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Contents

Recruitment and Training of Underrepresented Students in Nutrition: The HANDS Program Experience[1]

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Abstract

One of the ways to increase minority participation in nutrition and agricultural sciences is to recruit, retain and mentor diverse populations in college and beyond. The UMass Health and Nutrition Diversity Scholars Program (HANDS) was designed to recruit and mentor university nutrition majors from underrepresented groups. From 2005-11, we recruited 14 Scholars into this USDA-funded scholarship program. Recruitment activities included a website, blog, promotion in residence halls, class presentations and referrals from campus advisors and multicultural program support staff. Weekly Scholars Seminars included academic development, mentorship, professional development, and community service activities, plus addressed culture, health disparities and nutrition research. The number of underrepresented nutrition majors in the university grew from 14 in 2005 to 32 in 2011. Overall, most Scholars were very satisfied with HANDS, and all found the Scholars Seminar to be at least somewhat useful. Qualitative data indicated that HANDS helped students become exposed to the profession and post-graduation opportunities, but Scholars requested additional professional development activities and field trips. Scholars also remarked on the academic skills they developed. Institutional changes as a result of HANDS included ongoing collaboration for recruitment and support among campus advisors and multicultural student affairs offices, and program continuation beyond the grant-funded period.

Introduction

Minority populations experience poorer health than the majority non-Hispanic white population in the US (Johnson-Askew et al., 2011). The incidence of certain nutrition-related chronic diseases is higher in many minority populations, with concomitant disparities in health care utilization (Johnson-Askew et al., 2011). To reduce health disparities, a key recommendation for educators in nutrition and other health professions is to prioritize recruiting and mentoring of traditionally underserved students (Johnson-Askew et al., 2011; Institute of Medicine, 2003).

Despite the expectation that the Hispanic population will grow to 25% of the US population by 2050; the African American population rise to 15.7% and the Asian American and Pacific Islander population increase to 10.3% of the US population by 2050 (US Census Bureau, 2011), only 3% of registered dietitians are Hispanic/Latino, 2% are black and 5% are Asian (American Dietetic Association, 2009). Similarly, 96% of US farm operators are white (U.S. Department of Agriculture, 2009). Expanding mentorship programs aimed at recruiting, retaining and supporting underrepresented students can lead to increasing racial and ethnic diversity within the field of nutrition and other agriculture-related sciences (Fletcher and Himburg, 1991; Ralston, 2000).

Recruitment of underrepresented minority students into university nutrition or agriculture programs can include activities to build relationships with community colleges, participation in career fairs, collaboration with campus diversity offices, conducting special summer programs and outreach to high schools with high proportions of minority students (Fletcher and Himburg, 1991; Taylor et al., 2003; Greenwald and Davis, 2000). Attending career fairs, participating in minority organizations and speaking with students, faculty and staff in the major can also be influential in decisions about a student's choice of major (Outley, 2008). Scholarships and other financial incentives are also cited as a very important recruitment tool (Colson, Palan, and Smith, 1992; Greenwald and Davis, 2000; Outley, 2008).

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Mentorship programs can take many forms, including mentored research, service learning, or professional development programs. Faculty/student mentorship in research can enhance the academic experience of students (Moss, 2011). Undergraduate research can facilitate self-confidence, independence, career preparation and degree completion (Good et al., 2013). Mentorship in agricultural research has also been shown to enhance student perceptions of agriculture as a field of study (Moss, 2011). Mentorship in the form of service learning can enhance academic performance, student interest, social responsibility and cultural competence, while building critical-thinking and problem-solving skills, teamwork and leadership skills (Kessler and Burns-Whitmore, 2011; Pierce et al., 2012). A mentorship program emphasizing professional development, social support and recognition was highly effective in recruiting and retaining minority nutrition students (Ralston, 2000).

To help streamline the process of training students and nutrition professionals in diversity, the Academy of Nutrition and Dietetics (AND) offers tools to assist college faculty to implement mentoring programs for underrepresented students and to help create outreach programs to interest students in a dietetics career (Fitz and Mitchell, 2002). To feed the pipeline of underrepresented students entering college, AND also offers the Building Our Future Mentor Program Toolkit, which includes guidelines for mentorship programs, such as marketing, training mentors and recruiting students in various age groups (American Dietetic Association, 2001). Despite these tools and models, progress in developing a diverse dietetic workforce has been slow, with minority participation in 2008 only slightly above levels seen in 1997 (ADA, 2009; Greenwald and Davis, 2000). Thus, it continues to be important for educators to build on prior experiences and models, and share successes and recommendations for future university diversity initiatives.

The University of Massachusetts Amherst adapted these models in developing the Health and Nutrition Diversity Scholars (HANDS) program to increase the recruitment and mentoring of underrepresented minority nutrition majors, and to improve the infrastructure for serving diverse students. Beginning in 2006 through a 5-year multicultural scholars program grant from the U.S. Department of Agriculture (USDA), the HANDS program offered funded scholarships and supports to five undergraduate students from traditionally underrepresented groups in the nutrition field. The purpose of this article is to share HANDS activities and outcomes and discuss recommendations for future university diversity mentorship programs in nutrition and related agricultural sciences.

Program Description and Methods

The HANDS program consisted of a set of intentional activities to recruit and train underrepresented students new to the nutrition major. Efforts to recruit HANDS Scholars from off-campus consisted of strengthening relationships with area community colleges and participating in a regional project to expand the pipeline of students pursuing college study. The primary source for recruiting HANDS Scholars was from on-campus non-nutrition majors and incoming students, as there was a large pool of ALANA students on campus, and ALANA students were underrepresented in the nutrition major relative to the campus itself. Recruitment activities on-campus included development of posters and outreach to advisors in residence halls, development of relationships with campus academic advisors and multicultural program support staff, presentations on campus by faculty and students, and announcements in classes with non-nutrition students. A website was developed with application materials and information about the program. Application criteria included a minimum of 2.75 grade-point average, statement of interest and status as a non-nutrition major or incoming student. Underrepresented ALANA (African-American, Latino, Asian and Native American) and first generation college students were eligible to apply. An interview with program directors was required and a commitment to stay with the program while pursuing nutrition as a major was requested.

All HANDS Scholars were required to participate in a 1-credit Scholars Seminar each semester, with the main purpose of fostering professional skills and career preparation. Through the seminar, Scholars met weekly or biweekly with independent and group activities along with regular discussions or reflections. HANDS activities centered around seven major themes (Table 1):

Recruitment

Every semester, Scholars organized recruitment initiatives for attracting students to the HANDS program, including posting fliers on campus, hosting recruitment tables at campus events and highly visible areas and announcing the program in introductory nutrition courses. Scholars contributed to the HANDS website regularly, adding highlights of Scholar accomplishments and posting in a Scholars' blog.

Personal Assessment and Academic Development

Scholars assessed their personal development and learning needs each year and identified strengths and professional development goals for the semester. Sessions for new Scholars included library skills, time management and study skills, and learning about the different resource communities on campus.

Mentorship

Scholars read about and discussed the mentor/mentee relationship and had opportunities to have professional mentors in the field as well as to mentor other nutrition students and high school students. Scholars met with nutrition faculty and alumni on and off campus to learn more about the profession. Off-campus mentors were introduced to the Scholars, gave a brief overview of their career and experiences

Table 1. Examples of HANDS Program Activities.

Recruitment	Personal Assessment and Academic Development	Mentorship	Professional Development	Culture, Nutrition and Health Disparities	Community Service, Nutrition Education and Communication	Nutrition Science and Research
Posted HANDS fliers on campus	Maintained study log	Learned about the mentor/ mentee relationship	Attended state Dietetic Association Conference	Attended workshops and seminars on race, class, gender	Presented nutrition education programs in residence halls	Presented research on nutrition topics
Staffed recruitment tables at campus events	Attended Diversity in Learning and Introduction to Campus Resources workshops	Met with guest speakers re. their experiences in the field	Attended annual department and college research conferences	Invited guest speakers on health disparities	Volunteered at a campus health fair	Observed work in nutrition and food science labs
Introduced the program in nutrition courses	Developed library skills	Met with E-mentors from around country	Prepared cover letters, resumes, and personal statements	Shared weekly snacks of cultural foods	Presented nutrition workshops to children and adults	Reviewed literature on nutrition topics
Developed HANDS website	Assessed personal development and learning needs	Hosted panel discussion about the nutrition profession to high school students	Conducted mock interviews	Wrote papers and presented topics addressing culture and foods	Maintained HANDS Blog with reflections, experiences and advice	Shared summer research in nutrition and health studies
	Set time management goals	Presented academic tips and resources to other nutrition majors		Attended seminar, reflected on social identity	Drafted journal manuscript on HANDS	
				Hosted multicultural breakfast		

and answered questions via Skype. This E-mentorship allowed Scholars to learn about different specialties and career opportunities in the nutrition field from diverse professionals from outside of the local area, with the option of continued connection via E-mail.

Professional Development

Professional skill development of junior and senior Scholars differs from those of freshman and sophomore students. As a result, the focus on professional development activities, such as writing resumes, cover letters and personal statements, varied each semester according to the need and level of the student. Scholars participated in mock interviews in which they were interviewed by practitioners for a variety of professions. Scholars also interacted regularly with professionals in the field by attending meetings of the state and regional dietetic associations and other professional conferences on and off campus.

Culture, Nutrition and Health Disparities

Each year, Scholars explored nutrition, culture and health disparities through seminars, guest speakers, literature reviews, presentations and discussions. Scholars also hosted multicultural breakfasts for other nutrition students where they researched the role of breakfast in different cultures and prepared foods from diverse areas of the world.

Community Service, Nutrition Education and Communication

To gain nutrition education and communication skills, Scholars presented nutrition-related programs in small group projects in residence halls, at campus events and with community organizations such as at a local soup kitchen. Scholars shared experiences through the blog posted on the HANDS webpage. Senior Scholars also contributed to the present article as a way to experience writing for professional groups.

Research

Research was an ongoing theme of the HANDS program, either through literature reviews of current topics, seminar presentations, discussions with university faculty, or participation in research projects.

Scholars were administered a brief program evaluation at the end of each semester assessing usefulness of the Scholars Seminar and satisfaction with the HANDS program. Items were based on a 3-point scale (very useful/satisfied; somewhat useful/satisfied; not useful/satisfied). Beginning 2010, a fourth point (useful/satisfied) was added to the scale based on student feedback. The frequency of responses was summed over all semesters, resulting in 30 survey responses for the 14 Scholars who participated during the period evaluated. Comments on usefulness and satisfaction were solicited, along with general suggestions for improvement. As Scholars could provide more than one comment per evaluation survey, the 30 surveys collected contained 34 comments regarding usefulness of the Scholars Seminar or HANDS, and 40 suggestions for the future. Each open-ended comment was categorized by the themes addressed in seminar, along with additional themes that emerged.

Results

Over the period from 2005-10, a total of 12 Scholars from diverse backgrounds who were new to the nutrition major were enrolled, ranging from two Scholars in the early semesters, to six to eight Scholars after the program became more established. In 2011, after the funded period ended, an additional two underrepresented minority nutrition students joined the HANDS program. Of the 14 who participated in HANDS over the evaluation

period, two had transferred to another major and two had left the university, three graduated in 2011 and seven remained active in the program by the end of 2011. The number of underrepresented nutrition students in the major had more than doubled from 14 students in 2005 (12% of majors) to 32 in 2011 (15% of majors).

Data from the end of semester evaluations (n=30) show that the program was rated positively by all Scholars each semester (Table 2). The Scholars Seminar was rated very useful by 40% of Scholars and somewhat useful or useful by 60% of the students. Over half of the Scholars were very satisfied with the HANDS program (60%) and 40% of Scholars found the program somewhat satisfactory or satisfactory.

Scholars provided 34 comments in response to questions about the usefulness of the seminar or satisfaction with the program. Another 40 comments were provided in response to open-ended suggestions for improvement (Table 3). Most of the comments on usefulness or satisfaction with the program related to the professional development activities offered. Students noted that the course helped them become exposed to the real-world setting and post-graduation opportunities, but requested additional time for shadowing professionals, volunteering, or attending conferences. Other frequent comments related to the course structure, professor, or were affirmations that the program was going well. Many Scholars also remarked positively on the personal assessment and academic skills they developed as a result of the program activities. Suggestions for the future included the recommendation to include additional fieldwork activities to engage Scholars off campus through trips, nutrition education, and service projects, or noted a general desire to have more activities. Scholars had suggestions for recruiting new Scholars and increasing awareness of the program on and off campus, as well as the need to address academic development skills, such as improving speaking skills or offering tutoring services.

Institutional changes as a result of the HANDS program included ongoing collaboration for student recruitment and support among campus advisors in the premedical and new student programs, multicultural student affairs offices, and student support offices such as the Learning Resources Center. The program continued after the grant-funded period, providing the Scholars Seminar and supports to students without scholarship funding, and expanding to serve a broader range of diverse students, including individuals from an immigrant/refugee population and reserve military personnel.

Discussion

Over the five-year period funded by the USDA, the number and percentage of ALANA nutrition majors increased. While HANDS Scholars were a subset of the total number of ALANA students in the major and the increase cannot be directly attributed to the HANDS program, the activities used to recruit Scholars to the major also served to attract minority students who chose not apply to become HANDS Scholars. As a result of the HANDS outreach, the multicultural activities of students in the major were regularly highlighted through the website, blog and special functions open to all majors. The ongoing recruitment activities on campus as well as connections with multicultural offices and campus advisors also served to promote the nutrition major as an excellent choice for academic study. The HANDS

Table 2. Student Perceptions of the Scholars Seminar and the HANDS Program[1].

Item	Very Useful/ Satisfied	Useful/Satisfied or Somewhat Useful/Satisfied	Not Useful/ Satisfied
Usefulness of Scholars Seminar	12 (40%)	18 (60%)	0
Satisfaction with the HANDS Program	18 (60%)	12 (40%)	0

[1] The 14 Scholars provided 30 survey responses over the period evaluated.

Table 3. Categorization of HANDS Scholar Comments and Suggestions [1].

Category	Number of Comments on Usefulness of Scholars Seminar or HANDS (%)	Number of Comments on Suggestions for Future (%)	Sample Quote
Recruitment	0	4 (10.0%)	"Get T-shirts, hoodies, etc., to represent our program."
Personal Assessment and Academic Development	3 (8.8%)	3 (7.5%)	"I developed useful study habits and was able to set up a way to manage time efficiently."
Mentorship	0	1 (2.5%)	"Mentorship (not just meeting for scheduling, etc.)"
Professional Development	7 (20.6%)	2 (5.0%)	"I now have an idea on what I need to do after I graduate."
Culture, Nutrition, and Health Disparities	2 (5.9%)	1 (2.5%)	"We really need this type of program because I feel it is important to have minorities in the nutrition and science field."
Community Service, Nutrition Education, and Communication	1 (2.9%)	3 (7.5%)	"Become more active in the community, such as the Survival Center."
Nutrition Science and Research	2 (5.9%)	2 (5.0%)	"Possibly include more help with research skills and presentation skills."
Fieldwork/Trips	0	8 (20.0%)	"We should have scheduled more field trips."
Social	2 (5.9%)	1 (2.5%)	"The multicultural breakfast helped us become closer as a group." "Find time for more activities to build connection within the group; such as trips and projects."
Professor/Course Comments	5 (14.7%)	3 (7.5%)	"Our professor is very supportive. Always help us." "I feel some assignments were more useful than others."
General Activities	1 (2.9%)	4 (10.0%)	"We should have more activities."
Miscellaneous	8 (23.5%)	6 (15.0%)	"More training and test of our knowledge."
Affirmation	3 (8.8%)	2 (5.0%)	"I think it is going in a good direction."

[1] The 14 Scholars provided 30 survey responses over the period evaluated, including 34 comments on usefulness of the Scholars Seminar or HANDS and 40 comments on suggestions for the future.

program has been institutionalized in the Department, continuing after the funded period has ended, and expanding to include a range of diverse students. Continuing features of the HANDS program include regular recruitment contacts with campus advisors, special functions such as the multicultural breakfast, acknowledgement at the annual department awards dinner, offering Scholars seminars each semester, and modest departmental financial support.

Overall, Scholars were very satisfied with the HANDS program and found the Scholars Seminar to be useful. The HANDS program included many of the elements that were noted as factors contributing to success in minority and male dietitians, such as work/study skill development, peer support, mentorship, and scholarship support (Greenwald and Davis, 2000). The program also contained service learning and research components, which can enhance academic experience, performance and career preparation (Good et al., 2013; Moss, 2011; Kessler and Burns-Whitmore, 2011). Recognition of Scholars was in the form of highlighting Scholar expertise through programs they planned and delivered for other majors and acknowledgement at the annual Department alumni lecture event. Scholar activities and work were also promoted through the Scholars' blog. While the Scholars did not comment specifically on the usefulness of the blog, a student blog with reflections was found to be a useful component of an undergraduate research mentoring program (Good et al., 2013). Scholars highlighted the professional development and personal assessment and academic development activities in their comments about usefulness and satisfaction. The most frequent suggestions were for additional recruitment and field trips, activities, and nutrition education or community service projects. As a result, two "regular" activities were built into the HANDS program: a community service project in which Scholars planned and prepared a meal together at a local soup kitchen, and the planning and implementation of a multicultural breakfast open to other nutrition majors and faculty. These served to increase meal planning and cultural food skills, while promoting HANDS and enabling group work with a social experience.

While Scholars were satisfied with the HANDS program overall, there were some challenges in simultaneously addressing the different academic and professional needs and time availabilities of Scholars in lower and upper levels. We have begun to offer two different Scholars Seminar courses - one for upper division and one for lower division students, focusing on different academic and professional activities according to the year in which a Scholar is enrolled. For example, a senior Scholar might focus on writing cover letters and revising resumes, searching for job opportunities after graduation or researching and/or applying to graduate programs, while a freshman or sophomore Scholar may focus on time management, study skills and career exploration. To facilitate Scholars working on a group project or outreach program together, we used an overlapping Scholar's Seminar time slot for planning and to enable senior Scholars to mentor junior students. Scholars also commented on the need for more field experiences, but it was very difficult to schedule group activities off campus given their heavy and varied course and work commitments. Meetings, outreach programs and shadowing of professionals were scheduled in the evenings and early mornings if possible. Another challenge was continuing the program after the funded period had ended, which was also noted as a challenge in the undergraduate research mentorship program by Good et al. (2013). Yet, students find that financial scholarships for minority college students is one of the most important strategies to promote diversity in the field of agriculture and natural resources (Outley, 2008). Although we had some challenges in recruiting new students without financial incentives once the funding period ended, prospective Scholars were still interested in joining the HANDS program for its focus on diversity, small group dynamic and professional benefits and interactions. Without financial incentives or scholarships, it was important to publicize the other perceived benefits of the mentorship program, including academic and peer support, experience in outreach programs, individualized attention, networking opportunities and professional development. Even without scholarship support, the HANDS program requires funding to provide recruitment incentives, supplies for community outreach programs and functions such as the multicultural breakfast and registrations for conferences and special programs. Without grant funds, administrative support is critical to address these modest expenses.

Summary

Since the inception of the HANDS program, the diversity in the nutrition major has increased. This multicultural scholarship program and its affiliated seminar were useful to the Scholars, providing academic support, career preparation, mentorship and professional and community service opportunities in nutrition, while addressing issues in nutrition research, culture and health disparities. Institutional changes included ongoing collaboration for recruitment and support among campus advisors and multicultural student affairs offices, and program continuation beyond the grant-funded period. With academic preparation, exposure to the nutrition field and support from fellow students, mentors and advisors, undergraduate nutrition diversity mentorship programs can help prepare students to enter the field ready to address the nutrition-related medical conditions and dietary preferences, habits, and needs of a growing minority and culturally diverse population.

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A Synthesis of Mobile Learning Research Implications: Agricultural Faculty and Student Acceptance of Mobile Learning in Academia

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Abstract

Mobile technology is pervasive in our daily lives. The use of mobile devices is changing the educational model in traditional classrooms and eLearning classrooms. Mobile learning is the use of mobile technology to deliver educational content and is a growing educational tool in our educational institutions. A synthesis of research on the implications of mobile learning was conducted. The synthesis found students are accepting of mobile technology and their lives, as the technology is widespread throughout society. Factors such as self-efficacy and technology acceptance are driving mobile learning use. Further research on what mobile learning means in terms of educational practices, as well as student and teacher acceptance is needed. Understanding acceptance and practice in regards to mobile learning will inform instructors as they try to implement the technology in teaching.

Introduction

People around the globe have integrated mobile technology into their daily lives. The United Nations Educational, Scientific and Cultural Organization (2011) found mobile networks serve 90% of the world and 80% of people living in rural areas. Lee et al. (2010) defined mobile technology as portable devices, like smartphones or tablet devices, allowing users to access and share data wirelessly. Ng and Nicholas (2009) suggested mobile technology is changing the classroom, as students and instructors are freed from a dependence on traditional educational procedures for learning.

Mobile technology provides asynchronous and portable functions for users to engage in various tasks unencumbered by location and time limitations. Users' mobile devices are providing anytime, anywhere services ranging from commerce to entertainment to information (López-Nicolás et al., 2008). The U.S. has seen mobile technologies become commonplace in the lives of its citizens. The Pew Research Center's Internet & American Life Project (2012) found almost half of all adults in the U.S. have a smartphone and smartphone users outnumber more basic phone users. Mobile technology is shifting the paradigm for how people conduct business, have fun, and communicate with others. The ubiquitous nature of mobile devices has allowed users access to a marketplace with any time or place access (Varnali and Toker, 2010).

Mobile Learning

Mobile learning is increasing in popularity as students increasingly have mobile devices, but there has been little in the way of research into their adoption of mobile learning compared to eLearning (Park et al., 2012). Liaw et al. (2010) suggested mobile learning is the use of mobile technology for educational engagement. Park (2011) found mobile devices' ubiquity gives educational practitioners and researchers the ability to use it in a variety of instructional settings. Shen et al. (2009) reported observation, assessment, and evaluation are needed to make sure of mobile technology's appropriate use in instructional settings.

The desire for learner-centered opportunities to meet the needs of today's learners is increasing the scope of mobile learning. Nordin et al. (2010) suggested many theories of learning are tied to the traditional classroom setting but mobile learning bypasses the traditional classroom, meaning mobile learning needs its own theories. Mobile learning will be more accessible for researchers and educators to understand if a framework encompassing definitions, approaches, and theories is developed to guide mobile learning practices (Keskin and Metcalf, 2011). Nordin et al. (2010) found many theories of learning are tied to the traditional classroom setting but mobile learning bypasses the traditional classroom, meaning mobile learning needs its own theories.

Trebbi (2011) reported the influence of information technology on educational practices is creating a new frontier for learning, with novel roles for teachers and students. Demirbilek (2010) suggested the growing nature of mobile devices in educational settings has created an important need to examine educators' perceptions of the use of mobile technology for learning purposes. Uzunboylu and Ozdamli (2011) recommended teacher

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attitudes toward mobile learning be understood in order to successfully employ it in instructional environments. Mohamad et al. (2012) recommended research-based mobile learning and teaching policies and procedures to assist teachers.

Mobile Technology and Agricultural Education

Agricultural education researchers have examined mobile technology in diverse learning environments. Researchers should examine agricultural education students' acceptance and willingness to use mobile learning in the classroom (Irby and Strong, 2013). Rhoades et al. (2008) reported agricultural education students perceive the Internet as an easier to use technological tool to advance their learning in academic settings. Agricultural education researchers have not examined students' acceptance and use of mobile technologies in coursework. Agricultural education faculty should further examine student's use of mobile technologies in coursework (Strong et al., 2012). The study was conducted to examine the literature regarding students and teacher's acceptance and use of mobile technology in academic environments. The purpose of this study is to synthesize research in regards to mobile learning and provide a greater insight into mobile learning in agricultural education.

Purpose and Objectives

The study synthesized selected research studies related to mobile technology in academic environments. The study was conducted to provide a more thorough understanding of the issue. More specifically, this study sought to:

1. Search for literature on the acceptance and use of mobile technology in educational environments;
2. Search for literature on the adoption of mobile technology in institutions;
3. Search for literature on students' self-efficacy in relation to mobile learning; and
4. Develop a synthesis of the findings.

Materials and Methods

The theoretical framework of the study was created from social cognitive theory, the diffusions of innovations, the technology adoption model, and the unified theory of acceptance and use of technology. The methodology of the study was conducted through integrative inquiry.

Social Cognitive Theory and Self-Efficacy

Bandura (1986) developed social cognitive theory to explain human behavior as an interaction of personal characteristics, perceptions, practices, and the environment. Self-efficacy explains how individuals handle different tasks. Bandura (1977) defined self-efficacy as one's willingness to believe they can handle different challenges. Individuals with low self-efficacy avoid new and difficult tasks, while individuals with high self-efficacy will engage such tasks (Bandura, 1977).

Mobile technology use and self-efficacy have been examined in research studies. Self-efficacy was found to be a moderator on the adoption of mobile commerce services (Islam et al. 2011). Mobile service data usage by Americans and Koreans was studied with a framework based on self-efficacy and the technology acceptance model (Yang, 2010). Self-efficacy has been used to examine students' attitudes toward mobile learning (Yang, 2012).

Diffusions of Innovations

Rogers' (2003) diffusion of innovations has been used to study innovations in a variety of areas. Rogers (2003) found an innovation has five attributes: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the extent people believe an innovation is better than the one currently in use. Compatibility is how an innovation is compatible with people's belief and value systems. Complexity is how difficult people find an innovation to use or understand. Trialability refers how people can try out an innovation before deciding to adopt the innovation. Observability is the extent to which people can view the innovation's results (Rogers, 2003).

The diffusion of innovations has been used to examine the adoption of instructional technology innovations like eLearning and mobile learning. Duan et al. (2010) used Rogers' innovation characteristics to frame a study on the adoption of eLearning. Shippee and Keengwe (2012) utilized the diffusion of innovations to examine the factors necessary for the successful implementation of mobile learning. The diffusion of innovations served as the framework for a literature review covering mobile learning trends (Hung and Zhang, 2012).

Technology Acceptance Model

Davis (1989) created the Technology Acceptance Model (TAM) as an information systems model indicating how users accept and use technology. Perceived usefulness and perceived ease of use are two important components of this model. How an individual believes a technology system would increase his or her job functioning is known as perceived usefulness. An individual's perception of the amount of effort needed to use a technology system is known as perceived ease of use. Perceived usefulness and perceived ease of use can be used to determine a user's intention to use a technology system (Davis, 1989).

Technology usage in educational settings has been examined through the use of the technology acceptance model. Perceived usefulness and perceived ease of use were key determinants in users' behavioral intention to use the computers (Teo et al., 2009). The technology acceptance model has also been used for researching eLearning systems acceptance. The technology acceptance model can be utilized to study instructor acceptance of eLearning systems (Yuen and Ma, 2008). Mobile technology use has been examined through the use of the technology acceptance model. Chen et al.

(2011) used the technology acceptance model to frame a study on learner attitudes in a mobile learning setting. Gao et al. (2011) extended the technology acceptance model to develop an instrument to gauge mobile services acceptance.

Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) described a user's behavioral intention to use an information system and was built upon concepts explored in social cognitive theory, diffusion of innovations, and the technology acceptance model (Venkatesh et al., 2003). Venkatesh et al. (2003) suggested UTAUT explains user intentions to use an information system and the subsequent usage behavior through four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is the benefit a user expects from an information system. Effort expectancy is the effort a user expects to exert when using an information system. Social influence is how a user perceives others' use of an information system. Facilitating conditions reference the infrastructure a user thinks is necessary to use an information system. The UTAUT has been used to frame studies on users' continuing relationships with mobile providers (Zhou, 2013), individuals' use of mobile devices for internet access (Zhou, 2011), and to investigate mobile learning intention among university students (Lowenthal, 2010).

Integrative Inquiry

The study used a process of selecting and synthesizing literature known as integrative inquiry. Marsh (1991) identified integrative inquiry as one of the most complex models of practical inquiry that may be initiated. An integrated inquiry is a research synthesis of integrative knowledge that gathers information from various sources that are relevant to a specified audience. Through the implementation of an integrative inquiry, current or previous studies are synthesized for knowledge that will help address contemporary deficiencies and illuminate potential solutions (Marsh, 1991). An integrative inquiry gathers studies of a specific topic, reviews them individually, organizes them in order to distinguish and compare related questions, and analyzes and develops implications about what is known and what needs investigating (Marsh, 1991).

Marsh (1991) described the process of combing and combining current and completed studies for knowledge to inform decision making as integrative inquiry. Integrative inquiry is used to produce knowledge beneficial to policymaking respective of context (Marsh, 1991). Roberts (as cited in Marsh) delineated six steps for directing an integrative inquiry. The six steps were employed to conduct this study and were as follows:

1. Identify the need, conduct preliminary search, clarify request;
2. Conduct the search of and retrieval of studies;
3. Selecting, screening, and organizing studies;
4. Determine the conceptual framework and fitting it to the information from the analysis; fit analysis information;
5. Develop the synthesis and interpretation into a material product; and
6. Delivering the results of synthesis (Roberts, as cited in Marsh, p. 277-279).

Integrative inquiries have been utilized to study a variety of research topics respective of context. de Gea et al. (2012) used an integrative review process to examine empirical research involving the nursing education and ICTs. Donner (2008) conducted a review of literature regarding mobile use in the developing world to fit a framework for mobile use determinants. Isaak-Ploegman and Chinien (2009) conducted an integrative review to develop an instructional design process for the differing cognitive styles in distance-learning environments. Parr and Edwards (2004) implemented an integrative inquiry to synthesize research on inquiry-based instruction and the problem-solving approach. The study used data gathered from refereed journal articles in the areas of information technology and agricultural education. Limits were instituted to confine the review of literature to the years of 2004 – 2013 given the technological context of the literature.

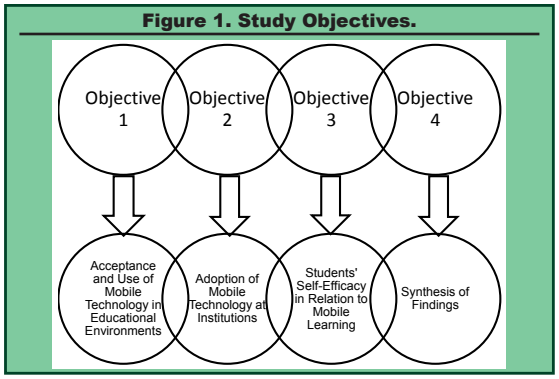
Results and Discussion

The results of the integrative inquiry yielded several factors surrounding the development of mobile learning in academic settings. Findings are presented per research objective (Figure 1).

Objective One

The first objective was to canvass the literature related to the acceptance and use of mobile technology in educational environments. Aubusson et al. (2009) found mobile learning could transform instructor learning and gives educators new means to use the classroom for observation, sharing, and teaching. Rogers et al. (2010) found mobile devices can use many forms of graphical representation to allow students to increase knowledge in more effective manner. The use of iPads can increase teacher productivity and learning (Kearney and Maher, 2013). Schuck et al. (2012) found mobile learning can increase teaching effectiveness and mobile technology use would benefit professional learning communities.

Figure 1. Study Objectives.



Mobile learning educators and developers must understand student acceptance when designing mobile learning content (Iqbal and Qureshi, 2012). Stockwell (2008) found users engage novel technologies with varying degrees of interest, skills, and ideas leading to varying technological acceptance rates. Kennedy et al. (2010) found various factors may affect students' technology experiences and preferences, meaning a full range of information about their use of technology are needed. Students with the time and access to mobile devices can use mobile learning to engage in student-centered, authentic learning (Cochrane and Bateman, 2010).

Educators and instructional designers must ensure mobile learning provides productive learning outcomes for students (Chuang, 2009). Wang and Shen (2012) suggested mobile learning should provide satisfying scholastic experiences as part of its facilitation of perpetual learning. Dale and Pymm (2009) suggested mobile learning will need to prove its value as a learning tool as the increasing acceptance of mobile devices in our society is blurring the relationship between work and play. Idrus and Ismail (2010) found mobile devices erase restrictions by becoming one with the learner, making the concept of learning more applicable. A model of adoption is needed to help determine the demographic factors surrounding students' acceptance of and willingness to use mobile learning (Yadegaridehkordi and Iahad, 2012).

Mobile technology offered agricultural educators the means to disseminate information in a more efficient manner. Agricultural science and technology teachers had positive perceptions in regards to use of mobile technology like iPods and mp3 players to improve student engagement (Murphrey, Miller and Roberts, 2009). The use of mobile technology can decrease the resources needed to communicate and share information (Aker, 2011). An online resource guide to increase agricultural knowledge of cotton was found to be valuable and useful by users (Cooper-Jennett et al., 2010).

Mobile learning has surfaced in literature involving extension education studies. Carter and Hightower (2010) suggested Extension's use of mobile learning should be studied due to mobile technology's global reach. The creation of mobile learning applications could be advanced through the sharing of the applications with Extension Systems across the nation (LaBelle, 2011).

Objective Two

The second objective of the study was to search the literature related to the adoption of mobile technology at institutions. Young adults have made mobile technologies part of their everyday routines. Huang et al. (2013) reported 87% of college students own a portable computing device and 55% have a smartphone. Mobile devices provide important information conduits for college students. Mobile communication technologies are commonplace on college campuses and vital to students' maintenance of interpersonal relationships (Chen and Katz, 2009).

Lu (2012) states several higher education institutions face difficulty in creating and implementing eLearning and mobile technology systems into current campus information systems due to the relatively new adoption of eLearning and m-learning technologies. Experienced eLearners are more likely to find mobile learning more accommodating than those without eLearning experience (Yadegaridehkordhi and Iahad, 2012). Mobile learning offers value to educational institutions in the form of credibility and cost effectiveness (Mohammad et al., 2012). Gu et al. (2011) found through the use of sound instructional design processes to create educational content, mobile learning can enable lifelong learning.

McContha et al. (2008) found the increase of wireless networks across higher education institutions has created the infrastructure for mobile learning to be adopted by educators. Mobile devices are very popular in colleges and universities and could become an essential tool for learning (Shin et al., 2011). College and university campuses have populations particularly open to the use of mobile learning. Matias and Wolf (2013) suggested most people will soon be getting online through their mobile devices, and educators should embrace the chance to augment student learning outcomes by successfully using mobile technology in educational settings. Cheon et al. (2012) suggested higher education students' greater use of mobile devices compared to primary and secondary students may lead to quicker adoption in college and university settings.

Objective Three

The third objective of the study was to search the literature related to students' level of self-efficacy in regards to mobile learning. Goode (2010) suggested students' technology knowledge is initially formed by educational engagement at home and in school, with reinforcement by higher education experiences. Peng et al. (2009) found mobile learning offers amazing technical abilities for students. Mobile learning faces difficulties due to the various mobile devices used and educational adaptation issues but offers learners distinctive opportunities for educational engagement (Elias, 2011). Kulksa-Hume (2010) found mobile learning can challenge educators as they must comprehend students' needs in a more productive and accessible way due the technology creating a focus on learning over teaching. Careful development of learning techniques for mobile learning is needed to ensure its educational advantages and avoid it being an obstacle for learning (Koszalka and Ntloedibe-Kuswani, 2010).

Approaches for agricultural educators to improve student's self-efficacy with mobile learning have been studied. Mobile learning should be demonstrated as an extension of students' current mobile technology use to reduce their perception of mobile learning being a difficult task, and thus, provide opportunities to increase self-efficacy (Irby and Strong, 2013). Agricultural information experts have exhibited positive attitudes towards the

use of mobile learning in various areas of agricultural education (Yaghoubi et al., 2010).

Objective Four

The fourth objective was to develop a synthesis of the findings. The advent and omnipresence of mobile learning is shifting the educational environment. The use of an integrative inquiry identified produced a review of studies addressing the potential benefits of mobile learning, the acceptance and adoption of mobile technology, and the relationship between self-efficacy and mobile learning acceptance and adoption.

How mobile learning is similar and dissimilar to eLearning is still being understood. Literature on the acceptance and use of mobile learning in educational environments suggests the use of mobile learning offers potential benefits, requires new instructional design ideas, and more research on its acceptance and adoption. Literature on the acceptance and adoption of mobile technology suggests the technology is widely used with a majority of college students relying on the technology in a variety of ways. Literature on students' self-efficacy and mobile learning suggested a need to study to relationships between the two factors in terms of mobile learning acceptance and adoption.

Bandura's (1986) self-efficacy, Rogers' (2003) diffusion of innovations, Davis' (1991) TAM, and Venkatesh et al.'s (2003) UTAUT may provide researchers potential constructs to understand mobile learning acceptance among students and instructors.

Self-efficacy is how willing individuals are to attempt a particular task based on perceived difficulties associated with the task (Bandura, 1977). The literature suggests mobile technology is commonplace among college students and their use of the technology is frequent. Mobile learning may be perceived as a more attractive task by highly self-efficacious students but not those with low self-efficacy. Students with low self-efficacy may be wary of confronting even a familiar technology like mobile technology.

Rogers' (2003) characteristics of an innovation and innovation adoption process are part of the theory of the diffusion of innovations. Students could decide to adopt mobile learning if they are made aware of its relative advantage compared to traditional learning as the literature suggests mobile learning offers learning benefits due to its ability to occur at any time or location. The literature suggests college students are accepting of mobile technology in their lives, thus possibly allowing them to realize the compatibility of mobile learning with their current mobile technology usage.

TAM and the UTAUT respectively explain the adoption and acceptance of technology among users (Davis, 1991; Venkatesh et al., 2003). TAM served as part of the foundational basis for UTAUT, which explains the acceptance of an information system. UTAUT also built upon ideas of social cognitive theory and the diffusions of innovations. Literature suggests mobile technology has been accepted among college students and is an adopted form of technology. College students' acceptance and adoption of mobile technology could lead to their eventual adoption and acceptance of mobile learning.

Summary

The data indicated more research needs to be conducted on mobile learning acceptance and the potential benefits to students and teachers. Agricultural educators and researchers should further research mobile learning acceptance in the context of self-efficacy and the UTAUT. Future studies should examine the interaction between self-efficacy, performance expectancy, effort expectancy, behavioral intention, and facilitating conditions.

Instructor and student perceptions and adoption of mobile learning need to be understood with greater clarity. Educators should investigate student acceptance of mobile learning when creating content for mobile devices (Iqbal and Qureshi, 2012). The acceptance and attitude of instructors toward mobile learning must be studied for successful use in instruction (Uzunboylu and Ozdamli, 2011). Understanding these relationships may increase understanding of mobile learning acceptance among educators and students and offer approaches to enhance student learning.

Research into mobile learning is needed to develop processes for teachers to reach learners' through this technology (Mohamad et al., 2012). Researchers can use a Delphi panel made up of experts in agricultural education; to determine the competencies needed for agricultural educators to effectively utilized mobile learning technology. Wang and Shen (2012) recommended new design procedures and techniques for mobile learning.

Proper instructional design for mobile learning can ensure its ability to create lifelong learning opportunities (Gu et al., 2011). Agricultural education faculty could allow students to use their mobile devices to complete class learning objectives. Instructors should demonstrate the usefulness and ease of use of mobile learning by demonstrating educational activities such as turning in assignments and giving presentations through mobile technology to increase student self-efficacy. Agricultural education faculty could use mobile technologies in novel ways by creating learning opportunities that embrace the positive characteristics of mobile learning through experiential learning activities. Instructors should implement mobile learning experiences by utilizing the ubiquitous strengths of the mobile technology to cultivate opportunities for student engagement and learning.

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Qualitative Assessment of Pre-Healthcare Undergraduates' Perceptions of Childhood Obesity to Inform Premedical Curricular Changes[1]

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Abstract

Little is known about undergraduates' understanding of complex health issues like childhood obesity. Researchers sought to examine to what degree pre-healthcare undergraduates can identify and describe the complexity of childhood obesity to inform premedical curricular approaches in light of the 2015 changes to the Medical College Admissions Test®. Through this qualitative analysis, researchers determined that pre-healthcare students with nutrition and social science majors and health minors and significant experience with obese people or prevention programs were more knowledgeable about childhood obesity than their counterparts. All students were able to describe many causes of childhood obesity, putting a focus on the child's diet and familial influence. However, they did not describe the complexity of prevention as well, citing mostly programs they had personally seen in practice or had heard about in popular media. Based on these findings, we suggest undergraduate institutions provide students with specialized coursework and service-learning experiences that include exposure to health behavior-related concepts, such as the social ecological model. Because community programs targeting children are often accessible by college students, childhood obesity is a useful context to provide this education, helping students deepen their understanding of health and reflect on their roles as future healthcare providers.

Introduction

In a 2012 open letter to premedical students from the Association of American Medical Colleges, President Darrell Kirch said, "*Our profession increasingly recognizes that our current health care model needs to do more to promote prevention and wellness for patients*." Therefore, as he noted, "*[T]he health care system of tomorrow will require a different kind of doctor.*" It will require one who understands "*how [people] think, interact, and make decisions*" (Kirch, 2012). This will be reflected in the 2015 Medical College Admissions Test® (MCAT®), which will shift from an emphasis solely on expertise in the natural and physical sciences, to an assessment of knowledge in the behavioral and social sciences as well (Association of American Medical Colleges, 2012).

The context of the MCAT® has a direct influence on premedical curricula; therefore, as the MCAT® changes, so too will the required or recommended coursework in the behavioral and social sciences (Sklar, 2013). This will require premedical courses that foster an opportunity for meaningful development of the desired skills and dispositions, allowing students to apply discipline-based theories to specific health-related issues in the community and reflect on the role of the healthcare provider in the context of the problem (Gross et al., 2008; Frazer and Twohig, 2012). Because many premedical students pursue majors in the agriculture and life sciences, educators in these fields will be the ones to instigate curricular changes in light of students' current understanding of public health concerns, like obesity. Simply adding an introductory psychology course as a prerequisite, for example, is not likely enough to maximize these newly desired student

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learning outcomes; therefore, undergraduate institutions should consider other ways to integrate the social and behavioral sciences into their premedical curricula (Hilborn et al., 2012).

Childhood obesity is an excellent model for demonstrating the complex interrelationships between the biological and psychosocial determinants of health because of the multifactorial nature of contributors to weight status (Davison and Birch, 2001; Harrison et al., 2011). More specifically, it can be used in premedical curricula to introduce students to theoretical frameworks that describe those complex interrelationships, providing a foundation for considering evidence-based approaches to prevention and treatment within the healthcare system. Due to the high prevalence of childhood obesity (Ogden and Carroll, 2010), undergraduate institutions can use community programs with which they typically already have established partnerships (e.g. YMCAs) as a vehicle for students to apply this learning in a community setting.

Little is currently known about pre-healthcare undergraduate students' views regarding childhood obesity, the sources of that knowledge, and how it affects their understanding of the disease. In particular, we were interested in examining the question: To what degree can students identify and describe the complexity of childhood obesity? This understanding could provide a baseline of information from which to develop curricular approaches, using childhood obesity as a model to help integrate the social and behavioral sciences into premedical curricula.

Table 1.Major interview questions and probes asked of pre-healthcare students (n=30) during qualitative interviews

1. Describe an obese child. Probe: What do they look like? Probe: How do they act? Probe: Is there anything different between a "normal weight" child and an "obese" child? Probe: Can you think of anything else?
2. What leads to childhood obesity? Who contributes to the causes? Probe: Can you think of anything else?
3. What are the consequences of childhood obesity? Probe: Can you think of anything else?
4. What should or can be done to prevent childhood obesity? Probe: Can you think of anything else?
5. Where did you learn the information you shared with me today? Probe: Where did you learn how to describe an obese child? Probe: Where did you learn the causes of childhood obesity? Probe: Where did you learn the consequences of childhood obesity? Probe: Where did you learn about the prevention of childhood obesity? Probe: Is there anywhere else you might have learned this information?

Table 2. Participant demographics of qualitative interviews with pre-healthcare students (n=30)

Characteristics	Students (#)	Percentage [a]
Major		
Biological Sciences	22	73%
Social Sciences/Humanities	8	27%
Physical Sciences	2	7%
Engineering	2	7%
Business	1	3%
Minor		
Health-related	7	23%
Biological Sciences	4	13%
Other	8	27%
Gender		
Male	8	27%
Female	22	73%
Had taken introductory nutrition course	21	70%

[a] Major and minor percentages do not add up to 100% because five students had multiple majors, and of the 16 students with minors, three were double-minors.

Materials and Methods

Participants and Recruitment

We interviewed pre-healthcare undergraduate seniors about the etiology of childhood obesity, employing a qualitative approach to give a "complex and holistic picture" of students' perceptions (Jencik, 2011). We recruited seniors who had completed at least seven semesters of coursework and were planning to apply to or enter professional or graduate school in a health-related discipline, using flyers and listservs, stopping data collection when saturation was reached (Krefting, 1991; DiCicco-Bloom and Crabtree, 2006; Bowen, 2008). This research was approved by the Institutional Review Board at North Carolina State University.

Data Collection

Before data collection, we developed a standardized interview guide that included major questions and probes (Table 1), and all three interviewers participated in standardized qualitative research training. We audio-recorded each in-person interview (45 to 90 minutes) and took detailed notes, reviewing the notes with the student at the end of each interview (Guba, 1981; Krefting, 1991). After transcribing the audio files verbatim, we used direct content analysis to analyze data to determine when saturation occurred (Krefting, 1991; DiCicco-Bloom and Crabtree, 2006; Bowen, 2008).

Data Analysis

Prior to data analysis, we developed five *a priori* main coding categories to help guide our analytic process. During the first phase of data analysis, we used open coding (Goulding, 1999) to develop a coding manual containing 47 sub-codes, which emerged from the data. Two of the authors coded all transcripts independently, using NVivo 9 qualitative analysis software as both a tool to code the data and to calculate reliability (QSR International, 2009). The two coders met periodically during data analysis to compare codes, reach consensus, and check inter-rater reliability (Schilling, 2006). Of note, we obtained an overall "excellent" Kappa of 0.83 (Cohen, 1960; Cohen, 1968; Landis and Koch, 1977).

The first author then independently analyzed the quotes to determine dominant emergent themes of student knowledge across each category. As a research team, we then came to consensus on the major dominant emergent themes and consulted with an expert not involved in data collection/analysis to gain an outside opinion on the relevance of themes.

Results and Discussion

Of the 30 students interviewed, the majority were majoring in a biological science (n=22) and of those with

a minor, a health-related minor was most common (n=7). Additionally, 21 students (70%) had taken or were currently taking an introductory nutrition course (Table 2).

Two dominant emergent themes surfaced: (1) Impact of Experience and (2) Disconnect between Causes and Prevention. The first theme suggests that the types of experiences in which students participated (both curricular and extracurricular) had an impact on their depth of knowledge regarding the etiology of childhood obesity. However, the second theme proposes that these students were not thinking about the problem systematically and lacked awareness of the complexity of theory-based approaches to prevention and treatment.

Impact of Experience

When asked for their sources of knowledge about childhood obesity, students most commonly cited (1) medical school prerequisite science courses, (2) internship and community experience, (3) personal experience or observations, (4) family and (5) media. They least frequently cited (1) scientific literature, (2) medical doctors and (3) specialized courses/electives.

When discussing courses, all students cited science courses where they may have learned about anatomy and physiology, adult obesity, or diabetes. Most students also cited personal experiences interacting with obese friends and family members as a source of knowledge. When describing the opportunities for personal interactions one student said, *"Everyone's gone to school and … seen or [grown] up with obese children, or like me, having obese children … runs in my family."* These personal experiences may explain why students were able to describe the emotional consequences of childhood obesity and not just the physical effects that might have been learned in science courses.

However, the most knowledgeable students – those who could articulate a somewhat deeper understanding of the complexities of childhood obesity – also had meaningful volunteer, service-learning, or internship experiences. As one student noted, *"I've volunteered at the Food Bank and homeless shelters, and … I feel like I got exposure to lower income people and realized how hard it is for them to provide healthy options."* These opportunities allowed students to interact with obese children and their parents in a real world setting and to see the challenges associated with prevention and treatment for both families and community programs.

Two other common sources of knowledge were media and everyday conversations with friends and family. Students' descriptions of knowledge from the media covered a wide span, from credible news sources to reality television shows. Similarly, students' conversations with friends and family varied from conversations with parents who are healthcare providers and friends who are nutrition majors to everyday conversations about topics in popular media. Interestingly, the least cited sources of information about childhood obesity included scientific literature, doctors, and specialized courses, all more credible sources for future physicians.

Disconnect Between Causes and Prevention

The "Impact of Experience" theme purports that the more knowledgeable students were nutrition and social science majors, health minors, and students who had in-depth relationships with an obese friend or family member, and those with meaningful volunteer or internship experiences. However, even in the most knowledgeable students, we observed a disconnect between students' descriptions of contributing factors and the prevention tactics they said would target those contributing factors.

With regard to causes, the majority of students were able to describe contributors to childhood obesity closely related to the child's and family's behaviors, including diet, family, and physical activity. One student said, *"I feel like a lot of obesity in children is caused from parents … when you're younger, especially, you … model off your parents, and if your parents aren't being very health-conscious or trying to eat in a healthy way, there's not a very high likelihood that you're [going to] do the same."* While most students' responses focused on parents and child's diet, some students discussed the impact of more external factors, including the school system and parent education. While a minority, some of the more knowledgeable students were able to give rich descriptions of the complexity of contributing factors, including the barrier of socioeconomic status. One student described socioeconomic status in this way: *"[P]eople who have low incomes or who can't afford [a store] like Whole Foods, or who can't really get nice vegetables at Harris Teeter, they have to get the cheaper food and more inexpensive food. [For example] buying a cheeseburger at McDonalds is much cheaper than buying even a sub at Subway."* Overall, all students were able to list the child and family-related contributing factors, but few students were able to describe more external impacts on healthy behaviors.

While most students' descriptions of contributing factors focused on those closely related to the child and family, students' descriptions of the causes were more comprehensive than their descriptions of solutions. In their discussions about prevention and treatment, students described programs targeting diet and physical activity through education with most students discussing programs they had seen or heard about. Popular topics included First Lady Michelle Obama's "Let's Move" campaign and changes to the school lunch program, two topics in the news at the time of the interviews. Additionally, students were able to describe less nutritious options from their own school lunch experience and could articulate clear changes to be made. As noted by one student, *"Just not having unhealthy options there and spending more money on making the healthy food taste good so that the children can learn that 'Oh healthy food can be delicious!'"* Many students also pulled from their own experience building healthy lifestyle practices as children. One student said, *"[W]hen I was young, I think my parents put a big emphasis on [healthy eating], and I can tell as I've grown up my personal preference … has*

come through based on their influence." Many students received parental encouragement and explained that this was an important factor for developing healthy habits in children.

Interestingly, despite continued probing, almost all of the students failed to mention the role of healthcare providers in preventing and treating childhood obesity. Overall, students tended to focus mainly on family and school-based interventions rather than a variety of approaches to prevention (e.g. behavior change counseling and policy changes). For example, students could see that changes needed to be made to the way the food system is run, including cost and accessibility of healthy foods and marketing to children; however, they did not give clear descriptions of how this could be accomplished. This disconnect between students' descriptions of causes and prevention indicates that their ideas of prevention are limited and not reflective of the complexity of known contributors.

The results of this study suggest that childhood obesity could serve as a vehicle by which to prepare students for the MCAT 2015® and a more prevention-based medical education. Pre-healthcare undergraduate seniors with nutrition and social science majors, a health minor, or volunteer or internship experiences were more knowledgeable about the behavioral and social determinants of childhood obesity than their counterparts. They gave descriptions of the barriers parents may face in providing children affordable, healthy foods (e.g. socioeconomic status) and the impact of current systems (e.g. school lunch program) on nutrition health behaviors. Students without this coursework and volunteer experience had a more limited view, focusing most of their discussion the child's diet and parental influence. Also, students rarely mentioned the role of healthcare providers in prevention and treatment, despite their desire to enter this profession. In general, even the more knowledgeable students lacked depth in their understanding of the behavioral and social determinants of childhood obesity.

An understanding of the complexity of childhood obesity, leading to more effective healthcare-related approaches to prevention and treatment, can be facilitated, in part, through providing students with a social ecological perspective of the disease. This perspective on health behavior includes various levels of contributing factors and has been applied to many different health-related behaviors, such as smoking, alcohol consumption, and drug use (Simons-Morton et al., 2011). Davison and Birch (2001) depict the social ecological model related to childhood obesity with three levels of contributing factors – child, parent, and community – and posits that a child's characteristic (e.g. health-related behavior) cannot be explained (and therefore ultimately changed) without an understanding of the context in which that characteristic exists. A more recent expansion of the social ecological model depicts the "6 C's" of contributors to weight status: cell, child, clan, community, country, and culture (Harrison et al., 2011).

Each of these contexts exists within its own "ecological niche," creating a model of ever-widening spheres of influence, from the child and her family to her community, society, and culture as a whole. Both models also make clear the bi-directional, rather than uni-directional nature of the interactions between the level, which is key to developing successful approaches to both prevention and treatment. For example, while parental eating behavior can influence a child's eating habits, research has shown that the child's characteristics (e.g. age, sex, and weight) can affect the parent's attitudes and behaviors towards feeding her (Davison and Birch, 2001; Savage et al., 2008). This understanding of the complex bi-directional nature of interactions related to childhood obesity requires a developed sense of reasoning and analysis which the MCAT 2015® also seeks to encourage. Introducing students to a social ecological model for health behavior is one way to provide them with a framework grounded in the behavioral sciences to better understand and articulate sound prevention and treatment strategies and to describe their role as future healthcare providers in the implementation of those strategies.

Premedical programs could achieve learning outcomes related to the behavioral and social science components of public health programs, such as childhood obesity, through coursework or out-of-class experiences. For example, programs could create new interdisciplinary courses specifically targeting health-related topics such as childhood obesity, or obesity more generally, or incorporate health-related social science principles into nutrition courses where there is already a lot of overlap between biological and social sciences. Topics that might be incorporated into such courses include not only etiology frameworks such as the social ecological model, but also behavior change theories (e.g. Stages of Change) and counseling approaches (e.g. motivational interviewing) (Simons-Morton et al., 2011). These theories could be helpful, as Kaplan et al. (2012) describe, in preparing "aspiring physicians to understand patients' social, environmental, and personal characteristics," (p. 1267) in order to train more effective physicians equipped to consider multiple factors in prevention and treatment (Cuff and Vanselow, 2004; Kaplan et al., 2012). This undergraduate introduction to the social and behavioral sciences is especially important because, in a survey of physicians, 44% reported that medical school did not adequately prepare them to treat patients from a behavioral standpoint (Astin et al., 2006).

In addition to coursework, since pre-healthcare students already seek out internship and volunteer experiences to gain experience for professional school, undergraduate institutions can encourage students to seek out valuable experience mirrored with desired learning outcomes related to the behavioral and social sciences. For example, students could teach nutrition education programs in local afterschool programs like the YMCA, affording them the opportunity to see community

approaches to prevention. However, consistent and meaningful outcomes are not likely to be achieved without combining that experience with academic content and guided reflection (e.g. service-learning).

Service-learning experiences have already been incorporated into some undergraduate pre-healthcare and graduate/professional school programs with some addressing obesity and others healthy living as a whole (Begley et al., 2009; Himelein et al., 2010; Anderson et al., 2011). In fact, many medical service-learning programs seek to explore complex issues, like a multifactorial understanding of childhood obesity, and have resulted in students reporting a better understanding of childhood obesity, community issues and needs, and patient behaviors both in and out of the clinic, helping students feel more prepared and eager to work in underserved communities in the future (Burrows et al., 1999; Borges and Hartung, 2007; Buff et al., 2011; Hunt et al., 2011). Combining this community experience with coursework through the vehicle of service-learning may equip premedical students to not only be more successful in their MCAT® scores but also in learning about a prevention-based approach to healthcare.

Future research could explore the effectiveness of these service-learning opportunities through analysis of guided reflection assignments, through comparison of MCAT® scores, or through differences in performance once students enter medical school. Additionally, future qualitative explorations could determine similar research questions in medical students to compare their knowledge to the knowledge of pre-medical students.

Limitations

While measures were taken to ensure that the research was unbiased and applicable to the greater population, there were still limitations to the study. Because the interviews were conducted at one institution, findings might not be generalizable to all undergraduate programs in the nation. Due to the nature of recruitment, students who volunteered for the interviews might be more interested in the topic than the general pre-healthcare student population, though we sought to increase participation of students less interested in the topic by offering a Pre-Health Club participation point incentive.

Summary

Our study provides a baseline understanding of pre-healthcare students' knowledge of childhood obesity that suggests that they need more exposure to these concepts, especially as it relates to their roles as future healthcare providers. By providing students with coursework or service-learning opportunities that link the biological and social sciences with experience with obese children in the community, students may perform better on the MCAT®, be more prepared to enter medical school with a prevention-focused mindset, and have a deeper understanding of the complexity of health.

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Background Experience Affects Student Perceptions of the Livestock Industry

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Abstract

Demographic information of students in introductory animal science courses allows instructors to tailor content to student needs and interests. This study compared student demographics with student perceptions of livestock production practices. Students in two introductory animal science sections (section A: n = 310, section B: n = 328) participated in a pre-course and a post-course survey. Both sections were comprised primarily of first-year undergraduate students; a majority was female with either horse experience or no livestock experience. Thirty percent of section A and 58% of section B was enrolled in the College of Agriculture. Forty percent of section A and 60% of section B had prior 4-H or FFA involvement. Pre-course, the sections disagreed on whether horses are pets or livestock, how media portrays agriculture, and whether slaughterhouse practices are humane. Post-course, more of section A than section B considered horses as livestock, and both sections agreed that media negatively portrays agriculture, weather has the greatest influence on producer success, and slaughterhouse practices are humane. These results suggest that students with no livestock experience may view agriculture differently than students with experience, but more exposure to livestock production issues may challenge students to evaluate their views of agriculture.

Introduction

Instructors of introductory animal science courses are faced with the challenge of adapting their course content as the demographics and background experiences of their students differ each semester, with more students having less agricultural experience as the years progress. These differences in student demographics and background experiences may affect students' perceptions of agriculture, which may include common misconceptions perceived by the public. The lack of knowledge about, or exposure to, agriculture production may be responsible for these misconceptions. For example, agriculture illiteracy has been documented in consumers (as reviewed in Terry et al., 1992), high school students (Smith et al., 2009), and elementary school teachers (as reviewed in Terry et al., 1992). Besides a lack of agricultural education, introductory animal science student perceptions may be influenced by student background experiences.

Differences in student perceptions of agriculture may be impacted by background factors that include each student's hometown, experience (or lack of experience) with an agriculturally-related organization, and home environment. For example, Frick et al. (1995b) showed that rural and urban inner-city high school students were more knowledgeable about topics in natural resources than agriculture, but the two groups differed as rural students had the least knowledge of agricultural plants and urban inner-city students had the least knowledge of agricultural policy. Furthermore, high school students who lived on a farm have been found to be more positive about farming than students who did not live on a farm (Smith et al., 2009) and urban elementary students who did not have gardening experience lacked an understanding of crop pests and their control in plant growth (Trexler, 2000). At the university level, Talbert and Larke (1995) noticed that minority students in introductory agriscience courses at one university tended to be from non-farm, non-rural areas and had more negative perceptions of agriculture and agriculture education. While it appears that a student's hometown and home environment may have a significant impact on the student's perception of agriculture, a student's involvement in agriculturally-related organizations may also play a role in how the student perceives the field.

While participating in agriculturally-related organizations such as 4-H or FFA, students may be exposed to

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a wide array of agricultural issues and presented with opportunities to raise or handle livestock animals. Frick et al. (1995a) demonstrated that 4-H members who lived on a farm had more knowledge about agriculture than 4-H members who did not live on a farm. Also, 4-H members who lived on a farm and were enrolled in high school agriculture education classes had the most positive perceptions of agriculture. With the various background experiences of university students in introductory animal science courses, instructors of these courses would benefit from acquiring a better understanding of how different experiences alter student perceptions of agricultural practices. The objectives of this study were to document the demographics of two introductory animal science classes and determine if student background experiences correlate with student perceptions of livestock production.

Materials and Methods

The Texas A&M Institutional Review Board Committee approved this study (Protocol #2011-0652). Participation in this study was voluntary and students did not receive an incentive for participation. The introductory animal science course was chosen for this study because the student population is more diverse in this course than upper-level courses and it is typically the first exposure students have to livestock production issues in the animal science curriculum at Texas A&M University. While the two sections (section A and section B) used in this study during the fall 2011 semester were instructed by two different professors, the course material for both sections was mutually agreed upon by both instructors.

Participants were asked to complete a 26-question multiple choice survey during the first lecture (pre-course) and the last lecture (post-course) of the semester. The survey included questions about student demographics, background experience, career objectives, and views on current issues in animal production. For every opinion-based question, each participant was asked to select the answer that best reflected his or her opinion. Student responses were analyzed using SAS 9.2 (SAS Inst. Inc., Cary, NC). Frequency analyses were conducted to describe the student population within each section. Pearson correlations and pooled or Satterthwaite t-test analyses were conducted to detect differences in student responses between sections.

Results and Discussion

A total of 638 students (section A: n = 310 and section B: n = 328) completed the pre-course and post-course surveys for this study. Seventy percent and 75% of the student population in section A and section B, respectively, were female. Most participants were first-year students enrolled in either the College of Agriculture and Life Sciences or the College of Veterinary Medicine and Biomedical Sciences (Table 1). The majority of both sections had no livestock judging experience (section A: 78%, section B: 66%) and intended to pursue a career in veterinary medicine (section A: 65%, section B: 63%). Most participants had the most experience handling horses rather than any other livestock species, but had no previous involvement with the 4-H or FFA organizations (Table 1). Of the students in section A and section B that had livestock handling experience, 41% and 50% had more than six years of livestock handling experience.

Table 1. Demographic Information for Section A (n = 310) and Section B (n = 328) of an introductory animal science course.

Demographic Category	Section A (% of students)	Section B (% of students)
Year in College Program		
1st Year	54%	65%
2nd Year	25%	25%
3rd Year	15%	7%
4th Year	6%	3%
College of Enrollment		
Agriculture and Life Sciences	30%	58%
Liberal Arts	2%	2%
Science	2%	3%
Vet Med and Biomed Sciences	56%	27%
Other	10%	10%
Most Handling Experience		
Horses	34%	35%
Cattle	19%	17%
Poultry	3%	4%
Swine	5%	8%
Sheep/Goats	9%	10%
None	30%	26%
4-H/FFA Involvement		
Both	10%	18%
4-H Only	5%	8%
FFA Only	25%	32%
None	60%	42%

A significant correlation ($r = -0.27$, $P < 0.0001$) was detected between course section and student college of enrollment where 56% of section A students were enrolled in the College of Veterinary Medicine and Biomedical Sciences and 58% of section B students were enrolled in the College of Agriculture and Life Sciences. Also, a significant correlation ($r = -0.10$, $P = 0.01$) was detected between course section and student 4-H/FFA involvement where 40% of students in section A and 58% of students in section B had 4-H and/or FFA experience. Pre-course, no significant correlations were detected between course section and student views on which species (cattle, horses, poultry, swine, or sheep/goats) is the most intelligent, whether animals have feelings, whether animals deserve respect from humans, and whether it is ethical to clone animals. However, significant correlations were detected pre-course between course section and five livestock production questions: 1) whether horses should be classified as pets or livestock ($r = 0.14$, $P = 0.0005$); 2) whether the media portrays agriculture in a positive, negative, or neutral fashion ($r = -0.15$, $P = 0.0001$); 3) what the greatest influence (weather, politics, or media) is on livestock producer success ($r = 0.10$, $P = 0.01$); 4) whether genetically-modified foods are safe for human consumption ($r = -0.09$, $P = 0.03$); and 5) whether current slaughterhouse practices are humane ($r = 0.11$, $P = 0.004$).

Both sections agreed (section A: 65% of students and section B: 65% of students, $P = 0.79$) pre-course that horses are the most intelligent species when compared

to cattle, poultry, swine, and sheep/goats. Also, both sections agreed that animals have feelings (section A: 94% of students and section B: 93% of students, *P* = 0.45), deserve respect from humans (section A: 99% of students and section B: 98% of students, *P* = 0.22), and that it is not ethical to clone animals (section A: 51% of students and section B: 52% of students, *P* = 0.56). In contrast, section A students believed that horses should be classified as pets and the media portrayed agriculture in a neutral fashion, while section B students believed that horses should be classified as livestock (*P* < 0.0001, Figure 1) and the media portrayed agriculture in a negative fashion (*P* = 0.0004, Figure 2). Significantly more students in section A (69% of students) than section B (58% of students) believed when given a choice of weather, politics, or media, the weather had the greatest influence on livestock producer success (*P* = 0.0003). Section A students claimed that genetically-modified foods are safe for human consumption (55% of students) and current slaughterhouse practices are not humane (53% of students). Significantly more section B students (66%) than section A students (55%) claimed that genetically-modified foods are safe (*P* = 0.003). However, section A students (53%) claimed current slaughterhouse practices are not humane, but section B students (56%) claimed these practices are humane (*P* = 0.02).

Post-course, no significant correlations were detected between course section and student views about whether horses should be classified as pets or livestock, whether animals deserve respect from humans, what the greatest influence (weather, politics, or media) is on livestock producer success, whether genetically-modified foods are safe for human consumption, and whether current slaughterhouse practices are humane. However, significant correlations were detected post-course between course section and student views on four livestock production topics: 1) which species (cattle, horses, poultry, swine, or sheep/goats) is the most intelligent (r = - 0.16, *P* < 0.0001), whether animals have feelings (r = 0.08, *P* = 0.05), whether the media portrays agriculture in a positive, negative, or neutral fashion (r = - 0.09, *P* = 0.03, Figure 2), and whether it is ethical to clone animals (r = 0.12, *P* = 0.003).

While the majority of both sections agreed post-course that horses should be classified as livestock rather than pets, significantly (*P* = 0.005, Figure 1) more students in section A (70% of students) than section B (59% of students) felt this way. Both sections also agreed that animals deserve respect from humans (section A: 99% of students and section B: 97% of students, *P* = 0.40), weather (not politics or media) has the greatest influence on livestock producer success (section A: 52% of students and section B: 51% of students, *P* = 0.40), genetically-modified foods are safe for human consumption (section A: 91% of students and section B: 89% of students, *P* = 0.48), and slaughterhouse practices are humane (section A: 85% of students and section B: 89% of students, *P* = 0.12). Post-course, the majority of both sections (section A: 51% of students and section B: 64% of students) believed that horses are the most intelligent species when compared to cattle, poultry, swine, and sheep/goats. However, significantly (*P* < 0.0001) more students in section A (44% of students) than section B (27% of students) claimed that swine was the most intelligent species. The majority of both sections also believed post-course that animals have feelings (section A: 94% of students and section B: 89% of students) and it is ethical to clone animals (section A: 77% of students and section B: 67% of students), but significantly more students felt this way in section A than section B (animals have feelings: *P* = 0.05 and ethical to clone: *P* = 0.008). While the majority of both sections agreed post-course that the media portrays agriculture in a negative fashion, significantly (*P* = 0.05, Figure 2) more students in section A (21% of students) than section B (17% of students) believed that the media portrays agriculture in a neutral fashion.

The differences in student perceptions between the two sections in this study would suggest that back-

Figure 1. Introductory animal science student responses when students were asked to classify horses as either pets or livestock animals. Students from two sections (section A and section B) were surveyed pre-course (P < 0.0001) and post-course (P = 0.005). The cross-hatched bars represent students in section A (n = 310) and black bars represent students in section B (n = 328).

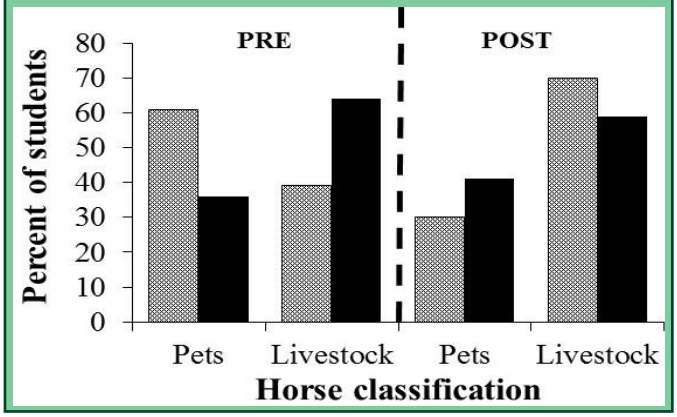
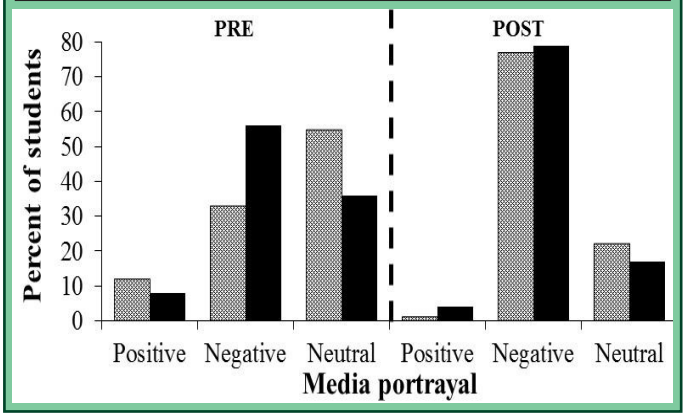


Figure 2. Introductory animal science student responses when students were asked whether the media portrays agriculture in a positive, negative, or neutral fashion. Students from two sections (section A and section B) were surveyed pre-course (P = 0.0004) and post-course (P = 0.03). The cross-hatched bars represent students in section A (n = 310) and black bars represent students in section B (n = 328).



ground experience may play a role in how students view agriculture, including issues related to animal intelligence and animal welfare. These results are similar to the findings in a study by Terry and Lawver (1995) that showed students from farm or ranch backgrounds had more favorable perceptions of food safety practices and animal welfare than students without farm or ranch background experience. Terry and Lawver (1995) also demonstrated that students from the College of Agricultural Sciences had more favorable perceptions towards food safety practices and animal welfare than students from the College of Arts and Sciences. Furthermore, Schibeci and Riley (1986) noticed that students' attitudes towards science and achievement in science were significantly affected by their home environments. While a student's home environment may play a role in how he or she perceives agriculture and science, it is important to also pay close attention to public perception and how media portrays agriculture to students.

A previous study by Rasmussen et al. (1993) asked students to compare the mental capabilities of school-age children with dogs, cats, birds, and fish. Students believed simple thinking could be completed by children and all the animals, but complex thinking could only be completed by children. While farm animal intelligence was not addressed in the previous study, a difference in student perceptions of farm animal intelligence was seen in the present study. Both sections believed that horses were the most intelligent farm animals before the semester began, but more students recognized swine as the most intelligent farm animal species at the end of the semester. Surprisingly, students in the present study also differed in their perceptions of horses as livestock animals or pets. The controversy of classifying certain animal species as either livestock animals (that would potentially be used for human food) or companion animals is worldwide. For example, university students in Spain differed in their perceptions of rabbits as livestock or companion animals (González-Redondo and Contreras-Chacón, 2012). From the present study, it appears that introductory animal science course instructors could benefit from recognizing their students' background experiences and how those experiences impact students' views of agriculture.

Summary

Students enrolled in introductory animal science courses have varied levels of experience with, and knowledge of, livestock animal production that can make it more difficult for course lecturers to present course material that is appropriate for all the students. This study provided demographic information for students in two sections of an introductory animal science course and analyzed student perceptions towards livestock animal production practices and controversial animal welfare issues. Although it is unclear which background experiences influenced student perceptions towards agriculture, the distinct differences between the two sections in regards to the student's college of enrollment, 4-H or FFA experience, and animal handling experience resulted in differences between the sections in student perceptions of animal intelligence and animal welfare.

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Impact of a ServiceLearningBased Community Nutrition Course on Students' Nutrition Teaching SelfEfficacy

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Abstract

Nutrition education is an important component of public health prevention and nutrition educators need to be adequately trained to build selfefficacy (SE) in teaching. Service-learning (SL) is a pedagogy that combines academic learning with service in the community, making it an ideal framework for undergraduate institutions to prepare students to be nutrition educators. In order to test the hypothesis that a SL course increases students' SE in teaching nutrition in the community, researchers developed the SET-NC survey and administered it to students enrolled in a Community Nutrition course (experimental group) and a Public Health Nutrition course (control group). Results indicate that there was a significant increase in SE over the course of the semester in the experimental group but not in the control group. Therefore, this SL course increased future nutrition educators' SE in teaching nutrition in the community and the course design may provide insight into the development of future SL courses designed to increase students' SE in teaching health and science in the community. Additionally, future validation of the SET-NC survey may result in a useful tool for instructors seeking to measure students' SE in teaching nutrition in the community.

Introduction

Service-Learning (SL), an educational pedagogy that combines academic material, relevant service and critical reflection (Ash and Clayton 2004), is not new to science disciplines. In fact, within the discipline of nutrition, SL is commonly used in community nutrition courses, due to the nature of the subject material (Kessler et al., 2011; Pierce et al., 2012). The purpose of community nutrition courses is to provide undergraduates with the fundamentals of designing, implementing and evaluating community programs, which includes helping build their skills in providing nutrition education to diverse populations. Undergraduates may provide nutrition education to community participants in a variety of venues, including public schools, churches, after school programs and community centers. In this context, the goals of nutrition education outreach are two-fold: (1) to provide quality evidence-based nutrition education to community participants of diverse ethnic and socioeconomic backgrounds and (2) to provide students with opportunities to synthesize and apply academic concepts through teaching others. In order to provide quality nutrition education programs in the community, undergraduates need to be trained in best practices of teaching to aid in skill building. Critical reflection can facilitate this skill building.

Critical reflection, a key component of SL, allows undergraduate students to expand/enhance learning in the areas of personal growth, civic learning and academic enhancement (Ash and Clayton 2004, 2009). Personal growth reflection can fuel students' growth as nutrition educators, civic learning reflection allows for critical analysis of the effectiveness of nutrition education programs and academic enhancement reflection enables students to see how their discipline specific coursework can be taught in the community.

Self-Efficacy (SE) is one area of personal growth and awareness, which Bandura (1997) describes as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments." The cyclical model of teaching selfefficacy presented by Tschannen-Moran et al. (1998) can be applied to the SE of undergraduate students ("student teachers") teaching nutrition education programs in the community as part of an SL course. This model combines Bandura's four

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sources of efficacy expectations: mastery experiences (in which the student teacher masters a technique), physiological/emotional arousal (the current state of body and mind of the student teacher), vicarious experiences (watching others perform similar duties) and verbal persuasion (including pep-talks from supervisors) with what they call performance feedback. This information is then interpreted by the student teacher through cognitive processing, allowing her to judge competence in the task at hand and inform future efficacy information. Therefore, it is important for undergraduate instructors, who are training nutrition educators ("student teachers"), to understand the contributors to SE in order to provide their students with a supportive environment to build skills and SE.

High SE is important because educators (i.e. nutrition student teachers) with higher SE are more effective and their students (i.e. community participants) have higher SE related to the course content (e.g. nutrition) (Bruning et al., 2011). Educators with higher SE are also more open to new ideas, organized and likely to plan, enthusiastic about the subject matter and likely to expend effort in teaching (Tschannen-Moran et al., 1998). However, educators with low SE also run the risk of creating a self-fulfilling prophesy of not succeeding as educators (Tschannen-Moran & Woolfolk Hoy, 2007). When facing nutrition-related public health concerns, the health professions need nutrition educators who are creative, organized and enthusiastic about health and nutrition.

One way to increase future nutrition educators' SE is to provide opportunities for mastery experiences. Experience providing nutrition education has been shown to significantly increase future health educators' SE in teaching the topic and their willingness to teach it in the future (Fahlman et al., 2011). Professional development (i.e. guided skills-based training) has also been shown to improve performance; however, time spent teaching nutrition has a more significant effect on performance (Fahlman et al., 2011). Therefore, nutrition undergraduates should be given opportunities to gain experiences teaching nutrition in the community (i.e. through SL) while also receiving guided instruction from experienced nutrition educators (i.e. undergraduate instructors).

Two of the authors developed a SL Community Nutrition course consisting of two parts: (1) pre-service-learning nutrition education training and (2) service-learning experience where students teach an established nutrition education program in the community. Over the course of four years, the researchers have conducted focus group discussions, analyzed students' critical reflection papers and had conversations with students to improve the course. Through this evaluative process, the researchers believe that the SL course increases students' SE in teaching nutrition in the community. Therefore, researchers sought to quantitatively test the hypothesis that a SL Community Nutrition course increases undergraduate nutrition students' SE in teaching nutrition in the community.

Methods

Study Design

In order to assess students' SE in teaching nutrition education in the community, researchers developed a community nutrition teaching SE survey and administered it to two groups of students: an experimental group of students in an SL course (n = 20) and a control group of students not in the SL course (n = 63). Researchers administered the survey to students at three time points: (1) beginning of the semester, (2) midterm and (3) end of the semester. Researchers then analyzed the data to determine the effect of the SL course on students' SE in teaching nutrition in the community. All study protocols were approved by North Carolina State University's Institutional Review Board.

Participants and Recruitment

Participants were students enrolled in an upper-level nutrition course, either Community Nutrition (experimental group) or Public Health Nutrition (control group). Both courses require an introductory nutrition course as a pre-requisite and students in Community Nutrition must be Nutrition majors or minors. Both courses serve as a nutrition elective for Nutrition majors and minors. Researchers chose the students in Public Health Nutrition course as a control group because the content covered in the two courses is similar with the major difference between the two courses being the service-learning component. The control group was also used to ensure that the Community Nutrition students' self-efficacy was not increasing over time merely due to increase in knowledge or outside experiences (e.g. volunteer experiences). All 20 Community Nutrition students completed the survey at all three time points and 38 of the 63 students (60.3%) enrolled in Public Health Nutrition completed the survey at all three time points. Students who did not complete all three time points and students who were enrolled in both Community Nutrition and Public Health Nutrition were excluded from the control group.

Course Design

Community Nutrition is a SL course that consisted of a 3-hour lecture and a 4-hour lab. In the lecture, students learned about nutrition program development, implementation and evaluation as well as cultural foods and nutrition policy. The corresponding lab was composed of two parts: pre-SL training and the SL experience. During the 6-week pre-SL training, students prepared to teach an established cooking and nutrition education program in the community by learning key skills needed to be a successful nutrition educator (lesson planning, knife skills, facilitated dialogue and best practices in teaching). The course instructors assigned students to groups of five, with each student having a unique teaching role. During the 6-week SL experience, students taught an established nutrition education program (Cooking Matters, 2013) to kids, teens, or senior adults at local community partner sites.

Throughout the semester, the instructors purposefully provided students with activities and assignments to increase their SE as nutrition educators, which can be classified into Bandura's four sources of efficacy expectations: vicarious experiences, mastery experiences, verbal persuasion and physiological/emotional arousal. The instructors provided students with vicarious experiences through a best practices video and real-time evaluation of peers. At the beginning of the training experience, students watched a best practices video featuring former Community Nutrition students and the instructors guided students to use their critical thinking skills to evaluate the video clips as the group discussed effective teaching strategies and areas for improvement. Students also observed their peers in "real-time" and evaluated their performance of three mock lessons: (1) teaching knife skills, (2) an individually taught 10-minute lesson and (3) a group taught 60-minute lesson. The course design facilitated the process of students mastering teaching skills in an incremental fashion. First, they practiced teaching knife skills to their peers. Next, they taught a 10-minute lesson (alone) to their peers while their peers act like community participants. Finally, having mastered teaching alone, they taught a 60-minute lesson (in a group), once again having peers act as community participants as well as some guest participants. Throughout the semester, students received verbal persuasion (feedback) from both their peers and the instructors, giving students an opportunity to discover their strengths and weaknesses. The instructors also sought to help students maintain a positive emotional state by creating a supportive environment of sustainable community partners, an open-door policy for instructors and support from a peer teaching assistant/community liaison.

Instrument Development

Researchers searched the literature for a teaching SE survey related to skills needed to teach nutrition in the community. Not finding a SE survey that mirrored skills taught in the Community Nutrition SL course, researchers developed the Self-Efficacy in Teaching Nutrition in the Community (SET-NC) survey. Researchers developed the SET-NC, creating items by adapting survey questions from the Nutrition-Teaching Self Efficacy Scale (Brenowitz and Tuttle, 2003), General Self-Efficacy Scale (Imam, 2007) and the College Teaching Self-Efficacy Scale (Prieto, 2005). Researchers also used personal experience teaching the Community Nutrition SL course and observing students teaching in the community to develop questions. The initial pool of survey items consisted of 65 items and after editing for redundancy, the 35-item SET-NC was the result. Items span the topics of problem solving, specific teaching abilities and extent of nutrition knowledge needed to teach basic nutrition topics in the community. A full list of questions can be found in Table 1. The SET-NC is measured on a 5-point Likert scale (Strongly Disagree to Strongly Agree) with scores ranging from 35 to 175. Two items are negatively coded and must be reverse coded.

Data Collection

Researchers administered the SET-NC to the experimental and control groups at three points in the semester: (1) the beginning of the semester (before pre-SL training), (2) midterm (after the pre-SL training and before the SL experience) and (3) the end of the semester (after the SL experience).

Table 1: Self-Efficacy in Teaching Nutrition in the Community (SET-NC) Questions

1	I can be flexible in my teaching even if I must alter my plans.
2	I can adapt to the needs of my students (motivation, interest, prior knowledge, etc.) when planning nutrition lessons to be taught in the community.
3	I have the ability to persist when community participants have difficulty with a concept when teaching nutrition in the community.
4	I have the ability to explain nutrition concepts at an age appropriate level when teaching nutrition in the community.
5	I have the ability to ask age appropriate questions when teaching nutrition in the community.
6	I can control disruptive behavior when teaching nutrition in the community.
7	If a community participant in my class becomes disruptive and noisy, I feel assured that I know some techniques to redirect him/her quickly.
8	I can promote student participation when teaching nutrition in the community.
9	I have the ability to maintain the attention of community participants when teaching nutrition in the community.
10	If a community participant did not remember information I gave in a previous lesson, I would know how to increase his/her retention in the next lesson.
11	I can gauge community participants' comprehension of what I have taught when teaching nutrition in the community.
12	When I am confronted with a problem, I can usually think of a solution when teaching in the community.
13	I can calmly handle any problems that may arise when teaching nutrition in the community.
14	I feel insecure about my ability to teach nutrition in the community.*
15	I can speak clearly and understandably when teaching nutrition in the community.
16	My teaching training program and/or experiences have not given me the necessary skills to be an effective nutrition educator.*
17	I can provide an alternate explanation or example when community participants are confused.
18	I have adequate training to teach nutrition in the community.
19	I have the skills necessary to teach nutrition concepts effectively to people in the community.
20	I can create a positive classroom climate for learning when teaching nutrition in the community.
21	I can encourage community participants to ask questions during class.
22	I have the ability to show enthusiasm when teaching nutrition in the community.
23	I can reflect on my teaching practice with the aim of making appropriate improvements when teaching nutrition in the community.
24	I can use information derived from my own self-reflection to improve my teaching in the community.
25	I can remain calm when facing difficulties when teaching nutrition in the community.
26	I can select the appropriate materials for each class when teaching nutrition in the community.
27	I can solve most problems if I invest the necessary effort when teaching nutrition in the community.
28	I can spend the time necessary to plan for teaching nutrition in the community.
29	I know how to handle unforeseen situations when teaching nutrition in the community.
30	I can usually handle whatever comes my way when teaching nutrition in the community.
31	I can update my knowledge of the subject I am teaching in the community.
32	I understand nutrition concepts well enough to teach them to people in the community.
33	I can answer people in the community's nutrition related questions.
34	I have the ability to use appropriate teaching materials and aids when teaching nutrition in the community.
35	I have the ability to use appropriate activities and experience when teaching nutrition in the community.

*reverse-coded questions

Data Analysis

Researchers entered the data into SPSS-21 software, using only data from students who completed all three time points. In order to obtain a composite score for each student, the negatively coded items were reverse-coded and then the responses to the 35 items were summed. Researchers conducted a repeated measures analysis of covariance (RM ANCOVA) with the time 1 SET-NC score as a covariate, the within-subject factor being occasion (corresponding to time 2 and time 3 SET-NC scores) and the between-subject factor being group (experimental or control). Independent-samples t-tests were also conducted to compare SET-NC scores of the experimental group and the control group at the three time points. Statistical significance was determined at $p < 0.05$.

Results and Discussion

An independent-samples t-test was conducted to compare SET-NC scores of the experimental group and control group at time 1. Results indicated that at baseline, students in the experimental group (μ=144.50, σ=13.86) scored significantly higher than students in the control group (μ=133.4, σ=13.67); t=-2.10, p=0.04. Therefore, time 1 was used as a covariant for the RM ANCOVA analysis.

Results of the RM ANCOVA indicated significant main effects for group F(1,2142.73)=21.09, p<.001 and the interaction between occasion and group F(1,381.47)=5.25, p=.026. There was not a significant main effect for occasion. Decomposing the interaction, results indicated the experimental group had significantly higher SE scores than the control group at both time 2 (p=0.008) and time 3 (p<0.001). Follow-up independent-samples t-tests of SET-NC scores of the two groups at time 2 indicated that students in the experimental group (μ=143.35, σ=13.05) scored significantly higher than students in the control group (μ=128.72, σ=15.52); t=-3.57, p=0.001. A similar follow-up independent-samples t-test at time 3 indicated that students in the experimental group (μ=153.60, σ=16.40) scored significantly higher than students in the control group (μ=131.17, σ=13.12); t=-5.60, p<0.001. Within the experimental group, students scored significantly higher at time 3 than time 2 (p<0.001) but there was no significant differences in the control group over this time period.

Researchers hypothesized that the SL course would have a significant impact on students' SE in teaching nutrition in the community. Results indicated that the hypothesis was correct. Community Nutrition students' SET-NC scores increased significantly over the course of the semester, indicating that participating in a SL course positively impacted students' SE. Because the control group students' scores did not change significantly over time, merely being enrolled in an upper-level nutrition course related to public health does not significantly increase SE. Therefore, the effects seen in the experimental group can be attributed to the information learned and experiences gained from the SL experience.

Students who enroll in Community Nutrition may be different from those who enrolled in Public Health Nutrition. Community Nutrition students' SE was significantly higher than Public Health Nutrition students' SE at the beginning of the semester, possibly due to previous teaching experiences. Another reason for this initial difference in SE may be due to the factors that motivate students to sign up for the SL class. Student teachers who begin teaching with higher SE are more likely to motivate themselves and perpetuate a higher SE (Tschannen-Moran et al., 2011); therefore, students who seek to become nutrition educators may be more motivated to maintain this SE over time. Personal interest and future career plans may also have motivated students to build their community nutrition teaching skills. However, optimistic student teachers' SE tends to decrease as they discover they do not have the skills they need to effectively teach (Tschennan-Moran et al., 1998). Therefore, it is important to build an educational environment that helps all students' SE increase, even when difficulties may arise.

In light of these results, the course design may provide insight into how key components of the Community Nutrition SL course may contribute to students' increase in SE over the course of the semester through vicarious learning, verbal persuasion, mastery and physiological/emotional arousal.

Vicarious Learning

Through a best practices video and real-time evaluation of peers, the instructors provided students with opportunities for vicarious learning early in the semester. There is evidence to support the merits of vicarious learning (Hagen et al., 1998); however, other studies have shown it is not a significant contributor to SE (Tschannen-Moran and Hoy, 2007). Therefore, providing vicarious experiences may be beneficial but may not replace actual teaching experience like that gained from a SL experience.

Verbal Persuasion

After students had learned vicariously from previous Community Nutrition students and their peers, the instructors verbally persuaded students through constructive criticism, highlighting both strengths and weaknesses with the ultimate goal of increasing SE. It is important for students to receive verbal persuasion that provides them with an opportunity to grow; otherwise they run the risk of decreasing their SE and giving up on teaching (Tschannan-Moran et al., 1998). This feedback should also be given frequently and be specific (Margolis and Mccabe, 2006). Additionally, professional development is a contributor to teaching SE; therefore, quality of instruction (and feedback) is important in building more efficacious student teachers (Tschannen-Moran et al., 2011).

Mastery

While verbal persuasion and vicarious experiences are important contributors to SE, the most influential source of efficacy information is mastery experience (Tschannen-Moran et al., 2007). The instructors designed the SL course to provide nutrition undergraduates the opportunity to master community nutrition teaching skills, and the combination of verbal persuasion through constructive criticism and incremental practice allowed most students to master the skills needed to be effective nutrition educators. Through constructive criticism from both peers and instructors and weekly critical reflection sessions during the SL experience, students' SE significantly improved by the end of the semester.

Critical reflection plays a key role in facilitating verbal persuasion and controlling physiological /emotional arousal, but it also mitigates the cognitive processing that turns efficacy information into analysis of the task and assessment of personal performance. Ash et al. (2009) describe a model by which students can reflect on their experience in the community and instructors can guide student learning. In the Community Nutrition course, the instructors fostered an atmosphere of self-reflection by facilitating reflection sessions during the SL experience and having students write a critical reflection paper at the completion of the semester. Therefore, instructors who wish to provide SL experiences for students should incorporate critical reflection so students are in the practice of evaluating their abilities and their limitations.

Physiological/Emotional Arousal

Finally, physiological/emotional arousal plays a role in building SE. students' state of mind and the context in which they teach influence the development of their SE. The instructors spent the last five years developing sustainable partnerships with community partners who believe providing the nutrition education program is a mutually beneficial process. The teaching environment is a key contributor to teaching SE, especially for novice teachers (Tschannen-Moran et al., 2007). Knowing that even under near "perfect" conditions, conflict and surprises may arise, the instructors identified peer teaching assistants/community liaisons to aid in times of conflict and assist with immediate peer feedback. Building this framework for a "low stakes" first teaching experience in the community, the instructors gave students emotional support to foster increases in SE. Through weekly critical reflection sessions, the instructors also gave students a chance to voice their concerns and triumphs and gain both peer and instructor feedback on how to respond to similar situations in the future. The instructors also met with students to resolve group and individual conflicts on an as-needed basis, knowing that students need social support while developing their skills.

This research provides significant evidence for beneficial student outcomes from a SL course. Students need to be provided "low-stakes" opportunities for mastery of teaching skills in order to build their efficacy in nutrition education. This training model can be adapted to involve any life science education program, allowing instructors at undergraduate institutions the opportunity to prepare their students to be effective community educators.

Limitations

There are limitations to the research, including that the sample was of students at one university. Students enrolled in this university may be different from students at other universities. Therefore, these findings may not be generalizable to the population of nutrition undergraduates as a whole. Additionally, there may have been a social desirability response where students may have believed that their SET-NC scores should have increased over time, causing them to artificially inflate their responses.

Summary

Results indicate that the Community Nutrition course, a SL course, significantly increased students' SE in teaching nutrition in the community. Undergraduate institutions can use the course design as a framework to develop similar life sciences courses aimed at increasing students' SE through verbal persuasion through feedback, vicarious experiences, low-stakes experiences to achieve mastery and a supportive environment to foster increases in SE.

Future research could involve the validation of the SET-NC through administration in undergraduate nutrition programs nationwide. After validation, the SET-NC could be a useful tool in measuring the effectiveness of undergraduate nutrition programs in preparing students to teach nutrition in the community.

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Factors Influencing Choosing Food and Agriculture Related STEM Majors

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Abstract

The need for food safety related professionals in the food and agricultural sciences is projected to increase by 10% from 2010 to 2020. Undergraduate institutions need to meet this demand by recruiting students into science, technology, engineering and math (STEM) major areas of study that support food safety professional career paths. The predictability of factors influencing students to choose STEM and non-STEM majors in three colleges offering baccalaureate degrees related to food and agriculture sciences, liberal arts and other non-STEM majors was investigated. An online survey obtained information from students (N=458) regarding the influence of factors related to extracurricular activities, aptitude, environment, relationships, career ambitions and educational experiences on a student's choice of major. The survey data was used to generate odds ratios using logistic regression analysis. The odds ratios provided a comparison of predictors that potentially influenced a student's choice of a major when all other factors in the study were accounted for. The inclusive logistic regression model identified three predictors as highly significant ($P < 0.01$) in choosing a STEM major in the colleges of Arts and Sciences, Agriculture and Biological Sciences and Education and Human Sciences. The odds ratios of passion for chosen career (1.50, $P<0.01$), financial gain and stability (1.98, $P<0.001$) and high school courses (1.14, $P<0.001$) were all highly significant. These predictable variables potentially influence recruitment strategies for universities and the educational STEM programs in high schools and introductory college courses.

Introduction

There is a growing need for students educated in the sciences, technology, engineering and mathematics (STEM) related majors supporting food and agriculture careers. Academic institutions need to identify how to best recruit, retain and prepare students for degrees in agriculture related fields of study (Association of Public Land-Grant Universities [APLU], 2009; Bartsch and Levi, 2009; Committee on a Leadership Summit to Effect Change in Teaching and Learning [CLS], 2009). The United States Bureau of Labor Statistics (USBLS) (2012) projected an increasing demand of 10% from 2010 to 2020 for professionals in degrees related to food and agricultural science. At the same time, the APLU forecasted only 55% qualified professionals to fill the demand. This increased demand is considered a standard growth, relative to many other types of applied STEM professional careers. This demand also increases food safety professional's employment opportunities and salaries that are competitive with similar professional STEM career paths.

The National Research Council's Board on Life Sciences special committee produced four broad societal challenges in food, environment, energy and health (Higher Education Challenge Grant Program [HEC], 2013). The first challenge is to generate food plants to adapt and grow sustainably in changing environments. The second is to understand and sustain ecosystem function and biodiversity in the face of rapid change. The third challenge expands sustainable alternatives to fossil fuels. The final societal challenge is to understand individual health. These challenges address the need for students to meet societies' demands both nationally and globally in STEM fields of study is a grave concern by educators, industry and government.

Several factors potentially influence a student's decision regarding their declaration of a major when beginning their course of study. The factors influencing student's career path choices are commonly investigated by focusing on one or two factors such as family, teachers, social groups, gender, ethnicity, courses, academic abilities, attitudes, life experiences, personal

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and professional goals and career aspirations (Baker et al., 2009; Brake et al., 2008; Ferry, 2006; Gerardi, 2006; Hong and Schull, 2010; Kelly et al., 2009; Mallory and Summer, 1986; Marshall et al., 2010; Tang et al., 2008; Thompson and Bolin, 2011; Tillberg and Cohoon, 2005; Whalen and Shelley, 2010). Gaining insight regarding the factors that have a stronger predictability for students to choose a major have potential to influence educational programs and/or recruiting tools used by high schools, colleges, industry and government.

The purpose of this study was to identify the predictability of factors influencing a student to choose a STEM major rather than a non-STEM major when entering college. The colleges included in the sample population were those with agriculture and food science related majors (Colleges of Education and Human Sciences (EHS) and Agriculture and Biological Sciences (ABS)). The colleges of engineering, pharmacy and nursing were not included since these STEM related majors are not closely associated to food safety career paths more commonly observed in food and agricultural sciences. To increase the number of non-STEM majors, the college of Arts and Sciences (AS) was also included in the study. Based on the increased demand for food safety STEM related professionals, this study hypothesized that the predictors related to financial gain and security will have a higher odds ratio for students choosing a STEM major than those choosing a non-STEM major in the colleges of ABS, AS and EHS.

Methods

Participants

The sample population identified for this study included 1,826 students from the three colleges of ABS, EHS, AS. A total of 458 students completed the survey, of which 79% were in their first semester of college at South Dakota State University. Recruiting students with newly declared majors reduced the impact of environmental factors possibly contributing to their decision after immersion in a university experience within their major (Hodges and Barbuto, 2002; Mallory and Summer, 1986; Tang et al., 2008). The convenience sample was based on the following criteria: STEM majors most closely related to food and agricultural sciences are in the colleges of EHS and ABS and diversity among non-STEM majors in the colleges of EHS, ABS and AS (visual and performance arts, journalism, marketing, business, rural sociology, economics and consumer affairs). Several studies focus on one variable such as rural in comparison to non-rural life experiences, gender, work experience or ethnic groups (Brake et al., 2008; Hodges and Barbuto, 2002; Mallory and Sommer, 1986). Thompson and Bolin (2011) compared STEM to non-STEM influential factors, however their investigation was limited to education and business majors, and this seven-year cohort study analyzed secondary academic data, not personal values and experiences of the participants.

Survey Tool Development

A survey obtained data on the factors that were influential for a student declaring a major area of study. The survey design was retrospective and prospective in nature (Hodges and Barabuto, 2002; Kelly et al., 2009; Tang et al., 2008;). Participants reflected on life's experiences influencing their college major decision. The prospective portion of the survey incorporated personal and professional goal statements related to career path, including college major. Participants assigned a numerical value of a self-perceived level of influence. Other survey items were descriptive such as identification of class-size or involvement in an extracurricular activity.

The survey was developed for delivery and distribution via Internet using QuestionPro©, an on-line survey program. Survey management practices incorporated for online delivery included a perceived ease of use, monetary incentive, technology that does not allow additional ballot stuffing, confidentiality and privacy (Dillman et al., 2009; Singh et al., 2009). This study was deemed exempt by the South Dakota State University Institutional Review Board.

Students outside the sample group completed the survey tool and provided feedback regarding the readability and clarification of questions throughout the development phase (Radhakrishna, 2007). The internal reliability of the survey was measured with Cronbach's alpha ($p < 0.05$) and inter-item correlation using Pearson's Product-Moment Correlation for identification of inconsistencies. Influential factors were addressed with several questions on the survey to improve reliability (Gliem and Gliem, 2003), particularly factors that were of an emotional or psychological nature.

Survey Distribution

Faculty in the colleges of EHS, ABS and AS provided the survey link to the target population through the universities online course management system. Coverage error was addressed by distribution of the survey through required classes of all newly declared majors (Dillman et al., 2009; Key, 1997). Students maintain money debit accounts accessed with their student ID card. As an incentive to participate in the study, $2 was credited to each student's debit account when a completed survey was submitted electronically. Their names were also entered for a $25 drawing (Dillman, 2012; Porter and Whitcomb, 2003).

Statistical Analysis

The survey question format was developed for statistical analysis of the data using logistic regression and principal component analysis (PCA). Students identified their declared major, which was categorized into a STEM or non-STEM major. A total of 62 major areas of study were listed on the survey with 49 different majors identified by the participants.

There is no test that provides an absolute value to combine survey items into predictor variables (Webster,

2001). Therefore, the statistical tool of PCA and experience with the survey items by the researchers generated predictor variables utilized in the logic regression models. This also reduced the number of predictor (independent) variables as identified by Meda et al. (2009) and avoid multicollinearity. Principal component analysis results identified commonality between survey items using factor-loading computations (Table 1). Principal component analysis supported the creation of 20 predictor variables (SAS Support Website [SASWS], 2005) from the initial 38 survey items. Each of the 20 predictor variables (Table 2) created from PCA was assigned a title to provide meaning to the predictor. The 20 predictor variables were placed into one of eight groups including relationships, extracurricular activities, graduating class size, agriculture environment, educational experiences, career ambitions and aptitude. These groups were incorporated into logistic regression models (SASWS, 2005).

Categories of Predictor Variables

All students completing the survey identified participating in at least one extracurricular activity. The predictor variables of extracurricular activities (Table 2) generated from the factor loading values from PCA (Table 1) included agriculture, academic/leadership, athletics, scouting, debate and arts. Previous studies (Baker et al., 2009; Balschweid and Talbert, 2004) focused on one or two specific extracurricular activities, not several as this study did.

Based on the PCA results (Table 1), the relationship predictor variables (Table 2) included personal relationships (parents, friends and relatives), educators (high school and college teachers) and employment (supervisor or co-worker). The students rated the level of influence by each person on a scale of 0 to 10 (0 = not influential and 10 = extremely influential). Similar studies focused on fewer variables. Ferry (2006), Marshall and others (2010) investigated the influence of family and community within a specific ethnic groups career development. While another study focused on the influence of parents and teachers while accounting for gender when choosing a major in computer sciences (Tillberg and Cohoon, 2005).

Due to the increasing demand for food and agricultural science professionals (USBLS, 2012), the survey addressed market forces, passion for a career and a more passive approach. The students were presented with ten statements and asked to identify if the statement was not a factor, somewhat agree, essentially agree and couldn't agree more. Based on the PCA results (Table 1), the predictor variables (Table 2) addressing career ambitions included research, passion/enjoyment, financial gain/security, parents career and passive. Several of the predictor variables were in agreement with investigations addressing market forces and parent's career (Hodges and Barbuto, 2002; Kelly et al., 2009; Tang et al., 2008; Tillberg and Cohoon, 2005).

Students assigned a self-perceived value (0 to 10) to life experiences that may have influenced a

Table 1. Potential Influential Factors from Student Survey Condensed into Predictor Variables using Principal Component Analysis

	Loading Factors			
Extracurricular Activities (Values > 37 flagged "*")	**Agriculture**	**Arts**	**Athletics**	**Academics Leadership**
4-H	82*	5	1	-4
FFA	81*	-2	6	-1
Scouting	1	69*	-2	-19
FCCLA/FBLA	4	-4	-16	57*
Athletics	-4	-11	84*	-18
Theater/Oral-Interp	16	55*	3	47*
Music/Dance	18	55*	6	21
Debate	-24	53*	2	-10
Speial Interest/NHS/SC/FL	-3	-1	15	74*
Relationships (Values > 47 flagged "*")	**Personal**	**Employment**	**Educators**	
Parents	79*	-1	16	
Friends	60*	26	23	
Relative	79*	12	0	
HIgh School Teacher	16	0	84*	
College Teacher	10	28	69*	
Employer	11	85*	12	
Career Ambition (Values > 45 flagged "*")	**Passion**	**Financial**	**Parents Passive**	
Researched career	53*	50*	-21	
Financial Gain	-16	79*	13	
Job Security	26	74*	4	
Parent's Career	24	-5	71*	
Passion	86*	2	-2	
Enjoyment	85*	2	7	
Passice-Courses	-52	13	46*	
Goals	65*	33	-5	
Passive - more research needed	-22	11	66*	
Relationships (Values > 52 flagged "*")	**Experiences**			
High School Course	31			
College Course	45			
Job	44			
Vounteer Work	63*			
Extracurricular Activities	48			
Movie or Book	54*			
Trip or Vacation	64*			
Youth Camp	58*			

Note:
Printed values are multiplied by 100 and rounded to the nearest integer.
* refers to items that have commonality from factor loading computations using Rotate Factor Pattern - Rotation Method Varimax, SAS (version 9.2, Cary, NC, USA)

student's choice of major. Using PCA (Table 1), the predictor variables of events (volunteer work, movie or book, trip/vacation and youth camp), high school and college courses were created (Table 2). A similar study by Tang et al. (2008) focused on opportunities, such as life's experiences, impacting students to explore careers.

Inclusive Logistic Regression Model

Logistic regression analysis calculated the odds ratio of the predictors using an inclusive model (Table 3). The inclusive model included all 20 predictors (Table 2) potentially influencing a student to choose a STEM or non-STEM major (Pallant, 2010). The results were statistically significant at one of three alpha levels: $P < 0.05$; $P < 0.01$; and $P < 0.001$. All data was standardized through logistic regression analysis, therefore all ordinal variables were weighted the same. The Statistical System Software package SAS (Version 9.2, Cary, NC, USA) was used to conduct the analysis.

Results and Discussion

Description of Respondents

Of the potential 1,826 students exposed to the survey link, 458 students fully completed the survey (response rate of 25%) with 311 students choosing a STEM major compared to 147 non-STEM majors. Although there was an imbalance, the number of students responding by majors was representative of the number of graduates with the same majors at South Dakota State University. Additionally, an imbalance within a sample is found to be of minor importance when using logistic regression (Crone and Finley, 2012).

The majority (47%) of the students responding to the survey were from the ABS College. Twelve percent were enrolled in the AS College and 31% in the EHS College. Several students (9.74%) were from the University College (UC). All of the UC students were in the first two years of the college and newly declared non-STEM majors. Including these students increased the critical mass of the sample for the logistic regression analysis. Students that are undecided about their major had the option to enroll in the UC to support them in the process of choosing a major.

The representation of the sample group (those completing the survey) to the reference population (students in the colleges of ABS, EHS and AS) was identified by comparing the percentage of each major completing the survey to the percentage of students that graduated in 2013 with the same majors. When referring to the 49 majors identified by the respondents, 42 majors had percentage differences of 2% or less between sample group and reference population. The trend-lines (Figure 1) demonstrate similarities between the sample group and reference population.

The students represented a rural demographic. 53% of the students were from schools with less than 100 students in their graduating class (10.5% less than 25 students) and 28% were from graduating classes greater than 200 students. Growing up on a farm was self-identified by 36% percent of the students. The greatest percentage of students (45%) had a high school grade point average (GPA) of 3.6 to 4.0 (scale of 0 – 4), while the highest percentage range of ACT scores were 21 to 25 (47%). ACT served as the indicator for scholastic aptitude since it is the standard adhered to by the South Dakota Board of Regents (2010).

Table 2. Predictor Variables - created through principal component analysis and utilized in Logistic Regression Analysiss Models

Variables	Description of Question
1. ACT exam-score (aptitude)	Stand-alone. College entrance exam majority of students take for SDSU admittance. Ranging from <15 to >30, or NA
2. Grow up on a farm	Stand alone (Yes or No)
3. Graduating Class Size	Stand alone: <25, 26-50, 51-100, 101 – 200, > 200, Home Schooled, NA
4. Scouting	Stand-alone (refers to Boy or Girl Scouts).
5. Debate	Stand alone since < 5% chose this activity
6. Academics and Leadership	Family Community and Career Leaders of America (FCCLA), Future Business Leaders of America (FBLA), National Honor Society (NHS), Student council (SC), Foreign Language (FL)
7. Athletics	Stand alone –all sports including rodeo, martial arts, cheerleading
8. Agriculture	4-H and/ FFA
9. Arts	Theater, Dance, Music, Oral Interpretation, Film
˙Items below assigned a value (0 to 10, or 1 to 5) of self-perceived influence by students completing survey	
10. Work Relationships	Employer, Coworker
11. Personal Relationships	Parents, Friends, Relatives
12. Educators	High School and College Teachers
13. High School Course	Stand alone
14. College Course	Stand alone
15. Event	Book, Movie, Youth Camp, Vacation
16. Research	Thoroughly researched career possibilities. Stand alone
17. Parents Career	Closely related to parents career. Stand alone
18. Passion/Enjoyment	Passion for career, enjoyment, money not as much of an issue,
19. Financial Gain/Security	Career goals clear, Financial Gain, Job security
20. Passive	Decision tied to completed coursework, limited career research

N=458 Results of Principal Component Analysis of 38 item survey
Note: ACT – College Entrance Exam Test; NA – Not applicable
˙All values standardized by Logistic Regressions Analysis
Principal Component Analysis computed using Rotated Factor Pattern – Rotation Method Varimax, SAS (version 9.2, Cary, NC, USA)

Logistic Regression Analysis

Based on the purpose of this study, an inclusive regression model incorporated all the predictor variables to identify the odds ratio of one predictor influencing a student to choose a STEM major (Table 3). The inclusive model goodness-of-fit analysis reached the 99.99% confidence level. Three of the 20 predictors significant at a 99.9% confidence level were financial gain/stability, passion/satisfaction and high school course.

Two of the significant ($P < 0.01$) predictors recognized as influential factors were related to career ambi-

tions (Table 3). The odds ratio of passion/job satisfaction was 1.50 (P < 0.01) for choosing a STEM over a non-STEM major. Students valuing financial gain/stability had even higher odds ratio (1.98, P < 0.001) of choosing a STEM major in the three colleges studied. These results were in agreement with the Social Cognitive Career Theory (SCCT), which evolves throughout a person's lifetime (Lent and Brown, 2006). An individual's behavior (choosing a major) is reflective of the goals (career ambitions) they set and strive for.

The predictor of high school courses was positive (1.14, P < .001) when all other variables were held constant (Table 3). The survey did not identify specific courses. These results were supported by the SCCT, which relates expected outcomes to actual experiences (Lent and Brown, 2006). College courses were not identified as significant. A majority (79%) of the students completing the survey were in their first semester of college. Therefore the experience of a college course influencing their choice of a major was not available to them.

Table 3. Inclusive Model - Odds ratios of predictor cariables influencing students to major in a STEM field of study when all other cariables are accounted for. Sample (N=458)-- Newly declared majors from colleges of Agriculture Biological Sciences, Arts and Sciences, Education and Human Sciences.

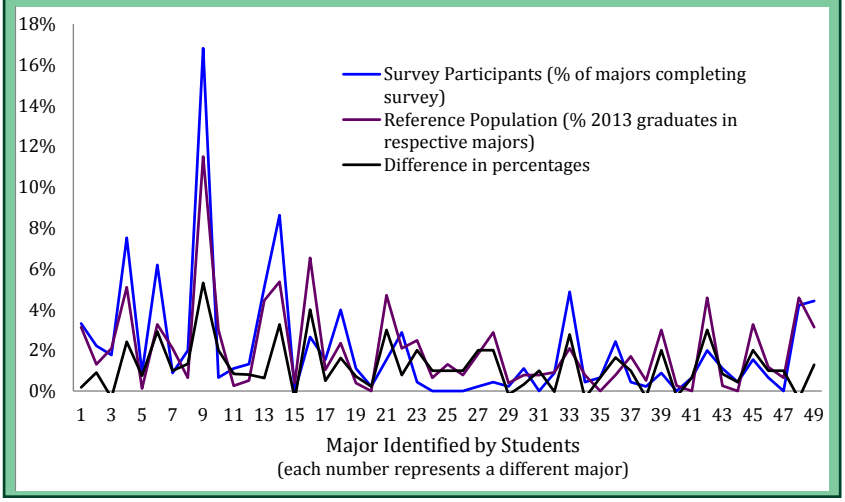
Predictor Variables	Coefficient	Std Error	Odds Ratio
Aptitude -- ACT exam score	0.30	0.16	1.36
Agriculture Environment -- Grew up on farm	-0.03	0.10	0.97
High School Graduating Class Size	-0.31	0.32	0.73
Extracurricular Activities			
Scouting	0.85	0.64	2.33
Debate	1.20	0.72	3.32
Agriculture (4-H and FFA)	-0.05	0.11	0.95
Academic/Leadership (FCCLA, FBLA, NHS, SC, quiz bowl, FL)	0.20	0.15	1.22
Arts (theater, music, visual, dance, film)	0.09	0.13	1.07
Athletics	-0.40	0.23	0.67
Relationships			
Personal (parents, friends, relatives)	0.08	0.12	1.08
Educator (high school and college teachers)	-0.04	0.13	1.04
Employment (employer and co-worker)	0.04	0.13	0.96
Career Ambitions			
Researched	-0.11	0.20	0.90
Parents Career	-0.22	0.19	0.80
Passion/Enjoyment	0.40	0.15	1.50**
Financial Gain/Security	0.68	0.15	1.98 ***
Passive	0.34	0.18	1.40
Educational Experiences			
High School Course	0.13	0.04	1.14 ***
College Course	-0.04	0.04	0.96
Events (movies, books, camps)	-0.11	0.14	0.89

Note: Goodness of Fit: Wald: 56. P < 0.0001***

*, **, *** Significant at P < 0.05, 0.01, or 0.001, respectively using Chi-Square

Coefficients and Odds Ratios Calculated with Logistic Regression Analysis, SAS (version 9.2, Cary, NC, USA)

Figure 1. Comparison of sample group (N=458) to reference population: Percentage of students by major completing survey compared to percentage of students graduating by major in colleges of Education and Human Sciences, Arts and Sciences, Agriculture and Biological Sciences



A study by Brake and others (2007) asked 25 students to share the three most important activities or people that influenced their decision to pursue a career in technology/engineering. The number of students identifying math or science classes and clubs was marginal, 12 of the 25 students. When teachers were included in the results, along with classes and clubs, the results accounted for all of 25 students. However, the odds ratios for teachers (high school or college) were not significant (P > .01) in this study (Table 3).

The odds ratios for the predictors in the relationships category were not significant (P > .01) (Table 3). Examples of these variables included influence from family, friends, coworkers, employers and teachers. This same phenomenon is seen in similar studies where teachers, family and community were identified as influential in choices related to career, major and choice of college, regardless if it is STEM or non-STEM (Ferry, 2006; Hong and Schull, 2010; Marshall et al., 2010).

Growing up on a farm and size of high school were not significant (P > 0.1) (Table 3). Students were asked if they grew up on a farm; they were not asked to identify if growing up on a farm influenced their choice of a major. Thirty-six percent of the respondents grew up on a farm. This was substantial when considering the number of people that actually live on farms in the United States is 2% (Environmental Protection Agency [EPA], 2012). When the logistic regression models were applied solely for growing up on a farm and size of high school, they did not have a good fit (P > 0.5).

Conclusions

Students are 1.5 times more likely to choose a STEM major in the colleges of ABS, AS and EHS if a passion for their career and job satisfaction were important to them. This observation is based on the significant odds ratio (1.50, P<0.01) of passion/satisfaction (Table 3). Additionally, students valuing financial gain/stability are 1.98 (P < 0.001) times more likely to choose a STEM major in the same three colleges (Table 3).

The results of this study supported the hypothesis: based on the increased demand for food safety STEM related professionals, this study hypothesized that the predictors related to financial gain and security will have a higher odds ratio for students choosing a STEM major than those choosing a non-STEM major in the colleges of ABS, AS and EHS. Additionally, the odds ratios for passion/enjoyment (1.50) and high school course (1.14) were also significant (P < 0.01). Therefore, the career ambitions predictors of financial gain/security and a passion/enjoyment potentially impact recruitment strategies to STEM majors in the colleges studied.

The significant odds ratio (1.14, P < 0.001) of the high school course predictor potentially supports the importance of educational systems striving to make STEM related courses engaging and with a problem-solving approach (Next Generation Science Standards (NGSS), 2013). The survey included one item related to high school courses, more research is needed focusing on the impact of high school classes specific to students that have chosen a major related to STEM courses connected to the safety of the food supply.

Additional studies to build from this project include focusing solely on food safety related majors to investigate factors that influenced their career path. More in-depth data could be useful in recruitment strategies for students to food safety related majors (particularly those related to agriculture and food sciences).

Limitations of the Study

The population studied was limited to students in three colleges at South Dakota State University. Since this study focused on STEM majors related to agriculture and food science, the colleges of Engineering, Nursing and Pharmacy were not included in the research. Since these three colleges have programs that are solely STEM in nature, the results would likely have higher odds ratio values, increasing the predictability in the models that were studied.

Gender differences were not analyzed in the initial logistic regression models. Follow-up tracking identified 39% of the students as males and 61% female. The analysis was later conducted with and without gender. There was no statistical significant difference in the results when the gender was included in the logistic regression model. However, equal numbers of males and females may have changed the results.

The percentage of students living on farms was not representative of the U.S. population. However when targeting only three colleges, with one being the Agriculture college, the higher percentage was expected. Growing up on a farm is a different experience from growing up in an urban area.

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Does Study Abroad Increase Employability?

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Abstract

The purpose of this study was to explore the competencies and experiences valued by prospective employers in the agriculture and natural resources (ANR) industry to understand if study abroad experiences increase employability. All recruiters agreed interpersonal communication and leadership skills are necessary to be effective in their organizations and a majority of the recruiters had an interest in hiring employees with previous study abroad experience despite somewhat ambivalent views on the importance of cultural and global competencies for employees. Facilitators of study abroad programs in ANR should emphasize the skills sought by recruiters and overtly create opportunities for students to develop these skills.

Introduction/Theoretical Framework

The international expansion of businesses in the 21st century has underscored the need for talented and trained college graduates prepared to work in a global economy; agricultural companies are no different (Bybee and Fuchs, 2006; Dunavant and Heiss, 2005; McDowell et al., 2008). Flattening of the world (Friedman, 2006) through increases in trade agreements and rapid advances in technology has expanded many agricultural companies into international organizations with hubs in many nations. Examples include Syngenta, Archer Daniels Midland and John Deere. As agricultural companies increase their global positions, they "have begun to recognize the importance of recruiting personnel with knowledge and understanding of cultural issues, as well as the capacity to manage relationships and a culturally diverse workforce" (Crossman and Clarke, 2009, p. 599).

Employers often do not put much value in study abroad programs despite wanting students to have international experiences (Crawford et al., 2011). Crawford et al., (2011) found employers, students, faculty and alumni rank international experiences the lowest of all experiences that students are exposed to during their academic careers. According to Matherly (2004), managers think study abroad programs are filled mostly with "students [who] lived with other Americans, took courses from U.S. professors and socialized mostly among themselves" (Herren, 2006; Matherly, 2004, p. 9). However, Gardner et al., (2009) found many of these managers "had no first-hand experience with these programs because study abroad was not available to them during their undergraduate days or they were not aware these programs existed" (p. 19).

Study abroad programs provide students with the opportunity to learn about another culture while continuing their education through a variety of activities and experiences. Nearly 280,000 students in the United States participated in a study abroad program in 2011 (Redden, 2012). Students today understand the importance of diversifying their educational portfolio to ensure better candidacy for employment (JWT Education, 2003), and employers are looking for "graduates [who] are capable of contributing to 'economic competitiveness in a global context'" (Cranmer, 2006, p. 170). However, students need assistance "unpacking" these international experiences (Crawford et al., 2011).

The responsibility is on students to effectively articulate how their study abroad participation enhanced their employability given that managers may be misinformed or negatively prejudiced against study abroad experience. Despite evidence indicating managers have poor opinions of study abroad experience, Matherly (2004) indicated companies have an interest in students with "meaningful 'real world experience' with another culture" and who can "speak about [their] experience in terms of the transferable skills that he or she developed while abroad and how they can be applied to the workplace" (p. 9). The conflicting research highlights the need to better understand how students with study abroad experience can frame their experiences in messages that are understood and valued by prospective employers. The study reported in the following sections was intended to address this need.

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The researchers approached this study through the lens of developing human capital. Since the 1950's, human capital has been the foundation for why individuals should focus on the development of key skills and knowledge (Schultz, 1961). Human capital originated as an economic concept promoting the development of a stronger, more able and competitive workforce. Schultz (1961) contended "the productive capacity of human beings is now vastly larger than all other forms of wealth taken together" (p. 2). An individual's personal investment in activities that produce measureable outcomes in skill, knowledge and "other similar attributes" creates a working model for human capability (Schultz, 1961, p.8).

To improve one's capabilities there are five major categories of emphasis: health, on-the-job training, formal education, study programs and migration (Schultz, 1961). According to Becker (1962), human capital is one's investment in activities that will have considerable impact in the future. Both Schultz and Becker placed considerable emphasis on education as being the primary means for developing human capital.

According to Griliches (1997), an individual with low initial human capital may improve that situation by investing in intensive full-time schooling followed up with on-going training. Over the past fifty years, education has been the primary targeted means for ensuring employability in certain career fields (Griliches, 1997). However, if the return on investment begins to diminish with market saturation, then individuals must seek out alternative ways or experiences to build human capital that provide added value.

To guide the development and interpretation of this study, the researchers consulted literature within a context of agriculture and natural resources (ANR) related to: (a) general skills and competencies desired by employers of new graduates, (b) cultural and global competencies of graduates and (c) the impacts of study abroad on developing competencies.

General Skills and Competencies Desired by Employers

The literature generally supports that employers value soft skills in new employees as much or more than they value technical skills (Crawford et al., 2011). For example, Alston et al., (2009) found technical competencies in mathematics, social sciences, agricultural sciences, physical sciences, biological sciences and the humanities were all rated as less important than soft skills. In contrast Jogan and Herring (2007) found employers in the equine industry value a mixture of technical and soft skills. The contemporary literature is beginning to provide a better understanding of the specific soft skills desired by employers.

Communication skills are widely valued by employers (Crawford et al., 2011; Jogan and Herring, 2007). Several specific aspects of communication emerged in the literature. These included: understanding instructions (Alston et al., 2009), listening (Alston et al., 2009; Robinson et al., 2007) and verbalizing (Alston et al., 2009). Two studies highlighted the importance of communication skills but failed to elaborate on specific aspects of those skills (Jogan and Herring, 2007; Radhakrishna and Bruening, 1994).

Employers also valued problem-solving skills (Crawford et al., 2011) and numerous terms were used to describe this set of skills. Some examples include decision making/problem solving (Crawford et al., 2011), decision making (Robinson et al., 2007) and analytic skills (Robinson et al., 2007). Two studies implied a certain level of technical understanding was needed to solve problems (Jogan and Herring, 2007; Radhakrishna and Bruening, 1994). Despite the desire for problem-solving skills, employers often indicated that the new graduates were deficient in these skills (Robinson et al., 2007).

The ability to work with others is also valued by employers (Crawford et al., 2011). Some specific examples included teamwork (Alston et al., 2009; Crawford et al., 2011), leadership (Crawford et al., 2011), working well with others (Robinson et al., 2007), ease to work with (Irlbeck and Akers, 2009) and interpersonal skills (Jogan and Herring, 2007; Radhakrishna and Bruening, 1994).

Another common set of skills valued by employers related to self-direction. This concept is represented with several terms in the literature like self-management (Crawford et al., 2011), ability to work independently (Robinson et al., 2007b), organization and time management (Robinson et al., 2007b) and dependability (Alston et al., 2009).

Cultural and Global Competencies of Graduates

Today's college graduates must be culturally aware and prepared to work in a global economy (National Research Council, 2009). The need to internationalize the undergraduate curricula in agriculture and natural resources has been noted for some time (Duffy et al., 1998) and is supported by students studying agriculture and natural resources (Sammons and Martin, 1997). Students value global competence and seek out international experiences to "enhance their overall life experience, for the opportunity to live in another culture and to increase their employability" (Briers et al., 2010, p. 5) and ultimately increase their human capital.

According to Russo and Osborne (2004), a globally competent student: (a) understands the world from multiple perspectives, (b) understands international dimensions of their discipline, (c) is able to communicate across languages and cultures, (d) demonstrates awareness and adaptability related to other cultures and (e) continues to develop his/her global competence throughout life. In a study supported by the American Association of Colleges and Universities, Hart Research Associates (2010) found employers want to hire graduates who: "[have] the ability to understand the global context of situations and decisions, [understand] global issues and developments and their implications for the future, [understand] the role of the United States

in the world and [understand] cultural diversity in America and other countries" (pp. 1-2). In a study specific to agricultural education, Conner and Roberts (2013) found graduates needed to have a basic understanding of political, cultural and agricultural issues from around the world.

Despite the calls for preparing students to work in a global environment, there are several indications that this has not yet happened. In general, students do not understand agriculture and natural resources on a global scale. Redmann et al., (1998) found students were deficient in their understanding international agriculture. In a similar study, Wingenbach et al. (2003) found only approximately 5% of the students in their study could earn a passing score on an assessment of their knowledge of international agriculture.

The Impacts of Study Abroad Experiences on Developing Competencies

The outcomes of study abroad programs have been well documented in the literature. The specific outcomes vary by each program. The impacts of study abroad programs include changes in technical knowledge, cultural awareness, attitudes and soft skills. For example, in a service oriented study abroad program, Black et al., (2013) documented student impacts in the themes of adaptation, culture, collaboration, communication and value of knowledge. In a study of three different study abroad programs, Coers et al., (2012) found students had increased understanding of agriculture in the country visited, as well as international agriculture in general. Students also had more favorable attitudes about traveling internationally. Student perceptions about the importance of international educational experiences were mixed. In an earlier study, Zhai and Scheer (2002) found study abroad programs impact students' global perspectives and their awareness of cultural diversity.

The existing literature examines the desired competencies for new graduates from multiple perspectives and generally agrees that soft skills are the most desired skills for new employees. The literature also generally supports the importance of global and cultural competence for today's college graduate. Research has also shown study abroad programs can develop technical and soft skills. However, one voice is missing in this literature: the voice of the recruiter that travels to colleges and universities using career fairs in an effort to find the most qualified candidates. Van Vianen (2000) referred to the role of a recruiter as being responsible for assessing potential employees' fit. This fit is often gauged on three levels: (a) cognitive ability and work motivation, (b) job specific cognitive abilities, knowledge and personality traits, or (c) organizational culture. This is often referred to as "P-O" or person-organization fit (Van Vianen, 2000, p. 113). These recruiters serve as the gatekeepers or first screeners of new graduates seeking employment (Blevins, 2013). Understanding which competencies are sought by recruiters and their perceptions of the value of study abroad in developing those competencies is important for helping students increase their employability.

Methods

The purpose of this study was to explore the competencies and experiences valued by prospective employers in the ANR industry to understand if study abroad experiences increase employability. Specifically, the objectives were to (a) identify the skills and experiences sought by recruiters, (b) describe the perceived importance of cultural and global competencies for employees in each recruiter's organization and (c) determine if recruiters had interest in hiring prospective employees with study abroad experience. A basic, or generic, design (Merriam, 2009) was used to guide the study.

Context

In February of 2013, a Career Expo was hosted by the College of Agricultural and Life Sciences at the University of Florida. Over forty employers attended the Career Expo. Twelve of these were purposively selected for interviewing. Selection criteria emphasized the national reputation of each employer as well as the size of the employer, with preference given to organizations that are likely to hire a large number of new graduates each year.

The recruiters from twelve employers were initially targeted for inclusion as potential participants. Representatives from eleven of the twelve employers provided consent to be interviewed. The employers were Dow AgroSciences, LLC; Florida Nursery, Growers, and Landscape Association; Helena Chemical Company; LYKES BROS. INC.; Monsanto; Murphy Brown LLC; Rabo AgriFinance; USDA Farm Service Agency; USDA Food Safety and Inspection Service; USDA Natural Resources Conservation Service; and Walt Disney World Animal Programs. Careers offered by these companies are broadly related to biotechnology, crop production and protection, ranch management, pork production, agricultural finance and credit, food safety, natural resource conservation and animal husbandry.

Data Collection

Primary data for this study were collected though semi-structured interviews conducted during the Career Expo. The University of Florida Institutional Review Board 2 approved the study protocol (2013-U-0101). Representatives from each of the consenting employers were interviewed individually by a researcher from the team. Participants were asked to discuss (a) the skills and experiences they look for in potential employees, (b) if cultural and global skills, knowledge and perspectives were necessary for success and how potential employees might demonstrate those, (c) if the employer worked to develop cultural and global skills, knowledge and perspectives in its employees, (d) the importance of cultural and global skills, knowledge and perspectives for career progression and (e) the employer's potential

interest in hiring prospective employees with study abroad experience. All interviews were audio recorded with written informed consent from the participants prior to data collection.

Data Analysis

The recorded interviews were transcribed professionally by an independent party. Two of the researchers independently conducted the initial analysis of the data set. Peer debriefing occurred with the entire team of researchers to vet the initial findings and develop the final interpretation of the data. Data were analyzed using the constant comparative method (Glaser and Strauss, 1967). This generated theoretical properties of each category, providing an understanding of the data and its relation to and effect on other categories (Erlandson et al., 1993).

The initial analysis of the data included reading and determining recurring themes throughout the data. The thick rich description of the data set allowed for inductive analysis leading to the discovery of patterns, themes and categories (Lincoln and Guba, 1985). Similarities emerged in responses among respondents. These similarities in the data provided the foundation for generating identifiable categories within each objective area. The defining rule for the constant comparative method is "while coding an incident for a category, compare it with the previous incidents in the same and different groups coded in the same category" (Glaser and Strauss, 1967, p. 106). Data were coded into emergent categories and through constant comparison of the categories and their properties, the researchers developed theoretical perspectives about the contexts.

When conducting qualitative research, potential for researcher bias exists. All of the researchers belong to a center that advocates for the importance of global experiences for university students. Three of the faculty researchers had prior experience leading short-term study abroad trips for undergraduate and graduate students. One of the faculty researchers lived in Europe for a large portion of childhood. Amongst the graduate student researchers, three had experience participating in, coordinating and/or evaluating short-term study abroad trips, two were returned Peace Corps Volunteers, two are first-generation Americans and one had experience on an extended study abroad. Collectively, the research team had traveled to 36 unique countries at the time of this study for personal or professional reasons.

A pro-global education bias may have influenced the analysis and interpretation of findings. However, the research team used several techniques recommended by Lincoln and Guba (1985) to enhance trustworthiness. An audit trail was maintained throughout the data analysis. Member checks were conducted with the respondents to allow for verification of data and findings. This provided respondents with the opportunity to correct or clarify any statements recorded. Finally, two peer debriefings to discuss the findings were conducted with professionals (a) not associated with the study, (b) not associated with the global center and (c) with limited personal or professional international experience.

Results

Objective 1 – Skills & Experiences Sought by Recruiters

Leadership and communication skills

All respondents focused on the development of interpersonal leadership and communication skills as important for prospective employees. The identified skills were inclusive of the willingness to learn, self-confidence, motivation, integrity and industriousness. There was also considerable emphasis placed on the need for written and verbal communication skills (R3, R4, R5, R6, R7, R11). Recruiter 3 noted "In every aspect of our job we must be able to communicate verbally as well as on paper … so that is probably the number one thing." Recruiter 4 provided that "you have to have people skills and be able to have strong writing and communication skills. They are huge [for our organization]."

Relationship building

Another consistent theme was the ability to build relationships (R3, R4, R5, R7, R8, R9). For example, Recruiter 3 shared "For us it is important that you are personable, that you can speak to someone in person, that you are not afraid to talk to them face to face and that you can shake hands." Recruiter 9 explained, "Being able to listen to somebody, understand what their needs are and develop solutions that are in line with their needs and their available resources [is critical]." With respect to building relationships, it was also noted that an understanding of diverse systems and cultures would be beneficial (R1). Respondents noted an understanding of systems and their diversity helps establish more positive relationships. Recruiter 12 said "I definitely think that an understanding of diverse cultures is necessary [for our organization]."

Adaptable and flexible

The ability to adapt to changing systems and demonstrate flexibility with respect to complex issues was an emergent theme. Respondents noted that with the emerging trends of globalization and diverse stakeholders, it is becoming increasingly important to be flexible and open to the ever-changing landscape of organizational practice (R1, R3, R6, R8, R9). Recruiter 6 explained employees within his/her organization were charged with many different roles and responsibilities requiring different skill sets, which created a need for individuals who could adapt based on situational circumstances. Similarly, Recruiter 3 reported "We look for flexibility. We want people who are not only necessarily adapted to change, but also people who are able to go to different territories and units."

Academic preparation

The respondents provided a myriad of perspectives with respect to specific degree programs. The majority

of respondents noted the agriculturally related competencies and perspectives that students learn in their academic programs are highly useful, but secondary to the interpersonal leadership and communication skills developed while in the university setting (R2, R3, R5, R6, R7, R8, R11). Specifically, respondents noted a foundational understanding of the ANR industry is a benefit to the new hired employees (R2, R5, R6, R11), but a strong combination of interpersonal skills and agricultural perspectives would create an ideal candidate (R2, R5). Recruiter 5 said "*[Interpersonal skills] are first, and then we are looking for experience in agriculture or knowledge of agriculture. [Agricultural] knowledge is definitely a plus, but it is not required for a position here.*"

It was clear from the interviews conducted that soft skills are in high demand by employers, even more so than technical skills. All recruiters agreed the development of interpersonal communication and leadership skills is necessary to be effective in their organizations. This finding is consistent with prior research exploring employability skills (Alston et al., 2009; Crawford et al., 2011; Jogan and Herring, 2007; Robinson, Garton and Terry, 2007 Robinson, Garton and Vaughn, 2007). Written and verbal skills as well as relationship-building abilities were also identified as important. To capitalize on this finding, past study abroad participants should emphasize how their experiences helped develop their communication and leadership skills.

Objective 2 – Perceived Importance of Cultural and Global Skills for Employees

Some of the respondents explained they were not explicitly looking for global perspectives and experience (R2, R3, R5, R11) but rather "graduates who are willing to learn from their experiences" (R2). Recruiter 5 felt global perspectives and experience were "important" for personal development but would not be required for prospective employees "to perform the responsibilities of their job." However, a majority of the respondents noted the importance of global skills, knowledge and perspectives as employee longevity increased with the company (R2, R3, R4, R7, R9, R11). Recruiter 3 said "*Global skills will help you move ahead. The more you can see globally, the more likely it is that [an employee] will move up the chain of command*." Recruiter 7 provided a similar perspective, reporting "*If [employees] hope to develop themselves, be high performers and advance in the company, they will likely have to develop [global skills, knowledge and perspectives].*"

Some of the respondents discussed specific programs administered by their organizations that foster the development of cultural and global skills in their employees (R3, R5, R7, R8, R11). Despite reporting cultural and global skills were not skills explicitly sought after in prospective employees, Recruiter 3 later said "*It is absolutely important to develop [global perspectives] while they are with our organization. We offer classes and on the job training to develop these.*" Recruiter 7 shared employees in his/her organization learn global and cultural skills through "*on the job training, formal and informal training and coaching.*"

Less support was voiced for the importance of cultural and global competencies for prospective employees. Several respondents stated cultural and global competencies were not vital criteria to be successful in securing employment or maintaining employment. However, other respondents articulated the need for employees to develop those competencies during employment at their organizations and several were able to describe organizational efforts for that purpose. This study's results are interesting because they seem to contradict the growing globalization of organizations and companies (Crossman and Clarke, 2009), especially ANR companies. According to Crossman and Clarke, stakeholder insights included clear associations between perceived outcomes of international experience and graduate employability. However, much of the prior research explores perceptions from a myriad of organizations whereas this study was limited to the viewpoints of a small number of ANR companies and U.S. governmental agencies.

Objective 3 – Role of Study Abroad in Prospective Employee Development

Recruiters were asked to gauge their perceptions of their organization's interest in hiring students with study abroad experience. Seven (R1, R3, R5, R7, R8, R10, R11) of the eleven recruiters reported study abroad experience was a consideration during the hiring process. Of the four recruiters (R2, R4, R6, R9) who said it was not, three acknowledged study abroad experience does develop skills and adds "to the overall mix of attributes" (R9) but they did not feel it was a priority. Recruiter 4 was quite frank, reporting "*I am not sure, because I don't believe I have ever had an employee who studied abroad, so I couldn't give you an honest answer.*"

Enthusiasm for prospective employees with study abroad experience was evident in the responses of the other recruiters. Recruiters' responses began with or included terms like "definitely" (R1), "absolutely" (R3, R10) and "for sure" (R8). They spoke of the value of study abroad experiences in broadening students' perspectives. For example, Recruiter 5 felt students with study abroad experience "*might bring a little more to the table as far as perspective and different ideas …. new and innovative thinking is very important.*" Recruiter 7 also felt a difference existed between prospective employees with study abroad experience and those without, further elaborating study abroad experience is important: "*Because it gives you a better appreciation of why things work the way they work. But, I mean, the U.S. is not the world. We depend on customers and we depend on suppliers and depending on how we interact with those countries, or how we interact with those cultures … we can get a lot of benefits from them …. So when you talk to somebody who hasn't traveled outside of the U.S. and somebody who has traveled outside of the U.S., they seem to be more … I wouldn't say educated, but*

they understand why sometimes [international opinions about Americans differ] … because you get to see things from a different lens in a different culture."

Similarly, a few recruiters (R2, R5, R7) indicated they would be more likely to select the prospective employee with study abroad experience when faced with otherwise comparable options. This was true even for one of the recruiters (R2) who indicated study abroad experience was not something his/her organization specifically looked for in prospective employees. R10 felt that study abroad experience was an indicator of character: *"Studying abroad shows education … shows their determination and shows that [the prospective employee] went up and beyond, you know, what the normal student would do. You know, if you go out and you know, you studied abroad, you are paying your money and you are actually learning an advanced skill, you are showing that you possibly, in our work force, that you are willing to go up and beyond to do that, so, I mean, it gives you a leg up on competition that way. (R10)"*

Recruiters were clear that prospective employees would need to be able to communicate how their study abroad experience would be of value to the organization. Recruiter 2 explained: *"For us, it is definitely much more important that they have experiences either within what you are doing or experiences that can translate to something that we can use as an employer. So, if the study abroad program gives them those skills, that's great."*

Recruiter 5 emphasized the applicability of the experience as well, noting, "*if there was something … pertinent to that country that is pertinent to us, I might ask them something about that.*" Recruiter 10 was more direct, stating that he/she would want to know how a prospective employee would apply "the ethics that they used overseas, abroad" to "my company." Finally, variance in the ability of prospective employees to successfully communicate the value of their study abroad experience was noted. Recruiter 11 noted, "*I think some of them do a better job than others … I think that has to do with their personality …. The ones that feel travel is important, they want you to know that.*"

A majority of the recruiters expressed an interest in hiring employees with previous study abroad experience. This strong enthusiasm awkwardly contrasts the somewhat ambivalent views on the importance of cultural and global competencies for employees. A possible explanation can be extrapolated from the work of Gardner et al. (2009), who found that while international experiences and study abroad experiences are synonymous, employers do not operationalize the terms in the same fashion. It appears a similar problem may exist when exploring what recruiters look for from prospective employees. Recruiters may not realize the soft skills they seek are often the same skills included in conceptualizations of cultural and global competencies. In order to minimize this gap in understanding, job-seeking students need to communicate in terms understood by potential employers.

Similarly, Gardner et al. (2009) stated "the value of study abroad depends on how well the student can reflect on and articulate his or her experience" (p. 20). One of the interviewed recruiters for this study made the same observation. Students should be able to effectively communicate the skills acquired while traveling and learning about other cultures in such a way that enhances their contributions as potential employees, with a noted emphasis on how a study abroad experience has specifically led to the development of relevant soft skills. Facilitators of study abroad programs should consider making this an integral part of their post-experience activities.

Furthermore, it is important to better prepare students before they go abroad to maximize the development of the intended soft skills. Understanding the skills and competencies they will enhance through their experience a priori may make them more aware of instances when this is happening and thus better able to articulate their experiences in an interview setting. Facilitators of study abroad programs in ANR should help students understand the skills needed to be marketable upon graduation and overtly create opportunities of students to develop these skills. Future research should investigate best practices for accomplishing these outcomes.

Summary

This study examined experiences and competencies valued by college fair recruiters in the ANR industry. According to Shultz (1961) an individual is more likely to engage in activities, which have a greater likelihood to produce measureable outcomes in skill, knowledge and "other similar attributes" (p. 8). The skills and experiences identified in this study are complementary to study abroad. This finding reinforces the role of study abroad experience as a means for investing in human capital. As noted in Becker's (1962) work, individuals will invest in areas contributing to their economic future. Within this study, employers indicated that they would give more attention to a candidate with study abroad experience when all other factors were comparable. Past study abroad participants should be sure to highlight these experiences on their resumes and interviews to increase their employability.

As academic institutions across the world strive to expand the international opportunities available to students, it is important to be able to justify the need for such programs. If universities want to better serve their students and prepare them for the competitive, modern workforce, then they must see associations between the benefits from study-abroad programs and job recruitment. However, if career recruiters do not see high value in study abroad programs, it could lead to reduced funding and opportunities for students to gain international experiences. In addition, a reduction in study-abroad programs could stifle the development of soft skills sought after by employers and further reduce the value of college graduates in an aggressive, global market.

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Demographic Predictors of Critical Thinking Ability in Undergraduate Animal Science Students

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Abstract

Background information may provide useful indication of ability to think critically and aid instructors in fostering the critical thinking process. Descriptive factors that may predict critical thinking ability include: age, gender, grade point average (GPA), classification and extracurricular activities. The focus of this study was to quantify the critical thinking ability of animal science students and determine what differences in their demographic information exist. The Watson-Glaser Critical Thinking Appraisal (WGCTA) exam provided means to objectively measure critical thinking ability of students enrolled in required animal science courses. Each student completed a questionnaire determining demographic information. Several demographic characteristics demonstrated higher scores on the WGCTA; students in the 18-20 age range ($P = 0.0039$), those who reported ≥ 3.5 GPA ($P = 0.003$) and those who had evaluation experience in an organized youth or collegiate judging team or participated in an evaluation course ($P = 0.00067$). Gender and classification do not appear to accurately describe critical thinking ability. Important considerations for educators include encouraging critical thought from all students, regardless of age. Further, an evaluation course is an important component of animal science curricula and early evaluation experience in programs such as 4-H and FFA may be beneficial when developing critical thinking skills.

Introduction

Challenges faced by American colleges and universities are numerous. Graduating a student capable of critical analysis and proficient at making independent real-world decisions is an ultimate goal (Barrie, 2006; Karantzas et al., 2013; Moore, 2004). Historically, university graduates lack some higher order thinking skills (Behar-Horenstein and Niu, 2011). We believe critical thinking consists of a mental process that utilizes a person's ability to identify and assess a situation, understand and recognize possible relationships between previously learned material and make an informed judgment which is a result of base knowledge interacting with a variety of personal perspectives and subjective focuses. A better understanding of approximate critical thinking ability is advantageous to identify learning endeavors most valuable for developing curricula, augmenting course design and supporting significant programs that enhance critical thinking at a young age.

Multiple demographic predictors have been studied to identify their influence on critical thinking ability, including: age, gender, grade point average (GPA), classification, overall involvement in on-campus clubs and interaction with faculty and peers (Gellin, 2003; Ricketts and Rudd, 2005; White et al., 2012). Evaluation of animals or products is a historically important component of an agriculture curriculum and thought to increase higher order thinking in participating students (Nash and Sant, 2005; White et al., 2012). Therefore, this study sought to determine if demographic information such as gender, age, classification, GPA and previous judging experience are reliable indicators of critical thinking ability in undergraduates majoring in animal science.

Materials and Methods

Three upper level courses required in the major were selected to represent the undergraduate population of animal science students at Clemson University. Students completed a researcher-designed questionnaire (Figure 1) and the Watson-Glaser Critical Thinking Appraisal (WGCTA) exam. All testing and observation was approved by the Institutional Review Board (IRB) at Clemson University.

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Figure 1.

Name: Testing No.:

Please take your time to answer every question truthfully and to the best of your ability.

1. Please indicate your classification by circling the appropriate response:

Freshman Sophomore Junior Senior

2. Please indicate your age by circling the appropriate range:

18-20 21-24 >24

3. Please indicate your GPA by circling the appropriate range:

< 1.5 1.5 – 2.0 2.1 – 2.4 2.5 – 2.9 3.0 – 3.4 > 3.4

4. Please indicate your gender by circling the correct response:

Male Female

5. Have you ever been involved in a judging program before (i.e.: 4-H, FFA, or evaluation class in college; must be at least 1 semester of experience)?

Yes No

Researcher developed demographic questionnaire for students enrolled in upper level courses in the Animal Science at Clemson University. In 2008, students (n=81) took the Watson-Glaser Critical Thinking Appraisal exam to determine approximate critical thinking ability. Demographic information about the students was compared to their critical thinking scores to determine if any correlations exist.

Population

The target population included all students enrolled in the animal and veterinary science curriculum. The sample population (n=81) consisted of students enrolled in three upper level courses within the department of Animal and Veterinary Sciences at Clemson University. Four students were enrolled in more than one of the courses utilized simultaneously, but were only counted once in the data set. These upper level courses were chosen because all undergraduate students take the courses to receive a Bachelor's of Science degree in Animal and Veterinary Sciences.

Instrumentation

The WGCTA test, form A and B, from Pearson (San Antonio, TX) assessed each student's critical thinking ability. The WGCTA seeks to provide an estimate of an individual's standing on a composite of attitude, knowledge and skills by means of evaluating the student's ability to think critically in five categories; 1) Inference, 2) Recognition of Assumptions, 3) Deduction, 4) Interpretation and 5) Evaluation of Arguments. The Inference section requires the test taker to discriminate among degrees of truth or falsity of inferences drawn from given data. Recognition of Assumptions requires the ability to recognize unstated assumptions or presuppositions in given statements or assertions. Deduction entails determining whether certain conclusions necessarily follow from information in given statements or premises. Interpretation consists of weighing evidence and deciding whether generalizations or conclusions based on the given data are warranted.

Finally, Evaluation of Arguments distinguishes between arguments that are strong and relevant or weak and irrelevant. The components include problems, statements, arguments and interpretations of data. All components are aimed at mimicking real-world situations one might encounter at work, school or in newspaper and magazine articles. Validity and reliability have been established for the WGCTA by the respective authors with a reliability coefficient of 0.74 (Watson and Glaser, 1980). Another study that utilized the WGCTA for high school students (n=384) yielded a reliability coefficient of 0.78 (Cano, 1993). Researchers in Texas found that the WGCTA exam remained reliable and consistent when given to undergraduate and graduate students (n=58) at Southwestern State University (Gadzella et al., 2005).

Students were asked to complete a 5-item researcher designed questionnaire (Figure 1) to determine demographic information at the beginning of the semester in each of the courses. The questionnaire was utilized to formulate correlations between specific demographic information and critical thinking ability as measured by the WGCTA exam. The questionnaire identified characteristics of each student with respect to age, gender, classification, GPA and previous judging experience. Characteristics were self-reported by the student and therefore may be subjective.

Data Analysis

Data were coded and analyzed using Microsoft Office Excel (descriptive statistics) and SPSS 17.0.1 for Mac OS X. Descriptive statistics utilized included means, averages and percentages. All standard deviations reported are for the samples and not the mean. To determine relationships between critical thinking skill level and certain demographic and descriptive attributes of students (and interactions between demographic indicators), a multivariate ANOVA and Pearson's correlation were utilized. A Tukey test was conducted to determine relationships among some variables. Differences were considered significant when $P < 0.05$ and a trend for significance was assessed when $0.15 > P > 0.05$.

Results and Discussion

Mean score for all students on the WGCTA exam was 58.4 ± 7.0 on an 80 point scale which is slightly above national standards for undergraduate students.

Gender

Participants in the study were 79% female (n=64), which is consistent with the target population. No significant differences ($P = 0.47$) between genders with regard to critical thinking ability was found in this sample group. Results from this study are concordant with others who observed no significant influences of gender on the ability to think critically (Friedel et al., 2006; Ricketts and Rudd, 2005; Torres and Cano, 1995). In contrast, Wilson (1989) observed gender as a significant indicator of critical thinking skill in college freshmen using the WGCTA exam.

Age and Classification

Logically, as age increases, so would maturity and the ability to think at a higher level of cognition, however,

the opposite of expected was seen in the current study. Students were grouped by age: 18-20; 21-24; and >24. There were 42 students in the 18-20 group, 37 in the 21-24 group and 2 in the >24 group (Table 1). Because the >24 group was small, data was combined with the 21-24 group. Students in the 18-20 age range scored significantly higher (P = 0.0039) than students in the 21+ category (64.2 ± 6.34 vs. 58.4 ± 7.65, respectively). Age results are presented in Table 1. Critical thinking ability was comparable (P ≥ 0.44) across classification of sophomores (n=24); juniors (n=32); and seniors (n=25); no freshman were enrolled in the upper-level courses studied (Table 2).

Many researchers investigating critical thinking ability related to demographic information reported that age had no significant effects on critical thinking ability (Facione, 1990, 1991; Jenkins, 1998; Rudd et al., 2000; and Ricketts and Rudd, 2005). Cano (1993) found conflicting results regarding the influence of age on the cognitive level of performance associated specifically with critical thinking abilities, using the Developing Cognitive Abilities Test (DCAT) and the WGCTA exam. Researchers reported significant differences between senior students' and freshman/sophomore students' scores (48.71 and 43.81/ 47.45, respectively) on the DCAT. However, the WGCTA showed no effects of age on final scores using the same students. Previously, Cano and Martinez (1991) observed similar results of increased cognitive score with regard to age/grade level using the DCAT to test high school agriculture education students. The DCAT measures multiple constructs and characteristics of higher order thinking, including critical thinking, while the WGCTA only measures a student's ability to think critically.

Age may be an indicator of ability and competence for higher order thinking in general, including critical thinking ability. Although as age and assumed maturity increase, in these findings, critical thinking ability was lowest for the older students. The higher critical thinking scores for the younger population is most likely due to the individuals enrolled in the courses sampled. The youngest students were enrolled in upper level courses potentially ahead of their peers and might have higher cognitive abilities than their counterparts with more drive to perform well on exams, which will be expanded on in the next section.

Table 1. Watson-Glaser Critical Thinking Appraisal (WGCTA) exam results for student age categories.

	18-20	21-24	P value
n	42	39	
WGCTA Score	64.2	58.4	0.0039
Standard deviation of the sample	6.34	7.65	

In 2008, students (n=81) enrolled in the Animal and Veterinary Sciences department at Clemson University completed a 5-item investigator developed demographic questionnaire to determine student age and completed the WGCTA exam to determine critical thinking ability. A multivariate analysis of variance was utilized to determine if a correlation between critical thinking ability and student age existed.

Table 2. Watson-Glaser Critical Thinking Appraisal (WGCTA) exam results for student classification categories.

	Sophomore	Junior	Senior	P value
n	24	32	25	
WGCTA Score	60.3	59.3	60	≥ 0.44
Standard deviation of the sample	6.05	7.35	7.27	

In 2008, students (n=81) enrolled in the Animal and Veterinary Sciences department at Clemson University completed a 5-item investigator developed demographic questionnaire to determine classification and completed the WGCTA exam to determine critical thinking ability. A multivariate analysis of variance was utilized to determine if a correlation between critical thinking ability and student classification existed.

GPA

Students were grouped into five GPA categories. Only 2 students fell in 1.5-2.09 category (2 %), 8 in the 2.1-2.49 (10 %), 25 students fell in the 2.5-2.99 (31 %), 22 in the 3.0-3.49 (27 %) and 24 fell in the ≥ 3.5 range (30 %). Because of low sample size, the 1.5-2.09 and 2.1- 2.49 groups were combined (Table 3). Students in the ≥ 3.5 GPA category scored significantly higher (P = 0.003) on the WGCTA than the 2.5 – 2.99 category and tended to score higher than the ≤ 2.49 (P = 0.129) group (Table 4). The youngest age group (18-20) had a Pearson's correlation coefficient of 0.76 (P < 0.01) with the highest GPA group (>3.5). Obviously the younger students were high performing students, as evidenced by their correlation to the highest GPA category and higher WGCTA scores. Conceivably, students with a higher critical thinking skills also score higher on standardized tests and have higher GPA's. GPA has been a significant predictor of critical thinking ability and in some cases, the only useful predictor (Giancarlo, 1996; Jenkins, 1998; Thompson, 2001).

Table 3. Watson-Glaser Critical Thinking Appraisal (WGCTA) exam results for grade point average categories.

	≤2.49	2.5-2.99	3.0-3.49	≥3.5
n	10	25	22	24
WGCTA Score	59.39	58.13	60.77	64.83
Standard deviation of the sample	6.55	6.50	7.12	6.13

In 2008, students (n=81) enrolled in the Animal and Veterinary Sciences department at Clemson University completed a 5-item investigator developed demographic questionnaire to determine GPA and completed the WGCTA exam to determine critical thinking ability.

Table 4. Tukey test results for undergraduate student grade point average (GPA) categories based on the Watson-Glaser Critical Thinking Appraisal exam scores reported in Table 2.

GPA categories		Mean Difference	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
≤ 2.49	2.5-2.99	1.26	2.44	.955	-5.15	7.68
	3.0-3.49	-1.38	2.51	.946	-7.96	5.19
2.5-2.99	≥ 3.5[b]	-5.44	2.46	.129	-11.89	1.01
	≤2.49	-1.26	2.44	.955	-7.68	5.15
	3.0-3.49	-2.64	1.90	.510	-7.64	2.35
3.0-3.49	≥ 3.5[a]	-6.70	1.84	.003	-11.53	-1.87
	≤ 2.49	1.38	2.51	.946	-5.19	7.96
	2.5-2.99	2.64	1.90	.510	-2.35	7.64
≥ 3.5	≥ 3.5	-4.06	1.92	.158	-9.1	.98
	≤ 2.49[b]	5.44	2.46	.129	-1.01	11.89
	2.5-2.99[a]	6.70	1.84	.003	1.87	11.53
	3.0-3.49	4.06	1.92	.158	-.98	9.1

Students were grouped by grade point average (GPA), ≤ 2.49 (n=10); 2.5-2.99 (n=25); 3.0-3.49 (n=22); and ≥ 3.5 (n=24). In 2008, students (n=81) enrolled in the Animal and Veterinary Sciences department at Clemson University completed a 5-item investigator developed demographic questionnaire to determine GPA and completed the WGCTA exam to determine critical thinking ability. Within GPA categories, the superscript letter "a" indicates a critical thinking difference (P = 0.03) and the superscript letter "b" indicates trend for a difference in critical thinking ability (P = 0.13).

Table 5. Watson-Glaser Critical Thinking Appraisal exam results for students who had previous judging experience and for students without prior judging experience.

	Judging	Non-Judging	P value
n	42	39	
WGCTA Score	64.3	57.9	0.00067
Standard deviation of the sample	4.9	7.1	

Previous judging experience was characterized as completion of a formal university course, collegiate evaluation team experience, or youth (4-H/FFA) training. In 2008, students (n=81) enrolled in the Animal and Veterinary Sciences department at Clemson University completed a 5-item investigator developed demographic questionnaire to determine previous judging experience and completed the WGCTA exam to determine critical thinking ability. A multivariate analysis of variance was utilized to determine if a correlation between critical thinking ability and student evaluation experience existed.

Previous Judging Experience

Students were asked to indicate their level of experience with evaluation (judging) training. Students with one semester or more of evaluation experience (n=42) characterized as completion of a formal university course, collegiate evaluation team experience, or youth (4-H/FFA) training were categorized separate from students who had no evaluation experience whatsoever (n=39). Students who had been involved in previous evaluation/judging activities scored significantly higher (P = 0.00067) on the WGCTA compared to students who had no previous judging experience (64.3 ± 4.9 vs. 57.9 ± 7.1, respectively) (Table 5).

These findings agree with previous research reporting that students who had participated on a competitive collegiate judging team demonstrated higher critical thinking scores compared to their peers who had no previous evaluation training (White et al., 2012). Evaluation training is perceived to benefit students in a number of ways, including improving problem solving skills and increasing higher order thinking capabilities (Nash and Sant, 2005).

Summary

The results of the current study suggest there are several useful predictors of an undergraduate's ability to think critically. We recommended that opportunities for critical thinking be built into every possible classroom situation and instructors realize that not every student will reach the same level of critical thinking ability during any given semester. Educators need to recognize that the best performing students (≥3.5 GPA) are not the only students capable of critical thought and to employ challenges that assist all students in developing enhanced skills in critical thought processes. Further, younger students are well equipped to think critically and instructors should expect more independent thought from these students. In the past it was thought students early in their college career lacked critical thinking abilities (Tsui, 1999), an assumption that is not corroborated in the current research. The current study brings to light the lessened critical thinking ability of the older students compared to the younger students, which has not been reported before. Most likely the younger students in this study are the highest achieving of their peers as they are enrolled in upper level courses potentially ahead of schedule. Most importantly, evaluation training may be beneficial to enhancing critical thinking ability of animal science undergraduate students and should be included as an important component of the curricula in an animal science program. This finding is also a strong advocate for including evaluation training through early learning programs such as 4-H and FFA.

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Biodiesel: Awareness, Use and Perceptions of Students at Four U. S. Universities

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Abstract

Knowledge about renewable energy is limited and a lack of information pertaining to biofuels is prevalent. If consumers believe there are negative consequences towards use of biofuels then they are less likely to use biodiesel. Based on perceptions portrayed through media formats, the battle between food and fuel has been formulated and presented to the public. This study sought to examine selected college students' awareness, use and perceptions of biodiesel and determine if there was variance between selected regions based on gender, major (agriculture vs. non-agriculture), type of area where students were raised (farm, rural non-farm, town or city), or political orientation (conservative, moderate, or liberal). Findings indicated that one in five (20.9%) participants reported owning or driving a vehicle fueled by diesel while over three-fourths (76.4%) had heard of biodiesel. Furthermore, males, agriculture majors, and students raised on a farm were significantly more likely to have heard of biodiesel than females, non-agriculture majors, and students raised in a town or city. Illinois State University students tended to be more likely to have purchased biodiesel, be more positive about the benefits of biodiesel and have a lower level of concern about the effects of biodiesel.

Introduction

Liquid biofuels have received renewed interest among the public, government, and industry due to diminishing petroleum supplies, increasing energy demands, the geographical concentration of known petroleum reserves, and concerns about the environment (Koonin, 2006; Rojey et al., 2010). The U.S. Energy Independence and Security Act of 2007 mandated that 136 billion liters of renewable biofuels be in use by 2022 (Schnepf et al., 2010). Furthermore, the National 25 x '25 Committee, comprised of U.S. leaders in agriculture and forestry, has set a goal that farms and ranches will produce 25% of U.S. energy by 2025 (Acker, 2008).

Although there is strong political and agricultural industry support for first generation biofuels, not all critics have been convinced of the net benefits of increased production and use. Some question the performance (Skipper, 2007), environmental and economic impacts (Lehrer, 2010), and food availability and cost effects (Pimentel et al., 2009) of first generation biofuels. According to Acker (2008), research and education must play key roles in meeting the U.S. National 25 x '25 Committee's renewable energy goals. One research priority (Acker, 2008) is to "assess consumer behavior and attitudes towards renewable energy" with the goal of understanding perceived advantages and concerns (p. 57). Evidence has further been found that political affiliation may predispose persons to oppose biofuels (Cacciatore et al., 2012).

Research has shown that individual judgments often depend on how an issue is framed by the news media and other opinion leaders (Chang, 2009; Druckman, 2001; Van de Velde et al., 2010). Additionally, Chang (2009) identified fuel vs. food as a commonly used media frame for reporting on biofuels. The food vs. fuel frame portrays increased biofuel production resulting in decreased food production and/or increased food

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prices. The acceptance of biodiesel could be improved by utilizing alternative communication channels that may overcome national, geographic, social and cultural, or other boundaries (Jensen et al., 2011).

The theory of reasoned action (TRA) (Ajzen et al., 1980) posited that human actions, such as using biodiesel, are guided by three considerations: (a) beliefs about the consequences of an action (behavioral beliefs), (b) beliefs about the normative expectations of others (normative beliefs), and (c) beliefs about the presence of factors that may promote or hinder the behavior (control beliefs). Taken as a whole, these beliefs lead to the formation of behavioral intentions which serve as precursors to behavior (such as use or non-use of biodiesel).

The purpose of this study was to determine selected college students' awareness, use, and perceptions of biodiesel. Specific objectives were to:

Determine students' awareness of biodiesel and determine if awareness differed by university or the demographic variables of gender, major (agriculture vs. non-agriculture), residence (farm, rural - nonfarm, town or city), or political orientation (conservative, moderate or liberal);

Determine students' use of biodiesel and determine if biodiesel use differed by university or the demographic variables of gender, major (agriculture vs. non-agriculture), residence (farm, rural - nonfarm, town or city), or political orientation (conservative, moderate or liberal);

Determine students' perceptions of biodiesel and determine if a significant ($p < .05$) proportion of the variance in perceptions of biodiesel can be explained by a single or linear combination of predictor variables.

Methods

The population for this study was comprised of students enrolled in introductory agricultural economics courses at the University of Arkansas, Texas Tech University, Utah State University, and Illinois State University during the fall or spring semesters of the 2011-2012 academic year. These universities were purposively selected based on geographic diversity (Southeast, Southwest, Mountain West and Midwest U.S.) and willingness to participate. Introductory agricultural economics courses were selected because these courses meet general education (social science) requirements at these four universities and, consequently, enroll a mixture of agriculture and non-agriculture majors. All research protocols relating to human subjects were approved by the respective university institutional review boards prior to data collection.

The survey was administered in each class by the course instructor or one of the researchers during either the fall or spring semesters of the 2011-2012 academic year. At the University of Arkansas, 90 of 105 (85.7%) students enrolled were present and provided usable responses; at Texas Tech University, 200 of 235 (85.1%) provided usable responses; at Utah State University 318 of 470 (67.7%) provided usable responses; and at Illinois State University 90 of (154) (58.4%) provided usable responses. Overall response rate was 72.4%. The anonymous nature of responses precluded follow-up of absent or non-responding students.

The instrument was developed by the researchers based on a review of the literature related to consumer awareness, use, and perceptions of biofuels (Halder et al., 2011; Kinsey et al., 2003); Kulscar et al., 2011; Popp et al., 2009; Skipper et al., 2009; Selfa, et al., 2010; Vogt et al., 2008; Xue et al., 2011). The completed instrument contained three sections. Section one had three items to determine if the respondent owned or drove a diesel-fueled vehicle, had ever heard of biodiesel, or had ever purchased biodiesel. Section two contained 34 items on a 1 to 5 Likert-type scale (1 = "strongly disagree" and 5 = "strongly agree") designed to determine respondent perceptions about biodiesel. To prevent response set, 11 of these 34 items were negatively worded. Section three had five demographic items related to gender, age, type of area where the student was raised [farm, rural - nonfarm, town (< 10,000 population, or city (>10,000 population)], academic major and political views (conservative, moderate or liberal).

The test-retest procedure was used to determine instrument reliability (Gall et al., 2006). The survey was administered twice, at a 14 day interval, to seven undergraduate students not included in the main study. The coefficients of stability were 1.0, 0.81, and 0.99, for sections one, two and three, respectively. A panel of five individuals with expertise in survey methods (n = 2), biofuels research (n = 2), and biodiesel marketing (n = 1) reviewed the instrument and judged it to possess face and content validity.

Data were analyzed using descriptive and inferential statistics. Principal components analysis was used to identify the number and nature of the underlying factors responsible for covariance in the 34 items designed to measure perceptions of biodiesel (section two). Following principal components analysis, negatively worded items were reverse-coded and factor scores were constructed for each identified factor, factor reliabilities were assessed, and the resulting factor scores were used as criterion variables in subsequent multiple regression analyses (Hair et al., 1998, Hatcher, 1994).

Results and Discussion

A majority of all respondents were male (63.2%) and were raised in either a town (26.6%) or a city (39.4%). Respondents were almost evenly divided between agriculture (50.2%) and non-agriculture majors (49.8%). A majority reported their political views as conservative (51.3%), followed by moderate (39.3%) and liberal (9.4%). There were significant differences by university on the variables of gender, major, residence and political orientation (Table 1).

Pairwise Chi Square tests were used *post hoc* to identify significant ($p < .05$) differences by university for each variable (Cox et al., 1993). Utah State University

Table 1. Respondent Demographic Characteristics by University

	University A		University B		University C		University D		
Characteristic	*f*	%	*f*	%	*f*	%	*f*	%	χ^2
Gender									17.71***
Male	51	58.6	100	52.9	213	71.2	56	62.9	
Female	36	41.4	89	47.1	86	28.8	33	37.1	
Major									329.71****
Agriculture	71	81.8	175	93.6	42	14.1	42	48.3	
Other	16	18.4	12	6.4	255	85.9	45	51.7	
Residence									39.91****
Farm	30	35.3	50	27.3	45	15.5	13	15.3	
Rural/nonfarm	18	21.2	20	10.9	28	9.6	15	17.6	
Town (≤10,000)	16	18.8	45	24.6	93	32.0	17	20.0	
City	21	24.7	68	37.2	125	43.0	40	47.1	
Political orientation									44.74****
Conservative	36	43.9	116	63.7	152	52.4	18	24.3	
Moderate	38	46.3	46	25.3	121	41.7	42	56.8	
Liberal	8	9.8	20	11.0	17	5.9	14	18.9	

***p < .001; ****p < .0001

Table 2. Diesel Vehicle Ownership/Use and Awareness and Purchase of Biodiesel, by University

Question	Response		
University	Yes (%)[z]	No (%)	χ^2
Do you own or drive any vehicle that runs on diesel?			2.64
University of Arkansas (n = 89)	16.8_a	83.2	
Texas Tech University (n = 194)	23.7_a	76.3	
Utah State University (n = 314)	20.1_a	79.9	
Illinois State University (n = 88)	17.0_a	83.0	
Have you ever heard of biodiesel?			12.38**
University of Arkansas (n = 90)	85.6_a	14.4	
Texas Tech University (n = 199)	79.4_{ab}	20.6	
Utah State University (n = 311)	70.4_b	29.6	
Illinois State University (n = 90)	81.1_{ab}	19.9	
Have you ever purchased biodiesel?			15.93**
University of Arkansas (n = 74)	5.4_{ab}	94.6	
Texas Tech University (n = 155)	4.5_b	95.5	
Utah State University (n = 236)	5.9_{ab}	94.1	
Illinois State University (n = 71)	18.3_a	81.7	

[z]For each question, percentages in the "Yes" column that share a subscript letter are not significantly different (p < .05) by pairwise Chi Square analyses.

**p < .01.

Table 3. Purchase of Biodiesel by Students Driving/Owning Diesel Vehicles and Aware of Biodiesel, by University

	Have you ever purchased biodiesel?			
	Yes		No	
University	*n*	%	*n*	%
University of Arkansas	3	21.4_{ab}	11	78.6
Texas Tech University	4	11.8_b	30	88.2
Utah State University	8	16.0_b	42	84.0
Illinois State University	8	61.5_a	5	38.5

For each question, percentages in the "Yes" column that share a subscript letter are not significantly different (p < .05) by pairwise Fisher's Exact Test.

had a significantly higher percentage of males (p < .001) than Texas Tech University; no other pairwise comparisons were significant. Significant differences (p < .0001) were found between the percentages of agriculture and non-agriculture majors for all paired comparisons except between the University of Arkansas and Texas Tech University. The University of Arkansas had a significantly higher (p < .01) percentage of respondents raised on a farm than did Utah State University or Illinois State University; the percentage of farm-reared respondents at Texas Tech University was also significantly higher (p < .05) than at Utah State University.

A majority of students at Utah State University (52.4%) and Texas Tech University (63.7%) indicated having a conservative political view; the percentage of students that indicated conservative political views at both schools was significantly higher (p < .0001) than at Illinois State University (24.3%). Texas Tech University had a significantly larger (p < .01) percentage of students indicating a conservative political view than the University of Arkansas. Texas Tech University had a significantly smaller percentage of students (25.3%) indicating a moderate political view than the University of Arkansas (p < .05), Utah State University (p < .01), and Illinois State University (p < .0001). Fewer than 10% of total respondents indicated a liberal political view; there were no significant differences between universities regarding the percentage of students that indicated a liberal political view.

Overall, approximately one in five (20.9%) students reported owning or driving a diesel vehicle; this percentage did not differ significantly (p > .05) by university (Table 2). Over three-fourths (76.4%) of all respondents had heard of biodiesel. University of Arkansas students were significantly (p < .01) more likely to have heard of biodiesel than Utah State University students; there were no other significant (p > .05) differences in awareness of biodiesel by university. Of those students who had heard of biodiesel (n = 527), only 1 in 14 (7.1%) reported ever having purchased biodiesel. Illinois State University students were significantly more likely to have purchased biodiesel than Texas Tech University students; there were no other significant (p > .05) differences between universities in the percentage of students who had purchased biodiesel.

Data on the purchase of biodiesel was further examined for the subset of students who owned or drove a diesel vehicle and had heard of biodiesel (n = 111). Overall, 20.7% of these students had purchased biodiesel. The results of the Fisher's Exact Test indicated a significant (p < .01) difference in the percentage of students having purchased biodiesel by university. Based on pairwise analyses (Table 3), a significantly higher percentage of Illinois State University students had purchased biodiesel than Texas Tech University (p < .01) and Utah State University (p < .01) students. No other paired comparisons by university were statistically significant (p > .05).

Student awareness of and purchase of biodiesel were next examined by the demographic variables of gender, major, residence and political views (Table 4). Males were significantly (p < .05) more likely than females and agriculture majors were significantly (p < .0001) more likely than non-agriculture majors to have heard of biodiesel. Students raised on farms were significantly more likely to have heard of biodiesel than students raised in town (p < .05) or in the city (p < .0001). Students raised in a rural, nonfarm area were significantly (p < .05) more likely than students raised in the city to have heard of biodiesel. Conservatives, moderates and liberals were equally likely to have heard of bio-

diesel. The only significant difference by demographic variable in the purchase of biodiesel was for residence, where students raised on a farm were more likely ($p < .05$) than students raised in a city.

Students' responses for the 34 items measuring perceptions of biodiesel were analyzed using exploratory factor analysis with squared multiple correlations as prior communality estimates. The principal factor method was used to extract the factors followed by a varimax (orthogonal) rotation. The scree plot indicated the presence of two meaningful factors which were retained for rotation (Hair et al., 1998; Hatcher, 1994). In interpreting the rotated factor pattern, an item was determined to load on a given factor if the loading was .40 or greater on that factor and less than .40 on the other factor (Hair et al., 1998; Hatcher, 1994). Using this criterion, 15 items loaded on the first factor (Support for Biodiesel) and six items loaded on the second factor (Concerns about Biodiesel). The two-factor solution satisfied the requirements for interpretability as described by Hatcher (1994); a minimum of three items loaded on each factor, each factor had a unique and identifiable conceptual meaning, and the factors demonstrated simple structure. The two factors explained 74.3% of the variance associated with the original 34 items. Table 5 presents the two named factors, the items, loadings and the coefficient alpha reliability estimate for each factor.

Table 4. Association of Demographic Characteristics with Awareness of and Purchase of Biodiesel

	Have you ever heard of biodiesel?					Have you ever purchased biodiesel?				
	Yes		No			Yes		No		
Variable	*n*	%	*n*	%	χ^2	*n*	%	*n*	%	χ^2
Gender					5.78*					2.94
Male	327	78.6	89	21.4		29	8.8	301	91.2	
Female	170	70.2	72	29.8		8	4.6	166	95.4	
Major					37.7****					1.96
Agriculture	282	85.7	47	14.3		24	8.7	253	91.3	
Non-agric.	210	65.0	113	35.0		12	5.4	210	94.6	
Residence					24.0****					10.83*
Farm	120	87.6	17	12.4		16	13.6	102	86.4	
Rural - nonfarm	66	82.5	14	17.5		5	7.6	61	92.4	
Town (<10,000)	124	73.8	44	26.2		8	6.2	122	93.8	
City (>10,000)	168	66.4	85	33.6		6	3.5	165	96.5	
Political views					3.02					0.36
Conservative	248	77.7	71	22.3		18	7.3	229	92.7	
Moderate	176	71.8	69	28.2		13	7.3	172	93.0	
Liberal	42	71.2	17	28.8		2	4.8	40	95.2	

*p < .05, **p < .01, ***p < .001

Table 5. Student Perceptions of Biodiesel: Factor Structure, Item Loadings, and Coefficient Alpha Estimates for the Two-Factor Solution

Factor 1: Support for Biodiesel (alpha = .86)	Factor loading
By using biodiesel I can contribute to a cleaner environment	.70
The U.S. government should support research and development in biodiesel	.61
It is better to use biodiesel because it is made from renewable resources	.58
I am willing to go out of my way to purchase biodiesel	.55
Biodiesel can significantly reduce U.S. dependence on foreign oil	.54
Increased use of biodiesel will reduce global warming	.52
I believe that average global temperature is increasing	.50
Biodiesel produces fewer harmful emissions than does petroleum diesel	.50
It is worth paying extra for biodiesel	.50
If I had a diesel car or truck, I would use biodiesel	.50
Biodiesel is better for my engine than regular diesel	.48
Increased use of biodiesel will result in more jobs in rural areas	.45
Emissions from automobiles have no effect on average global temperature	-.44
Cars and trucks run better with biodiesel	.41
The U.S. is too dependent on foreign oil sources	.41
Factor 2: Concerns about Biodiesel (alpha = .74)	
Increased use of biodiesel will cause a shortage of food	.67
Increased use of biodiesel will cause an increase in the cost of food	.65
Increased biodiesel production will decrease food production	.56
Diesel engines will not run properly on biodiesel	.55
Using biodiesel results in increased engine repair and maintenance costs	.50
Using food crops for biodiesel is justified	-.41

After reverse-coding negatively-loaded items, composite factor scores were created by summing responses to all individual items in the factor and then dividing by the number of items comprising the factor (Hair et al., 1998; Hatcher, 1994), thus, retaining the original 1 to 5 item-scaling for each factor. These factor scores were used as dependent variables in subsequent analyses. In interpreting these scores, a higher score on Factor 1 indicated a higher level of support for biodiesel, while a higher score on Factor 2 indicated a higher level of concern about the potential negative effects of biodiesel.

The overall mean of 3.41 (SD = 0.53) on Factor 1 indicated students had a moderately positive level of support for biodiesel. The overall mean of 2.82 (SD = 0.60) on Factor 2 indicated that students were undecided to slightly unconcerned about the effects of biodiesel. Thus, overall the students had a somewhat positive perception of biodiesel. Bivariate and multiple regression analyses were used to examine the relationships between the predictor variables (university, owning/driving a diesel vehicle, purchasing biodiesel, type of place raised, political views and major) and the criterion variables (support for biodiesel and concerns about biodiesel).

Effect coding and dummy coding (Table 6) were used in order to prepare categorical predictor variables for correlation and regression analyses. Effect coding was used for predictor variables with three or more levels (university, type of place raised, and political views). With effect coding membership in one level of each categorical predictor is indicated by coding a "-1" in the "Yes" category. Effect coding, as opposed to dummy coding, allows each category of each predictor variable to be compared with the grand mean for the criterion variable instead of the mean for a defined reference group, as is the case with dummy coding (Hair et al., 1998). However, caution must be used in interpreting the sign of the correlation coefficient and the standardized multiple regression coefficient (Beta weight) for each variable effect coded as "-1." because of the negative coding, a positive relationship will carry a negative sign while a negative relationship will carry a positive sign (Hair et al., 1998).

Dummy coding was used to code binary categorical variables (own or drive a diesel vehicle, have purchased biodiesel, gender and major); only one category was coded since each variable could be fully described by membership (or non-membership) in the respective category. In interpreting results related to dummy coded variables, the comparison is to the un-coded reference group (Hair et al., 1998).

There were significant ($p < .05$) bi-serial correlations between 8 of 15 potential predictor variables and the criterion variable, support for biodiesel (Table 7). The correlations for these eight predictor variables and support for biodiesel ranged from -0.11 to 0.23. Using descriptors suggested by Davis (1971), the magnitude of all significant relationships was low. Multicollinearity among the eight predictors was assessed using variance inflation factors (VIF). All obtained VIF values (ranging from 1.04 to 1.44) were substantially less than 5, indicating low levels of multicollinearity between predictor variables (Hair et al., 1998).

The regression equation containing the eight predictor variables was statistically significant [F (df = 8, 458) = 8.05; $p < .0001$ (adjusted $R^2 = .1079$)] and explained 12.56% of the variance in support for biodiesel. Beta weights (standardized multiple regression coefficients) and squared semi-partial correlations (Table 8) were reviewed to assess the importance of each of the eight variables in predicting support for biodiesel. Being an Illinois State University student, owning or driving a diesel vehicle, being male, and having a liberal political view all had statistically significant Beta weights and squared semi-partial correlation coefficients. The positive sign associated with the Beta weights for Illinois State University students and liberal political view indicated students in these categories supported biodiesel to a greater extent than the average student. The negative Beta weights for owning or driving a diesel vehicle and being male indicate these students are less supportive of biodiesel than students not owning or driving a diesel vehicle or students whose gender is female. While the relative magnitudes of the squared semi-partial correlation coefficients were consistent with the Beta weights, the best predictor (having a liberal political view) explained only 2.36% of the unique variance in support for biodiesel.

Five of the 15 variables had significant ($p < .05$) bi-serial correlations with the criterion variable, concerns about biodiesel (Table 9). The correlations for these five

Table 6. Coding of Categorical Predictor Variables

Categorical variable Levels	Variable label	Dummy coding Yes	Dummy coding No
University			
Arkansas	D1[a]	-1	0
Texas Tech	D2	1	0
Utah State	D3	1	0
Illinois State	D4	1	0
Own or drive a diesel vehicle?	D5	1	0
Have purchased biodiesel?	D6	1	0
Gender			
Male	D7	1	0
Type of place raised			
Farm	D8[a]	-1	0
Rural - nonfarm	D9	1	0
Town (pop. ≤ 10,000)	D10	1	0
City (pop. > 10,000)	D11	1	0
Political views			
Conservative	D12[a]	-1	0
Moderate	D13	1	0
Liberal	D14	1	0
Major			
Agriculture	D15	1	0

[a]Category effect coded as "-1".

Table 8. Beta Weights and Squared Semipartial Correlations from Multiple Regression Analysis Predicting Support for Biodiesel

Variable	Variable name	Beta Weights[a] Beta	t[c]	Squared semipartial correlations[b] sR^2	F[d]
D3	Utah State University	-.039	-0.75	.0011	0.57
D4	Illinois State University	0.160	2.17*	.0091	4.75*
D5	Own/drive diesel vehicle	-0.166	-2.64**	.0134	7.00**
D7	Male	-0.120	-2.39*	.0110	5.74*
D8	Raised on farm	0.068	1.04	.0021	1.10
D11	City (pop. > 10,000)	.0305	0.57	.0006	0.31
D12[e]	Conservative	0.088	1.74	.0058	3.02
D14	Liberal	0.307	3.51***	.0236	12.32***

[a]Standardized multiple regression coefficients.

[b]Percentage of unique variance accounted for by each predictor when controlling for all other predictors. [c]For *t* tests determining significance of Beta Weights, df = 462. [d]For *F* tests determining the significance of ΔR^2, *df* = 1, 461. [e]Effect-coded as '-1". Model R^2 = .1226; Adj. R^2 = .1092.

*p < .05, **p < .01, ***p < .001, ****p < .0001

Table 7. Intercorrelations between Predictor Variables and Support for Biodiesel[a]

Variable	D1[b]	D2	D3	D4	D5	D6	D7	D8[b]	D9	D10	D11	D12[b]	D13	D14	D15	Support
D1[b]	-	.24****	.35****	.15****	.03	.02	.04	.13****	-.10***	.07	.11**	-.06	-.05	.00	-.25****	-.09
D2		-	-.57****	-.25****	.04	-.07	-.14***	-.09*	-.03	-.03	-.03	-.16****	-.17****	.04	.54****	-.07
D3			-	-.36****	.00	-.04	.15****	.13***	-.08*	.11**	.07	-.04	.06	-.10**	-.65****	-.11*
D4				-	-.03	.15****	.00	.06	.06	-.06	.05	22****	.08*	.20****	-.02	.16***
D5					-	.26****	.10*	-.38****	-.05	-.10**	-.19****	-.07	.04	-.08*	.20****	-.19****
D6						-	.08*	-.13***	.01	-.02	-.11**	.00	-.01	-.03	.07	-.02
D7							-	.00	.01	-.07	.04	-.09*	-.05	-.06	-.18****	-.13**
D8[b]								-	.19****	.30****	.40****	19****	16****	.11**	.33****	.15***
D9									-	-.22****	-.29****	-.02	.02	-.07	.08*	-.05
D10										-	-.46****	.04	.05	-.01	-.10*	.05
D11											-	.13***	.09*	.16****	-.23****	.10*
D12[b]												-	.75****	.30****	.13**	.19****
D13													-	-.24****	-.13***	.05
D14														-	-.04	23****
D15															-	-.05
Support																-

[a]Phi coefficients calculated between predictor variables; point biserial correlations calculated between predictor variables and support. [b]Membership in category effect coded as -1, therefore, negative coefficient indicates positive correlation and positive coefficient indicates negative correlation.

*p < .05, **p < .01, ***p < .001, ****p < .0001.

Table 9. Intercorrelations between Dummy Variables and Concerns about Biodiesel[a]

Variable	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	Concerns
D1[b]	-	.25****	.35****	.15****	.03	.02	.04	.13***	-.10**	.07	.11**	-.06	-.05	.00	-.25****	.04
D2		-	-.57****	-.24****	.05	-.07	-.14***	-.09**	-.03	-.03	-.03	-.16****	-.17****	.03	.54****	.08
D3			-	-.36****.	.00	-.04	15****	.13***	-.08*	.11**	.07	-.04	.06	-.10**	-.65****	.09*
D4				-	-.03	15****	.00	.06	.06	-.06	.05	.22****	.08*	.09*	-.02	-.19****
D5					-	26****	.10*	-.38****	-.05	-.10**	-.19****	-.07	-.05	-.09*	.20****	.00
D6						-	.08*	-.13***	.01	-.02	-.11**	.00	-.01	-.03	.07	-.11*
D7							-	.00	.01	-.07	.04	-.09*	-.05	-.06	-.18****	.00
D8[b]								-	.19****	.30****	.40****	.19****	.16****	.11**	-.33****	-.03
D9									-	-.21****	-.29****	-.01	.02	-.07	.08*	.01
D10										-	-.46]	.04	.l0*	-.01	-.10*	.04
D11											-	.13***	.09*	16****	-.23****	-.07
D12[b]												-	.75****	.30****	-.13**	-.11*
D13													-	-.24****	-.13***	-.04
D14														-	-.04	-.10*
D15															-	.04
Support																-

[a]Phi coefficients calculated between predictor variables; point biserial correlations calculated between predictor variables and support. [b]Membership in category effect coded as -1, therefore, negative coefficient indicates positive correlation and positive coefficient indicates negative correlation.

[b]Membership in category effect coded as -1, therefore, negative coefficient indicates positive correlation and positive coefficient indicates negative correlation.
*p < .05, **p < .01, ***p < .001, ****p < .0001.

Table 10. Beta Weights and Squared Semipartial Correlations from Multiple Regression Analysis Predicting Concerns about Biodiesel

		Beta Weights[a]		Squared semipartial correlations[b]	
Variable	Variable name	Beta	t[c]	sR²	F[d]
D3	Utah State University	0.028	0.48	.0004	0.20
D4	Illinois State University	-0.260	-3.02**	.0182	9.14**
D6	Have purchased biodiesel	-0.197	-1.89	.0071	3.57
D12[e]	Conservative	-0.054	-0.93	.0017	0.85
D14	Liberal	-0.155	-1.48	.0044	2.21

[a]Standardized multiple regression coefficients. [b]Percentage of unique variance accounted for by each predictor when controlling for all other predictors. [c] For *t* tests determining significance of Beta Weights *df* = 462. [d]For F tests determining the significance of ΔR^2 *df* = 1, 477. [e]Effect-coded as '-1". Model R^2 = .0524; Adj. R^2 = .0425.

**p < .01.

predictor variables and concerns about biodiesel ranged from .09 (Utah State University student to -0.19 Illinois State University student. Using descriptors suggested by Davis (1971), the magnitude of each significant relationship was low. Multicollinearity among the five predictors was assessed using variance inflation factors (VIF). All obtained VIF values (ranging from 1.03 to 1.24) were substantially less than 5, indicating low levels of multicollinearity between predictor variables (Hair et al., 1998).

The regression equation containing the five predictor variables was statistically significant [F(df = 5,476) = 5.24; p < .0001 (adjusted R^2 = .0425)] and explained 5.24% of the variance in concerns about biodiesel. Beta weights (standardized multiple regression coefficients) and squared semi-partial correlations (Table 10) were reviewed to assess the importance of each of the five variables in predicting support for biodiesel. Being an Illinois State University student was the only predictor with a statistically significant Beta weight and squared semi-partial correlation coefficient. The negative Beta weight indicated Illinois State University students a lower level of concerns about biodiesel than the average student. Being an Illinois State University student explained 1.82% of the variance in concerns about biodiesel.

Summary

This study sought to examine selected college students' awareness, use and perceptions of biodiesel and determine if awareness, use, and perceptions varied by university, gender, major (agriculture vs. non-agriculture), type of area where students were raised (farm, rural non-farm, town or city), or political orientation (conservative, moderate or liberal). The results of this study have implications for educators, researchers, consumers and the U. S. biodiesel industry. Approximately one in five (20.9%) students reported owning or driving a diesel vehicle while over three-fourths (76.4%) had heard of biodiesel. Only about 1 in 14 (7.1%) of those having heard of biodiesel had ever purchased biodiesel. If one assumes that students unaware of biodiesel had never purchased biodiesel, then only 5.6% of all students surveyed had ever purchased biodiesel.

These observed differences in awareness and use may be due to differences in the concentration of biodiesel retail outlets in the four states where these universities are located. The concentration (km^2/retail outlet) of biodiesel outlets was highest in Illinois (1,445 km^2/outlet), followed by Arkansas (15,305 km^2/outlet), Texas (20,329 km^2/outlet) and Utah (21,990 km^2/outlet) (National Biodiesel Board, n.d.). A higher concentration of biodiesel outlets obviously provides greater purchasing opportunities through increased availability and may serve to increase awareness through observation and informal peer networks (Van de Velde et al., 2009).

Males, agriculture majors and students raised on a farm were significantly more likely to have heard of biodiesel than females, non-agriculture majors and students raised in a town or city. Students raised on a farm were more likely to have purchased biodiesel than students raised in a city. These results indicate a need to especially target consumer education efforts about biodiesel toward females, non-agriculture majors, and those raised in urban areas. These findings are consistent with Van de Velde et al. (2011).

The results of principal components analysis indicated that two factors were capable of explaining 73.4%

of the variance in the original 34 items assessing perceptions of biodiesel. These two factors were named "support for biodiesel" and "concerns about biodiesel." The support for biodiesel factor contained 15 items explicitly or implicitly comparing biodiesel to petroleum diesel on environmental, renewable, domestic and performance characteristics. The concerns about biodiesel factor contained six items related to the effects of biodiesel on food availability and cost and engine performance and maintenance and repair costs. Because items loaded on two broadly generic factors rather than on multiple specific factors, the researchers concluded these students have fairly unsophisticated knowledge and attitudes toward biodiesel and were most likely reacting to the overall perceived "goodness" of biodiesel as a renewable energy source without a deep level of technical knowledge. This is consistent with previous research demonstrating consumer attitudes are primarily developed through affective not cognitive processes (Bang et al., 2000; Hartman et al., 2012).

Regardless of the exact mechanism by which these attitudes were developed, students at these four U.S. universities had moderately positive levels of support for biodiesel. Results of regression analyses indicated that having liberal political views (sR^2 = .0236) was the best unique predictor of support for biodiesel, followed by owning or driving a diesel vehicle (sR^2 = .0134), being male (sR^2 = .0110), and being an Illinois State University student (sR^2 = .0091). However, the linear combination of these four predictor variables left 94.3% of the variance in support for biodiesel unexplained. This indicates that, while statistically significant, these four variables are weak predictors of support for biodiesel.

Students at these four U.S. universities were undecided to slightly unconcerned about potential negative effects of biodiesel production and use. The results of multiple regression analyses indicated that being an Illinois State University student was the only significant unique predictor of concerns about biodiesel (sR^2 = 0.182). The most consistent finding of this study was that Illinois State University students tended to be more likely to have purchased biodiesel, to be more positive about the benefits of biodiesel, and to have a lower level of concern about the effects of biodiesel production and use. While this "university effect" was not particularly strong, it was consistent and may be a result of the higher concentration of retail biodiesel outlets in Illinois. Greater availability likely leads increased use of biodiesel, which, in turn, may lead to more positive attitudes toward biodiesel.

The relationships between university and demographics and support for biodiesel and concerns about biodiesel were relatively small; overall students could be categorized as neutral to moderately positive in their perceptions of biodiesel. This, coupled with students' relatively unsophisticated perceptions of biodiesel, suggest a need for information about a wide range of issues related to biodiesel if these students are to be informed consumers and renewable energy leaders. This is consistent with previous research (Acker, 2008; Kinsey et al., 2003; Skipper, 2007; Van de Veld et al., 2011). Further research is also needed to better understand factors affecting college students' (and consumers') attitudes toward biodiesel.

Interpreted through the lens of Ajzen et al. (1980) theory of reasoned action, these results may explain the relative non-use of biodiesel by these students. Students are only moderately positive in their perceptions of the benefits of using biodiesel. When these factors are coupled with the lack of biodiesel availability, it is of little wonder that only about one in five (20.7%) students owning or driving a diesel vehicle and aware of biodiesel had ever purchased biodiesel. Thus, increasing biodiesel use will likely depend on both increasing consumer demand (through education) and increasing availability of biodiesel (through increased retail outlets).

Finally, future research should explore policies to increase biofuel use with consumption tax credits. It is very important to understand the effects of such policies on the markets for agricultural products, biofuels, and reduction of dependence on foreign oil and increased public awareness of biodiesel. Research for improving transportation and production infrastructure may assist increasing the availability of biodiesel leading to increased use of biodiesel, which, in turn, may lead to more positive attitudes toward biodiesel. Social marketing campaigns coupled with usage of QR-code stickers at businesses where diesel is sold may also increase public awareness and knowledge regarding biodiesel.

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Psychological Indices of Animal Judging Team Participants: Predictors for Development of Optimal Performance

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Abstract

It is generally accepted that a competitive mindset is essential to successfully compete in collegiate sports. Unlike sports, where both mental and physical skills are required, agricultural students compete in judging contests, solely on mental skills. Therefore, quantifying the mindset of judging competitors, and determining the efficacy of psychological inventories may prove useful in identifying and developing student judging performance. Following informed consent, multidimensional psychometric inventories were completed by 265 collegiate judging participants (161 males, 104 females) from 13 universities. Coaches ranked team participants by judging proficiency/skill level (high, moderate, low). Data were analyzed by skill level, gender and judging event. MANOVA indicates significant main effects across skill level (P = 0.007) and judging event (P = 0.003), but not gender (P = 0.19). Highly-ranked competitors exhibit significantly less tension, depression, anger, fatigue, and confusion, and significantly greater skills in controlling anxiety and maintaining concentration, confidence, and motivation than lower-ranked competitors. Top performers are more power-oriented, more repressive-focused and internalistic than lower-ranked peers. Discriminant function analysis revealed 88% of judging competitors were correctly classified by skill level using psychological variables. In conclusion, psychometric inventories can assist judging coaches in identifying a student's capacity and potential development to successfully compete in a judging environment.

Introduction

A competitive mindset is advantageous to successfully compete in sports. Areas of investigation included mood states, psychological skills, motivation, competitive anxiety, training adaptation, and locus of control (Bresciani et al., 2011; Feher et al., 1998; Geukes et al., 2013; LeUnes and Burger, 1998; Meyers et al., 1994; Stewart and Meyers, 2004). From these and other studies, compelling evidence indicates a strong association between an individual's psychological/emotional status and actual performance, as well as the usefulness of psychometric instruments in quantifying and monitoring the psychological profile deemed necessary for optimal performance (Bresciani et al., 2011; Raglin et al., 1996; Sheldon and Eccles, 2005; Smith et al., 2002; Terry, 1995). Others also note that present mindset and psychological skill set are significant predictors of performance development and competitive potential (Chamberlain and Hale, 2007; Geukes et al., 2013; Mahoney, 1989; Sheldon and Eccles, 2005; Psychountaki and Zervas, 2000).

At academic institutions, agricultural students also participate in competitive programs in the form of animal judging team contests to test their ability to evaluate and select animals, while providing an avenue for competitors to continue to enhance their knowledge and communication skills. Ultimately, the student gains substantial knowledge of the animal industry's standards and accepted criteria of quality.

Unlike sports, where both mental and physical abilities are required, animal judging is dependent solely on mental skills. A judging contest often lasts several hours depending on the species and level of competition and, oftentimes, under challenging conditions. Judging team members are required to evaluate several classes of animals during a morning session, ultimately ranking or "placing" each animal from first to last based on conformation and/or performance potential (i.e., marketability, athleticism, genetic/reproductive). During the afternoon session, students explain their decisions

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by orally presenting their placings, referred to as "reasons," to a qualified animal judge. Each competitor is scored on both their placements and rationale on those placements relative to how the officials judged the various classes. Scores are tabulated to determine both individual and team awards.

The mental skills involved in successful animal evaluation and selection include the ability to manage anxiety and mental fatigue while consistently maintaining a high level of concentration, composure, self-discipline, confidence and motivation (McCann and McCann, 1992; Moore, 1991; Nash and Sant, 2005). Team members must also be skilled in making acute, objective decisions and possess the ability to organize and succinctly verbalize these decisions (Boyd et al., 1992; McCann et al., 1991). To achieve optimal potential, extensive efforts in the identification, development and monitoring of sound mental strategies are key ingredients throughout the competitive season, involving decision-making skills developed through long hours of intense training.

Although limited in scope, research on agricultural judging dates back to the turn of the century. Early studies primarily addressed the efficacy of grain judges in the evaluation of corn yields (Hughes, 1917; Wallace, 1923), and winter wheat (Trumbo et al., 1962). Later research on horse and livestock judging focused on psychological skills development and assessment (Phelps and Shanteau, 1978; Shanteau and Phelps, 1977), personality typing (McCann et al., 1988, 1991), coaching influence (Shanteau, 1978), and development of life-skills (Boyd et al., 1992; Nash and Sant, 2005).

In the evaluation and selection of judging students, coaches may perceive that certain attributes exert an influence on the ability to effectively compete. These include prior experience and level of success, degree of intellect as reflected in a student's academic progress in course work or degree plan, age or maturity, motivation, or gender (McCann et al., 1988, 1991; Moore, 1991). Shanteau (1978) indicates a significant increase in judging proficiency in trained versus untrained students. With the extensive amount of information processing and strategy required in animal judging, selecting students with a high degree of intelligence and prior experience would make sense. There is no general consensus, however, on how to adequately define or independently assess these attributes. Experience and maturity may be difficult to quantify, obtaining information on academic status is typically deemed obtrusive and in violation of a student's right to privacy, and attributes such as age and prior performance have not been proven to guarantee future success.

In regards to gender differences, with the extensive participation of females in collegiate judging programs, it is critical that psychological response on female competitors be investigated for comparison and development. Research conducted on other livestock-related contests, such as rodeo, reveals that males possess significantly greater psychological skills in anxiety management, confidence, and motivation than female competitors (Meyers et al., 1996). Male competitors involved in numerous sports also exhibit significantly greater coping, self-confidence, and cognitive skills, and lower precompetitive anxiety and catastrophizing response when confronted by competitive challenges (Feher et al., 1998; Meyers et al., 1999; Trafton et al., 1997).

Interestingly, the intense competitive nature of animal judging at the national level has only led to limited investigation addressing the relationship between psychological competitiveness and judging performance (McCann et al., 1988, 1992). When former judging team members were requested to list positive attributes gained by participating in a judging team program, competitiveness was listed among other traits such as communication skills, confidence, animal evaluation skills, motivation, and self-discipline (McCann et al., 1992). Since actual competitive performance is typically the standard to evaluate a student's skill set (Smith et al., 2002), no research efforts have focused on a comprehensive, multidimensional approach utilizing a battery of competitive-specific psychometric inventories modified to the competitive judging environment. Therefore, the purpose of this study was to quantify the competitive mindset of judging competitors by skill level, gender, and judging event, and to determine the efficacy of psychological inventories in identifying and developing competitive performance in a judging environment for future student development. Consequently, it is believed that higher skilled judging participants exhibit a more optimal competitive mindset than less-skilled peers, and that males demonstrate a profile deemed more conducive for successful performance than females.

Methods

Subjects and Procedures

Following Institutional Review Board approval and prior to the study, judging coaches from 13 colleges and universities were randomly contacted by phone to discuss the purpose, procedures, and benefits of the research, and subsequently agreed to participate in this study. During their respective team meetings, student participants were fully informed of the nature of the study and provided written informed consent. This resulted in a total of 265 collegiate animal science judging team members (161 males, 104 females; 21.3 $\pm$ 2.2 yrs) representing seasonal team rankings ranging from one to 25 in their respective events.

Based on the theory that psychological indices of successful performance are multidimensional involving several domains (Gould et al., 2002; Sheldon and Eccles, 2005), a psychometric battery of inventories consisting of the Profile of Mood States (POMS; McNair et al., 1971), the Sports Attitude Inventory (SAI; Willis, 1982), the Sport Competition Anxiety Test (SCAT; Martens, 1977), the Controlled Repression-Sensitization Scale (CR-S; Handel, 1973), Levenson's IPC Scale (IPC; Levenson, 1981), and the Psychological Skills Inventory for Sport (PSIS; Mahoney et al., 1987) were mailed to

the judging coaches. The battery was then administered to each participant by his/her respective coach and completed during a single team meeting. Participants were encouraged to answer all questions to the best of their ability according to written directions. Coaches were also requested to submit in writing the ranking of team members into three groups according to judging proficiency: high, i.e., individuals that consistently perform well at judging practice and contests; moderate, individuals that often have inconsistent performances during judging practice and contests; or low, individuals struggling to successfully compete at the collegiate judging team level. Compiled inventories and ranking sheets were then mailed to the principal investigator for scoring and statistical analyses. No incomplete inventories were returned and all returned inventories were completed within a 14-day period of time.

Instrumentation

Profile of Mood States (POMS). The POMS is a 65-item inventory used extensively to assess six dimensions of mood state: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, confusion-bewilderment, and a composite score, i.e., total mood disturbance [TMD = (tension + depression + anger + fatigue + confusion) - vigor] (McNair et al., 1971). Answers range from strongly agree to strongly disagree, with reliability and internal validity (r = 0.65 - 0.93; Cronbach % = 0.87 - 0.95) of the POMS supported in over 250 publications (LeUnes and Burger, 1998). Successful competitors typically exhibit the “iceberg profile,” a phrase coined by Morgan (1984) indicating a satisfactory mood state that is high in vigor while low in the other performance-compromising states.

Sports Attitude Inventory (SAI). The SAI was developed to evaluate three forms of competition-specific motivation: power, motivated to achieve success, and motivated to avoid failure (Willis, 1982). The inventory consists of 40 statements with a 5-point Likert-type format, ranging from strongly agree to strongly disagree. Higher scores denote higher perceived competence. Construct and concurrent validity has been established (r = 0.69 - 0.95; %= 0.76 - 0.78) and normatives developed across numerous sport populations and gender (Feher et al., 1998; Trafton et al., 1997; Willis and Layne, 1988).

Sport Competition Anxiety Test (SCAT). Originally developed to determine the level of anxiety typically felt prior to competition (Martens, 1977), the SCAT is comprised of 15 statements with a 3-point Likert-type scoring format ranging from hardly ever to often. Scores range from 10 to 30, demonstrating low to high competitive anxiety, respectively. Test-retest reliability (r = 0.91 - 0.97) and validity (% = 0.72 - 0.90) have been firmly established (Feher et al., 1998; Martens, 1977; Trafton et al., 1997). Stress, anxiety and tension have been determined to both negatively and positively affect competitive response dependent on the type of competition and level of ability (Chamberlain and Hale, 2007; Geukes et al., 2013).

Controlled Repression-Sensitization Scale (CR-S). The CR-S is comprised of 30 true-false statements used to measure one’s ability to concentrate or focus during competition (Handel, 1973). A low score indicates the ability to repress or block out external distractions and focus on performance, whereas a high response indicates sensitivity to distractions during competition. Successful competitors will usually exhibit a low CR-S score. The reliability and validity of the CR-S have been extensively documented in the literature (r = 0.82 - 0.94; %= 0.62 - 0.91; Feher et al., 1998; Handel, 1973; Trafton et al., 1997).

Levenson’s IPC Scale. Originally conceived to quantify the influence of reinforcement on behavior, the IPC scale indicates three dimensions of locus of control over one’s life: internal, powerful other, and chance (Levenson, 1981). Subjects respond to 24 statements via a 6-point Likert format. Scores range from 0 to 48 on each dimension, with higher scores preferred for the internal construct, and low scores desirable for the powerful other and chance-oriented dimensions. An extensive amount of research has been conducted on locus of control substantiating both validity (%= 0.60 - 0.91) and reliability (r = 0.71 - 0.96) across numerous competitive populations, with Levenson’s scale continuing to be viewed as psychometrically sound (Daiss et al., 1986; Feher et al., 1998; Levenson, 1981).

Psychological Skills Inventory for Sport (PSIS). The PSIS is a 45-item instrument which indicates six psychological skills relevant to competition: anxiety management, concentration, confidence, motivation, mental preparation, and team emphasis (Mahoney et al., 1987; Mahoney, 1989). Higher scores indicate greater perceived ability derived from a 5-point Likert scoring format. Research with the PSIS has established internal consistency, convergent validity, test-retest reliability, and scale construct effectiveness (r = 0.47 - 0.87; %= 0.64 - 0.72; Mahoney, 1988, 1989; Meyers et al., 1994).

Statistical Analyses

Data were grouped for analyses by skill level (high, moderate, low), gender and animal judging event (horse, livestock). As previously mentioned, the amount and quality of prior experience has always been difficult to define or control for in any study dealing with a competitive population. For instance, although the Aexperience factor@ is typically emphasized, any successful attempt at comparing the number of years of competition, the number of contests per year, or the level of contest experience from one student to another is improbable. In other words, a student with less years of participation may have obtained a higher quality of coaching or experiences. Subsequently, the authors decided that rankings derived from collegiate competition would best define the quality of experience, and was the preferred choice among the participating coaches. Multivariate analyses of variance (MANOVA) were performed utilizing General Linear Model procedures on a Statistical Analysis System (SAS) platform to

determine significant main effects. Least squares means procedures were employed due to unequal number of observations upon which to compare differences between variables. Post hoc analyses using analysis of variance (ANOVA) and Tukey's HSD procedures were performed on each dependent variable when significant main effects were observed. Statistical significance was determined a priori at the 0.05 level. Discriminant function analysis was performed using all psychological test scores from the inventories as predictors of skill level of subjects as predetermined by coaches rankings. The three groups were high, moderate and low-skilled competitors.

Results and Discussion

Skill Level

Comparison of psychological responses between high, moderate and low-ranked competitors is shown in Table 1. Wilks' Lambda criterion indicates a significant skill level effect ($F_{42,396}$ = 1.66; P = 0.007) across mood states, motivation, repression-sensitivity, locus of control and psychological skills. High-ranked competitors exhibit significantly less tension, depression, anger, fatigue, and confusion and possess significantly higher skills in controlling anxiety, and maintaining concentration, confidence, and motivation (P < 0.05 to 0.0001) than lower-ranked judging participants. The high-ranked individuals are more power-oriented, more repressive/focused and internalistic than their less-skilled peers.

These findings are consistent with prior personality research conducted on animal judging team members (McCann et al., 1988, 1992), and other traditional agriculturally-related competitors (Meyers et al., 1996, 1999). With regard to the POMS, not only do scores of high-ranked competitors reveal the Aiceberg profile@ across all independent variables in this study (Morgan, 1984), the relationship observed between positive psychological traits and high-skill level is consistent with other sport studies (Chamberlain and Hale, 2007; LeUnes and Burger, 1998; Meyers et al., 1994).

In regards to the utility of the psychometric subscales to predict a participant's skill level, discriminant function analysis indicates a significant association between skill level groups and psychological variables, with 88% of judging competitors correctly classified according to high, moderate or low skill levels. This suggests that psychometric inventories, typically used in sport, do have application within the highly competitive, judging team environment.

Gender

Mean psychological response of judging students by gender is shown in Table 2. Although no significant main effects is observed between gender ($F_{25,196}$ = 1.27; P = 0.19), there is a tendency for males to exhibit lower levels of tension, depression, confusion and total mood disturbance than female students. Males also demonstrate a tendency to respond higher in anxiety management, concentration, confidence and motivation, as well as more driven to attain power, more influenced

Table 1. Mean Psychological Construct Scores Between High, Moderate, and Low-Ranked Competitors

	Skill Level		
Variables	High	Moderate	Low
Participants	78	104	61
POMS			
Tension-Anxiety	12.5 A 0.8[d]	12.4 A 0.7[d]	15.7 A 0.9[e]
Depression-Dejection	7.4 A 1.1[d]	9.1 A 0.9[b]	12.5 A 1.2[e,c]
Anger-Hostility	8.8 A 1.9[f]	10.2 A 0.7[d]	13.4 A 1.0[g,e]
Vigor-Activity	17.7 A 0.6	17.4 A 0.5	17.1 A 0.7
Fatigue-Inertia	9.0 A 0.7[b]	9.3 A 0.6[b]	11.4 A 0.8[c]
Confusion-Bewilderment	7.6 A 0.6[b]	7.8 A 0.5[b]	9.4 A 0.6[c]
Total Mood Disturbance	27.7 A 3.4[f]	31.4 A 2.8[d]	45.3 A 3.8[g,e]
SAI			
Motivated by Power	46.3 A 0.8[f,h]	42.9 A 1.6[g]	41.4 A 0.8[i]
Motivated to Achieve Success	71.7 A 0.8	69.5 A 0.7	69.8 A 0.9
Motivated to Avoid Failure	37.5 A 0.8	36.3 A 0.7	37.2 A 0.9
SCAT	17.3 A 0.3	17.4 A 0.2	17.1 A 0.3
CR-S	11.3 A 0.5[b]	12.3 A 0.4	13.1 A 0.6[c]
IPC			
Internal	37.3 A 0.6[b]	37.2 A 0.5[b]	35.4 A 0.7[c]
Powerful Other	16.9 A 0.9	16.8 A 0.7	16.8 A 1.0
Chance	17.1 A 1.0	17.8 A 0.8	18.4 A 1.1
PSIS			
Anxiety Management	66.9 A 1.4[d]	64.1 A 1.2	60.8 A 1.6[e]
Concentration	71.1 a 1.4[d,h]	66.0 A 1.2[e]	62.7 A 1.6[i]
Confidence	75.3 A 1.8[f,d]	69.3 A 1.5[e]	65.2 A 2.0[g]
Mental Preparation	61.3 A 1.1	60.1 A 0.9	59.0 A 1.2
Motivation	75.0 A 1.4[d,h]	69.8 A 1.2[e]	66.7 A 1.5[i]
Team Emphasis	77.5 A 1.0	75.6 A 0.8	75.3 A 1.1

[a]Mean A SEM; POMS, Profile of Mood States; SAI, Sports Attitude Inventory; SCAT, Sport Competition Anxiety Test; CR-S, Controlled Repression-Sensitization Scale; IPC, Levenson's IPC Scale; PSIS, Psychological Skills Inventory for Sport. [bc] P <.05, [de] P <.01, [fg] P <.001, [hi] P <.0001

Table 2. Mean Psychological Response of Competitors by Gender

	Gender	
Variables	Male	Female
Participants	161	104
POMS		
Tension-Anxiety	12.8 A 0.5	13.9 A 0.7
Depression-Dejection	9.4 A 0.7	10.2 A 1.0
Anger-Hostility	11.3 A 0.6	10.6 A 0.8
Vigor-Activity	17.5 A 0.4	14.1 A 0.5
Fatigue-Inertia	9.6 A 0.5	9.8 A 0.6
Confusion-Bewilderment	7.5 A 0.4	8.9 A 0.5
Total Mood Disturbance	33.1 A 2.2	36.4 A 3.0
SAI		
Motivated by Power	44.9 A 0.5	42.3 A 0.7
Motivated to Achieve Success	70.4 A 0.6	69.8 A 0.7
Motivated to Avoid Failure	36.2 A 0.6	37.0 A 0.7
SCAT	17.5 A 0.2	16.9 A 0.2
CR-S	12.1 A 0.3	12.3 A 0.4
IPC		
Internal	37.6 A 0.4	35.9 A 0.5
Powerful Other	18.2 A 0.6	15.6 A 0.6
Chance	18.4 A 0.6	17.1 A 0.8
PSIS		
Anxiety Management	65.8 A 0.1	63.2 A 0.1
Concentration	69.2 A 0.1	65.2 A 0.1
Confidence	73.7 A 0.1	67.1 A 0.1
Mental Preparation	60.0 A 0.1	60.8 A 0.1
Motivation	71.2 A 0.1	69.6 A 0.1
Team Emphasis	75.3 A 0.1	76.6 A 0.1

[a]Mean A SEM; POMS, Profile of Mood States; SAI, Sports Attitude Inventory; SCAT, Sport Competition Anxiety Test; CR-S, Controlled Repression-Sensitization Scale; IPC, Levenson's IPC Scale; PSIS, Psychological Skills Inventory for Sport.

to seek behavior reinforcement from others and believe that chance played a role in judging outcome when compared to female competitors.

The nonsignificant differences observed between gender and event by gender, however, are not surprising based on equivocal findings in other studies. While some competitive populations exhibit significant differences between males and females in anxiety management, confidence and cognitive awareness (Encarnacion et al., 2000; Meyers et al., 1988, 1992, 1996), others competitors reported in the literature reflect similarity in psychological response (Feher et al., 1998; Meyers et al., 1990). Findings may be indicative of the similarity of daily preparation and expectations, regardless of gender, that is required in this extremely competitive environment, or simply attributed to the greater psychological uniformity of individuals drawn to this type of activity (Encarnacion et al., 2000).

Judging Event

Wilks' Lambda criterion indicates a significant main effect ($F_{25,196}$ = 2.07; P = 0.003) by judging event, with mean psychological responses of competitors shown in Table 3. Horse judging competitors exhibit significantly higher tension, depression, fatigue, confusion, and significantly lower concentration, confidence and motivation response (P = 0.05 to 0.001) than livestock judging participants. Horse judging students are also less power-motivated (P = 0.02), and express less precompetitive anxiety (P = 0.03) than livestock judging competitors.

Table 3. Mean Psychological Response of Competitors by Judging Event

	Judging Event		
Variables	Horse	Livestock	*P*
Participants	106	159	
POMS			
Tension-Anxiety	14.4 A 0.7	12.2 A 0.7	.03
Depression-Dejection	10.9 A 0.9	8.2 A 1.0	.05
Anger-Hostility	10.5 A 0.7	10.3 A 0.8	NS
Vigor-Activity	16.8 A 0.5	17.8 A 0.5	NS
Fatigue-Inertia	11.3 A 0.6	8.5 A 0.6	.001
Confusion-Bewilderment	9.3 A 0.5	7.2 A 0.5	.002
Total Mood Disturbance	39.6 A 2.9	28.5 A 3.0	.009
SAI			
Motivated by Power	42.3 A 0.7	44.6 A 0.7	.02
Motivated to Achieve Success	69.8 A 0.7	71.0 A 0.8	NS
Motivated to Avoid Failure	36.9 A 0.7	36.9 A 0.7	NS
SCAT	16.8 A 0.2	17.6 A 0.3	.03
CR-S	12.1 A 0.4	12.5 A 0.4	NS
IPC			
Internal	36.7 A 0.5	36.6 A 0.6	NS
Powerful Other	17.0 A 0.7	16.6 A 0.8	NS
Chance	18.2 A 0.8	17.7 A 0.9	NS
PSIS			
Anxiety Management	63.1 A 1.2	65.3 A 1.3	NS
Concentration	64.6 A 1.2	68.7 A 1.3	.03
Confidence	67.1 A 1.5	73.0 A 1.6	.007
Mental Preparation	60.1 A 0.9	60.8 A 1.0	NS
Motivation	68.0 A 1.2	73.6 A 1.2	.002
Team Emphasis	75.7 A 0.8	76.7 A 0.9	NS

[a]Mean A SEM; POMS, Profile of Mood States; SAI, Sports Attitude Inventory; SCAT, Sport Competition Anxiety Test; CR-S, Controlled Repression-Sensitization Scale; IPC, Levenson's IPC Scale; PSIS, Psychological Skills Inventory for Sport.

The significant differences in mood states, precompetitive anxiety and psychological skills between horse and livestock judging competitors has not been reported elsewhere in the literature. Event differences are noted, however, in such sports as equestrian, rodeo, and football (LeUnes and Burger, 1998; Meyers et al., 1988, 1999). Findings, again, reiterate both the variability and similarities commonly perceived by individuals between and within a specific competitive environment (Sheldon and Eccles, 2005).

Limitations

Although this study reflects an initial attempt in addressing this unique population of competitors, possible limitations to the study are the extensive, but not all-inclusive number of indices that were quantified. Although the psychological aspects of competition are clearly multidimensional, and that other psychological indices may be pertinent to successful performance (Gould et al., 2002; Sheldon and Eccles, 2005), the authors feel that the array of inventories and the time required to address the extensive number of questions and subsequent subscales provide substantial insight into a competitive population not recently investigated. Prior discussions with coaches, judging team members, and prior author experience as they relate to optimal performance, also substantiate our selection and use of the inventories provided. In summary, findings clearly indicate that the incorporation of psychometric assessment reveals potential predictors of competitive performance as confirmed in prior studies and paradigms (Meyers et al., 1994; Psychountaki and Zervas, 2000; Sheldon and Eccles, 2005, Smith et al., 2002).

Conclusion and Implications

The purpose of psychometric assessment in almost any arena is multifaceted. Of prime consideration is the identification of psychological constructs of exemplary individuals who habitually perform at high levels. The assessment of the status of poorly performing individuals on these same constructs is of parallel importance. The results at this time indicate that the multidimensional use of psychometric inventories that address competitive variables, deemed essential for optimal sport performance, has the potential for use in identifying and delineating a student's capacity and potential development to compete in an animal judging team environment. The brief format of these self-report instruments, effective in obtaining information where limitations on time are a factor during the judging season, provides a quantitative yardstick prior to the season to supplement a coach's overall assessment, while also revealing critical cues on subtle nuances that may go unnoticed leading to maladaptive behavior (Meyers et al., 1992; Smith et al., 2002). During the judging season, scores may aid coaches in differentiating those students that effectively address the competitive environment from those competitors that may require additional attention to insure optimal performance (Bresciani et al.,

2011; Raglin et al., 1996; Smith et al., 2002). Subsequent readministration of psychometric inventories may provide information concerning changes in attitudes and strategies of students following cognitive interventions, or identify impending psychological dysfunction preventing optimal return to top performance.

At this point, initial research concerning the utility of psychometric instruments in assessing animal judging team performance is encouraging, as judging students appear to parallel the psychological profile of both team and individual sport athletes. The unique nature of this competitive non-sport activity reveals an individual who faces new challenges on a daily basis, prompting similarity in psychological mindset. Further research establishing precompetitive preparation in judging competitors with performance outcome and physiological response, as confirmed in other sports, may provide additional insight into the judging student's perception of imminent competition (Meyers et al., 1990; Psychountaki and Zervas, 2000; Silva and Hardy, 1986). Research exploring additional indices of exemplary performance specific to the judging environment, and at other levels of judging competition, also warrant further attention. Such knowledge would enable coaches to optimize the training environment through more developmentally structured programs that emphasize the optimal preparation of the competitive mindset, for scholastic achievement both in and outside of the classroom.

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Evaluation of a Blended Design in a Large General Education Nutrition Course

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Abstract

The purpose of this study was to evaluate the effectiveness of a blended delivery method in a large enrollment introductory nutrition course (n=400) offered to both on-campus and distance education students at a University in the western United States. In this blended class, half of the content (1.5 credits) was delivered in an instructor led synchronous format; the other half was delivered asynchronously in the online environment using Blackboard and enhanced with various instructional technologies. Student course evaluations and final grades were used to compare students' level of satisfaction with the course and performance across student groups (on-campus vs. distance education). The majority of students (80%) recommended that the course continue to be taught in the blended format. Both student satisfaction and performance were influenced by student group. On-campus students earned higher grades than did distance education students, although distance education students reported higher levels of satisfaction with the blended design. A blended delivery method may be a successful alternative approach to large enrollment traditionally lecture-based courses. Blended delivery of such classes may offer students greater flexibility and the option of smaller class sizes.

Introduction

According to the National Center for Education Statistics, undergraduate enrollment at accredited institutions of higher education in the U.S increased by 37% between 2000 and 2010.

Many institutions are experiencing record increases in enrollment, yet faculty appointments and other resources often remain the same. One solution to this problem is to increase the number of students taught per course, however, empirical evidence suggests that students in large enrollment courses rate these courses less favorably and perceive themselves as learning less than they do when taught in smaller sections (Monks and Schmidt, 2010; Toth and Montagna, 2002). The blended learning model is gaining popularity due to evidence that if offers advantages over both traditional and purely web-based models of instruction (Stizmann et al., 2006; Department of Education, 2010). In some cases, it may provide an alternative approach to the traditional lecture-based delivery of large enrollment courses.

Blended learning, also known as hybrid learning, is the integration of traditional face-to-face instruction with online learning and instruction in which students have some degree of control regarding the time, place, and or pace of the instruction (Holden, 2010; Duhaney, 2004). Blended learning can assume many formats. Well-planned blended course designs maximize the benefits and minimize the limitations of fully face-to-face or online formats. For example, where face-to-face learning is usually teacher-directed and provides little flexibility in terms of time, place, and pace of instruction, online learning expands the boundary of the physical classroom and puts students in charge of when, where, and how they learn. Kinzie and Sullivan (1989) propose that students' motivation to learn is enhanced when learners have greater control over these factors. In addition, while students of fully online courses often feel isolated from other students and instructors, traditional face-to-face instruction provides opportunity for frequent and direct interactions. These differences are noteworthy because motivation to learn and the degree of student-student and student-instructor interaction are independent predictors of both student satisfaction and performance (Colquitt et al., 2000; McFarlin, 2008; Riffel and Sibley, 2005).

Cohen et al. (2011) found that students enrolled in higher-education nutrition courses gained knowledge in both online and traditional face-to-face nutrition courses, however, student satisfaction for these courses was mixed and depended to a large degree on student and instructor characteristics. Little research is available on the effectiveness of blended delivery of courses within the discipline of nutrition or as applied to large enrollment courses (> 200 students). The objective of this study was to evaluate the effectiveness of a blended delivery method that included both traditional face-to-face classroom instruction with online learning activities in a large enrollment general nutrition course offered to both on-campus and distance education students.

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Materials and Methods

The study procedures were reviewed and approved by the Institutional Review Board at Utah State University. All students enrolled in the general nutrition course (NDFS 1020) during spring semester 2011 were invited to participate. The on-campus and distance sections of the course were taught by different instructors. Only students who agreed to participate and who completed the course were included in the analyses presented here (n=285 on-campus students; 97 distance-education students).

The Blend

Approximately half of the course (1.5 credits) was delivered in the traditional face-to-face lecture-based format. The other half of the course was delivered in an online learning environment using the platform of the Blackboard learning management system (Blackboard Vista, Blackboard Inc., Washington D.C., 2010-2011).

Asynchronous Elements

Content for the course was organized into 12 modules. Modules were further organized into four pages, which were designed to direct students through a flow of activities and assessment that we thought would best support student learning. The "Read It" page listed module objectives and contained a link to the corresponding chapter of the online textbook. The "Study It" page included self-study quizzes, PowerPoint® slides from lecture, and other self-study material. The "Assess It" page contained all graded materials including weekly "no-pressure" quizzes that were open-book and could be taken multiple times without a penalty, weekly assignments with questions pertaining to a semester-long personal diet analysis project that utilized software (MyDietAnalysis version 4.0, Pearson Education Inc., Upper Saddle River, NJ, 2009) and links to online exams. The "Live It" page included supplementary and practical application resources, such as links to relevant websites, information concerning nutrition-related careers, instructional food preparation videos, and links to discussion boards regarding topics of special interest. Some of the "Live It" activities were offered as extra credit (up to 3% of total points).

The four exams, including one comprehensive final, were timed (50 minutes), closed-book, and administered online on designated dates. Exams included multiple choice, true/false, and matching questions and were generated from question banks generated by course instructors such that each student received a unique exam. Students electronically signed an honor code statement at the end of each exam which declared that did not used any notes, text, internet, or other reference material and that they neither gave nor received aid from any person during the examination.

Synchronous Elements

On-campus students met for one hour-long lecture period each week where information was presented in a face-to-face format by an instructor. The objective of the face-to-face lectures was to deliver content in a manner that emphasized key concepts and encouraged discussion, application, and engagement from students. This was different from the traditional delivery of this course which was taught in one large section (n=300 students) and met for a 50 minute period three days per week. The distance education sections were offered a similar synchronous experience via the virtual classroom broadcasting technology known as Wimba (Wimba Classroom, Wimba Inc., NYC, NY, 2010-2011). This was different from the traditional delivery of the online courses which included pre-recorded lectures, but no opportunity for synchronous learning. Distance education students not wishing to participate in the synchronous element of the course could opt instead to view the recorded version of the weekly lectures. This option was not provided to the on-campus students.

Assessments

Students were asked to complete a student profile during the first week of the semester. This assignment asked students to report on their personal characteristics (age, gender, year in school) and included questions on their usual dietary habits and physical activity. Students were also asked to complete a 31-question mid-semester course evaluation that included questions about the different elements of the course.

Data Analysis

Data were analyzed using PASW SPSS statistics (SPSS version 18, SPSS Inc., Chicago, IL 2009). Analysis of variance and Pearson Chi-Square analyses was used to evaluate differences in performance and satisfaction of the course by student group (on-campus vs. distance education).

Results and Discussion

Demographic characteristics of students enrolled in both the on-campus and distance education sections of this course are listed in Table 1. The majority of students was female, from Utah, had declared a major and was taking the class as one of several options to fulfill a breadth course in the life-sciences, which is an institution-level requirement. The average age of on-campus students was younger than that of distance education students. This is consistent with others who have found similar differences between students in distance education programs compared to traditional on-campus students (Qureshi et al., 2002; Russell et al., 2008). More distance education students also rated their dietary and physical activity habits as "average" or "poor " as compared to on-campus students. Students younger than age 25 rated themselves higher on the dietary and physical activity assessment questions compared to older students, independent of student group (P=0.05).

Course content and all assignments for the on-campus and distance education courses was standardized. On-campus students earned higher scores

than did distance education students on both quizzes and exams (Table 2). On-campus students also had a greater number of attempts on "no-pressure" quizzes compared to distance-education students (P = 0.001). Many factors may have influenced the difference in the number of attempts on no pressures quizzes including differences in motivation to learn and amount of available study time. Distance students for example, who were older on average than on-campus students, may have more demands on their time due to career, family, and other responsibilities than younger on-campus students. This is consistent with the observations of Qureshi et al., (2002) who found that distance education students are generally older and more likely to face barriers to learning due to competing demands on their time and other resources.

Some have found older distance learners to be more motivated to learn than younger traditional students (Dibiase, 2000); yet others have found that opportunities for distance education may encourage distance learners with busy work schedules to procrastinate or to otherwise perform poorly, especially when the course is fast-paced and communication with the instructor is limited (Bigelow, 1999; Salmon, 2000). Our observation regarding differences in the distribution of final grades is consistent with these findings. In our sample, a higher percentage of distance education students received failing grades than did on-campus students (P = 0.022).

Table 3 summarizes student responses to questions about the blended method of the course. The majority of students in both student groups reported being satisfied with the blended design. Distance education students reported greater satisfaction with the blended design than did on-campus students (P=0.026). The majority, 96% of on-campus students and 71% of distance education students, also reported that this was their first experience with a blended class.

Increasing interaction and sense of community has been found to be associated with higher levels of student satisfaction in both traditional and distance education courses (Wu, et al., 2010; McBrien and Jones, 2009; Vermunt, 2005). Opportunities for interaction are less common in distance education courses than they are in traditional on-campus courses, and in our observations, this is a common frustration voiced by distance education students. In our study, 60% of distance education students felt that the hybrid design provided a better opportunity to communicate with the instructor and their peers than what was offered in a traditional distance education course. This was not the case for on-campus students. This difference in perceptions of opportunity for student interaction may explain the observed differences in course satisfaction by student group.

Table 4 summarizes students' perceptions of the effectiveness of different components of the course. Distance education students expressed greater appreciation for the flexibility that the hybrid delivery method provided (P=0.009) and also gave positive feedback regarding instructor-student communication, indicating that the blended format may have provided better communication opportunities than traditional distance education courses. In contrast, most on-campus students felt there was more communication between instructor and student in traditional classes than what was provided in the blended course (P<0.0001). Increasing opportunities for student-student and student-instructor communication in blended courses by utilizing discussion boards, virtual classrooms (such as Wimba) and study and office hours, may help to improve levels of student satisfaction and learning.

On-campus and distance education students provided similar rankings regarding the helpfulness of the different learning resources provided in the courses. They rated no-pressure quizzes, the textbook, and the face-to-face lectures as the most helpful resources. This indicates that both distance learners and traditional on-campus students valued both student centered learning activities (such as the no-pressure quizzes) as well as the traditional face-to-face lecture component of the course.

Table 1: Student characteristics by student group (on-campus vs. distance education); blended general education nutrition course spring 2011.

Characteristic	On-Campus (n=285)	Distance Education (n=97)
Less than 20-years-old [1]	57%	12%
Female	74%	82%
Major declared	68%	74%
Dietary habits ranked low [1, 2]	17%	38%
Physical activity ranked low [1, 3]	21%	30%

[1] Difference significant at a P<0.01 level based on a 2-tailed Pearson Chi-Square analysis with 4 degrees of freedom.
[2] Quality of dietary habits ranked as "lower or less healthy than most people my age"
[3] Level of physical activity ranked as "less than most people my age"

Table 2. Student performance by student group (on-campus vs. distance education); blended general education nutrition courses spring 2011.

	On-Campus n=285	Distance education n=97	P-value[1]
Average final score out of 1000	845.3 (±141.4)	754.9 (±246.6)	0.010
Average exam score out of 125	99.4 (±12.4)	95.4 (±14.6)	0.010
Average quiz score out of 20	18.5 (±1.8)	17.8 (±3.1)	0.008
Average assignment score out of 25	22.9 (±1.6)	22.1 (±3.1)	0.001
Number of quiz attempts	2.89 (±1.31)	2.34 (±1.48)	0.001

[1] ANOVA

Table 3. Percent of student who agreed with the following statements asked on the mid-term course evaluation by student group (on-campus vs. distance education); blended general education nutrition course.

Question Summary	% Of Students	
	On-campus (n=264)	Distance education (n=52)
I would recommend this course to a friend	89	92
I would recommend this course continue to be taught in a hybrid format*	77	90[1]
This class provided a high quality educational experience **	80	94[2]
The quality of course would be lower if it was delivered in a traditional format.**	41	54
If I were to give this course a grade, I would give it an A.	43	58

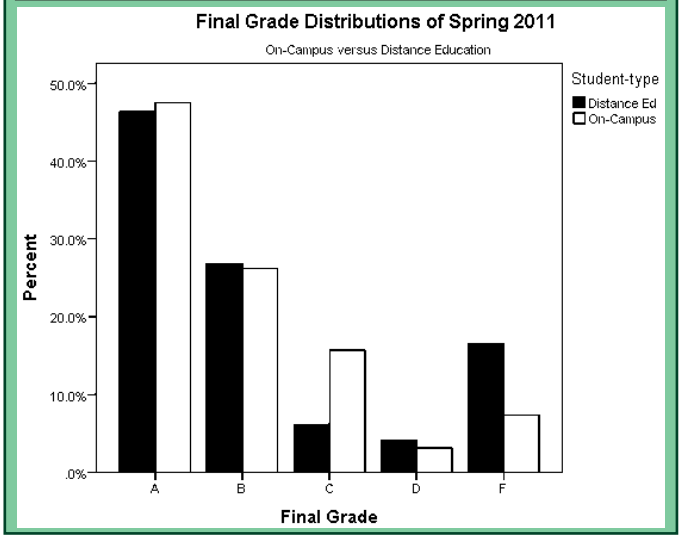
[1] P<0.05. [2] P<0.01 using a 2-sided Pearson Chi-Square analysis; 4 degrees of freedom.

Table 4: Student satisfaction by student group (on-campus vs. distance education) of a blended design of a general education course in nutrition.

	Survey Statement Summary	% of Students who Strongly Agreed or Agreed	
		On-Campus (n=264)	Distance (n=52)
Comfort level within hybrid learning environment	My first hybrid course [3]	96	71
	Accessing coursework on Blackboard is simple	80	87
	The syllabus is clear and detailed	86	90
	MyDietAnalysis is user-friendly	72	75
	I appreciate the flexibility of the course design [2]	81	98
Student Engagement	Read or reference the text book >3 times per week [3]	39	67
	Study for this class with another person at least weekly [2]	23	6
	I have used the discussion boards [2]	10	27
	Attending and or listening to face-to-face lectures is useful [1]	60	40
	Attended or listened to >85% of face-to-face lectures [2]	31	23
	The instructor encourages student participation during face-to-face lectures	78	75
	Opportunity to communicate with the instructor and my classmates is BETTER THAN in a traditional class [3]	26	60
	My instructor is responsive and available to students [2]	82	98
	The assignments encouraged application [2]	66	43

[1] P<0.05; [2] P<0.01 [3] P<0.001 using a 2-sided Pearson Chi-Square analysis; 4 degrees of freedom.

Figure 1. Distribution of final grades earned in a blended general education nutrition course by student group (on-campus vs distance education)



Another interesting observation is that 67% of distance education students indicated they referenced their textbook three times or more per week but only 31% of on-campus students reported accessing their textbook at least this often (P<0.0001; Table 4). Some research supports the hypothesis that younger students, who were also more likely to be traditional on-campus students, may struggle with the level of self-regulation needed to succeed in classes that require independent reading and learning (Richardson, 2012). Student responses on the mid-semester evaluation demonstrated that on-campus students were more likely to mention troubles procrastinating and missing due dates than were distance education students, despite our previously mentioned hypothesis that distance students may struggle with these factors because of additional demands on their time. In fact, at least 10 students mentioned specifically that the hybrid design encouraged procrastination and that had a negative effect on their performance in the course.

Strengths of the study include its high participation rates and standardized assessments across student groups (distance education vs. on-campus). It is noteworthy that 100% of students who completed the courses during the designated times consented to participate and were included in this study. We also include individual, instead of group level assessments of course outcomes, including indicators of the level of satisfaction for different elements of the course design. A few limitations of this study should also be noted. There were likely differences in instructor characteristics and teaching styles, as well as other factors not recorded or accounted for that may have confounded the differences in student satisfaction and performance that were evaluated and observed. Data collection tools were developed for this project and reviewed by a panel of experts but have not been validated using other methods and may not be appropriate for the assessment of the efficacy of other blended course designs in different classes, institutes, and populations.

Summary

A blended learning model for a large enrollment general education nutrition course seems to adequately facilitate student learning and may be a successful model of course delivery for large enrollment courses offered both on-campus and through distance education. This blended format allowed the course to be taught in smaller sections (three sections of 100 students which each meet with the instructor for one 50 minute period per week) with the same instructor teaching load as required for larger enrollment lecture-dominant courses (one section of 300 students which meet with the instructor for three 50 minute sessions per week).

Though most students had no previous experience taking blended courses, the majority of students in this study expressed a favorable opinion towards the blended design and indicated that they would recommend it to a friend. The blended format may be more acceptable to older students who have a higher level of self-regulatory skills. However, blended courses may also help younger students to develop better self-regulatory skills which have been previously associated with greater levels of academic success. In summary, a blended learning course design that consists of asynchronous and

synchronous elements appears to be a viable model for other large-enrollment introductory nutrition courses, and perhaps other courses in the life sciences, offered in a standardized format to on-campus and distance educations students.

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Current Learning Styles of Undergraduate Animal-Studies Students in a 2-Year and 4-Year Degree Program

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Abstract

Understanding how students perceive and internalize information, termed learning style, is thought to be important in delivering a quality education. We compared Animal Sciences students from the University of Florida (UF) to those enrolled in the Zoo Animal Technology Program at Santa Fe College (SFC). We administered two learning style instruments: the Group Embedded Figures Test (GEFT) and the Gergorc Style Delineator (GSD). The GEFT scored students into field-independent, neutral, or field-dependent learning styles. The GSD scored students into four learning styles: Concrete-Sequential (CS), Abstract-Sequential (AS), Abstract-Random (AR) and Concrete-Random (CR). With the GEFT, 63% of UF students indicated a field-independent learning style, compared to 19% field-dependent and 18% neutral ($P < 0.01$). Of SFC students, 46% indicated a field-independent learning style, to 34% field-dependent and 20% neutral ($P < 0.01$). Within the GSD, 49% of UF students indicated a CS learning style compared to only 21% CR, 15% AS and 25% AR ($P < 0.01$). Of SFC students, no significant differences were found amongst GSD learning styles. These results demonstrated the demographics and learning preferences of students currently enrolled in two animal-centered curriculums at a two-year and four-year institution of higher learning.

Introduction

In the past 50 years in education it has been postulated that understanding learning styles is critical to understanding how students synthesize and process information. Gregorc (1979) defined learning styles as distinctive behaviors which serve as indicators of how a person learns from and adapts to his (or her) environment and gives clues as to how a person's mind operates. Put simply, learning styles are preferences of the learner to a sensory modality which best suits them for receiving and internalizing information. Dobson (2009) described the four major sensory modalities as: visual (pictures, graphs, and tables), auditory (listening, discussion, question and answer sessions), kinesthetic (engaging in physical experiences or laboratories) and read/write (taking notes, writing reports).

Learning styles differ across academic disciplines (Mathews, 1994; Jones et al., 2003; Torres and Cano, 1994; Dobson, 2010; Garton et al., 1999). The importance of understanding students' learning styles has been demonstrated in many studies by students' higher achievement when taught through their preferred learning style (Dobson, 2009; Thomas et al., 2002; Dyer and Osborne, 1996). Further, a positive association was found in the Animal Science discipline that indicated students' achieved at a higher level when taught to their preferred learning style (Garton et al., 1999).

The focus of the study was to evaluate the learning styles of this generation's cohort of animal-studies students. We also compared students enrolled in the Animal Sciences program at a major state university (the University of Florida; UF) to students enrolled in another animal-centered curriculum at a state (community) college, the Zoo Animal Technology program Santa Fe College (SFC). As both are similar disciplines studying animal physiology and husbandry, our hypothesis was students preferred learning styles would not differ between the two programs.

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Materials and Methods

All procedures used in this study were determined to be exempt from review by the UF and SFC Institutional Review Boards.

The study was conducted in 2013 and the target population for this study was students enrolled in either the B.S. Animal Science's curriculum at UF (n = 155) or the A.S. Zoo Animal Technology Program at SFC (n = 67). Students enrolled at UF within the 4-year Animal Sciences curriculum were further evaluated depending on their enrolled degree option: Animal Biology Specialization (AB), Equine Specialization (EQ), and Food Animal Specialization (FA). The Zoo Animal Technology Program at SFC is unique as it has a Teaching Zoo on premises and students earn an Associates of Science Degree to either pursue a career within zoological societies, animal-care vocations or go on to pursue a 4-year degree in an animal-related field such as Animal Science. Students surveyed at UF were either enrolled in an Introduction to Animal Sciences course (n = 123) or Senior Seminar course (n = 32). Only students enrolled in an Animal Sciences discipline were analyzed for this study. The Introduction to Animal Sciences and Senior Seminar course are required of UF Animal Sciences students. All students surveyed at SFC were enrolled in a required Zoo Seminar course under one general degree option. Students were presented the learning style instruments at the beginning of the semester and could opt out if they wished. The two instruments chosen for this study were the Group Embedded Figures Test (GEFT; Witkin et al., 1971) and Gregorc Style Delineator (GSD; Gregorc, 1979).

The GEFT is a standardized instrument that has previously been used to assess individual learnings styles in students enrolled in collegiate agriculture programs (Rudd et al., 2000) to include Animal Science students (Garton et al., 1999; Torres and Cano, 1994). The GEFT is a timed test and assesses student's ability to discern simple figures concealed within 18 complex figures. Students correctly identifying 10 or less simple figures in the allotted time were considered field-dependent learners. Students correctly identifying between 11 and 13 simple figures were considered neutral, and those correctly identifying greater than 14 simple figures were considered field-independent learners (Garton et al., 1999). The national average for the GEFT was reported as 11.4 by Wilkens et al. (1971).

The GSD has been described as providing metrics on a student's perceptions and ordering abilities (Hawk and Shah, 2007). The GSD is a self-assessment instrument where students rank ten sets of four words that best described them. Based on the student's rankings, a score of 10 to 40 is possible in four separate learning styles: Concrete-Sequential (CS), Abstract-Sequential (AS), Abstract-Random (AR), and Concrete-Random (CR). The highest score amongst the four learning styles was scored as that student's preferred learning style.

Raw score data for student's preferred learning styles using the GEFT and GSD instruments were analyzed by SAS MIXED procedures (Version 9.3; SAS Institute Inc., Cary, NC, USA). Fixed effects for analyzing students at UF included the year in school (underclassmen, upperclassmen), gender (male, female) and degree option (AB, EQ, and FA). For comparisons between UF and SFC, fixed effects were school attended (UF, SFC) and gender (male, female). Statistical comparisons between the assessed learning modalities in the GEFT (field-dependent, field-independent) and GSD (CS, AS, AR, CR) were made by X2 analyses. Statistical significance was set at $P < 0.05$.

Results and Discussion

Education is currently embedded in the Information Age, and a paradigm shift in higher education is taking place. Reigeluth (1994) summarized the Industrial-Age factory model school system of compartmentalized learning into subject areas where students are expected to learn the same content in the same amount of time as outdated and quickly becoming obsolete. Watson and Reigeluth (2008) argue for a more learner-centered type of education where education is personalized to the individual student to promote maximum student engagement and success. We maintain that understanding a students learning style can facilitate this type of student-centered education. Therefore to help facilitate this change, updating the current student trends in learning styles in animal-study centered curricula was the objective of this study.

Student Demographics

A total of 222 students completed both the GEFT and GSD instruments with 155 students from UF and 67 students from SFC. Of the UF respondents, 131 (85%) students were female and 23 (15%) male. For SFC respondents, 60 (90%) were female and 7 (10%) male. Under the UF Animal Sciences degree options, 68% of the respondents were currently enrolled in the AB degree option, with 17% under the EQ option and 14% FA. Of the 106 students in the AB option 86% were female 14% male, EQ option 93% female 7% male and FA option 59% female 41% male. As UF accepts a large number of transfer students into its Animal Science's program, of the students in the Introduction to Animal Science course only 17 (11%) were classified as underclassmen (freshman or sophomore). The remaining 138 students were classified as upperclassmen (junior or senior) and enrolled in either the introductory or Senior Seminar course.

Given current trends, our examination of the female to male ration within both UF and SFC is not surprising. Of the 155 students surveyed at UF, 85% are female to 15% male; similarly, 90% are female to 10% male at SFC. These data differ sharply from data collected three decades ago with Animal Sciences students and a 45% female to 55% male ratio (Mollett and Leslie, 1986). The female population of this study was larger compared to an earlier study by Dyer and Osborne (1996) of students enrolled in Animal Sciences courses. In that study,

a 66% female to 34% male ratio was reported. Taken together, these data have significance as Witken et al. (1977) stated learning styles differ between genders. Indeed, many studies have corroborated gender differences in preferred learning styles (Dyer and Osborne, 1996; Philbin et al., 1995; Mathews, 1994; Torres and Cano, 1994). In our study, gender differences were not observed in SFC students and was most likely due to such a small sample size of males (n = 7). Yet, with a larger samples size our UF males had higher mean GEFT scores and may support these earlier studies conclusions.

The other interesting demographic data from our study of UF students is the number of students enrolled in the AB (68%) and EQ (17%) degree options, compared to the traditional Animal Science's FA (14%) degree option. The earlier study of Mollett and Leslie (1986) indicated only 34% of Animal Sciences students specified they intended to pursue veterinary or other post-graduate school (similar to the UF AB option), with the remainder indicating they anticipated their vocation to be in farming or an agriculture-related field. Our data appears to capture the current trends within UF and perceived national trends of students in the Animal Sciences who are more interested in learning about a wider range of animal species other than traditional livestock. These data may also support the conclusion drawn by Kauffman (1992) that Animal Science as a discipline is broadening its appeal to students by including species other than livestock in its curriculum.

GEFT Scores

While mean raw scores differed in the GEFT amongst degree options at UF, no differences were observed in percentage of students who were classified as field-dependent, neutral or field-independent learning styles, therefore data were combined for analysis. A greater ($P < 0.01$) percentage of UF Animal Sciences students were classified as having a field-independent learning style (98/155, 63%) compared to a field-dependent (30/155, 19%) or neutral (27/155, 18%) learning style (Figure 1A). Similarly, SFC students had a higher ($P < 0.01$) preference for a field-independent learning style (31/67, 46%) compared to field-dependent (23/67, 34%) or neutral (13/67, 19%) learning styles (Figure 1B).

When evaluating raw GEFT scores (Table 1), students at UF under the AB option scored higher ($P < 0.05$) compared to students enrolled in both the EQ and FA degree options. When UF student scores were combined and evaluated in comparison to SFC student scores, UF students scored higher ($P < 0.001$) with a combined GEFT score of 13.7 ± 0.32 when compared to SFC student mean scores of 11.7 ± 0.55. A gender effect was found in students at UF with males scoring higher ($P < 0.05$) with a mean score of 14.8 ± 0.64 compared to females 13.4 ± 0.36. No gender differences were found in SFC student scores, nor between classes (under and upperclassmen) at UF.

When evaluated by the GEFT learning style inventory, a higher percentage of UF and SFC students demonstrated a significant preference for a field-independent learning style. Torres and Cano (1994) described students with field-independent learning styles as viewing the world more analytically, find it easier to solve problems and were more likely to favor independent study. Conversely, those that indicated a preference for the field-dependent learning style are described as perceiving the world globally, find it more difficult solving problems and tend to favor the spectator approach to learning (Torres and Cano, 1994; Witkin et al., 1977).

For generational comparisons, we chose the GEFT due to earlier studies examining the field-independent and field-dependent learning styles of students in agriculture and the animal sciences. Interestingly, it appears the learning styles of Animal Sciences students using the GEFT have not changed significantly over the past two decades. In the 1994 study of Torres and Cano, of 21 Animal Science students surveyed 70% indicated a field-independent learning style. In a more robust study, Garton et al. (1999) reported of 187 Animal Science students surveyed, 56% indicated a preference for a field-independent learning style compared to only 22% field-dependent and 22% neutral. A similar study examining learning styles of agricultural education students, of 133 students surveyed, 55% indicated a field-inde-

Figure 1. Group Embedded Figures Test learning style inventory from students within the Animal Sciences Department at the University of Florida (Panel A) and students within the Zoo Animal Technology Program at Santa Fe College (Panel B).

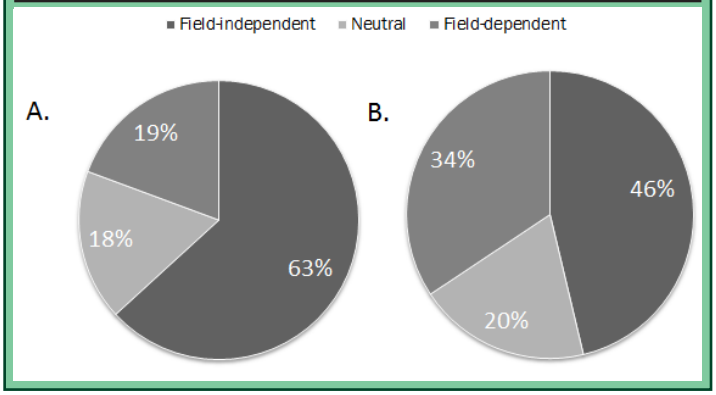


Table 1. Mean scores of students surveyed using the Group Embedded Figures Test (GEFT) enrolled in Animal Sciences at the University of Florida and Zoo Animal Technology Program at Santa Fe College.

Characteristic	No. of Students	Mean Score
University of Florida		
Degree Option		
Animal Biology	106	14.0 ± 0.36[A]
Equine	27	13.0 ± 0.69[B]
Food Animal	22	12.5 ± 1.04[B]
Overall Mean	155	13.7 ± 0.32 [C]
Santa Fe College		
Zoo Animal Technology	67	11.7 ± 0.55[D]

The GEFT is a timed test and assesses the student's ability to correctly identify simple figures concealed within 18 separate complex figures. Scores indicated the number of correctly identified figures. A,B indicated a significant difference ($P < 0.05$) amongst degree options at the University of Florida and C,D indicated a significant difference ($P < 0.05$) between students from the University of Florida and Santa Fe College.

pendent learning style, compared to only 30% field-dependent (Dyer and Osborne, 1996). Taken together, these results would agree with previous studies that learning styles tend to be similar across like disciplines (Mathews, 1994; Jones et al., 2003). These results also appear to confirm Witkin et al. (1977) summary describing field-independent learners as gravitating to disciplines in the natural sciences.

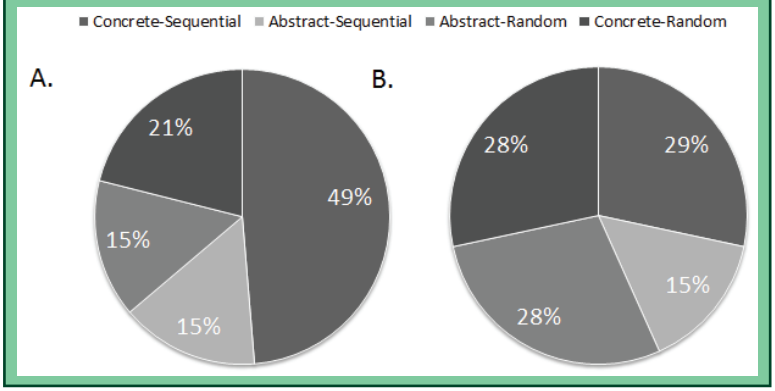
Students at SFC were similar to UF students and indicated a higher preference for a field-independent learning style; however, their responses were less so with only 46% of respondents falling into this category. Interestingly, mean GEFT scores of the SFC students were significantly lower compared to UF students. These data may disprove our initial hypothesis of no differences between the two cohorts of students. These results may also indicate that learning styles may differ across students pursuing a 2-year compared to 4-year college degree, rather than a difference within a specific discipline. Data comparing learning styles between students attending community college or two-year programs and four-year university students is lacking. In one study, Henson and Schmeck (1993) showed differences in community college and university student learning styles. However, more robust studies are needed to draw any significant conclusions. With the large number of 2-year agricultural centered college programs across the United States, it would be worthwhile in future studies to examine learning styles amongst these populations of students.

Table 2. Mean scores of students surveyed using the Gregorc Style Delineator (GSD) enrolled in Animal Sciences at the University of Florida and Zoo Animal Technology Program at Santa Fe College.

Characteristic	No. of Students	Mean Score			
		CS	AS	AR	CR
University of Florida					
Degree Option					
Animal Biology	106	27.5 ± 0.5^{A}	24.9 ± 0.4^{B}	23.3 ± 0.5^{C}	24.6 ± 0.4^{B}
Equine	27	26.9 ± 0.8^{A}	23.4 ± 0.9^{B}	24.5 ± 1.1^{B}	25.3 ± 0.9^{A,B}
Food Animal	22	26.5 ± 1.6^{A}	25.0 ± 0.9^{A}	22.6 ± 1.2^{B}	25.0 ± 1.3^{A}
Overall Mean	155	27.3 ± 0.4^{A}	24.7 ± 0.4^{B}	23.5 ± 0.4^{C}	24.8 ± 0.4^{B}
Santa Fe College					
Zoo Animal Technology	67	25.6 ± 0.6^{A}	23.2 ± 0.6^{B}	25.7 ± 0.6^{A}	25.6 ± 0.6^{A}

The GSD is a self-assessment instrument where students rank ten sets of words that best describe them. Student's highest score amongst the four categories identified that student's preferred learning style. A-C within a row indicated a significant difference (P < 0.05) amongst mean scores.

Figure 2. Gregorc Style Delineator learning style inventory results from students within the Animal Sciences Department at the University of Florida (Panel A) and students within the Zoo Animal Technology Program at Santa Fe College (Panel B).



GSD Scores

The GSD differs from the GEFT in that the instrument reveals two types of mediation abilities: perception and ordering. Additionally, the GSD separates respondents into four learning style categories (Gregorc, 1982). To our knowledge, no Animal Sciences students, nor students in 2-year college animal-centered programs, have been previously examined using the GSD instrument.

No significant differences were observed amongst the three degree options offered in the Animal Sciences department, nor by class (under versus upperclassmen) within an overall preference for a single learning style. Results of the mean raw scores of the GSD are depicted in Table 2. While raw scores did seem to differ amongst degree options, they did not impact the overall clear choice of UF students as evidenced with a higher (P < 0.01) preference for the CS learning style (74/153, 48%) compared to the AS (23/153, 15%), AR (23/153, 15%) and CR (32/153, 21%) learning styles (Figure 2A). The SFC students did not appear to have a higher preference amongst GSD learning styles (Figure 2B). When UF raw scores were compared to SFC students, significant differences were observed. The UF students scored higher (P < 0.01) than SFC students in the CS and AS learning styles, whereas SFC students scored higher (P < 0.01) in the AR learning style. No differences were found within CR styles.

Unlike the GEFT, we did not find any differences with regards to gender with the GSD. Furthermore, we did not find any preference to the four GSD modalities with SFC students. This would appear to lend even more support to disproving our initial hypothesis that there would be no differences in learning styles between UF and SFC students.

The results of the GSD learning style inventory indicated a significant preference to a preferred learning style with a majority of UF Animal Sciences students indicating a CS learning style. Gregorc (1982) described students with a CS preferred learning style as viewing and approaching experiences in an ordered and sequential manner. Students with this preference are able to discern between facts and are naturally structured and task oriented. Hawk and Shaw (2007) state the CS learner prefers direct, hands-on experiences, wants order and a logical sequence to tasks and follows directions well. Activities in the classroom that accommodate CS learners are worksheets, checklists, outlines, charts, field trips, diagrams and flow charts (Hawk and Shaw, 2007). AS learners are described as relying on logic and their intellect in their approach to critical thinking and prefer an environment that is ordered and mentally stimulating (Myers and Dyer, 2006). Activities in the classroom that accommodate AS learners are lectures, outlines,

reading, reporting, term papers and doing research (Hawk and Shaw, 2007). The AR learners are described as having feelings, concerned with emotions and their thinking, and find routine boring (Myers and Dyer, 2006). Activities in the classroom that accommodate AR learner are group work, mapping, discussions, role playing and keeping journals (Hawk and Shaw, 2007). Finally, the CR learner is described as having to rely on their intuition and instinct, and is more concerned with attitudes than facts (Myers and Dyer, 2006). Activities in the classroom that accommodate CR learners are brainstorming, case studies, hands-on learning, simulations, investigations and problem solving (Hawk and Shaw, 2007).

Summary and Implications

The results of this study demonstrated significant choices in the preferred learning styles of Animal Sciences students in both the GEFT and GSD learning style inventories. Data analysis of learning styles of SFC students showed significance in the GEFT but not the GSD. These results appeared to disprove our initial hypothesis of similar learning styles in animal-studies disciplines, as there were significant differences in preferred learning styles. This may be more of an indication of learning style preferences of students enrolled in a 2-year compared to a 4-year degree program and future research should explore this further. These data should be leveraged in animal-centered curriculums to facilitate change in current teaching methods to maximize student engagement and success in the classroom.

The challenge in higher education and more specifically students in animal-centered programs is how to accommodate a student's learning style in the classroom. While UF students, and to some extent SFC students, have a strong preference for a particular learning style, not all students scored the same. While many studies have shown greater student improvement when taught to their preferred learning style, these same studies demonstrated students whose learning style is not being taught to score worse than the targeted learning style students (Dobson, 2010; Thomas et al., 2002; Dyer and Osborne, 1996). It has been proposed that students being taught in an instructional environment that differs from their prefer learning style adapt and can actually benefit them by teaching important life skills on how to adapt to a less than optimum learning environment (Felder and Spurlin, 2005; Messick, 1976). However, Romanelli et al. (2009) proposed that teaching to one particular learning style alienates these students and instructors should alter their teaching methods to accommodate as many learning styles as possible.

We maintain that while transitioning the classroom from the Industrial-Age type education of typical lectures and exams, instructors should shift to a more learner-centered classroom environment. The difficulty in such an approach could be simplistic in a small classroom or more difficult with large-enrollment classes. A teaching strategy that is emerging in higher education due to technological advancements is the concept of the "flipped classroom." The flipped classroom is a teaching strategy in which rather than students attending lectures and doing homework/reading on their own, students view lectures online on their own and come to class to engage in instructional activities. Bishop and Verleger (2013) stated the flipped classroom combines a unique blend of learning theories once thought to be incompatible: active learning and problem-based learning activities founded upon a constructivist ideology and instructional lectures derived from direct instruction methods founded upon behaviorist principles. There is emerging evidence that this method of teaching not only increased undergraduate student achievement but students positively responded to this teaching method (Moravec et al., 2010; Day and Foley, 2006). We propose that future research should experiment with this type of approach of teaching to facilitate the inclusion of the many different learning styles and evaluate their students' academic achievement. Regardless of the teaching strategy employed, as the direction of higher education is rapidly changing we contend as a recommendation for practice educators should be aware of how best their students learn and should alter their teaching approaches accordingly.

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March 1965

A Brief Review of the Cooperative Movement -- 1965

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It is entirely appropriate to take a good look at the cooperative movement for farmers. Some competent observers think the new administration will devote much effort toward strengthening farmer cooperatives as a substitute for the controls and subsidies of the past thirty years. Should this change in policy materialize, the impetus would give the cooperatives a transfusion of new life and such unbelievable strength that many unforeseen changes in the marketing pattern could follow almost automatically.

The pioneers of the mountain west used cooperative effort as the device to provide the necessities of life. They taught each other, preached and organized to do all major undertakings cooperatively, which included surveying and dividing townsites, building irrigation systems, building gristmills, sawmills, and establishing the general store. The leaders displayed a missionary-like zeal and dedicated themselves and their resources into their success. As long as this enthusiastic leadership was present, adjustments were made and the organization succeeded. With the passing of the leader, private and corporate organizations replaced the co-ops. One by one they have all faded in the memories of the past. The second generation had not sacrificed and invested enough into them to be interested in their preservation. Private investment had greater appeal, and decision making could be made easier by other business organizations.

Industrial development forces successful men into highly competitive conditions, and the capacity to produce and market farm products at the lowest possible cost are companion challenges. The question is, can farmer cooperatives do the job, or is the corporate structure better qualified? Looking only at the past, it appears that well managed corporations have stood the test of time better than most cooperatives. At least it will pay young men to look carefully into the reasons for success in the markets and serving the needs of farmers of each type of business organization before selecting the cooperative method of providing markets or service.

Almost every industry dealing with the processing and marketing of agricultural products is subject to the law of decreasing costs. Since profits are usually small and short-lived, it is the capacity of the cooperative to keep costs low, that will determine to a considerable extent its competitive power. Authorities usually agree that money for advertising cooperatively produced goods can be saved over the advertising costs of its competitors. It may also be able to solicit business with less expense than is necessary by competitors because of the loyalty of certain producer and consumer groups. Also it may be able to reduce cost through large volume purchasing or handling. Since the cooperative has no profit motive, only the determination to render efficient service at the lowest possible costs, there can hardly develop abuses because of size. At any rate, a monopoly position would likely not carry with it the abuses usually possible with privately owned or corporate firms. In fact, the larger size would strengthen the competitive power of the co-op in both price and service because of the accompanying reduction of costs. The cooperative may also be successful in improving the quality of products or service rendered by means of supplying incentives to farmers and customers, thereby increasing its competitive position. Large organizations which cover many regions with different degrees of competitive pressures are able to make varied price adjustments which supplies many avenues for competitive power not possible with purely local organizations.

A vulnerable area, which has always been associated with the cooperative movements, is in the area of management. This involves both the board of directors and the employed manager. Although this may really not be a handicap in some industries, it usually becomes awkward to direct and control. Board members are often elected without knowledge of business and economic principles to make important decisions. Thus efficiency becomes a matter of chance rather than a planned efficient operation. Such untrained and inexperienced directors may tolerate mismanagement to the point of failure before changes can be made. Under such conditions it is difficult to distinguish between the responsibility of the manager and that of the board of directors, thus encouraging conflict and development of vacillating policies.

Whenever a large percentage of the membership displays unusual interest in a cooperative, it

will usually be in good hands. They will sacrifice for its success. As soon as it is difficult for the leaders to achieve good attendance at business meetings intended as a means of keeping membership loyalty, the management should heed the warning. At one time 25 members appeared at a co-op meeting for the purpose of electing a new director. There should have been 350 farmers in attendance. In the course of the evening two men were nominated for the office which selected the new director by a 13 to 12 vote to represent 350 farmers. It was later learned that the manager had personally visited most of the 13 men who were friends of one of the nominees. He had felt impelled to enter the political arena in order to pack the board of directors with men who agreed with his policies or whom he could influence. This example is surprisingly typical of situations arising in many of our local cooperatives. It is needless to describe the conflict of purpose and get-even attitudes which prevail in such an organization. Perhaps the worst condition of all is the need on the part of management and some of the board to conceal many of the decisions followed.

Sometimes co-ops have held back the patronage dividends as a retainer for the purpose of financing operation costs. These retainers are often little more than acknowledged, and no negotiable certificate is issued, and no interest is paid for their use. The control and decision are in the hands of the board of directors as to how long such retainers are kept and the policy with regards to their use is changed to meet the convenience of the firm. The membership, never having seen the money and with no power of direct control, soon lose interest. Most firms can hardly afford the loss of this support. It would seem extremely conducive to good management to have the enthusiastic sustaining influence of both the investor and the patron: who, for various reasons are not identical. The flow of capital into a firm is every bit as important as patronage. The interest and counsel of investors, even when costing an appreciable interest rate, may reflect itself in management and hence be realized in increased income and security of financial position.

Competition is the life blood of free enterprise, and the sources of competitive power need the support of farm people. The farmer needs to feel this power both as a purchaser of supplies and as a marketing agent. The large farmer cooperative, when properly organized and managed, is ideally situated to give this strength at the bargaining table. It should be able to represent him well when dealing with large firms in purchasing and marketing. One cooperative manager used to speak on the radio for 15 minutes during the noon hour each day. This was during the belt tightening period of the early 1930's. He always closed his remarks with this statement: "Remember, we always pay what we can, our competitor pays what he has to." Wherever highly competitive conditions already exist, the farm co-op has little chance to succeed in this price setting capacity. Its greatest opportunity lies in the secrets of leadership capable of developing patron and investor loyalty to induce competition.

A few years ago, a branch of a prominent co-op was organized to facilitate the marketing of potatoes. The patrons were solicited and an investment of $40 per carload was requested of each. The contracts were soon completed and enough money collected to erect a warehouse and the associated facilities. This was done under the direction of the local board. When fall came and the harvest started, the parent cooperative manager took over. The local board was largely ignored. He hired a stranger to manage the new warehouse over the objection of the local board. The new man came in thinking he merely needed to notify the members when to bring the potatoes. The competitors seeing what was happening, went to work contracting potatoes at real good prices. The result was that even the local officers sold potatoes to competitors and the new warehouse was idle nearly half of the first season. Since that time it has either been closed entirely or rented by competitors. Most farmers feel a pride in ownership and want a part in the control of resources. Take these away and little enthusiasm or loyalty remains.

If the real interests of the American farmer are to acquire property and make money under competition rather than devote considerable time to defending and promoting his own cooperative firm, he may find satisfaction through governmental assistance. Under the direction of the Farm Credit Administration the Federal Land Bank has become a shining example of success. It has become large enough to serve the whole country and still keep the local touch with the individual farmer. It has indeed attained efficiency in securing money at low interest rates for long term loans on a flexible repayment plan. It seems to be able to assemble all the capital that is required and the borrowers have developed an unusually cooperative spirit. The regulations required by law are just enough to insure good business for the lender.

The Production Credit Associations have attained a similar position in the short term credit field. Also the Marketing Order system has much to recommend it. In the order markets the Secretary of Agriculture selects the board of producers and can thus overcome the hazards of electing unqualified individuals into these responsible positions. The administration of the order then gives a certain amount of stimulus toward good business management for the cooperatives who function in such markets. Perhaps the auditing is sufficient supervision to keep management alert to the requirements of an unquestionable operation. Many kinds of changes

in coopertive programs have taken place to indicate that this influence is effective.

The corporate structure of mutual life insurance companies has proven to be an effective competitor in our present society. Some of the stock companies have adopted a policy of limited returns on capital set up by the Rochdale Weavers and have thus enabled the division of pure profits among the patrons. So many of these incorporated organizations exist as examples of success that their effectiveness in the field of agriculture cannot be questioned. They have also proven themselves capable of production for use without the profit motive if it were desirable.

In conclusion let us keep in mind the fact that it is the quality of leadership, the amount of energy devoted efficiently, and the degree of loyalty obtained from producers, consumers, and investors that makes the real difference in business firms. The form is much less important than the men that are involved. The flow of capital into the firm and the quality of the service rendered over the long run indicate the vision and leadership of the management. All is right when the confidence and the enthusiastic loyalty of a sufficient number of people is stimulated. Should the Department of Agriculture decide to take positive steps comparable to that taken by The Farm Credit Administration and then by use of such an agency as the Commodity Credit Corporation give stability and continuity to bargaining associations and distribution associations in areas where profits are attractive and competition could be helpful, many changes could be brought into being. It reminds one of the vision Abraham Lincoln expressed when the Department of Agriculture was first set up: "This new department of government is peculiarly adapted to serve the needs of all the people." It is conceivable that such bargaining associations could become nationwide, well financed, and so attractive to great consumer groups that they could compete with our great retail chains and super markets. Many skeptics of 50 years ago never thought a farmer's cooperative in farm financing could compete with our great banking system on the money markets of the world. This has already been accomplished and the broad benefits of long term cooperative credit have not reached the limits of their capacity to bless agriculture.

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Student-Designed Course in Land Ownership Changes

Introduction

Changes in land possession and ownership have been a part of agriculture and food systems ever since humans moved from hunting and gathering to more sedentary life styles and organized communities. Ancient civilizations achieved a degree of scale efficiency in food production that liberated many to become artisans, soldiers, teachers, and administrators who were not needed for direct food growing. Mechanization in the industrial revolution provided efficient alternatives to human labor, and further stimulated consolidation of farmland into larger holdings supported largely by fossil fuel based inputs of fertilizer and pesticides. Colonial powers exploited the natural resources and food production capacity of other lands to feed their own people and factories. But today there are sweeping changes of land ownership, often called "land grabs," and often legal within current local laws and dominant free market system. These transfers are reshaping the management of soil and water resources and distribution of benefits on a scale not seen in recent decades.

Our goal is to better understand this ongoing process. From the course syllabus, "*The loss of farmland to other uses as well as concentration of ownership have immediate effects on potentials for local food production and food sovereignty. Ownership changes reduce access to land by limited resource and beginning farmers, while free market policies and scales of production efficiency for commodity food production clearly drive consolidation of lands in a process claimed to be the only viable way for feeding a growing global population. Research and education on these land ownership issues are vital to inform policy, development agendas, and strategies for long-term sustainability of food production and ecosystem services.*"

With this perspective on changes in land ownership, we launched an on-line course to inform ourselves about the multiple issues surrounding use of land for food and other production outputs and to provide a foundation for a future course that will be accessible to students in the Nordic Region, Nebraska, and around the globe. The case study method pioneered by medical and business schools was chosen as the primary learning approach (Barnes et al., 1994). Different methods of using the case approach have been explored (Cliff and Nesbitt, 2005), and how design of cases impacts learning (Lundeberg et al., 1999). Applications in agriculture have been published by the American Society of Agronomy

Methods

We recognized the need for a university course that would guide students in learning more about massive changes in land ownership that have occurred over the past two decades. There is substantial information emerging from international conferences and technical journals in social sciences about the magnitude of changes and the impacts on former residents and farmers on the land, but limited attention in universities through formal courses; one exception is the International Institute for Social Sciences [www.iss.nl/education/] in The Hague, Netherlands.

Land Ownership Changes was offered as a graduate level independent study opportunity to a select group of students from University of Nebraska—Lincoln and Norwegian University of Life Sciences who were all appointed as special teaching assistants for three months and provided a modest honorarium for their work in developing the course. The course was three semester credits in U.S. or five ECTS in Europe. A syllabus was prepared with these course goals:

1. Develop an understanding of land use ownership changes at the local and landscape level: impacts and consequences on food production, economics of farms and communities, environmental impacts, and social dimensions.
2. Explore potentials of case study methods to understand dynamics of land ownership and impacts on food production and sustainability, long-term ecosystem services, and interactions in food systems among production practices.
3. Develop competence in case study development by each student crafting one open-ended case based on a local land ownership situation that has not yet been resolved.
4. Engage in critical assessment of case study papers done by peers in the course and discussion of alternative methods of learning about impacts of land use changes.
5. Provide critical examination of course methods and outcomes in order to improve the course for future years.

In keeping with course ownership and adaptive management of goals and activities, we first examined course priorities and requirements. The class met each week for two hours over Adobe Connect©, with students joining the course from India, Germany, Norway, Colombia, and U.S., for a period of twelve weeks. A technical specialist [D. Leingang] with experience in distance education was also one of the students, and provided valuable assistance with navigating in the electronic classroom and associated web site at UNL where documents were stored [passel.unl.edu/pages/].

After extensive reading and discussion about methods of case construction and their use as a learning device, each student developed a case based on one land ownership change in a country where they had personal experience and could access relevant resource materials. We reviewed these cases as a group, and made specific comments to the authors on how to improve them. The course was evaluated using a detailed survey of participants to assess organization, quality of the learning experience, and recommendations for the future. Each student prepared an individual reflection document to summarize their personal learning in the course.

Results

1. Cases developed for future students

Six open-ended cases were developed on situations that reflect current challenges resulting from land ownership change, and each of which includes dimensions of food production, economics and distribution of benefits, environmental implications, and social change. The topics were:

- Sugaring Up the Locals to Palm Over Their Land? A Look at the Effects from the Emerging Sugarcane and Palm Oil Industries in Guatemala [J. Simons].
- Yes, We Have No Bananas: Development versus Exploitation? Case Study of a Multinational Food Corporation in Philippines [C. Francis].
- A Journey Back to the Land, Las Pavas Case (Colombia): Land Restitution: Making Things Right or Legalising Land-grabbing? [K. Sanchez and H. Scharff].
- Defining Socially- and Ecologically Responsible Foreign Agricultural Investment: A closer look at a Norwegian 'reforestation' company in Madagascar [J. Smith].
- Special Economic Zones in India: Land Acquisition: Lawful or Just-less? [C. Bradburn].
- Bakken Boom: Curse or Boon? Examining the impacts of oil extraction in North Dakota [D. Leingang]

Through real-time discussions, we went carefully through each of these cases to examine their structure according to an agreed-upon outline [attention grabbing segment, introduction, goal, rationale/background, stakeholders, student activities, references]. Although we recognized the need and expected to encourage creativity in case design, the group concluded that a common structure would be useful to guide students in performing a 'compare and contrast' exercise across cases and in writing their own cases, and that innovation could be introduced in each of the sections. We further decided that a list of key stakeholders with their roles should be provided, but that an open-ended table would encourage students to expand this list through their reading of each case. We intended to strike a balance between providing too little information, giving a case that would perhaps discourage all but the most motivated students, and too much information, that would allow students to engage the questions without doing much research on their own.

The study questions at the end of each case were described as two types: those that are generic to studies of land ownership changes, and those that are specific to a particular case. The former will be included in all cases, and provide an obvious start for students to compare issues across cases they study in the course, while the latter will help them delve into case-specific issues that are unique to the context, stakeholders, or nature of the land acquisition or its specific use by new owners and participation by former occupants of the land. We decided that the generic questions would likely be required, while the specific questions could be given for the students to choose a subset of what they consider most important. For example there could be five generic questions required, then students could pick five of ten specific questions that they consider most relevant for the specific case. Students could also be required to provide one or two additional priority questions and answers to them. We have yet to decide the parameters for how students should answer the questions, but a general guideline is to require some independent research beyond the information provided in the course, and to develop a half-page response to each question plus references.

2. Evaluation of learning in land ownership distance course

An end-of-course survey to assess learning and provide guidance for shaping the new course next year included 24 statements with responses of "completely disagree" (1) to "completely agree" (9). The sample was too small to analyze statistically, but the responses provide valuable insight on the learning process. Students found the syllabus useful in a general way, with clear goals, but that more specific details would improve this for future students. From the start, students felt strong ownership of the course and appreciated being responsible for their own learning. The initial organization into three modules was quickly abandoned, as the team embraced one continuous process of learning about ownership changes that was not readily divided into sections. The students appreciated their role in 'adaptive management' of the course.

There was consensus that more concrete organization of informative material was needed in the introductory sessions to build interest and awareness among future students. Although several general references on land ownership were useful, this list should be expanded to include videos, excerpts from news broadcasts, and other relevant visual materials to capture the urgency of the land use issue. Students found that the in-depth readings for their own cases were most useful, along with those they accessed to be able to evaluate and suggest improvements for other student cases. The in-depth discussion we organized for each case was found to be particularly valuable to building general appreciation of the course topic and to take advantage of our group as a learning community.

3. Recommendations for future course

In our final group evaluation we recommend more information up front in the syllabus including readings and other relevant resources. Having students read and respond in writing to questions on several current cases would be valuable, and discussion of those cases in small groups would be important to learning. One idea was to establish a discussion room where students could asynchronously add comments to previous ideas and later meet on Skype or other electronic 'classroom' to discuss results. Having each student develop a case related to a geographic area of personal interest and experience would be highly valuable to learning. This could be subjected to peer review in small groups, as well as to oversight and review by the instructor. A reflection paper on learning at the end of the course was seen as valuable, while a final exam was not viewed as necessary. As with previous experience in conventional and distance courses, feedback from the instructor was highly valued.

Conclusions

This one-semester experience in learning about how to design a distance course provided recommendations about organization and content, and results will inform the design of an expanded course from these two universities in the future. Among the conclusions:

- Organizing the course into three modules is not useful; it should be one three-month course for three semester credits [UNL] or five ECTS [NMBU]
- Synchronous meetings of students and instructor may be valuabler for first introductions, but are technically cumbersome; an asynchronous schedule with weekly assignments is preferable
- More detailed instructions and better content including references to articles, chapters, and current cases are needed at the start of the course
- Course ownership with students is possible with a small and select group, but less feasible with a course having open enrollment and larger number of students
- Reading prepared, open-ended cases is valuable and written responses to questions contribute to solid preparation before a discussion of each one
- Having each student develop a case is a valuable strategy to learn more about one land ownership situation in depth, and should be a component of future courses
- Small group discussions are extremely important to developing a balanced perspective and challenging personal assumptions
- Engaging in peer review process provides a valuable learning opportunity and demands high level of engagement and responsibility to classmates
- It is difficult but essential to approach issues in an objective way, with focus on understanding both benefits and negative consequences of ownership changes
- Individual student action as a result of the course should be an integral goal: letters to the editor, articles in newsletters, other methods of promoting action
- Writing a final reflection paper increases potential for self assessment and is integral to the learning process
- Evaluation of student learning should include grading responses to questions on several cases, individual cases developed by students, and reflection papers

We conclude that issues surrounding changes in land ownership, specifically the impacts of "land grabbing," are among the most critical questions of our time. Access to land influences food production, distribution of benefits from agriculture, food security and food sovereignty. Although there are clear ethical guidelines publicized by international public and private non-profit organizations, it appears that these are rarely followed on a voluntary basis by national governments, investors within and from outside a country, and international funding organizations. We feel that this global issue should be a concern to anyone interested in the future of farming and food systems, included as a vital component of the educational programs of our universities, and critical to food security for the future.

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Using C-SPAN as a Teaching Tool in Agricultural and Natural Resource Policy Courses

Introduction

Agricultural and natural resources policy courses focus on public policy and its impact on the structure and financial performance of the agricultural and natural resources sectors, nationally and internationally. Different approaches are used in policy analysis, but focal points tend to be the political process, affected stakeholders, public participation, solutions to policy problems, and explaining the structural nature and factors influencing the policy problem. Discussion on national public policy issues tends to culminate in Washington, D.C. and involves the White House, senators, congressmen, their staff, lobbyists, and various sorts of policy experts. One outstanding way to incorporate a national perspective into these policy courses is to include actual discussion and historical perspectives that center on the "drama" that takes place in Washington as the public policy process produces laws, regulations, and real-world public policy. C-SPAN is one way to accomplish this.

C-SPAN is an acronym for Cable-Satellite Public Affairs Network. It is a non-profit cable-satellite television network with three channels and a radio station. Most cable and satellite television systems include at least one or two of their channels. It is best-known for gavel-to gavel coverage of all U. S. Congress sessions. Its content is unedited and includes congressional hearings, White House press briefings, presidential speeches, and general governmental meetings. There are regular interviews of individuals involved with current events. Most important, their website includes a video archive of past programming and other historical content. Lots of this content involves agricultural and natural resources policy issues.

What C-SPAN Offers

Currentness is a main asset of the network. Public policy issues are most interesting and relevant when they are topical. At the federal level, the Farm Bill is debated on about a five-year cycle and is the primary vehicle for defining public policy that affects agriculture, food, and natural resources. There are plenty of publications that describe the Farm Bill and that address the issues associated with it. However, only a discussion of the current Farm Bill will focus on immediate concerns, directions, and consequences. C-SPAN provides that currentness.

The network provides live coverage of both Senate and House debate on the Farm Bill, with that coverage easily retrievable from its video archives. Searching "farm bill" on its website (www.c-span.org) produced dozens of related events, discussion, and lectures. These included testimony of Agriculture Secretary Tom Vilsack on the department's current budget request before the House Appropriations Subcommittee on Agriculture (lasting two and one-half hours), a discussion of the Farm Bill by Secretary Vilsack after it passed, the White House signing ceremony for the Farm Bill, expert discussion of negotiations over the Farm Bill, panel discussions over the future of American agriculture and natural resources, and discussions of the Farm Bill by relevant House and Senate committees and subcommittee chairs.

Searching "agriculture" yields dozens of related videos on topics like government nutrition programs, Florida's cattle industry, factors that impact U.S. food prices, agricultural trade between the U.S. and Europe, food access and security, and President Franklin Roosevelt and the New Deal. Searching "natural resources" yields topics like state hunting and fishing rights, national monument designations, the Clean Water Act amendment, history of Hawaii' and sugar, artic and deep water oil exploration, wildfire management, and the lumber industry. Many videos are less than six months old. These are current discussions on very current topics.

C-SPAN has about two dozen series on topics like America and the Courts, American History, American Presidents, and American Writers. Scattered among these videos are many agriculture and natural resource topics. Under American History, for example, is a "Reel America" (C-SPAN's name for its historical videos) film titled "The River." It is a 31 minute movie produced by the U.S. government with a New Deal promotional theme on the importance of the Mississippi River Valley, that argues that poor farming and lumbering practices result in erosion, flooding, and poverty. The first film the U.S. government produced for commercial release and distribution is included in "Reel America" and it deals with agriculture. It is a 1936 documentary produced by the U.S. Resettlement Administration on the history of the Great Plains region from the 1880s to the 1930s Dust Bowl. "The Plow That Broke the Plains" was designed to spotlight New Deal programs.

One of the strong aspects of the network is an emphasis on current nonfiction authors and books. The emphasis continues to be current events and many of these books and authors address agricultural and environmental issues. For example, Wenonah Hauter,

author *of Foodopoly: The Battle Over the Future of Food and Farming in America*, was recently interviewed.

Assessment

No textbook and few journal articles are absolutely current, and much of public policy is being formulated in real time as classes take place. Students live in a world with instant access to news and communication, and have come to expect course material to be timely and to include more than the printed word. Access to most political dialogue tends to be short clips from news agencies with limited public access. CSPAN is the opposite of this. It is complete coverage of political events and is strives for accessibility. For an instructor trying to explain public policy, there is no better example than the actual legislative process, supplemented by experts explaining what is going on behind the scenes. For a professor willing to take the time, many nuggets of the public policy process can be gleamed from the CSPAN broadcasts to add real-world flavor to a course.

C-SPAN has programs to make its material accessible to the classroom. The emphasis is on the middle and high school classroom. However, much of the access applies equally well to the college classroom. Their entire website focused on access and its framework serves to produce reams of potential teaching material. For any policy professor, it is a goldmine of "easy pickings."

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Enhancing Student Experience in Plant Sciences through Inquiry Based Learning

Many students at land grant universities start their undergraduate studies with an undecided major or switch from major to major during their undergraduate career. With so many competing and more lucrative career options, recruiting undergraduate students into Plant Sciences is a challenge. Developing and maintaining an interest in agricultural majors is equally important in retaining those students who do enter into agricultural fields. Innovative and entertaining ideas must be applied to motivate and attract students towards plant sciences. One solution is a needed paradigm shift from traditional textbook-focused instructional methods to of inquiry based learning, where students exploring challenging questions appropriate to the field (Crawford, 1999). Inquiry-based learning is an active form of learning and enhances students' self-engagement with scientific activities (Edelson et al., 1999) resulting in an open environment in which students design their learning through exploration with the subject matter. An essential component of inquiry-based learning is that students work independently to solve problems rather than passively receiving direct, step-by-step instructions from the teacher. The instructor does not provide knowledge, but instead helps students along the process in discovering knowledge themselves.

This note provides an example of how a fun-filled, hands-on inquiry based learning model implemented in a general education introductory plant science course helped stimulate interest about plants in non-agriculture major students at New Mexico State University. In addition, the project as designed promotes problem-solving, team-work and presentation skills among students.

In an effort to increase student interest in plant sciences and make students aware of 1) the tremendous variety of plants, 2) the importance of plants in daily life, 3) plant origins, 4) plant production and management practices and 5) fun facts about plants, the instructor developed a multi-faceted project "Know Your Plant Project." For this project student teams are assigned a "mystery" plant or plant product. To ensure students consider a global perspective beyond domestic plants and issues, assigned "mystery" plants and plant products include international examples. Each team must then identify the plant or plant product they are assigned, research various aspects and uses of the plant or plant product, and create a presentation, including PowerPoint, for the entire class. Students were offered extra credit for including tangible objects in their presentations; many teams prepare and serve edible dishes to share with the class.

One key requirement for the "Know Your Plant Project" is that the instructor or teaching assistant of the course will not help in identifying the assigned mystery plant or plant product. Students are allowed to question faculty or students who are not directly linked with the course. Some mystery plants/plan products are seeds – student teams who receive seeds as their mystery product frequently choose to plant the seeds to try to identify the plants as it grows.

The "Know Your Plant Project" develops and measures presentation skills using a detailed rubric to evaluate presentations based on content, professional appearance, presentation skills and timely submission. The project also fosters team work: The project is assigned early in the semester and motivates students to work together and interact regularly to successfully complete the assigned project. Because the project requires students to interact with each other, students develop personal connections with others in the class, and not just with those in their own teams. This is a particularly important element because students come to this class from various colleges and majors, rarely know each other, and are not generally inclined to form personal associations. Students are evaluated for their individual contributions towards the group activity by the instructor and through confidential peer-evaluations. Peer evaluations are averaged and then included in cal-

culating the final grade on the project. To ensure students are attentive during presentations, each team is required to contribute a list of questions to the instructor from their presentations. Questions are then selected by the instructor for inclusion on quizzes.

A reflective element is also included in the project. In the reflection students provide feedback to the instructor about their experiences in the team activity. A vast majority of students indicate the project is a positive experience. Students report that the project fosters interest and investment in a particular plant – that they engage in deeper research and learn much more about their assigned plant than what is required or expected for the team activity. Many students also indicate that the project provides valuable lessons in teamwork, including cooperating and sharing responsibility with other team members. Finally students report that the project helps them learn how to find information and how to problem solve.

This "Know Your Plant Project" aroused student interest in the subject matter early in the semester and retained that interest throughout the semester. The results of the project demonstrate that inquiry based hands-on experiences are instrumental in 1) helping students connect abstract ideas to the real world, 2) building personal connections between students, and 3) generating and maintaining interest in agriculture and plant sciences. Through content-based inquiry and learning using the "Know Your Plant Project," students improve their teamwork and communication skills, as well as develop information literacy and problem solving strategies.

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Achieving Engagement through Real-World Examples

Introduction

Some of today's students have developed poor habits of "learning to forget" in an effort to maintain an acceptable grade, but not really learning the content. This "learning to forget" mentality includes learning content specifically for the test and then immediately disposing of the information. These students are apathetic, and our current classroom structure of lessons, reading book chapters, and an eventual test, only feeds and encourages their apathy. For students to be engaged they need a reason, a purpose. Some gain purpose through experiential learning activities and projects, but we believe even that system can be improved. Instructors should motivate their students with a solid learning plan, an endgame. Students want to graduate and get jobs (intrinsic motivation), so extrinsic motivation by the instructor(s) using real-world scenarios is necessary for students to see application for their future careers. This tactic was employed in a senior level graphic design course for agricultural communications and apparel studies undergraduates at the University of Arkansas. The course is traditionally a skill and project-based course. Students attend weekly lectures that focus on program competencies and create projects based on the specific competency covered in class. The instructors added design examples to daily lessons to foster discussion and motivate students to learn the material.

Procedure

The procedure is simple. Find examples that directly reinforce lesson content. For each lesson in the graphic design course, a design example that pertained to the lesson was shown and discussed. In the beginning of the course, basic principles of design were taught. These principles are reinforced throughout the course by having students identify principles in each design example. Additionally, depending on the material, students were asked how they would make the design example themselves. What program would they use? What tools would they employ to achieve that effect? Finally, students were often given an example of how the product might be used in industry. Some examples were easy like an event flier or invitation. Other examples were more challenging to help students visualize the competencies and programs on a deeper level, which also helped reinforce the broad scope of knowledge they must have in order to be prepared for the workforce. Design examples were retrieved from various outlets. The instructors used Pinterest, design blogs, Google searches, and their own personal work to pull examples. This strategy was effective for a graphic design course because it produced a wide variety of examples that incorporated traditional and modern design trends. Finally, throughout each lesson, the instructors pulled from personal industry experience to create relevant examples.

Assessment

Students throughout the semester became increasingly engaged in the course. More students participated in the design example discussion as the course progressed, and by the end of the semester they were sharing their opinions freely. Many showed a more complete understanding of design principles and indus-

try techniques than in previous semesters. Granted, there were still students who remained quiet and, at times, disengaged, but on average students seemed to pay more attention when lesson competencies were explained using industry examples. They were able to more easily visualize how the lesson pertained to their future career aspirations. The design examples also provided an introduction for each lesson, allowing the instructor to preview competencies through discussion. Finally, this course is skill-based in nature. Students traditionally follow the instructor along through various programs and competencies. So, by adding design examples with discussion, the instructors were able to appeal to the three types of learners—tactile, visual, and auditory; thus, providing a more complete opportunity for learning. The design examples improved the students' overall design aesthetics and professionalism. Industry examples should be integrated into all courses, if possible, to improve student understanding and increase student motivation to learn through application of real-world examples. This teaching tip should be used as a reminder for each of us to work to bring industry (even if in examples) into the classroom. This provides a better opportunity for us to make sure our students are workforce ready upon graduation.

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Crafting the Exam

In addition to teaching and delivery of information is measuring what students understand; that is, when preparing a course for delivery, the instructor is giving consideration to the appropriate questions to assess learning and one way to approach framing questions is to set expectations appropriately. We have found that using a tool such as Bloom's Taxonomy (2014), the level of deep can be considered in composing the question. For instance, Bloom's suggest six general areas for questioning: 1) knowing, 2) understanding, 3) applying, 4) analyzing, 5) creating, and 6) evaluating, thus the expectation is gradually different but points to a level of progression such as the difference in expectations between freshmen through senior level assignments.

So, how does one consider framing the questions?

Understand fully what you expect them to know relative to the course level and expectations.

Develop a strategy on how to gauge level of understanding. Here some tips to consider: a) Let's consider the instructor is wanting to give a multiple choice exam, then ask students to submit two to three multiple choice questions per person for consideration on the next exam. In this exercise, the instructor will gain an appreciation for the level of depth and if there were any miscommunications regarding the subject matter, i.e., possible instructor stated something incorrect and this would be an ideal time to make an adjustment in-class before the actual exam or b) Let's consider the instructor desires to test student's knowledge using open ended/written type questions. Similar to the multiple choice, the instructor can ask for possible questions and get a feel for how well the students may know the materials and/or if anything may have been miscommunicated. Like the multiple choice, if students are way off from the intended point, take the opportunity to bring the substance back to where it should be relative to the question. Further, the instructor should clearly communicate the writing expectations, i.e., grading, grammar or just reading for content or both, so no one is surprised when exams are returned.

When planning a test it is also important to consider class size and the time available to prepare and/or grade an exam. Some instructors desire to choose essay/open-ended type questions and for a large class that may be time prohibitive for both the test taker and grader if not crafted carefully. We have found that it requires less time to write an essay type test because point values are typically higher and there are fewer questions to develop than on a multiple choice type exam. Its known essay type tests will take much more time to grade and can be more subjective, especially when considering the level of detail expected compared to other types of exams.

When creating effective test questions it is key that the format of the test questions you select are best for what skills or concepts you are testing the students on. The methods outlined above that involve the students provide an excellent way to address student comprehension of the material, while building an extensive bank of questions. Lastly, it is critical to spend time formulating the questions so they are concise and well-written.

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