help increase the homework scores by a nominal amount of 1% to 5%. Though marginal, the improvement in raw scores is found to be statistically significant for fall 2013 and spring 2013 semesters; the paired t-test statistic values are 2.798 and 5.234 which are significant at 1% level. The statistical significance can be taken as evidence that underlying online experiments help improve students' knowledge of economic concepts. The slight increase is reflective of previous studies that involved online homework software (especially, Nguyen and Trimarchi, 2010). The increases in students' mean scores in spring 2014 and fall 2014 semesters have rather been marginal and non-significant. One possible reason could be the larger class sizes (table 1) compared to other classes. Even though the paired t-test does not show statistical significance, the Wilcoxon signed rank test shows that the improvement in student scores is statistically significant during all semesters as given below.

The Wilcoxon signed rank test results are presented in table 3. The computed z-scores range from 1.7409 in fall 2014 to 5.452 in spring 2013. The results are significant at 1% level during spring 2013 and fall 2013; and at 5% and 10% levels during spring 2014 and fall 2014 semesters. The Wilcoxon signed rank test results show that more than half (median score) of the students have been able to improve their homework scores upon completing a related online experiment.

Coefficient of variance: The positive effect of online experiments established through the statistical significance is a direct result of higher mean composite score and lower coefficient of variation. Hence, the problem sets with associated online experiments would portray higher mean composite scores or lower standard deviation or both. See figure 1. A cursory look at the chart also reveals that the problem sets with underlying experiments (denoted by triangles) and without experiments (denoted by dots) display a higher mean score or less variance or both. The vertical line signifies the average (mean) score for all problem sets during that semester; the horizontal line is the average measure of standard deviation during that semester. Any score that is below the horizontal line or to the right of vertical line – falling in the bottom right corner – can be considered ideal; or at the very least, the scores should fall to the right of the vertical line. The problem sets with ideal outcomes were three out of five in spring 2014, two out of three in fall 2013 and all the three out of three problem sets associated with experiments in spring 2013. During fall 2014, only one of the four problem sets associated with experiments (denoted by triangles in the figure) reflect the ideal outcome of higher mean or lower coefficient of variation or both.

Table 2: Paired t-test results for the difference in mean composite scores with and without experiments

Term	Mean composite score for problem sets without underlying experiments ()	Mean composite score for problem sets with underlying experiments ()	Mean value^ of	t-statistic
Fall 2014	81%	82%	1% (0.013)	0.894
Spring 2014	84%	85%	1% (0.014)	0.625
Fall 2013	86%	90%	4% (0.015)	2.708 ***
Spring 2013	82%	87%	5% (0.010)	5.234 ***

^ positive values of show that problem set scores increased with experiments; standard error in the parenthesis

*** significant at 1% level ; ** significant at 5% level; * significant at 10% level

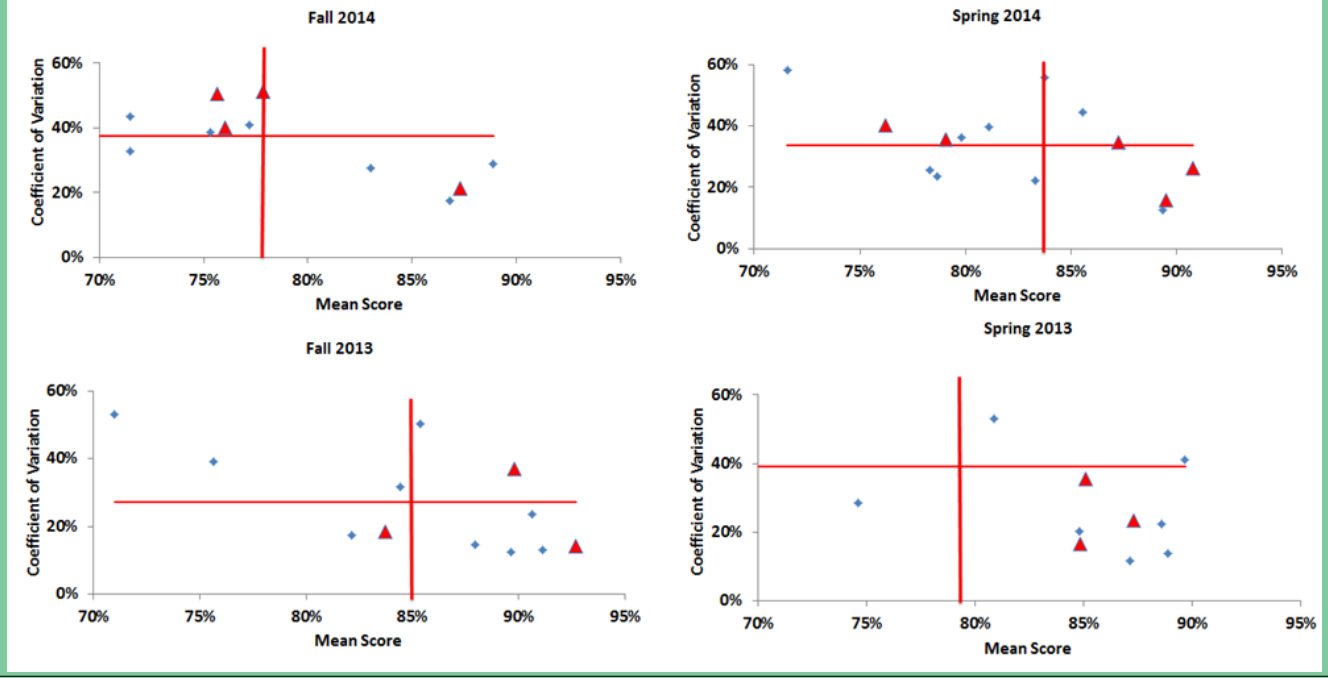
Table 3: Wilcoxon signed rank test results for the difference in median composite scores with and without experiments

Term	Sum of Ranks#	T-critical value for rank	z-score
Fall 2014	T- = 1811; T+ = 2749	1751	1.741 *
Spring 2014	T- = 1189; T+ = 2214	1277	2.369 **
Fall 2013	T- = 414; T+ = 1297	602	3.418 ***
Spring 2013	T- = 252; T+ = 1959	798	5.452 ***

The lower value of the sum is compared with the critical value; if the lower value of the sum is less than the critical value, then the null hypothesis is rejected.

T- and T+, respectively, refers to the sum of ranks of students whose problem set scores were lower and higher when underlying experiments were employed.

Figure 1: Distribution of individual homework scores^



^ The triangles and dots represent problem sets with and without underlying experiments, respectively. The vertical line is the mean score of all problem sets irrespective of the presence of absence of experiments; the horizontal line is the average value of coefficient of variation of all problem sets.

Qualitative assessment: The differences across different student batches are apparent: hence the student cohort (and possibly class sizes) could affect how well students benefit from online experiments. The students' descriptive answers for essay questions suggest that students are able to recall the setup of online experiments and recognize its economic significance. According to Carter and Emerson (2012), online experiments are as effective as manual experiments; according to this study, online experiments are effective in improving student scores. Overall, the results and observations presented here provide further evidence that online experiments can be a useful pedagogical tool in economics classrooms. There is a caveat to these results. The students completed the homework problem sets within a few days after the online experiment; hence, the results presented here could be more indicative of short term knowledge retention. The long run benefits can be established by including suitable exam questions in the final exam, after a substantial gap of participating in the online experiments.

Conclusions

This paper evaluated whether online experiments helped improve students' economic knowledge. The data from homework problem sets in four introductory microeconomics courses during spring 2013 through fall 2014 were used. Each student's homework was used to derive two composite scores – one based on the homework that included underlying online experiments and another composite score without any online experiment component. The summary statistics showed that mean scores were slightly higher by 1% to 5% when online experiments were employed as part of classroom teaching. The paired t-tests conducted on the mean scores and Wilcoxon signed rank test on the median scores showed statistical evidence (at varying levels) for improvement in student performance. In addition to higher mean score, the variation in student response was lower. The students' descriptive answers in exams showed better understanding of economic concepts when online experiments were employed for classroom instruction.

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An International and Domestic Examination of Faculty Epistemological and Pedagogical Teaching Beliefs[1]

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Abstract

Recent research has raised doubts about the quality of undergraduate teaching in the United States. Quality post-secondary education becomes more and more critical to both national competitiveness and the development of a robust agricultural economy. There is a continual need for productive research on effective teaching. To ensure undergraduate students are receiving the quality of education needed to be competitive in our global society, colleges of agricultural sciences must constantly advance their education and scholarship. The purpose of the research study is to identify the epistemological and pedagogical teaching beliefs of faculty in two colleges of agricultural sciences. The study employed a multiple case–study approach utilizing a basic qualitative design to frame their one-on-one structured interview research methods. The results were discovered through in-depth content analysis for rich description expressing the faculty member's beliefs they hold about their teaching. Findings revealed faculty at both agricultural institutions held contextualistic epistemological beliefs and learner-centered pedagogical beliefs. More dynamic assessment of epistemological and pedagogical beliefs are recommended in colleges of agriculture around the world to identify the interactive relationships between the development of epistemological and pedagogical beliefs of teachers and students, cultures and learning environments. Further research will also lead to identifying the philosophy of a culture and values embedded in a culture that impact the development and strengthening of teacher and student beliefs.

Introduction

A vibrant U.S. agriculture enterprise is paramount to the future well-being of the nation (National Academy of Sciences, 2009). By 2018, 44% of jobs in agriculture, food and natural resources will require some postsecondary education (U.S. Department of Agriculture Economic Research Service, 2014). Colleges of Agricultural Sciences are charged with the task of addressing our nation's societal and industry challenges by preparing *"a diverse workforce that includes scientists and professionals with knowledge and skills beyond today's standards"* (Doerfert, 2011, p. 19).

To expand and improve the current vision of effective teaching in the United States' agriculture education, it is imperative to gain a more global understanding of the pedagogical approaches of other leading agricultural universities award-winning teaching faculty. In its first articulated international strategy, the United State Department of Education (2012) called for "global competencies for all students" and "education diplomacy and engagement with other countries" (p.1). The global nature of the agriculture industry means that much can be learned from our peers engaging in similar missions across the world. This synergy can help ensure the U.S. agricultural education achieves its maximum potential.

Transforming and sustaining education in agriculture requires an ongoing commitment and investment in undergraduate education (National Academy of Sciences, 2009). Investment in undergraduate education will play an important role in shaping the future of agriculture and in meeting the challenges of the 21st century and beyond (National Academy of Sciences, 2009). Teaching of the agricultural sciences at the post-secondary level is strongly influenced by the skills, knowledge and dispositions of the faculty (National Academy of Sciences, 2009). Improving the undergraduate learning experience for students in agriculture, food and natural resources disciplines requires innovations in teaching, learning and the curriculum must be addressed (National Academy of Sciences, 2009). Emphasis on promoting teaching and learning and focusing on faculty develop-

[1]The Pennsylvania State University Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study.

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ment to ensure quality instruction and student engagement was a strong recommendation from the council (National Academy of Sciences, 2009).

For decades, educational researchers have examined the many facets of teaching practices, theories and effectiveness. The role of teachers' personal beliefs and theories have on their actual teaching practice has been a central focus of educational research in the past (Bullough, 1997; Clark and Peterson, 1986; Ethell, 1997; Kagan, 1992; Kane et al., 2002; Pajares, 1992; Richardson, 1996; Trumbull, 1990). Previous research has presented the complex relationship between teachers' beliefs and practices (Kynigos and Argyris, 2004). The literature has provided evidence that posits teacher beliefs being consistent and having a direct relationship with teacher practices, as well as, the complexities of beliefs and teaching practices that have little to no relationship (Bingimlas and Hanrahan, 2010). The study will expand on the influence of teacher beliefs on their practice of post-secondary agricultural educators.

The purpose of the research study is to identify the epistemological and pedagogical teaching beliefs of faculty in two colleges of agricultural sciences. The research study will allow for researchers to make further links between post-secondary agricultural sciences faculty espoused teaching theories and their actual teaching practice. The study was guided by the following objectives:

1. Identify the epistemological teaching beliefs of faculty in two colleges of agricultural sciences.
2. Identify the pedagogical teaching beliefs of faculty in two colleges of agricultural sciences.

Methods

The researchers employed a qualitative case study approach (Gube and Lincoln, 1989) and a constant comparative method was employed for data analyses (Strass and Corbin, 1990). Each university served as a case. The instructors selected to participate within each case were deemed to be excellent teachers according to their receipt of an award honoring their teaching. A purposive, extreme case sample (Gall et al., 2003) of seven university faculty at The Swedish University of Agricultural Sciences (SLU) and nine university faculty within the College of Agricultural Sciences at The Pennsylvania State University (PSU), served as the participants for the study. The participants represented ten different disciplines within Agricultural Sciences.

The Swedish University of Agricultural Sciences (SLU) and the College of Agricultural Sciences at The Pennsylvania State University (PSU) were selected for their dedication to scholarship in the area of agricultural sciences. The universities were also comparable in institutional mission, size and degree granting disciplines. The researcher conducted an exhaustive review of faculty members who teach undergraduate courses at each university and had been recognized through a teaching award for their teaching. Each university has an established teaching award that served as the initial source for identifying teachers recognized for their teaching. Those individuals who had won the award at their respective university for their teaching at the university level were considered potential study participants. A list was then generated by the researcher of faculty who were award winning and nominated by their university's administration. A list of twenty-seven faculty members combined from both Universities was generated who met all of the inclusion criteria. Seven faculty members from The Swedish University of Agricultural Sciences (SLU) and nine faculty members from the College of Agricultural Sciences at The Pennsylvania State University (PSU) agreed to participate in this study.

The research design was developed in order to capture both what teachers say about their teaching and to observe their teaching practice directly (Kane et al. 2002) within two institutions that focus on post-secondary agricultural education. This qualitative case study used multiple data sources to enhance data credibility (Patton, 1990; Yin, 2003). The data from the multiple sources included both qualitative and quantitative data.

Data was collected using in-depth, structured interviews. The use of in-depth interviews provided an opportunity for formal, structured interactions with the participants and informal conversation as well (Rossman and Rallis, 2003). A structured standardized open-ended interview method was utilized. A modified version of the Teacher Beliefs Interview (TBI) was used to capture the beliefs of agricultural sciences professors because of its special focus on epistemological beliefs (Luft and Roehrig, 2007).

The TBI was found to be both valid and reliable for secondary teachers and has been used and validated with college-level instructors (Addy and Blanchard, 2010).

Data analysis began with the interviews being transcribed verbatim. To analyze the transcribed interviews, content analysis was used. Content analysis is a technique that enables researchers to study human behavior in an indirect way, through an analysis of their communications (Fraenkel and Wallen, 2009). A conventional qualitative content analysis approach was used while utilizing a constant comparative strategy between the philosophy statements. Themes emerged both from the data (an inductive approach) and from the investigator's prior theoretical understanding of the phenomenon under study (an a priori approach). Researchers identified the presence of words and concepts that represent their epistemological and pedagogical beliefs within the transcribed interviews. After the coding was completed, the researchers compared similarly coded data to identify each possible dimension of a theme and the relation of a theme to other categories and themes (Corbin and Strauss, 2008). Coding identified different aspects of the same phenomenon and provided elaboration and variation. By using the constant comparative approach, the researchers were able to saturate the categories, searching for instances that represent the category until

the data does not provide additional insight to the category (Creswell, 2007).

Results and Discussion

Beliefs about the nature of knowledge, "epistemological beliefs," are important to understanding teachers' educational strategies. Prior research has documented teachers' beliefs influence teachers' practice and learning (Abdelraheem, 2004; Richardson, 1996). In the study, award winning teachers' epistemic beliefs (beliefs about knowledge and learning; Schommer, 1990) and their pedagogical beliefs were investigated (beliefs about teaching; Teo et al., 2008).

The findings regarding the epistemological and pedagogical beliefs are reported in the form of themes supported by quotes from the interview transcripts followed by text containing verbatim quotes.

Theme 1: The SLU faculty held a range of epistemic attitudes that were contextualistic in orientation.

The seven faculty members were likely to hold a range of epistemic beliefs. Teachers' epistemological beliefs influence the ways that they make important instructional decisions related to the curriculum, pedagogy and assessment (Schraw and Olafson, 2002). Schraw and Olafson (2002) describe three kinds of epistemological world views; realist, contextualist and relativist. A realist assumes that knowledge is acquired through experts and learning is a passive act. Contexualists see themselves as facilitators, who along with the learners collaboratively construct shared understanding. While the relativists view learners as independently and uniquely creating their own knowledge.

Professor Cathy: *"I'm a service marketing kind of person and I think the value created is created between us, between students, and between students and me, so if either of us are not interested, then there will be no value, so to me the student is a value creator as well, and a contributor in the case of case studies, sometimes the students may have more legal background, for example, than I do, and that sometimes interesting things in marketing will have a close connection to what's legal and what's not, and then I'll just have to stand back and say, tell us about it, could you share some of your wisdom. In that case the student will be the one with the greater wisdom sharing. My role is made of that of an orchestra setting the kind of and then remembering to bring in all the instruments so that everyone is participating as much as possible."*

Professor Matt: *"The role of the students should be an active one, of course. The student is constructing, I like the concept of constructivism, and has to be expose to some extent of confusion and the process of assimilation and acclimation events that take place that must make people realize that they don't know everything."*

Professor Don: *"We're equally important and maybe the students are more important, but there is a responsibility on me as a teacher as in some way a more experiences person to give this frame to try to explain why is this important, why do you need to learn this and that is more to motivate them to really start doing the hard job themselves, because they have to do it themselves, and so the motivator is my role more I would say."*

Realists believe that there is a fixed, core body of knowledge that is best acquired through experts via transmission and reconstruction. Realists teach actively to students who are viewed as passive recipients of a pre-established knowledge base. Contextualists posit that students must construct their own knowledge and that the teacher serves as a facilitator for collaborative, shared construction of knowledge. Teaching faculty with advanced education and teaching experience, more sophisticated epistemological beliefs should naturally have teaching practices that support and promote sophisticated epistemological beliefs. In summary, the seven participants of this study appeared to embrace both the realist and the contextualist epistemic beliefs.

Theme 2: The SLU faculty held a range of pedagogical beliefs that learner-centered in orientation.

Ertmer (2005), investigated teacher beliefs about teaching and learning, called these beliefs pedagogical. Teachers' pedagogical beliefs play a central role in their teaching practices, including choosing the subjects and activities, decision-making and evaluation in

Table 1. Summary of Epistemological and Pedagogical Themes of SLU Faculty

Themes	Descriptions
The SLU faculty held a range of epistemic attitudes that were realist and contextualistic in orientation.	Realists see themselves as the expert, actively disseminating knowledge. Realist teacher d believe that there is an objective body of knowledge that must be acquired, this position would hold that curriculum is fixed and permanent and focuses on fact-based subject matter Contexualists see themselves as facilitators, who along with the learners collaboratively construct shared understanding. Teachers who are Contextualists view knowledge as temporary, specific to a given situation, and constructed collaboratively. The knowledge can be evaluated by criteria which depend on the context of the situation (Schraw & Olafson, 2002).
The SLU faculty held a range of pedagogical beliefs that were learner-centered in orientation.	Learner-centered belief emphasizes student responsibility for learning and is focused on knowledge construction and how students are induced to work and learn together.
The SLU Faculty equally engages in reflection-in-action and retrospective reflection-on-action on their teaching practices.	Reflection-in-action, which occurs continuous and synchronous with teaching, and reflection-on-action, which occurs asynchronously at some point after class, and disconnected from teaching actions.
The SLU Faculty feel confident in their teaching abilities.	Individual faculty members belief about their ability to perform specific teaching skills in the classroom which affect their practice through the selection of teaching methods, their motivation to follow through with those methods, their persistence when they encountered difficulties in the classroom environment, and their ability to recover after perceived failure

Table 1 provides a summary of the epistemological and pedagogical themes of the award winning faculty at the Swedish University of Agricultural Sciences.

the classrooms (Ertmer, 2005). A commonly used distinction in studies is associated with two prototypical ideologies: teacher-centered or teaching-oriented belief and learner-centered or learning-oriented belief (Meirink et al., 2009; Schuh, 2004). The teacher-centered belief is based on an assumption of knowledge delivery that resembles traditional teaching methods and underscores the importance of knowledge reproduction; while the learner-centered belief emphasizes student responsibility for learning and is focused on knowledge construction and how students are induced to work and learn together. In terms of acquiring knowledge, teacher beliefs about teaching and learning can be broadly classified in the knowledge transmission category or knowledge construction category (Chan and Elliott, 2004; Samuelowicz and Bain, 2001). Thus, teacher beliefs typically encompass teacher-centered and leaner-centered pedagogical beliefs (Chai et al., 2009).

Professor Ellie: *"I look a lot on learning from the learners perspective and that you need to, I'm so convinced, both from my own children, my own experience and from all the students I've seen throughout the years, that this view that you have to start where you are, you have to find out where am I, and that is something like in problem-based learning, part of the process is to find out what do I know and what do I not know, where do I stand, and if there is more group discussing some of them might know more, some of them might know less, but they have to identify where am I in this understanding so where do I start when I need to fill up on this, where I need to learn more."*

Professor Don: *"I can present, but then we must work, the students must work and practice with something and that could be in group discussions as I said, it could be some sort of exercise, but it almost always after say twenty minutes, maybe an hour, it ends up with the students getting a task and working with and that could be in various ways - lectures and various forms of student activating lecture forums, exercises."*

The statements in the findings illustrate SLU faculty's beliefs that the teacher does not function as the primary source of knowledge in the classroom. Instead, the professor wishes to be viewed as a facilitator who assists students who are seen as the primary designers of their learning.

Theme 3: The SLU Faculty equally engage in reflection-in-action and retrospective reflection-on-action on their teaching practices.

There are different traditions in reflective practice that influence how one conceptualizes the role or emphasis of reflection in the life of the teacher (Zeichner, 1994). Schön (1987) highlighted the value of reflection in helping professionals learn about and improve their teaching practices. Reflection can occur at different points in relation to instruction. It can occur prior to, concurrent with and retrospective to instruction. Schön (1987) identified two categories of reflection, reflection-in-action, which occurs continuous and synchronous with teaching and reflection-on-action, which occurs asynchronously at some point after class and disconnected from teaching actions. The process of reflection promotes the interplay between general and personal pedagogical knowledge such that perceptions formed by personal beliefs and experiences are broadened and made more objective while conceptions and principles of pedagogy explicated by research are exemplified and contextualized (Shulman, 1987; Gess-Newsome and Lederman, 1999). The result of the reflection process is the context-specific pedagogical knowledge that helps guide teachers' decisions and actions (Gess-Newsome and Lederman, 1999).

Professor Philip: *"I always do, because very often even when you see the students' answers on the written exams or you can also see yourself that it's not, you look at the eyes of them and they look like they don't understand anything, and I often ask myself is this effective to just stand there and have our lectures, is that okay? I have reduced my lectures and let the students work more with questions, and then we reflect on the answers and go back, but I think it's very important that we tried to understand and tried to discuss and explain the subject in that way get them high level knowledge. I don't think it's effective just standing there talking to them, I don't think that. So I have reduced them, actually, but it's time I ask the question is this effective actually? This is the way you should teach children, and I'm not sure. I always question myself."*

Professor Ava: *"Well, we have a system I guess you have already heard about it at our university where we do evaluations in a very straight way, written and oral evaluations, so that's what I've been doing at the university. We do the same naturally when we do courses for industry assistance, where we have written evaluations, and I use those evaluations very actively every year when I'm going to plan the next year's teaching activities."*

Professor Don: *"One thing is, of course, the course evaluations. If my parts of the course or whatever is judged as good, then of course that's good, and if it's next year a little bit better and it could also be that the students who fill in the form say that okay, this is good, but that we didn't understand, okay, then until next year I may change that task a little bit or may exclude it or I may have it the same but give more information around it and see and try to improve single parts of it, so that's one thing. One thing is of course the meeting in the classroom and seeing spontaneously how the students react, and I see it quite quick, I think, and I see if students sitting like this, I know they're not listening now, but if I can have them listen and really they look almost like they want to eat, then I know this is good, this is good, so afterwards looking in the forms, continuously checking the students."*

Reflection is the vehicle for turning experience into learning (Boud et al., 1985; Sternberg and Horvarth, 1995). The findings present examples of the SLU faculty turning experience into knowledge through the use of reflection to improve and build on their teaching.

Theme 4: The SLU Faculty feel confident in their teaching abilities.

Faculty in higher education play an important role in preparing students for the demands of solving society's complex issues. Faculty beliefs about their teaching capabilities affect their classroom teaching behaviors (Morrell and Carroll, 2003; Yeung and Watkins, 2000). Individual faculty members' beliefs about their capability to perform specific teaching skills in the classroom affect their practice through the selection of teaching methods, their motivation to follow through with those methods, their persistence when they encountered difficulties in the classroom environment and their ability to recover after perceived failure (Bandura, 1997; Dellinger, 2001; Tschannen-Moran et al., 1998).

Professor Matt: *"Yes, I have to believe in my abilities, yes. Generally, I do. So that means if I see that they are frustrated because they don't understand, I believe both in their ability to learn and in my ability to sort of guide them through the learning, so I like that challenge actually, when they say they don't understand anything. So I think I am confident in my teaching ability, but I'm not confident in the way I teach, or we discussed a lot on how I choose methods. I'm never convinced that I have reached the final and best way of teaching."*

Professor Roger: *"I definitely feel confident in one sense absolutely. I don't go to the starting course and think, I can't do this, and I'm not a good teacher. So I certainly feel confident that I can teach well, but I don't just take it for granted."*

Professor Philip: *"Actually, I do. I feel since I used to say to my colleagues that when I had a course, I mostly felt it was a catastrophe, I think, and [now] each time I have it, the students are very satisfied and give me very good assessment. And when I talk to students and when I have my lecture, I actually feel very confident."*

Professor Cathy: *"For the most part, for the most part, yes. When I don't, it's usually when I have been stressed out by too many things that I have to do."*

Research into teacher beliefs about the nature of knowledge is important because of the pervasive influence that those beliefs have over attitude, motivation, and behavior. A great deal of empirical evidence has established the significance of beliefs for understanding teacher behavior (Clark and Peterson, 1986; Kane et al., 2002; Pajares, 1992). The findings regarding the epistemological and pedagogical beliefs of the PSU faculty are reported in the form of themes supported by quotes from the interview transcripts. Table 2 provides a summary of the epistemological and pedagogical themes of the PSU faculty followed by text containing verbatim quotes.

Theme 1: The PSU faculty held a range of epistemic attitudes that were both contextualistic and relativistic in orientation.

As previously mentioned, the researchers referred to Schraw and Olafson's (2002) teacher epistemological worldviews classification to categorize the PSU faculty beliefs. Schraw and Olafson's (2002) realitivist category describes knowledge as fixed, universal unchanging; known to the teachers as authority; and transmitted by them to the students. Teachers who hold relativists beliefs see knowledge as self-constructed and highly individualistic, with no opinion considered more valuable than another (Schraw and Olafson, 2002). Teachers who are contextualists view knowledge as temporary, specific to a given situation and constructed collaboratively. Contextualists posit that students must construct their own knowledge and that the teacher serves as a facilitator for this collaborative, shared construction of knowledge.

Professor Gabe: *"I would say that I don't know anything myself. In my graduate contemporary theory class, we read a lot of critiques of positivism and various post-structuralism, relativism, et cetera, et cetera – various kinds of social construction of reality and so forth. In any given day, I could go either way…I don't think we discover knowledge, I think knowledge is things that we construct collectively and not out of thin air, of course…I'm a pragmatist, John Dewey had it right, too, which he said it may be slightly less straightforward than Marx, but that we construct these things collectively and in his book, The Public and It's Problems, where a problem doesn't really exist until two people start talking about it as a problem, and I'd say it's the same about knowledge. Knowledge emerges when two people start talking about it and then maybe a third joins in and so*

Table 2. Summary of Epistemological and Pedagogical Themes of PSU Faculty

Themes	Descriptions
The PSU faculty held a range of epistemic attitudes that were both contextualistic and relativistic in orientation.	Contextualists posit that students must construct their own knowledge and that the teacher serves as a facilitator for this collaborative, shared construction of knowledge. Relativists also indicate that students need to construct their own knowledge and teachers should build an environment where students construct their knowledge and learn to think independently.
The PSU faculty held a range of pedagogical beliefs that were learner-centered in orientation.	Student-centered teachers have been found to use a wider repertoire of teaching methods, than teachers who adopt a teacher-centered approach to teaching. In student-centered teaching, transmission may be a component, but not an aim, as the focus is more on the students and their learning, rather than on teacher and his or her teaching. Teaching is interactive in a way that observes students' existing conceptions. Teaching is about facilitating students' learning:
The PSU Faculty equally engages in reflection-in-action and retrospective reflection-on-action on their teaching practices.	Reflection-in-action, which occurs continuous and synchronous with teaching, and reflection-on-action, which occurs asynchronously at some point after class, and disconnected from teaching actions.
The PSU Faculty feel confident in their teaching abilities.	Individual faculty members belief about their ability to perform specific teaching skills in the classroom which affect their practice through the selection of teaching methods, their motivation to follow through with those methods, their persistence when they encountered difficulties in the classroom environment, and their ability to recover after perceived failure

Table 2 provides a summary of the epistemological and pedagogical themes of award winning College of Agriculture Faculty at The Pennsylvania State University.

forth and you begin to establish something that maybe you could point to, that's not a bad idea, and you have knowledge."

Professor Kaleb: *"I guess I have two thoughts of that. On my own as a student I was perfectly happy in lectures and I was motivated to learn so that environment was fine for me and I also was really shy, so it would be kind of hypocritical for me to say that the way I'm doing it now is the right way, because the way I'm teaching now is really different from how I learned. I think there's kind of an array of epistemological beliefs that are effective. Anyway, let me talk about how I teach rather than how I learned, because how I teach is that I think that students are going to be engaging with each other and in this field where I teach environmental science in teams and complex problems where there are no right answers, and so I think that lecture solely is not effective for teaching that kind of thinking because it implies that the material that I'm projecting is kind of the way the world is, and I think in reality it's these problems that they're going to be facing are really messy. So my belief is that having the students do some co-learning where they are bringing forward ideas that confront my ideas and each other's ideas it's much more like the real world, and so I try and create environments where the students are doing that and honestly some of them don't like it, they think it vague and lame, but I think it reflects on the way environmental science happens."*

The PSU faculty espoused epistemological beliefs that contributed to both a contextualist and relativist standpoint.

Theme 2: The PSU faculty held a range of pedagogical beliefs that were learner-centered in orientation.

Pedagogical beliefs refer to preferred ways of teaching by teachers. These range from teaching as presenting or imparting structured knowledge, to teaching as facilitating understanding and bringing about conceptual change and intellectual development. Teachers who conceive teaching as transmitting knowledge are more likely to adopt a teacher-centered approach to teaching, while those who regard teaching as facilitative, tend to use student-centered approaches. In teacher-centered teaching, transmitted knowledge is gained or constructed by the teacher. Students are considered more or less as passive recipients of that information, and the existing knowledge students have is not taken into account. Learning outcomes are expressed in quantitative rather than qualitative terms without concern of the students' understanding of knowledge. In student-centered teaching, transmission may be a component, but not an aim, as the focus is more on the students and their learning rather than on teacher and his or her teaching. In student-centered instruction, the teacher believes teaching is about facilitating students' learning. Students are encouraged to construct their own knowledge and understanding and to strive towards becoming an independent learner. A student-centered teacher tries to recognize students' differing needs and take these as the starting point when planning the course (Biggs, 1996; Kember and Kwan, 2002; Prosser and Trigwell, 1999; Prosser et al., 1994; Samuelowicz and Bain, 2001; Vermunt and Verloop, 1999).

Professor Kaleb: *"It's a mix, so that's why I don't like the word primary because my most common approach is to mix very small short lectures that are 20 to 30 minutes long followed by class discussions, or if not discussions, in-class work, active learning in class, so I guess that's my primary approach is to do those two things."*

Professor Jacob: *"I guess I would have to go back to King (1993) that says, guide on the side. I do want to be a facilitator, I don't want to be the dispenser of knowledge, and I think again, that's probably why I rely so much on class discussion, because while I can kind of come up with a topic area and the content areas that are important to program planning and Ag education, let's say, or to becoming an effective teacher in the Ag mechanics laboratory, a lot of times it's better for us to get the content out there and discuss it so I do really see myself as a facilitator of the content rather than just a lecturer of the content."*

The statements in the findings illustrate PSU faculty's beliefs that the teacher does not function only as the primary source of knowledge in the classroom. Instead, the professor wishes to be viewed as a facilitator who assists students who are seen as the primary designers of their learning.

Theme 3: The PSU Faculty equally engage in reflection-in-action and retrospective reflection-on-action on their teaching practices.

Through the process of reflecting both "in practice" and "on practice," practitioners continually reshape their approaches and develop mastery in their practice. Activities such as debriefing with peers or learners, seeking feedback from learners on a regular basis, and keeping a journal can provide vehicles for reflective practice. The following statements support the PSU faculty engaging in both reflection-in-action and reflection-on-action.

Professor Bob: *"I do try to look at the end of the semester, even during the semester, the things that I'm doing and what I'm doing in class and try to think about, okay, how can I do it better? I certainly read through the SRTE's as positive and negative as that can be at times. I try to think, okay, what are the common themes, how can I make those things better, and how can I improve? I try to look at what others are doing, watch other teachers, again, going to things like NACTA, it was fantastic, I wish I could go again this year. That was a terrific opportunity and for me, I am not again as many people here, my main training is not as a teacher so when you get the opportunity to see what it's like to learn and some other techniques, most of the time I'm thinking about nutrition or what new lab technique I can use, and I'm spending all of my creative energy trying to learn those things. I've come to, oh, wow this is really cool, I can do some new things here, I can do things differently."*

Professor Hannah: *"I do it pretty regularly because I often think when I'm done teaching a class, oh, I should have done this, or next time I'll have to do this to maybe make it clearer. I look at my SRTE's each year, and I always use them when I'm revising and reorganizing my class the next year I teach it. I basically every year, I change things in my classes – try to make the issues more current, improved based on what I realized I could have done to enhance understanding, based on student feedback, and also based on the kinds of workshops or insights I get from reading materials or going to workshops."*

Professor Mark: *"When I am done with every class, I have notes, I also hand out to my students, I have an example here, a sheet at the beginning of the year on bright colored paper that says complaints, gripes, compliments, and whatever, and dates, comment. I ask them to write the date down, and it's on bright colored paper because I want it in their notebook. I use the SRTE's along with all my notes where I've written 'this didn't work', a big 'X' through it – don't do this again – and then every year I rebuild my notes and rebuild my course—minor, it's not major usually, but trying to incorporate in the feedback I get from the students and myself as I go through…You know when you walk out of a class whether that one hit on all cylinders or it was a flop."*

Theme 4: The PSU Faculty feel confident in their teaching abilities.

Bandura (1993) presented the construct of self-efficacy as the beliefs one has about his or her ability to perform the actions required to achieve specific outcomes. Teacher-efficacy refers to *"the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context"* (Tschannen-Moran et al., 1998, p. 233). Pajares (1992) contended that "beliefs are the best indicators of the decisions individuals make throughout their lives" (p. 307). Thus, it follows that teachers' beliefs about their teaching abilities may be an indicator of their future behavior, decisions, and classroom organization. In the teaching context, teacher-efficacy is expected to influence the goals teachers identify for the learning context as well as to guide the amounts of effort and persistence given to the task (Bandura, 1997; Tschannen-Moran et al., 1998). The following statements provide a rich description of the PSU faculty members' confidence in teaching.

Professor David: *"I do. I also don't think I'm the best at it. There's lots of room for improvement. I've gotten better over the years, I think, but I don't think I'm at the top of the hill yet and hopefully never will think I'm at the top of the hill because I think that would be a bad thing. I'm confident I guess in looking at my students' success. Again that's the measure to me is not whether they get an A or got a B, it's what can they really do, how do they perform when they're out on an internship, how do they perform when they graduate and go out, how do they perform when they're members of a community, and all those things are what's important, and I've got students who have left here with a 2.1 average, and I just knew they were going to be successful, and it didn't matter that they had a 2.1. I've had others that have gone out of here with a 3.9 and it was like, what in the world is this person going to ever do? Hopefully they find themselves. Am I confident? I would say I am, but I try not to be over confident about it, try not to be satisfied with it."*

Professor Cory: *"I know that I'm not perfect. Yes, I feel confident in my teaching abilities, but I also understand that there's lots of room for improvement, especially teaching with Dale! [Laughter] You see somebody who does it really well and you realize…*

Professor Gabe: *"More confident than I did when I was first starting out…I'm confident in the fact that students tend to enjoy and learn from good, critical conversations, and I think I'm confident in my ability to do that – to lead those kinds of conversations. I can choose a good article or book that I think will stimulate conversation in the classroom, and then we can have a good conversation, so I think I'm confident in that…So I'm somewhat confident."*

Summary

The findings present the conclusion that epistemological and pedagogical beliers of award winning faculty members, do not fall neatly into one category. The participants endorsed more than one epistemological belief. The SLU participants supported two epistemological beliefs indicated agreement with both the contextualist and realist beliefs. While the PSU participants supported two categories of beliefs as well, however, they endorsed the contextualist and relativist beliefs. The findings indicate that the faculty at both institutions has diverse beliefs that guide their practices. Presently, it is not clear whether this is because the award winning faculty deliberately chose to blend beliefs from different epistemological views in order to mix and match specific assumptions of these beliefs, or because they are somewhat naïve and have not closely scrutinized their own beliefs to examine whether they are conceptually consistent. Participants from both institutions held pedagogical beliefs that endorsed student-centered instruction; however, it is not clear whether this espoused belief guides their actual practice.

The present study provides an exploration of award winning faculty in colleges of agriculture teacher beliefs. Understanding the beliefs of teachers is critical to develop programs that have a lasting impact on new and experienced faculty. As we begin to understand how the beliefs of agricultural education faculty form, we will be able to develop professional development programs that are conducive to the optimal development of faculty members. Further research is needed that explores the relationship between espoused teaching beliefs of colleges of agriculture faculty and their actual practice.

More dynamic assessment of epistemological and pedagogical beliefs is also recommended in colleges of agriculture around the world to identify the interactive relationships between the development of epistemological and pedagogical beliefs of teachers and students, cultures and learning environments. Further research will also lead to identifying the philosophy of a culture and values embedded in a culture that impact the development and strengthening of teacher and student beliefs. More empirical studies are needed for researchers to build better understanding about which belief is affecting which action, and subsequently how to address or change teachers' beliefs (Ertmer, 2005).

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NACTA Reprint

September 2006

Should I Skip Class?

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Abstract

Professors routinely struggle with student attendance in the classroom. Often students that struggle with the lecture material have the poorest attendance and those who excel generally have excellent attendance. Some professors address this dichotomy by using announced or unannounced daily quizzes taken solo or in pairs (dyad) as a means to improve student attendance. In this study we evaluated the effect of unannounced quizzes on student grades in an Introductory Soil Science class over two consecutive semesters (136 students total) at the University of Tennessee (UT) and compared it with results from six semesters (425 students total) in a similar Introductory Soil Science class at the University of Minnesota (UM) where attendance points are structured into the syllabus with daily lecture quiz dyads. Results clearly show that all UT students that earned A's missed no more than three lectures and that students that missed no lectures earned at least a B. Similarly, UM students that earned A's attended at least 80% of all lectures. Therefore, we conclude that giving announced or unannounced quizzes is beneficial to students with both excellent and poor attendance habits. Quizzes and exams positively affect student learning thereby suggesting that class time used for taking and reviewing quizzes and exams is fundamental to student learning and mastery of the subject matter.

Introduction

Most instructors understand that student success in large lecture sections is highly correlated with student attendance, yet student attendance in large lecture sections often dwindles as the semester progresses. Highly motivated students have increased academic success (DeRoma et al., 2004) with excellent classroom attendance. Students give multiple explanations/excuses why class attendance drops such as early morning class times, conflicts with work, other exams or projects that seem to be more important than missing an occasional class. Many students eventually realize the importance of classroom attendance and participation but it is often too late to earn the grade that reflects their aptitude and abilities.

Allowing students to earn points through lecture quizzes can seem somewhat paradoxical. For example, students who are excelling in the class usually have better attendance suggesting that points associated with attendance will only assist students who are already attending and negatively impact those who are not. Some instructors include participation points in lecture syllabi in an attempt to overtly entice students to improve their attendance and, supposedly, their likelihood of earning a better grade. Lecture participation points may take the form of announced or unannounced quizzes, classroom attendance checks through assigned seats or roll call, or using in-class discussions to break up the rhythm.

One concern with using participation points in determining final course grade is that these points may only benefit students already successfully passing the course instead of assisting the struggling absentee student. All points that students can earn in a course should be equally available to all students. If students can pass a class without attending it, it seems unfair to essentially lower their grade due to lecture nonattendance. Some instructors address this issue by predicating a passing grade upon class participation/attendance even if passing grades were earned on all examinations (Druger, 2004).

Few research studies address classroom attendance at the university level; no studies indicated that lecture attendance was directly linked with the final grade earned for a course. In this study we evaluated classroom attendance for an introductory soil science course at the UT and the UM and its impact on final grades.

Materials and Methods

University of Tennessee

At UT the Introductory Soil Science course meets for three 50-min lectures and one three-hour laboratory per week. This intensive course covers 20 textbook chapters and 11 hands-on laboratories in a 16-week semester. We evaluated lecture attendance in two consecutive semesters in a class with 58 students and another class with 78 students.

The syllabus for this course included sixteen unannounced five-point quizzes. The instructor used

the following criteria to determine when quizzes were given. If—

1. Attendance in the classroom between two-minutes prior to class time and class time was less than two thirds of enrolled students, a quiz would be given during lecture unless:
2. A quiz had already been given that week; or,
3. It was the last lecture for the week and attendance was above two thirds of enrolled students for the previous two lectures, a quiz would be given regardless of attendance.

The quizzes consisted of questions that pertained to the day's lecture that could easily be answered correctly if the student was conscious throughout the lecture. All questions were based upon scientific principles and had to be answered with either graphs or short essay answers.

Student grades and absences were evaluated with SAS (version 8.2) using PROC REG. After regressional evaluation where attendance quiz points were included, attendance quiz points were deleted and grades assigned based upon points earned solely through lecture exams and laboratory worksheets using the same percentage values to determine the breaks between grades.

University of Minnesota

Results from six semesters from Spring 2000 through Spring 2004 were evaluated to determine the effect of attendance on student performance in Basic Soil Science. Similar to UT, lecture quizzes or dyads count for approximately 10% of the final grade. Dyads are given each class period and consist of two students working together to answer one question that pertained to the day's lecture. The student pair hands in one sheet of paper with both names written on it and these are graded by the instructor as well as evaluated for misunderstandings of the lecture principles.

The data were analyzed using PROC CORR and PROC GLM using SAS. The means, pearson correlations, and regression were performed on individual terms and the overall data.

Results

Students that attended classes regularly did quite well in the introductory soil science courses at both institutions. However, at UT those who missed no classes earned at least a B in the course and students that earned A's in the class missed no more than three lectures during the Spring semester of 2004 (Figure 1). Similarly, any student earning a B+ missed three or fewer classes; those earning a B missed five or fewer classes. The results were similar for students enrolled during Fall 2004; those that attended at least 80% of the lectures earned an A or a B whereas students with more sporadic attendance had lower grades (Figure 2). These results suggest that student attendance is important to student success in university lecture-based courses.

At the other end of the final grade continuum, students who earned a D missed at least three lectures (Figure 1); five missed lectures was the maximum any student missed and still earned a B. Students earning C's had between one and seven absences. It is clear from this study that attendance is very important in determining the level of student success in this course. The regression analysis

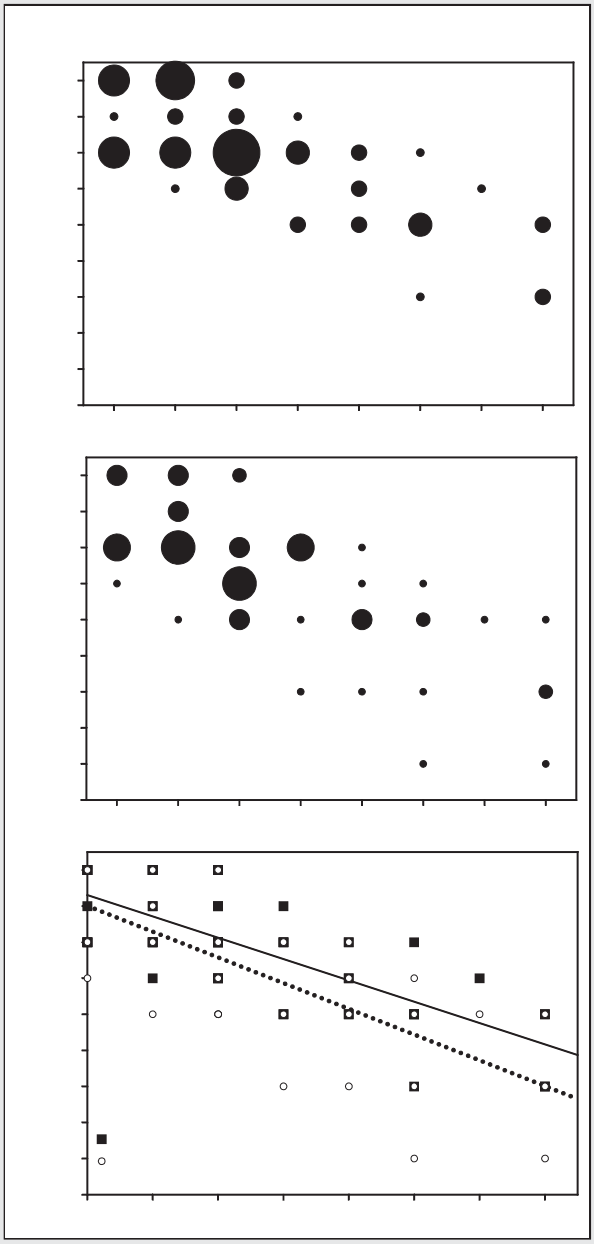

Figure 1. Relationship of class attendance and final grade at UT, Spring 2004. Plot A is the final grades with quizzes included, Plot B is the final grade without quiz scores. The size of the symbol in Plots A and B reflects the number of students with the same final grade and attendance, the smallest symbol size is one student and the largest symbol size is seven students. Plot C is with combined data from Figures 1 and 2. The solid regression line is the grade issued to students that included the quiz scores, the dashed line is with the quiz scores removed.

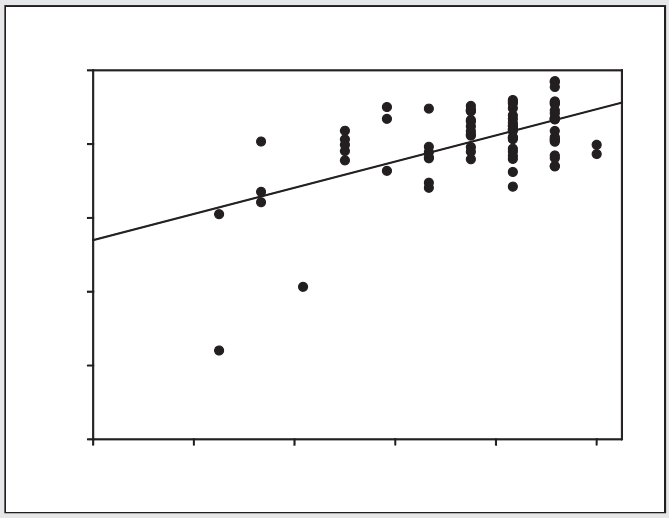

Figure 2. Relationship between attendance and final grades at UT during Fall 2004 semester.

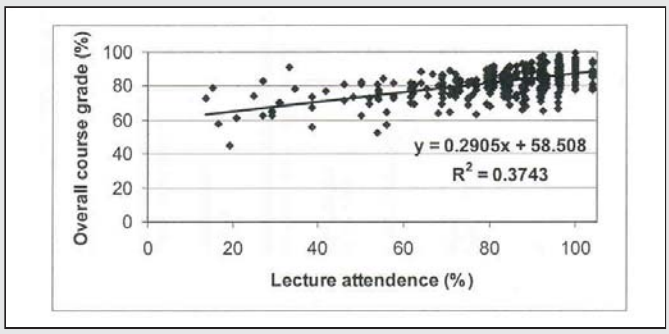

Figure 3. Correlation of student attendance to final grade in Basic Soil Sciences at UM. Data are from six semesters.

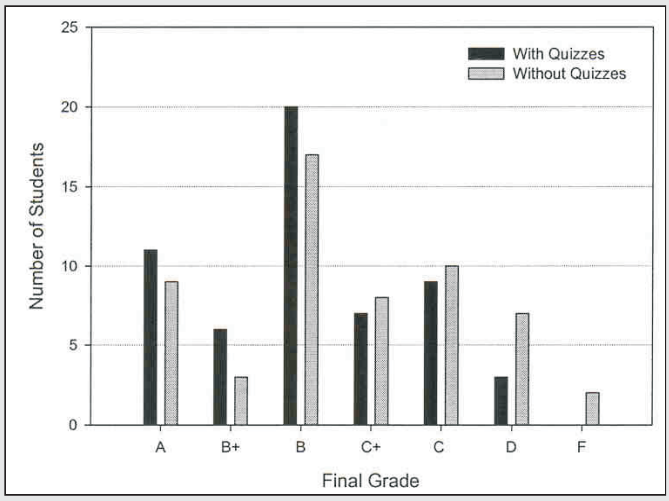

Figure 4. Final grades in Introduction to Soil Science at UT.

(Figures 1 and 2) indicates that attendance describes over 50% and 34% of the variation associated with attendance and grades for this course in Spring 2004 and Fall 2004, respectively.

At UM attendance also impacted student success. Students needed to attend at least 80% of the lectures to ensure success in the course; many students that attended less than 60% of the lectures did not, in general, fare well in the course (Figure 3).

However, it is not clear from this study what impact the quiz or dyad has upon final grade. It is possible that lecture attendance is not the most important factor; instead, the additional quizzes may assist the students in better understanding the principles that results in higher exam scores, similar to the results found by DeRoma et al. (2004). In many disciplines the effect of quizzes has been quite extraordinary. Gaynor and Millham (1976) found that psychology students who had weekly quizzes outperformed their counterparts that had only mid-terms and finalsessentially what non-attendees had in the course in this study. Duty (1982) reported similar results with chemistry students; Martin and Srikameswaran (1974) reported similar results in their studies with first-year chemistry students as well.

Class attendance is important; however, it could be possible that this class of students is dichotomously split between those students seeking to be successful in Intro Soils and those wishing to not fail Intro Soils. Young et al. (2000) report that students study for exams to either achieve success or to avoid failure. These two approaches to success may explain attendance strategies in this class.. Silvestri (2003) found in her research with an education class of 277 students that attendance did not really matter until students missed four or more classes. Students who missed four or more classes were in jeopardy of failing the course, results that are similar to this study.

In-class quizzes improve student grades even if students have imperfect attendance. Figure 4 illustrates the impact of the quizzes on final grade at UT. Using the same macro in the Excel gradesheet, quiz grades were omitted from the spreadsheet and grades were recalculated. By including quiz grades in the final grade more grades of A, B+, and B were assigned (at UT we do not give "minus" grades and only "plus" grades to B and C) and fewer C+, D, and F were assigned. It is important to note that no grades of F were assigned when quiz points were included in the class total. Adding the quiz scores shifted the grades upward, even for students struggling to pass the course. The Y intercept (Figure 1) increases 0.15 grade points and the spread between the regression lines increases as final grade decreases. Therefore, even students with poor attendance habits gained enough quiz pointson the days that they attendedto at least earn a passing grade.

We as teachers may underestimate the impact of our quizzes on the final course outcome, the grade earned by each student. The results of this study suggest that instructors concerned about student progression in college science courses consider quizzes and exams as very important learning tools and not just as evaluation tools. If quizzes are

important learning tools, as the data in this paper suggests, frequent testing is needed if instructors wish to maximize student learning potential. Instructors interested in improving student performance may need to learn how to write better quizzes and exams, metrics that encourage students to think during the evaluation process. Finally, from a pedagogical perspective, it is imperative that each quiz and exam is utilized as an instructional aid; e.g., spending time in class explaining correct answers to quizzes and exams appears to be time well spent.

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Crumpled Rounds: A Technique for Anonymous Participation in Class Discussions

Introduction

When it comes to participation in class discussions there are usually three types of students; those who never participate unless asked directly, those who participate occasionally when they feel confident they know the answer and those who always want to speak and monopolize a discussion. To encourage more inclusive and interesting, discussions in my class the challenge was to find a method that would engage the non-participants and at the same time gently limit the enthusiastic talkers so that everyone could participate. One way to overcome possible reasons for non-participation, such as fear of being wrong, or fear of talking in public, is to allow students to participate and have their "voice" heard while remaining anonymous.

Procedure

To encourage participation, I start many lectures by asking students to answer a particular question, write a comment about the lecture topic, such as what they hope to learn, or write a list of three to five things they know about the topic on a half sheet of paper. For example, I might tell them, "Write three characteristics of a low-water use landscape". The students write their answer but no names are written on the paper to keep the answers anonymous. The students then crumple the paper into a small ball and on my cue they toss their ball around the room to other students. The balls are tossed several times to ensure they are scattered about the room and no one knows whose "crumpled round" they end up with (also because students seem to enjoy throwing things at each other). Everyone is instructed to open the ball they catch and smooth out the paper so they can read the text. We then go around the room randomly or have volunteers read the answers on the paper. Students find it easy to read comments or answers that another student has written because there is no risk of personally being wrong and they can simply read off the paper without having to think. The original author can identify themselves and claim their answer if they wish or if they want to add a comment or explain their answer. With this method everyone has the opportunity to "speak" and the over-talkers are more limited by the text on the paper.

Assessment

Several interesting things happen with this technique; 1) if the instructor makes a positive comment about the answer or comment, such as "good point!" or "brilliant idea!", several students are eager to claim authorship, 2) students find that they know just as much and sometimes more than their peers and they generally think alike, with many writing similar answers or comments, and 3) additional discussion and/or questions are more likely to follow this method than a more traditional approach of asking a question and hoping for, or directly asking, someone to reply. Another advantage is the instructor has a much better idea about what all the students know or understand rather than just a few of the "talkers." With a little creativity several variations of this method can be used, such as drawing the scraps of paper from a box or flying paper airplanes with answers written inside.

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Grounded Application of Connectivism in the Classroom

Introduction

The way we gather information has changed dramatically over the past 20 years and this has implications for learning and engaging with the millennial generation. Connectivism can be thought of as both a learning theory and an instructional theory. Stephen Downes defines connectivism as *"…the thesis that knowledge is distributed across a network of connections, and therefore, learning consists of the ability to construct and traverse those networks*" (Downes, 2007, para. 1). While this seems pretty straight forward, some scholars feel that the theory isn't justified and already exists in terms of the constructivism, behaviorism, and cognitivsm disciplines. However, it is largely accepted as a useful tool in the classroom to engage with the large bank of information available over the internet. I use the term grounded to suppose that while the technological route is a necessary one to take for students and teachers to keep up with the cultural shift, class room learning should remain grounded in the interaction between students.

Procedure

A connectivist procedure is one that I have participated in as a student and believe works very well to find a balance between engagement with information through technology and also with engagement with peers through human interaction. Iowa State University has several required core classes for students in the Graduate Program in Sustainable Agriculture. One of these is Agroecosystems 509 which has three professors from different disciplines and begins with a week-long field trip around Iowa where we saw a range of agricultural systems. We saw a 5000-head of cattle operation, an ethanol plant, a direct market grass-fed dairy, a school greenhouse garden, a highly diversified 20-acre vegetable farm, a corn and soybean operation that uses cover crops, one that doesn't and the list goes on. This field trip was followed by a weekly 4-hour course, which included a lecture by one of the professors and then a peer engagement activity. Often times we were just asked to share our opinion on a certain topic. Other times we were asked to get in groups and come up with a collective response to a question. The most memorable was when we were asked to draw a landscape of our hypothetical future farm for homework and the following week we shared with the class on an overhead.

Assessment

In consideration of connectivism, it can be applied as a learning theory and an instructional theory for this case of Agroecosystems 509. In terms of connectivism as a learning theory, the millennial generation is very much reliant on computers and smart phones for how they gather information and communicate with friends. However, they are still human and require a high level of social interaction which should not be left behind. In fact, it should be propped up because the quick cultural shift toward technology has caught us off guard and our society wasn't particularly prepared for the shift.

In terms of connectivism as an instructional theory, it is important to note that throughout our lectures we were allowed to have our computers out and had a world of information at our fingertips. While the arrangement was never discussed, the expectation appeared to be that we were taking notes on our computers. Often students are in fact working on other assignments and seldom students will bring into the conversation information from other sources to bolster the discussion. On another note, we had one assignment where we were advised to employ the use of our computers to research a particular topic with a colleague 15 minutes and report back to the class what we found. That was actually very exhilarating because this is a task that we graduate students do all the time and we were being asked to perform this task as part of the class which is unusual.

It appears that graduate professors are just beginning to understand the use of technology in the classroom. The expectation for graduate students is certainly different and more hands-off than the expectation for undergraduate students. However, in both scenarios the computer, iPad, or clicker can be used to engage students. For me personally, being asked to research a topic was a new level of excitement that I hadn't experienced in graduate school since then. Another point is that teachers have to be more prepared for class to facilitate a higher degree of engagement with the students. The fallback is to just quickly get through a lecture and let the students go. In this 509 course there was one professor who took the extra time to engage us and we really responded strongly to it.

Conclusion

A successful graduate/undergraduate course should include a high level of human interaction and technological interaction to fully engage the millennial generation. While it may not be practical to engage both areas in every class, it would be most beneficial to do so. Certainly it is not reasonable to visit a farm each week, but it is possible to incorporate engagement between students and/or computers each week, in addition to the professor's lecture.

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Assessing Learning Objectives with Bloom's Revised Taxonomy

Why is it a Good Practice?

Updating and reimagining Agricultural Education and Training (AET) programs and curriculum should begin with a clear specification of the educational goals and objectives that will drive instructional activities that will be used to support learning. Instruction and learning activities must align with written goals and objectives in order to ensure that learning activities and assessments are focused and germane to future AET employment and entrepreneurial challenges. Bloom's revised taxonomy is an effective tool for writing, organizing and analyzing learning goals and objectives. Bloom's revised taxonomy allows AET faculty and instructors to effectively work with large amounts of complex information in order to bring more precision to applied practice.

How is Bloom's Revised Taxonomy Used?

Practitioners employing Bloom's revised taxonomy can describe and represent learning objectives using the two-dimensional taxonomic structure illustrated in Table 1. Table 1 illustrates that the intersection of the six categories of the cognitive process dimension and four categories of the knowledge dimension form twenty-four discrete cells which afford educators the oppor-

tunity to precisely classify learning objectives based upon the level (cognitive process) and type (knowledge dimension) of cognitive processing they require of learners. Practitioners can then assess whether or not the learning objectives they are using are requiring sufficient levels of cognitive engagement and complexity.

Table 1. A two-dimensional illustration of the relationship between the knowledge and cognitive processing dimensions of Bloom's revised taxonomy

	Cognitive Process Dimension					
Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual	A1	A2	A3	A4	A5	A6
Conceptual	B1	B2	B3	B4	B5	B6
Procedural	C1	C2	C3	C4	C5	C6
Metacognitive	D1	D2	D3	D4	D5	D6

Note. Adapted from Krathwohl, 2002. p. 216.

Any individual learning objective will fall under one of the six discrete categories of cognitive processing and at the same time will also be linked to one of the four discrete categories of knowledge dimension. The object in a learning objective statement is used to determine whether the learning objective is supporting factual, conceptual, procedural, or meta-cognitive knowledge acquisition and the verb in a learning objective statement is used to determine which cognitive process dimension is being applied in the learning process: remembering, understanding, applying, analyzing, evaluating, or creating. Learning objectives placed in the upper left hand corner of the taxonomic table tend to be more concrete, simple, structured and require less learner independence. And as the taxonomic niches traverse the table diagonally toward the lower right hand corner the learning objectives tend to be more abstract, complex, open, multifaceted and require greater learner independence.

Table 2. Example learning objective statements and their classifications

Learning Objective Statement	Classification
Identify the 16 essential elements all plants need for life, growth, and reproduction	A1
Analyze the relationship between the design of a landscape and its impact on the surrounding ecosystem	B4
Evaluate the efficacy of animal care plans based on real-time data	C5

Table 3. Example learning objective action verbs

Remember	Understand	Apply	Analyze	Evaluate	Create
listing	explaining	calculating	attributing	scoring	generating
defining	interpreting	demonstrating	differentiating	critiquing	composing
reciting	Comparing	operating	detecting	justifying	integrating
matching	Classifying	implementing	contrasting	valuing	transforming

Table 2 illustrates three example learning objectives and their classifications. Table 2 illustrates that the object in learning objective one was as follows: the 16 essential elements all plants need for life, growth and reproduction. Learning objective one required learners to demonstrate a type of knowledge that represents a basic building block which would be utilized in the construction of different types of knowledge. More specifically the object of the learning objective sentence required students to demonstrate knowledge of technical vocabulary, a type of factual knowledge. Therefore, learning objective one was classified as being within the factual knowledge category of the knowledge dimension of Bloom's revised taxonomy.

Table 2 demonstrates that the verb in learning objective one required learners to identify information. In this case, to identify the required information depends only on the learners' ability to recognize or recall, therefore, learning objective one was classified as being within the remember category of the cognitive process dimension of Bloom's revised taxonomy. Once both dimensions of a learning objective have been classified it can be placed into one of the 24 cells created by the intersection of the knowledge and cognitive process dimensions of the taxonomic table illustrated in Table 1. Using Table 1 as a guide, objective one would most appropriately be placed in cell A1 at the upper left hand corner of the taxonomic table.

Table 2 illustrates that the object in learning objective three was as follows: the efficacy of animal care plans based on real-time data. The object of the learning objective sentence required students to demonstrate knowledge of subject specific techniques, as well as, knowledge of criteria for determining when to use appropriate medical procedures. Therefore, learning objective three was classified as being within the procedural knowledge category of the knowledge dimension of Bloom's revised taxonomy. Table 2 demonstrates that the verb in learning objective three required learners to evaluate situations based upon data. In order to demonstrate the ability to complete the required evaluations learners must be able to enact appropriate interpretation and appraisal techniques that lead to accurate judgments. Therefore, learning objective three was classified as being within the evaluate category of the cognitive process dimension of Bloom's revised taxonomy. Utilizing Table 1 as a guide, objective three would most appropriately be placed in cell C5 at the lower right hand corner of the taxonomic table.

Table 3 lists verbs that can be utilized to design learning objectives that target the six levels of cognitive processing described in Bloom's revised taxonomy. Including appropriate action verbs into learning objectives will help AET faculty and instructors ensure that they are explicitly defining the level of cognitive processing they are requiring of their students.

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Ten Steps for Creating a Great Environment for Positive Group Work Experiences

Introduction

Group projects are often a source of anxiety and much groaning from students and professors alike! Many students would prefer to complete a project on their own and not have to rely on other students for a portion of their grade, yet some class projects are not conducive to allowing a single individual to complete. The real world and future workplace of many of these students demands that students work as a team. Researchers determined that teamwork and ability to communicate effectively were ranked highest in a list of soft-skills potential employees should have (Crawford et al., 2012). Therefore, group work is an important component of a well-rounded undergraduate curriculum.

The Ten Steps

Create the "right" group. Do not let students pick their own group members. Inevitably, some students will feel like an outcast at this opportunity and others will select their 'friends' and fail to work with others that may possess new ideas they haven't heard before. Instead, develop a tool that will score students in different areas that are important to your assignment. Additionally, addressing the idea that 'everyone hates group work' up front can get that stigma out of the way, and gives the instructor an opportunity to reiterate the complexity of the project and ensure students they are better off working with a group to complete this project.

1. Give students a questionnaire where you ask them a few important questions about themselves. Allow students to opt-out of a group with a certain individual. You never know when a bad relationship of some kind will negatively impact a group, so give the students an option to write the name (one) of another student in class they could absolutely not be in a group with. This will save you a headache later, and students really appreciate this opportunity. Make sure to shred this paperwork so no one knows besides you and the student. Ask questions that will indicate if the responder is quiet, outgoing, etc. when working in a group Example questions can be found in Figure 1.

Figure 1. Example questions for group placement

When you work in a group on a school project, how do you like to get started?
- Ask everyone their ideas
- Take the lead and start assigning responsibilities
- Tell everyone about your ideas first
- Quietly listen to everyone's ideas and go with one of those

What kind of group members do you want and work best with?
- People who have good ideas and help me when I get stuck
- People who follow orders
- People who are willing to work hard
- People who will get the work done without my help

Which of these is the most important quality you will bring to the group?
- Creativity
- Good listener
- Staying positive
- I'm smart
- Organization

Are you okay with a group member turning in an assignment for the group that you have not seen since the final version of?
- Yes
- No

   a) A funny saying or picture on the questionnaire will remind students that group work is warranted if not always popular.
2. Group students so every group has a leader, a quiet/shy member, a go with the flow member, etc. If your project is discipline specific and you have non-majors in the class, try to incorporate majors and non-majors in each group.
3. Once students are grouped up, discuss the assignment in detail with them. Have a hand-out where they can follow along. Have a detailed hand-out that students can take with them and refer to.

Group work creates an opportunity for real-world practice unlike others available in higher education. It is important to build in accountability for each student and each group, as well as walk students through a goals setting assignment. Further, devote class time to reviewing and updating group/individual goals and helping students discuss various scenarios where group-work isn't going perfectly (team-work conflict resolution). This will create an open dialog between students and assist them to be open with each other. Students working toward one common goal can be facilitated with the group goals and participation agreement.

4. Have students complete a Personal Goals Performance Agreement (PGPA; Figure 2). Include a section where students can describe scenarios where things might go poorly and how they will react to right the ship. Once completed, have students discuss their PGPA with each other and finalize their own.
5. Have students brainstorm a Group Goals Performance Agreement (GGPA; Figure 3). Include a section where the group can describe scenarios where things might go poorly and how they will react to right the ship. Have students work independently, then discuss and complete their GGPA as a group.
6. Have each individual turn in a PGPA and each group turn in a master GGPA. Keep these documents in a binder with details about the project so students can refer to them during the semester. This will help you keep students and you on track!
7. Once a week have the students look over the PGPA and the group look over their GGPA. Allow students to revise as they see fit.

Finally, you must hold students accountable for participating. Since the instructor cannot be at every group meeting, having students peer review each other is essential.

8. Allow students to self-evaluate and peer evaluate half-way through their project so students can get an idea of how they are performing. This allows students to discuss and correct any inconsistencies so everyone has the potential to earn the grade they want. Do this anonymously, but share the results with the students, so they know where they

Figure 2. Personal Goals and Performance Agreement worksheet

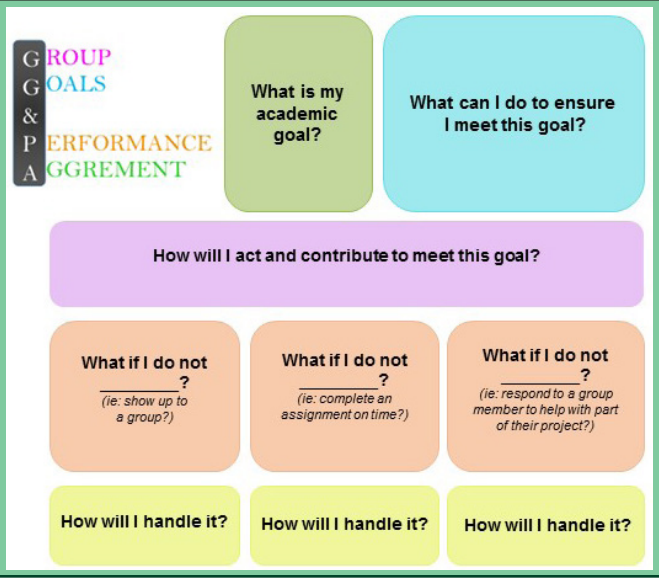
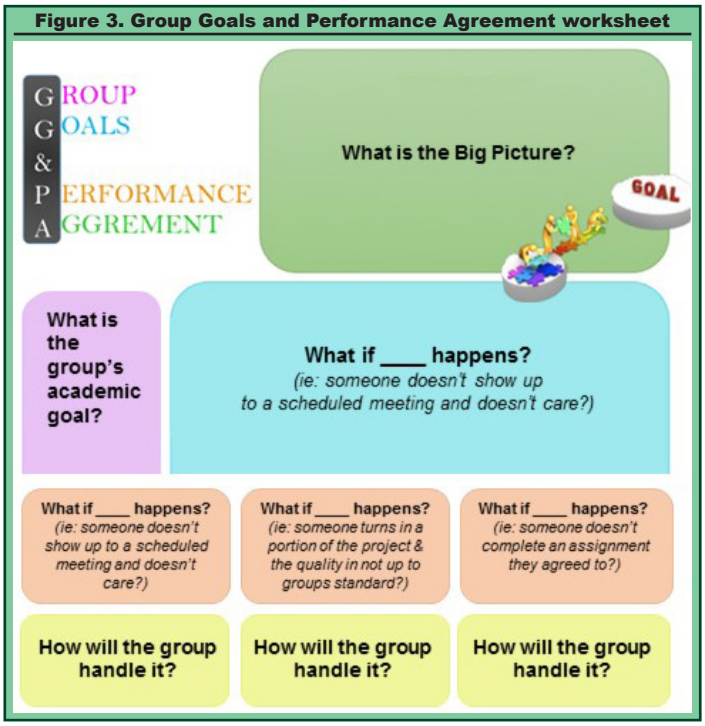


Figure 3. Group Goals and Performance Agreement worksheet



stand. Have the group discuss ways to get back on track if a member has strayed.

9. Have students self-evaluate and peer evaluate at the end of the project and make sure this counts toward their grade in some way. Ensure students know they will be graded by their peers and how their project grade and subsequent final course grade will be affected by their peer reviews.
10. Have a culminating event for the major project. Allow students a big event, rather than just turning in an assignment. For example: create a poster session where students can show off their work. Invite industry professionals to interact with students and discuss their project. Or, have students in an upper level course present information to a lower level course in the same discipline.

Conclusion

Group work can be a rewarding experience for students and instructors when the project is well thought out and steps are taken to ensure everyone can be successful. This 10-step method has been perfected and utilized for five semesters in an upper level equine management course with rave reviews from students. Use this guide, adapt it to fit your needs and Group-work On!

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