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Improving Museum Field Trips' Contributions to Experiential Education for STEM Disciplines: Why Should Ag Educators Care?

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Abstract

Core competencies taught in secondary science and mathematics are related to college preparation and personal and professional success, especially in disciplines categorized as STEM fields, including agricultural sciences. Success in STEM fields begins in elementary and middle school, with experiential learning which is one key to acquiring appreciation for, openness to, and mastery of technical information and scientific principles. Museum field trips, an elementary and middle school staple, constitute experimental learning primarily focused on using currently existing museum exhibits. This study focused on potential improvements and additions to current exhibits – including classroom preparation before the visit to create effective tools in imparting technical information and fundamental science principles. An exploratory modified case study was conducted by interviewing staff at three science museums in a Southwestern state to discover the relevance of selected museum exhibits to effective experiential learning and by content analysis of selected exhibits at each museum. Staff indicated their pedagogical philosophy was one of engaging the public and that the most important function of museum exhibits is to engage through entertainment. Findings of the study could be useful in efforts to improve the pipelines for non-traditional students to enter agricultural science curricula at the university level.

Introduction

Core competencies in science, information technology, mathematics, and statistics have been shown to be highly related to overall college preparation and to eventual personal and professional success, especially in disciplines categorized as "STEM fields" (Patterson and Leonard, 2011). Students' choice of and persistence in college majors in STEM fields have been shown to depend in part on stimulation of interest in mathematics and science in high school (Maltese and Tai, 2010).

Alongside such traditional majors as biology, physical science, mathematics, engineering, and computer information technology, agricultural sciences have been defined as STEM fields (Chen and Weki, 2009).

Successful completion of prerequisites — such as mathematics — to upper-division coursework required for agricultural majors has been shown to be a predictor of success in such majors, as well as being related overall GPA (Vitale et al., 2010). Moreover, students who completed higher levels of secondary school mathematics were more likely to persist in progress toward degrees in STEM fields (Chen and Weko, 2009). Additionally, studies have shown that technical competencies in the biological and physical sciences are essential for such careers as teaching secondary agricultural science (Rocka and Morrish, 2010).

Axiomatically, then, foundations for success in STEM fields through mastery of math and science are laid in the elementary and middle school grades, with experiential learning being one key to acquiring appreciation for, openness to, and mastery of such technical information and fundamental scientific principles. Museum field trips, a staple of elementary and middle school education, are one important type of experiential learning.

Therefore, it is important to discover ways to make such field trips more effective in fostering motivation to learn such information and principles, as well as in providing tools to acquire such skills. To that end, this study explores the opinions and attitudes of those responsible for museum exhibits, as well as examining the content and presentation of the exhibits themselves.

Conceptual Framework and Literature Review

Experiential learning and knowledge/skill acquisition. Exploration of the importance of experiential learning (EL) in the acquisition of knowledge and the mastery of skills dates to the work of Thomas Dewey and has long been accepted as axiomatic in curriculum design (Miettinen, 2000). As middle and secondary students (and even university students) often view science as

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dull, boring, or inordinately challenging, design of innovative curricula using mediated experiential learning activities may be crucial to motivating them to grasp knowledge and skills needed for future success in STEM related fields (Cokadar and Yilmaz, 2009; Fitzgerald et al., 2015; Tribus, 2005).

Experiential education has long been a linchpin of agricultural science education, because learning the fundamental practical and business skills needed by agricultural professionals cannot be done through classroom instruction alone; students must actively participate in the learning process. As Phipps and Osborne (1988) note, agricultural sciences emphasize learning by doing, as evidenced by their focus on laboratory work, field trips, problem solving, and supervised occupational experiences. Learning landscapes, varied in nature, form spaces where experiential learning can take place, especially in agricultural disciplines (Hansen, 2012).

Student participation in hands-on laboratory science, among other experimental activities, not only stimulates student enjoyment and motivation, but also proves more effective in transmitting science knowledge (Kellogg et al., 2010). In fact, so effective are such activities, the argument has been advanced that the experiential pedagogy heavily employed in secondary agricultural science instruction – including field trips — should also be employed in university agriculture programs (Estepp and Roberts, 2011).

Based on the theoretical work of, among others, John Dewey, Kurt Lewin, and Carl Rogers, during the latter half of the last century EL has evolved further to embrace modifications by David Kolb, Paolo Friere, Ivan Illich, A.H. Maslow, and Stephen Pepper, along with psychological tenets advanced by Carl Jung and Erik Erikson (Miettinen, 2000).

Theories of EL by necessity have considered fundamental questions about the process of knowledge acquisition. Logical empiricism held that such learning is based on perception: An unprejudiced observer can arrive at unbiased perceptions of reality. Such perceptions will then lead to induction of universal laws and theories, which in turn facilitate deduction resulting in inferences of new propositions concerning reality (Miettinen, 2000).

Traditional EL theory owes much to tenets of logical empiricism. Lewin posited six steps of the EL process: 1) definition of the problem after finding facts; 2) formulation of action possibilities; 3) practicing human relations skills to carry out the solution chosen; 4) from solution of a particular program, formulation of general principles of action; 5) planning specific steps for similar problems; and 6) group self-evaluation of its own problem-solving activity (Miettinen, 2000). Miettinen, among others, has criticized the Lewinian perspective on EL as making the interaction of the experience group the focus of inquiry, rather than the problem based in the community; he contends that experience is individualized, although it is tied to cultural contexts and values.

Dewey's formulation of EL seems to embrace this individualized view of experience; he saw EL as a way to progress through the learning process: 1) the individual perceives a problem; 2) the individual locates the problem in time and space and assesses its level of difficulty; 3) the individual conceives of a possible solution; and 4) the individual conducts further observation and experiment which lead to the acceptance or rejection of the solution posited. Dewey focuses on the role of reflection in EL, seeing reflection as the basis of conceptualization combined with pre-existing knowledge – for Dewey, EL is a cyclical process, not separable from its cultural context nor independent from previously learned concepts and hypotheses (Miettinen, 2000; Roberts, 2006).

Constructivism, however, presents a challenge to EL and the logical empiricism that forms its basis. Experience alone is not enough; instructors must help learners construct meaning out of experience. Constructivism, an educational philosophy that has gained increasing popularity in schools, maintains that all learners do not passively absorb knowledge but rather construct meaning from their experience; such constructed meaning may be of three types: 1) cognitive construction, a process whereby a learner constructs what really exists; 2) social construction, a process maintaining that subjective knowledge is constructed through a shared social system; and 3) radical construction, a process that holds all knowledge to be subjective and constructed solely within the individual learner (Matthews, 2002; Roberts, 2006). In constructivist thought, science is a mental representation constructed by the individual (Matthews, 2002).

In his 2006 article addressing the dearth of examination of EL theory in agricultural education literature, Roberts looked at prominent EL models, including those of Kolb (1984) and Joplin (1981), and posited an iterative cyclical EL model: Experiential learning requires a) initial focus by the individual learner; b) the learner's interaction with the phenomenon being studied; c) the learner's reflecting on the experience; d) the learner's developing generalizations about the situation; and e) the learner's testing those generalization. Roberts' model takes place within a particular context characterized by the four dimensions of the level, setting, and duration of the experience and the intended outcome of the experience for the learner.

Roberts model (2006) borrows somewhat from Joplin's 1981 model and stresses the iterative nature of EL: concepts drawn from one part of an experience may form the basis for further learning. He also notes congruence between EL and both the problem-solving approach and inquiry-based learning. Inquiry-based learning is a subset of experiential learning and has been shown to be effective if designed in terms of iterative improvement permitting the evolution of both materials and a general approach to such inquiry, based on feedback (Fitzgerald et al., 2015). A second model posited by Roberts in the same article (2006) combines concepts from Dale's

Cone of Experience (1946) with the taxonomy for EL's education objectives by Steinaker and Bell (1979), to integrate EL with social and individual learning contexts.

The museum field trip as experiential learning. Falk (1999) contends that much of what individuals learn is learned outside the traditional school system, and he credits museums as playing a vital part in such informal learning. Museums have been identified as important sites of non-formal (informal) science learning, more effectively engaging students, stimulating science understanding, and helping students feel responsible for their own learning (Eshach, 2007). However, the role of museums in this process is neither fully understood nor appreciated, in part because museums themselves historically have been unable fully to document their educational impact on visitors.

Falk (1999) contends that museum-based learning falls outside previous learning models that focusing on the transmission and absorption of specific knowledge, instead integrating material from museum experiences to reinforce concepts and principles with which students already are familiar: *"Thus, an investigation of museum learning must encompass a respect for what individuals bring to the museum in terms of prior knowledge, experience, and interest; an eye to focusing on what visitors actually see, do, say, and think about during their experience; and a sense of time that takes into account what happens subsequently in visitors' lives"* (p. 261).

Research has shown that museum experiences can boost student engagement with science concepts and enhance knowledge acquisition and retention; field trips to museums help teachers spark student interest, delivering vivid experiences that supplement classroom instruction (Gano and Kinzler, 2011). To transfer knowledge about fundamentals in less-traditional contexts such as museums, curriculum and presentation must be modified to allow adjustment to the situation in which such transfer is designed to occur (Barab et al., 2007; Tho et al., 2015).

Many museum professionals attempt to produce content-rich, often hands on, exhibit materials that stimulate and motivate students and reinforce classroom materials. The most innovative and effective museums provide on-site science intensive exhibits combined with online materials designed to supplement the field trip experience (Gano and Kinzler, 2011).

Classroom experiences combined with out-of-school (informal) learning experiences can form a two-pronged approach to enhancing STEM education. However, preparation beforehand for such out-of-school experiences through activities such as classroom discussions greatly increases the effectiveness of the learning opportunity, as does the structure of the opportunity itself, i.e., what is included in the field trip, such as meetings with science professionals (Slough and Bormann, 2011).

Representation and retention of women and ethnic minorities in STEM-related fields may be enhanced by targeted school intervention programs, including museum-based activities, in grades kindergarten through 12 (Valla and Williams, 2012).

Some researchers have criticized the effectiveness of the museum field trip's contributions to science learning, charging that exhibits foster entertainment over learning; obscure science fundamentals; involve sloppy science; present science as free from ethical concerns; or dishonestly present science as easy and free of problems (Eshach, 2007). Parkyn (1993) further argues that *"scientific phenomena are presented not within a conceptual framework but as an endless series of unconnected, entertaining magical events"* (p. 31). Despite their shortcomings, Eshach views out-of-school museum field trips as valuable additions to in-school science instruction, and he recommends that schools and museums work together to improve the experience through thoroughly preparing students beforehand in the science which the museum visit is purposed to illustrate or elaborate.

Museum visits as aids to mastery of technical information, scientific method, and subject matter fundamentals. Analysis of informal learning opportunities in STEM – including visits to museums – has shown that such experiential learning activities facilitate science learning, helping individuals to understand, generate, and evaluate scientific evidence and explanations; comprehend the process of development of scientific knowledge; and actually, participate in science practices and discourse (Ucko, 2012).

In addition, such experiential STEM learning activities positively affect students through allowing them to *"experience excitement, interest, and motivation to learn about phenomena in the natural and physical world"* and *"to think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science"* (Ucko, 2012, p. 3). This researcher further notes that informal education opportunities offered by museums have been singled out for support by the National Science Foundation.

Because research shows that as students age, they become increasingly less interested in STEM-related school subjects, Braund and Reiss (2006) contend that elementary, middle school, and secondary in-school science instruction needs to be complemented by informal learning opportunities based in the real world (e.g., field trips) and in presentation at sites such as science centers, arboretums, zoos, and museums. Students engaging in educational STEM experiences outside school prove more interested, excited, challenged, and engaged by science content; further, they are motivated to retain and build on the knowledge acquired in such contexts, which they perceive as more authentic (Braund and Reiss, 2006).

Informal experiential learning can add the following advantages to students' formal STEM coursework: a.) improved development and integration of concepts; b.) exposure to and possible participation in extended and authentic practical work; c.) access to rare material and to "big" science; d.) stimulation of further learning

and improved grasp of science fundamentals; and e.) encouragement of positive social outcomes such as engagement in collaborative work and increased assumption of responsibility for learning authentic knowledge (Braund and Reiss, 2006).

"Virtual museums" – for example, online immersive environments duplicating museums and access to their content – may retain many of the advantages for fostering science learning as their physical counterparts, especially if they retain a great deal of similarity to the actual experience (Katz and Halpern, 2015). Such online environments may bridge gaps between experiential learning and knowledge representation and provide increased opportunities for student engagement, although the effect may be moderated by specific cultural contexts for individual students.

Museum-based workshops in robotics can offer students choices often not present in school-based programs that focus on activities involving cars, rockets, and competition. Such workshops can develop alternative themes that include students interested in such diverse areas as art, music, and storytelling, highlighting collaboration and focusing on imparting important STEM-related concepts and fundamentals to a more diverse audience (Rusk et al., 2007).

Field trips to science museums can most effectively enhance students' learning when museum experiences emphasize building students' skills in scientific inquiry rather than focusing on acquisition of content knowledge (Gutwill and Allen, 2012). Sociocultural learning contexts differ between schools and museums, with museums more conducive to *"voluntary, self-directed learning, emphasizing affective responses such as positive attitudes toward science, interest in scientific careers, and feelings of empowerment to make sense of the natural world"* (p.131).

Research has indicated that field trips which attempt to focus on learning facts may actually interfere with students' experimenting with museum exhibits; the most effective museum experiences feature advance classroom preparation and a limited amount of structure connected to students' regular curriculum units, combined with free time for students to explore the museum on their own. Learning effects of the field trip experience may be enhanced when students simultaneously play an inquiry game designed to facilitate structured viewing of exhibits and collaborative learning (Gutwill and Allen, 2012).

Study Purpose

Regarding the use of museums as sites of experiential education, most teachers' efforts have focused on making the best use of museum exhibits as they currently exist; this study focuses on potential improvements and additions to current exhibits – including indications for student preparation in advance of the visit — to make them more effective tools in imparting technical information and aiding mastery of fundamental science principles.

To that end, an exploratory inquiry, using a modified case study approach, was conducted to find out the relevance of selected museum exhibits to experiential learning conducive to students' acquisition of technical information and master of science fundamentals. Research included interviews of museum professional staff – including curators/directors, educators, and exhibit developers – at selected museums to determine a.) their philosophy regarding the purposes and development of exhibits; b.) their assessments of the effectiveness of such exhibits in achieving their stated purposes; and c.) their views about museums' roles in extending the exhibit experience beyond any one visit, e.g., through creation of online curriculum enhancement materials. In addition, research included examination of several museum exhibits and conducting analyses of their potential contributions to student mastery of science fundamentals as based on state standards for middle school science learning.

This study formulated the following research questions:

RQ 1: What do museum professionals view as the role of museum exhibits in society?

RQ 2: What are the philosophical orientations of museum professionals toward informal science education through the museum experience?

RQ 3: What functions should museum exhibits primarily be designed to accomplish?

RQ 4: What role is played by state/national educational standards in the design of STEM-focused museum exhibits and supplementary materials?

Methodology

This exploratory descriptive study employed qualitative data collection procedures and data analysis techniques. Qualitative methodology was chosen to *"allow for the examination of a phenomenon and to describe it at a depth that would not be possible through quantitative research methods"* (Merriam, 1998, referenced in McKenna et al., 2014).

Data collection. Three museums were purposively selected for this study, based upon their location and primary mission.

All three are in a geographically and demographically diverse Southwestern state, which ranks near the bottom of all fifty states in terms of educational achievement; thus, the researcher was concerned with devising innovative improvements in elementary and middle school education to facilitate greater student success in secondary and university level STEM disciplines. Further, the researcher, who is not funded for this study, has proximity and access to these museums and to state/national (Common Core, Next Generation) standards for elementary and middle school science.

The missions of all museums selected are concerned primarily with science. All museums selected are nonprofit entities serving their respective communities,

and all are open to school field trips. All three are in the state's largest city.

The three museums chosen are members of the Association of Science and Technology Centers (ASTC), *"a global organization providing collective voice, professional support, and programming opportunities for science centers, museums, and related institutions, whose innovative approaches to science learning inspire people of all ages about the wonders and meaning of science in their lives"* (ASTC website, 2015). ASTC museums were singled out because of their declared focus on science education.

Data collection included two phases: semi-structured interviews with staff at the museums and review of selected museum exhibits. Interviews were conducted by the researcher with curators/directors, educators, and exhibit developers/constructors at each museum. The Institutional Review Board of researcher's employing institution approved the study protocol and all participants provided oral informed consent prior to participation in the study.

Each interviewee was asked about their duties, the genesis of exhibits, and their approach to science education through such exhibits and, if applicable, curriculum enhancement materials such as workbooks or web sites. Interviews were taped, and tapes were transcribed and analyzed by the researcher for emergent themes.

Staff interviewed were asked to identify exhibits and supplementary materials designed to convey STEM-related content to young students. The research reviewed such exhibits and analyzed any enhancement materials, for example, workbooks or web sites, associated with them. Efforts were made to compare exhibit content and materials to relevant state/national educational standards.

Data analysis. Thematic analysis was conducted on the information gained through staff interviews. Two coders analyzed the interview transcripts, noting the themes present in each individual transcript and producing a consolidated list. The resulting list was then used to analyze the museums' approach to exhibits and to compare different staff members' attitudes toward use of exhibits and enhancement materials to improve foundational STEM knowledge.

Qualitative content analysis of selected exhibits from each of the museums was conducted. Two coders analyzed exhibit data – videotapes, photographs, notes – to determine physical content presented in each exhibit and in accompanying enhancement materials, if applicable. Results were consolidated, then compared against state/national standards for elementary and middle school science. Concurrences and discrepancies between exhibit content and state standards were recorded and analyzed.

Results

The researcher visited three museums, reviewing a purposive sample of exhibits in each, and interviewed six museum professionals (museums and interviewees will be identified by aliases), two at each museum. The first museum (M1) was a hands-on, discovery type museum, at which the researcher talked with a program data and evaluation manager (M1I1, female, white, mid-thirties) and a STEM learning coordinator (M1I2, male, white, early forties). The second museum (M2) was a specialty museum focusing on nuclear history and science, at which the researcher interviewed the museum/foundation director (M2I3, male, white, sixties) and an education enrichment coordinator (M2I4, female, white, early thirties). The third museum (M3) was a large natural history and science museum, at which the researcher interviewed the executive director (M3I5, female, white, fifties) and the director of education (M3I6, female, white, early forties).

For this modified case study, all museum professionals were white, with two, males and four, females. Their ages spanned more than 30 years, with two in their thirties, two in their forties, and one each in their fifties and sixties. All interviewees had completed at least a bachelor's degree, and two had been educated as visual artists. Two interviewees had education degrees, with emphases in science teaching; one was a former wildlife biologist, while another majored in environmental science. One of the interviewees, who worked as a museum educator, earned a degree in film production. All interviewees had worked at museums for ten years or more and stressed the value of their on-the-job training; the two museum directors interviewed had extensive experience in exhibit design and construction.

Interviews

RQ1: Without exception, all interviewees strongly believed that the most important societal role of their museums and museum exhibits was to stimulate curiosity about and interest and engagement in science. All agreed that a type of entertainment education was the most important role to be fulfilled by museums and their exhibits.

M1I1: *"Engagement is really the big piece that museums and particularly hands-on museums can offer. I think that museums engage people with different learning styles and I've seen this multiple times here – and I recall a visit with a family whose son is in 5th grade, really struggling at school, had had a teacher last year that didn't support him, really didn't do well at school, and he was so engaged with the materials and the exhibits and was testing his ideas and trying things out in a way that can't necessarily happen in a classroom."*

M2I3: *"I think museum exhibits serve an important public role in that they are intended to make some level of meaning for people who come into the museum. So they have to have some impact, yet for a museum that has some controversial material, one has to be careful how the bias comes through, whether you are for one thing or against another. . . . so we really pay close attention to the different voices that show up in an exhibition. They might be voices of industry, they might*

be voices of government or academia, they might be voices counter – for example, environmentalists have voiced concern about nuclear power for some years. . . so the voices in the exhibitions we mount do that. We provide ideas that people might not necessarily think of and then let them draw their own conclusions."

Examples of relevant themes that emerged in interviewees' responses to their perceptions about museums' roles included engagement — importance of engaging visitors' interest, exhibits featuring hands-on engagement, visitors' making meaning from exhibits, museums deviating from the rote memorization that typifies in-school science, boosting attendance driving selection of featured exhibits; presentation of innovative ideas — exhibits providing novel ideas, helping visitors discover new interests; and increasing visitors' scientific knowledge — exhibits and programs being scientifically accurate, museums fostering critical thinking skills.

RQ2: All interviewees identified their philosophical orientations toward informal education through museums as regarding informal education as an essential component of a well-rounded education and a complement to the school experience. They also agreed that informal education experiences should be out-of-the-ordinary, exciting, thought-provoking, engaging, and interesting.

M3I5: *"I believe that informal education is not there to teach; it's there to spark an interest or curiosity so that they are more motivated to be in other places, maybe watch a program, or pay more attention in school or get on the internet and look something up for themselves because they have developed a natural curiosity for it, so our job is to spark curiosity."*

M1I2: *"One impressive thing I hear from adults – and almost everyone I've asked so far – most adults can relate a formative experience they had at an informal science learning institution or with a science teacher – we remember the teacher and the informal science experiences for many years afterwards – if we're carrying those things for that long, they are positive, good experiences."*

M2I4: *"In our science camps and programs, we have come over to the approach that we talk for five minutes and then we start the hands-on activities – and our philosophy there is that we really engage the children. We're starting to turn over camp programs to have new content so that you bring back in folks who might not return if they have already done a program – we are constantly reinventing ourselves in that way, we are constantly coming up with new material about what's current in STEM, what's current in the news, what's contemporary in terms of trends in interests of the children."*

M2I3: *"This museum was really different back 20 years ago; it was located on an Air Force base, had a narrow focus and few staff, and was run directly by the government. We have transitioned it to be a family-oriented, community-oriented, private museum. We believe in making work a good place for our staff; they should be reading about and becoming conversant with museum components, understand the museum purposes and content and how our STEM programs contribute to industry pipelines."*

Interviewees also stressed the need for exhibits to be family-friendly and for museum spaces to facilitate either lingering at an exhibit, either to examine it or to actively engage in hands-on interaction with it (M1I2, M3I5, M3I6) or moving quickly and easily through the space to allow the maximum number of visitors to enjoy the museum during a given time (M2I3).

Examples of relevant themes that emerged in interviewees' responses to philosophical orientation to informal education included importance of engaging the entire family – museum as family oriented, museum as family friendly, museum managed on principle of family (museum staff) first; and visitor engagement as primary.

RQ3: With regard to the most important functions that individual exhibits should fulfill, interviewees again agreed that individual exhibits should stimulate curiosity about and interest and engagement in science, when possible through hands-on interactive experiences. When asked whether they would typify an exhibit's most important function as (1) entertainment, (2) teaching facts, (3) teaching scientific fundamentals and principles, or (4) reinforcing classroom science teaching, they chose entertainment value or engagement as the most important thing an exhibit could embrace. However, interviewees agreed that an exhibit's entertaining characteristics should serve as a stepping-stone to supplementary programs and materials that could enhance more detailed STEM learning. Interviewee M2I3 further elaborated that he believed a museum's functions encompassed all the first three approaches listed by the researcher in this question.

M2I3: *"I think that museums should entertain, because the museum is actually in the leisure experience world, competing with sports and things that your family needs to do and church and all the other things that surround us as citizens. Museums have to find a way to attract enough attention to succeed, and I think without entertaining, or engaging if it's not entertaining, a museum needs to have something fascinating, it needs to have something rare, not found everywhere, that causes people to invest the time and money to come to the museum to see the 'real thing' as it were. Not all museums have real things; some exhibits feature concepts in learning, but we do both. We have 24,000 objects, and we have a large collection of scientific and historical material. So, I think that museums, at least we do here, do have to live in the destination market; we are the only museum of our kind in the world, so we pull people in from all over the world and the United States, who have interest in our technical and historical materials. Most of our attendance is not local."*

M1I1: *"I don't know that I necessarily agree with any of [the museum functions listed by the researcher]. The word entertainment is loaded in terms of museums and that's something that museums have been grappling with for decades – so for me, yes, joy and pleasure is an*

incredibly big part of the experience here, because joy and pleasure is part of being engaged. I would almost want to get at that, at the emotional investment and at the wanting to go; I've talked with many member families on the floor – one has a little boy who's now three years old, and every day when James gets up, he says 'I want to go to [M1]'. That's something that can be looked at as responding to entertainment, but I think it's deeper. . . . Our exhibits and our floor staff, our exhibits are designed to provide opportunity, and the floor staff and educators facilitate interaction and opportunities with the exhibits to enhance experience with scientific principles and phenomena."

M1I2: *"Developing critical thinking skills is what science is about, and I think that in a lot of ways, we try to develop that with students and visitors here – our staff try to work with them to develop that critical understanding."*

M1I1: *"There's no experience in learning that's going to stand on its own. Everything exists in a constellation, so a single visit to a museum maybe has the potential of creating a huge impact, but the impact and the effect of that museum is only strengthened by having a classroom experience before or after that. And especially having parents who are interested and involved in the follow up. What we're learning more and more in terms of the educational landscape is that kids need adults early on, and most often those adults are their parents who are engaged with those kids and who are engaged and who are interested in their learning. Kids who have parents that are engaged in their learning do so much better than kids who don't."*

M2I3: *"Scientific and historical accuracy in museum exhibits is crucial. I also believe it is important to teach scientific fundamentals and principles. This is where our educational team comes in, because they really do break down some of the science into pieces that facilitate student entry and get them engaged, they are here for a camp or they are our own teenage docents who present the science as they are learning it too. However, we are an informal science place, and although we try to make our programs fit into the school programs, we are not a classroom – we want kids to remember what they do here, and if we were to sit them down and lecture them like they do in a school classroom, it wouldn't work out so well for us."*

Examples of relevant themes that emerged in interviewees' responses to identifying museums' most important function included entertainment – simple engagement, joy, pleasure, thoughtful engagement; teaching facts – being able to think critically is more important than learning facts; teaching scientific fundamentals and principles – facilitating hand-on experience with scientific principles and phenomena, teaching the scientific process, need for adult involvement in science learning; and relationship to classroom teaching — here/not here to reinforce classroom teaching, complementing classroom instruction, setting students up for deeper discovery,

RQ4: Interviewees shared the opinion that state/national (Common Core, Next Generation) educational standards played little role in the design of STEM-focused museum exhibits. However, they agreed that museum educators paid a great deal of attention to inculcating relevant state/national (Common Core, Next Generation) educational standards into museum extracurricular programs and into supplementary materials intended for use by classroom STEM teachers.

M3I5: *"Certainly when we create any kind of a school field trip and when I've done it with other institutions, such trips always had to be aligned with the standardized testing standards in some way, shape or form — it had to be connected – and so enrichment was not so much a factor as whether there was some way a particular field trip could help kids pass these standardized tests — and that sort of flies in the face of what I think informal education should be all about."*

M1I2: *"For the science programs we've developed, we've read through the standards and say 'this standard applies here', so that for every program we have, we have a list of the standards it's hitting, because teachers need to have the ability, when getting us to come to their school or they come here, to be able to say how museum offerings are addressing standards. We want to be a resource for teachers and give them the tools they need, including specifying connections to particular standards."*

M2I4: *"For our science camps, we are very definitely looking at conforming to state/national educational standards. In dealing with teachers, we break down our programs into which standards – Common Core, Next Generation Science Standards – which components of these we are hitting, so teachers can request that information from us and here we go, that's what we are covering in this program. For example, with our K-5 Taste of Science Program, we pick from particular topics – if they are learning about chemistry in the classroom, if they are learning about energy, we give them, not just the board overarching topic but I often contact them with the individual activities, here's some choices, what's going to best align with what they are offering in the classroom and that's something, I'm not sure how many museums offer that, but our museum does offer that sort of selection so that we are complementing what the teachers are doing in their individual classrooms."*

M3I6: *"One of the things that we've been moving toward is that since teachers can't come to the museum as easily, we are trying to bring the museum to their classes. We've been working on a series of science kits that teachers can check out to bring to their classes. Now we're trying to broaden the idea – these kits have collection items but also some activities, and they have literacy items too to link to what's happening here in our state with testing needs and our governor's initiatives. We align all our kits to the state/national educational standards, so teachers can easily fit them into their lesson plans. But we also try to broaden them out to include reading, art activities, so that a teacher can pick*

and choose what to use from the kit; kits are also meant to span a wide range of grade levels so that each teacher can decide how to use the kit to their best advantage rather than our telling them how to use a kit with defined steps."

Examples of relevant themes that emerged in interviewees' responses concerning conformity of museum exhibits and supplementary materials to state/national (Common Core, Next Generation) educational standards included exhibits – museums building most of their own exhibits in-house, exhibits not being based on standards, exhibits being hands-on; museum camps/programs/teacher materials – programs being based on standards, programs benchmarked to state standards, programs and materials offering teachers choices, teachers needing to justify how museum visits and programs match standards; and standards themselves – standards are process oriented

Exhibits. Exhibits varied in subject matter and execution among the three museums visited, with the common thread that few were explicitly based on state/national (Common Core, Next Generation) educational standards.

M1I2: *"We have tied state/national educational standards to just one exhibit area [not specified], but we have not done it for all of them. There are some overall standards we hit with the exhibit floor in its totality – and that encompasses the inquiry process in large measure through the ways the science and technology standards address the engineering process, how you design, test, redesign, that sort of thing."*

M2I3: *"We normally wouldn't tie our exhibitions to state/national educational standards because ours is a general museum and many of our visitors are adults. Even though such standards are important for adults to also be aware of, if we made our exhibits too aligned with educational standards, we would lose that audience."*

M2I4: *"It is too challenging for us, as museum staff, to evaluate whether or not we are connecting to state/national educational standards at the individual exhibit level."*

Thus, the researcher's initial assumption that exhibits could be reviewed and tied to particular educational standards proved at worst, unfounded and at best, almost impossible to implement. Therefore, analysis of this objective was abandoned for qualitative description of each museum experience overall.

Exhibits at M1 were almost without exception hands-on, interactive exhibits designed to encourage experiential, participatory, inquiry-based learning. There were few written explanatory materials placed beside exhibits, and floor experience staff or docents usually intervened in the visitor experience only when something in the exhibit was not functioning properly, although in a few interactions when the researcher did not understand how an exhibit "worked," one of them helped to guide the experience. M1 exhibits had a heavy family-friendly flavor, encouraging children to plunge into the exhibit experience, and the layout of M1 consisted of many small, contained spaces where the visitor and his/her family could participate in an exhibit together and undisturbed.

Of the three museums visited, M1 has the most extensive fabrication shop for building exhibits, almost all of which are built in-house.

M1I2: *"Over 90% of what is on the exhibit floor was developed, designed, built, tested, refined, and re-tested in-house."*

M1 interviewees also stressed that scientists from local national laboratories and industries assisted in exhibit design.

M1I2: *"None of the staff areas here work in isolation – we have an exhibits group, an education group, and a floor experience group, and we partner together to design and construct exhibits, but we also invite in scientists. Most of our exhibit developers have their MFA but a good portion of our educators – especially those working with older students – are scientists, myself as well. But we do work with partners from [national laboratories, computer chip manufacturers, aerospace companies; we've been very fortunate to have those kinds of rich industries in town here. We also have a number of retired scientists who volunteer at our exhibit shop, building stuff, and obviously also on the science, making sure that we are accurate in what we are doing."*

M2, on the other hand, was for the most part a glossy immersion in viewing photographs and films and reading text-heavy placards placed near exhibits featuring actual historical artifacts of the nuclear age. M2 included a couple of hands-on experiential exhibits, principally a room where children, guided by a docent, could conduct controlled experiments and a STEAM exhibit encouraging visitors of all ages to try their hand at designing a nuclear reactor. M2's layout encouraged visitors to move expeditiously through the space by one of three pre-arranged routes, taking self-directed or docent-led "tours" designed to cover a particular aspect of the nuclear story. An entire hall dedicated to the science of nuclear energy is planned for M2 and will no doubt change the nature of at least part of the experience, as the existing hall seems heavy on history rather than science.

M2 also builds most of its own exhibits, although the researcher did not tour its shop. M2I3 (who has an MFA) told the researcher he is schooled and experienced in exhibit design, as is another employee who obtained a master's degree in exhibit design from a large Texas state university.

M2I3: *"We have exhibit design professionals on staff, two of whom designed all of the exhibits in entire museum. We have a new employee with a masters' degree in exhibit design who can plan, design, and make drawings and construction plans for exhibits. We have a great team, and we build most of our own exhibits. We also have a large number of collections and a curatorial staff that can interpret them. That's one of the things about this place, we have such a rich mix of things to put on display and to weave them together into story lines."*

M2 formerly was run exclusively by scientists from a national laboratory that had participated in the early development of the United States' nuclear arsenal; these and other scientists maintain their input into M2 today.

M3 is a large museum with a long history and an inventory of exhibits compiled over the years. M3 also features a number of traveling exhibits, which it often enhances/customizes for the state it serves. M3 also has an in-house fabrication shop, and M3I5 has extensive background in exhibit design, construction, and evaluation. There was no explicit mention of the involvement of local scientists from the community in exhibit design or construction, but M3 employs five curators from five different science disciplines, and these in-house scientists undoubtedly exercise input into exhibit development and fabrication.

M3 has the largest square-footage of the three museums visited. Its space is organized into halls dedicated to particular subject matter, and visitors can navigate through the space casually or may purposively move to a hall containing material in which they are particularly interested. M3 also maintains a nature center staffed by a docent, who helps children and other visitors navigate the hands-on exhibits there.

All three museums host numerous after-school and vacation programs for children from pre-school through high school. These programs focus on different aspects of science, and most of them conform to applicable state/national (Common Core, Next Generation) educational standards. In addition, all three museums have school-day enrichment programs targeting home schoolers. M1 has an outreach program in which museum educators travel to schools throughout the state to present science-focused programs. M2 features extensive online outreach materials and hosts intensive summer science camps, as well as internship opportunities for high schoolers. In the face of public schools' dwindling resources and time to take advantage of museum field trips, M3 focuses on developing science kits teachers may borrow to supplement classroom instruction. All three museums provide supplementary materials for teachers to check out to use in their classrooms.

This researcher concluded that although museum staff are cognizant of the requirements contained in state and national educational standards, exhibits are not designed nor constructed to conform to those standards. Some extracurricular programs and almost all supplementary teacher materials, as well as some online content, however, do conform to these standards.

Discussion

Study Results and the Literature

The themes articulated by participants in this pilot qualitative case study suggest that they agree with findings in earlier literature concerning the importance and usefulness of experiential learning (Cokadar and Yilmaz, 2009; Fitzgerald et al., 2015; Miettinen, 2000; Phipps and Osborne, 1988; Tribus, 2005) and that they agree science museum field trips bolster such experiential science learning (Falk, 1999; Eshach, 2007; Gano and Kinzler, 2011). However, they unanimously did not agree that such field trips, as they are currently constituted, can be valuable aids to mastery of technical information, the scientific method, and subject matter fundamentals (Barab et al., 2007; Braund and Reiss, 2006; Parkyn, 1993; Tho et al., 2015), although they acknowledged that extended learning programs offered by their museums can be valuable tools for young students to use in acquiring scientific knowledge and skills (Kellogg et al., 2010; Rusk et al., 2007).

As a group, participants stressed that most important societal contribution of museum exhibits was to provide a venue for entertainment education that promotes engagement for all visitors. They agreed that such engagement is best promoted through exhibits that present innovative ideas to encourage further exploration of science and nature and serve as stepping stones to supplementary programs and materials that enhance more detailed STEM learning. This finding supports literature which directs the focus of experiential learning experiences toward motivating students to engage with more formal science curricula emphasizing knowledge and skill acquisition (Cokadar and Yilmaz, 2009; Falk, 1999; Fitzgerald et al., 2015; Miettinen, 2000; Phipps and Osborne, 1988; Tribus, 2005). These statements by participants reinforce findings by Eshach (2007) that museums provide important informal learning venues which contribute to students' engaging with science learning and stimulate general science understanding while bolstering students' feelings of responsibility for their own learning trajectories.

The participants identified a museum's most important function as that of providing entertainment through encouraging simple engagement, joy, pleasure, and deeper thinking about ideas. They also expressed the opinion that museums should not concentrate on teaching facts, teaching scientific fundamentals and principles, or bolstering/reinforcing classroom science teaching (Gutwill and Allen, 2012). Rather, museum field trips may contribute to such reinforcement only if careful preparation is given students in advance of the visit (Eshach, 2007; Slough and Bormann, 2011).

Participants' experience with conducting museum field trips and other types of science-related educational activities such as summer programs and science camps agree that students benefit from such experiential learning most when the learning is hands-on and focuses on acquiring the skills of the scientific process rather than mere facts (Braund and Reiss, 2006; Falk, 1999; Gutwill and Allen, 2012; Ucko, 2012).

Importance of This Study for Higher Education in Agriculture

As the traditional student base of agricultural colleges and universities shrinks, to be augmented or even replaced by more-urban students who often lack any background in agriculture practice, such institutions of higher education need to revisit the continued effec-

tiveness of their long-trusted approach. By reaching new learner bases early, agriculture schools can attract expanded sources of students. One such way to accomplish student body diversification might be to pay attention to non-rural students' visits to museums, where they can be exposed to STEM, encouraged to study science, and excited and motivated to enter STEM fields, including the agricultural sciences for which high school science and math form the foundation (Chen and Weki, 2009; Maltese and Tai, 2010; Patterson and Leonard, 2011; Vitale et al. 2010). Such attention could even extend to actively consulting with science museums in order to ensure that they do their entertainment education function more effectively and that they include agriculture in their science exhibit/activity mix (Cokadar and Yilmaz, 2009; Fitzgerald et al., 2015; Phipps and Osborne, 1988; Tribus, 2004).

Limitations of the Study

Limitations of this study include its tiny museum and participant base and the fact that it was conducted in a rather remote and non-typical region of the United States. The qualitative methods used to collect and analyze data also preclude any generalizations of the results.

Suggestions for Further Research.

The researcher initially undertook this study with a view to conducting two areas of further inquiry: an expansion of the qualitative methodology to include a large and diverse population of science museums throughout the United States from which a larger random sample could be drawn for museum staff interviews; and a quantitative survey aimed at museum staff randomly selected from the larger population of museums previously mentioned. Both studies would yield more comprehensive and rich data, as well as, in the case of the survey, permitting hypothesis testing and subsequent generalizations. It is to be hoped that such work might lead to construction of a set of best practices to guide science museums in their mission to engage, inspire, and motivate the country's future scientists and agricultural professionals.

References

Association of Science and Technology Centers. http://www.astc.org/ October 15, 2015.

Barab, S., S. Zuiker, S. Warren, D. Hickey, A. Ingram-Goble, E-J. Kwon, I. Kouper and S.C. Herring. 2007. Situationally embodied curriculum: Relating formalisms and contexts. Wiley InterScience. DOI: 10.1002/sce.20217.

Braund, M. and M. Reiss. 2006. Towards a more authentic science curriculum: The contribution of out-of-school learning. International Journal of Science Education 28(12): 1373-1388.

Chen, X. and T. Weko. 2009. Students who study science, technology, engineering, and mathematics (STEM) in postsecondary education. IES, National Center for Education Statistics, Institute of Education Science, U.S. Department of Education.

Cokadar, H. and G.C. Yilmaz. 2010. Teaching ecosystems and matter cycles with creative drama activities. Journal of Science Education and Technology 19(1): 80-89.

Dale, E. 1946. Audio-visual methods in teaching. New York: The Dryden Press.

Eshach H. 2007. Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. Journal of Science Education and Technology 16(2): 171-190.

Estepp, C.M. and R.G. Roberts. 2011. A model for transforming the undergraduate learning experience in colleges of agriculture. NACTA Journal 55(3): 28-32.

Falk, J.H. 1999. Museums as institutions for personal learning. Daedalus 128(3): 259-275.

Fitzgerald, M., D.H. McKinnon and L. Danaia. 2015. Inquiry-based educational design for large-scale high school astronomy projects using real telescopes. Journal of Science Education and Technology. DOI: 10.1007/s10956-015-9560-x.

Gano, S. and R. Kinzler. 2011. Bringing the museum into the classroom. Science 331(25 February): 1028-1029.

Gutwill, J.P. and S. Allen. 2012. Deepening students' scientific inquiry skills during a science museum field trip. Journal of the Learning Sciences 21: 130-181.

Hansen, G. 2012. When students design learning landscapes: Designing for experiential learning through experiential learning. NACTA Journal 56(4): 30-35.

Joplin, L. 1981. On defining experiential education. Journal of Experiential Education 4(1): 17-20.

Katz, J.E. and D. Halpern. 2015. Can virtual museums motivate students? Toward a constructivist learning approach. Journal of Science Education and Technology. DOI 10.1007/s10956-015-9563-7.

Kellogg, J., J. Gili, K. Andrea-Marobela, A. Sosome, C. Flint, S. Komarnvtsky, G. Fear, L. Struwe, I. Raskin and M. Lila. 2010 Screens-to-nature: Opening doors to traditional knowledge. NACTA Journal 54(3): 41-48.

Kolb, D.A. 1984. Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Maltese, A.V. and R.H. Tai. 2011. Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. Science Education Policy 95(5): 877-907.

Matthews, M.R. 2002. Constructivism and science education: A further appraisal. Journal of Science Education and Technology 11(2): 121-134.

Merriam, S.B. 1998. Qualitative research and case study applications in education. San Francisco, CA: Josey-Bass. Referenced in McKenna, S., J.D. Miller and N. Jack. 2014. Determining the usefulness of an advising video for an animal science department. NACTA Journal 58(3): 165-173.

Miettinen, R. 2000. The concept of experiential learning and John Dewey's theory of reflective thought and

action. International Journal of Lifelong Education 19(1): 54-72.

Parkyn, M. 1993. Scientific imaging. Museums Journal 93(10): 29-34. Reported in Eshach H. 2007. Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. Journal of Science Education and Technology 16(2): 171-190.

Patterson, T.F. and J.G. Leonard. 2011. Ten years into the 21st century core curriculum: Our experience, insight, and future. NACTA Journal 55(3): 61-70.

Phipps, L.J. and E.E. Osborne. 1988. Handbook on agricultural education in public schools. Danville, IL: Interstate.

Roberts, T.G. 2006. A philosophical examination of experiential learning theory for agricultural educators. NACTA Journal 47(1): 17-29.

Rocka, T.D. and D.G. Morrish. 2010. Public school administrators' ratings of the biological and physical science competencies needed by beginning agricultural science instructors. NACTA Journal 54(3): 29-34.

Rusk, N., M. Resnick, R. Berg and M. Pezalla-Granlund. 2008. New pathways into robotics: Strategic for broadening participation. Journal of Science Education and Technology 17(1): 59-69.

Slough, T.L. and J.M. Bormann. 2011. Field trip to racetrack enhances classroom experience. NACTA Journal 55(4): 59-64.

Steinaker, N.W. and M.R. Bell. 1979. The experiential taxonomy: A new approach to teaching and learning. New York: Academic Press.

Tho, S.W., K.W. Chan and Y.Y. Yeung. 2015. Technology-enhanced physics programme for community-based science learning: Innovative design and programme evaluation in a theme park. Journal of Science Education and Technology 24(5): 580-594.

Tribus, M. 2005. Some remarks on the improvement of engineering education. Journal of Science Education and Technology 14(1):1-28.

Ucko, D.A. 2010. The learning science in informal environments study in context. Curator 53(2): 129-136.

Valla, J.M. and W.M. Williams. 2012. Increasing achievement and high-education representation of under-represented groups in science, technology, engineering, and mathematics fields: A review of current K-12 intervention programs. Journal of Women and Minorities in Science and Engineering 18(1): 21-53.

Vitale, J.D., S.P. Wanger and D.C. Adams. 2010. Explaining student performance in an undergraduate agricultural economics classroom. NACTA Journal 54(2): 2-9.

Differences in Critical Thinking Ability According to College Entry Pathway

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Abstract

The purpose of this study was to determine if entry pathway—direct from high school versus transfer from community college—influenced the critical thinking abilities of agricultural education students. Seventy-five senior-level agriculture undergraduate students completed a critical thinking assessment test. Although students entering the four-year university directly from high school had statistically significant higher ACT scores and semester GPA's (which are known predictors of critical thinking ability), there were no statistically significant differences in critical thinking abilities between the two groups. When comparing students' performance to national norms, regardless of entry pathway, students scored statistically lower than national norm data in the skill areas of identifying additional information needed to evaluate a hypothesis and providing relevant interpretations for a specific set of results. Further, agricultural education transfer students were shown to have a greater ability to think creatively than students who entered the four-year university directly from high school. Recognizing the importance of creative thinking to student success and overall critical thinking skill, curriculum and instructional development within agricultural education should focus on intentionally integrating creative and critical thinking.

Introduction

Developing competencies, such as critical thinking, that enable individuals to participate fully as citizens remains the unifying purpose of public education (Kuhn, 1999). However, a universally accepted idea of what constitutes critical thinking does not exist (Tsui, 1998). Defining critical thinking involves both simplistic explanations focused primarily on analyzing and evaluating information (Duron et al., 2006), and complex explanations of critical thinking such as a *"reasoned, purposive, and introspective approach to solving problems or addressing questions with incomplete evidence and information and for which an incontrovertible solution is unlikely"* (Rudd et al., 2000, p. 5). Critical thinking is believed present when students perform in the higher-ordered thinking levels of Bloom's (1956) taxonomy, such as in the categories of analysis, synthesis, and evaluation (Bers, 2005; Duron et al., 2006).

Critical thinking is developed because of critical thinking disposition and a set of facilitating factors, which include age, gender, grade point average (GPA), training, and experience (Ricketts and Rudd, 2005). Critical thinking disposition is an individual's motivation to use critical thinking skills (Pascarella and Terenzini, 2005). In a study exploring the relationship between critical thinking disposition and problem-solving abilities of undergraduate agriculture students, Friedel et al. (2008) concluded that *"students with a preference to solve problems by generating many solutions and employing a strategy of thoroughness and attention to detail"* (p. 34) have a higher critical thinking disposition. While Brisdorf-Rhoades et al. (2005) found greatly varying critical thinking dispositions among undergraduate agriculture communication students, Rudd et al. (2000) found students enrolled in one college of agriculture did not have strong critical thinking dispositions.

The link between critical thinking disposition and two facilitating factors of overall critical thinking ability, age

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and gender, is not clear. Bers et al. (1996) and Rudd et al. (2000) found female students had greater critical thinking dispositions than male students. However, Brisdorf-Rhoades et al. (2005) and Burbach et al. (2012) were unable to find significant gender relationships. Similar discrepancies are evident between critical thinking disposition and age (Bers et al., 1996; Burbach et al., 2012; Jacobs, 1995). Research exploring the relationship between gender and overall critical thinking ability (as opposed to disposition) provides slightly more consistency, with gender showing limited to no significant influence on critical thinking ability (Brahmasrene and Whitten, 2011; Friedel et al., 2008).

Another facilitating factor of critical thinking is GPA. Most students with high critical thinking skills are likely to perform well in college courses (Williams and Stockdale, 2003). Collegiate GPA was found to be one of the most consistent predictors of critical thinking disposition among undergraduate agriculture students (Burbach et al., 2012; Friedel et al., 2008). Brahmasrene and Whitten (2011) were able to link incoming undergraduate business students' high school GPA to overall critical thinking ability. Similarly, Ricketts and Rudd (2005) found a positive correlation between GPA and overall critical thinking ability of National FFA delegates when leadership and innovativeness constructs were held constant.

The remaining two facilitating factors of critical thinking, experience and training, were the focal point of this study. While some studies (e.g., Bers et al., 1996, Burbach et al., 2012) found significant positive relationships between education level (freshman, sophomore, junior, or senior classification) and critical thinking disposition, contradicting evidence has also been presented (Brisdorf-Rhoades et al., 2005). Recognizing that some gains could be attributed to natural development that would have occurred in the absence of college, Saavedra and Saavedra (2011) found students in their final year of college had statistically significant higher critical thinking abilities than first-year students. Although these studies found increases in student critical thinking disposition and ability over the span of a four-year degree, definitively attributing casual relationships to these increases is more difficult.

Gellin (2003) provided a possible explanation for these increases with the discovery that students continually involved in co-curricular activities achieved higher gains in critical thinking than those who were not involved. Delving deeper into the effects of experience and training on critical thinking development, Jacobs (1995) compared the critical thinking dispositions of traditional-aged community college students to those of entering freshmen at a private university (Facione et al., 1995). The community college group had weaker critical thinking dispositions than the incoming freshmen.

Although critical thinking disposition is related to critical thinking ability (Friedel et al., 2008; Ricketts and Rudd, 2005), an individual's disposition to think critically is a factor that should be examined with caution since it leaves a lot of unaccounted variance (Kuhn, 1999). Disposition is often interpreted in the sense of habit, but individuals do not employ critical thinking from habit. Rather they think critically because they see the value in doing so (Kuhn, 1999). Therefore, this study explored critical thinking ability rather than disposition. Specifically, a need exists to explore critical thinking ability in regard to the facilitating factors of experience and training. Research has shown weaker critical thinking dispositions among community college students as compared to entering freshmen at a private university (Jacobs, 1995). However, limited research exists on the critical thinking abilities of similar groups. Do students who enter a four-year university directly from high school have different critical thinking abilities than students who transfer from a community college?

Purpose and Objectives

As part of a larger investigation, the purpose of this study was to determine if entry pathway—direct from high school versus transfer from community college—influenced the critical thinking abilities of agricultural education and studies students. The following research objectives guided this study:

1. Compare selected demographic and academic characteristics of agricultural education students, categorized by entry pathway.
2. Compare the critical thinking abilities of students who entered the four-year university directly from high school to those of students transferred from a community college.
3. Compare the critical thinking abilities of students who entered the four-year university directly from high school to national critical thinking norms.
4. Compare the critical thinking abilities of students who entered the four-year university via community college transfer to national critical thinking norms.

Methods and Procedures

The Iowa State University (ISU) Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study. The target population of this study was all senior-level undergraduates (90+ semester credit hours; N=181) within the Department of Agricultural Education and Studies at ISU during the spring 2013 semester. Entry pathway was determined according to the ISU Registrar's official classification. As recommended by Dillman et al. (2009), the ISU 10-day enrollment list was used to select a random representative sample of 124 students at a 95% confidence level. In comparing demographic and academic information of the sample to population data, a Pearson's χ^2 analysis yielded no significant difference for gender, and multiple two-sample t tests yielded no significance differences for age, semester credit hours, semester GPA, cumulative credit hours, cumulative GPA, transfer credit hours, transfer GPA, total GPA, and ACT score.

We chose to assess critical thinking abilities with the Critical Thinking Assessment Test (CAT) because it uses open-ended responses and has national reference norms. The CAT is a National Science Foundation supported instrument created to assess and improve critical thinking and real-world problem-solving skills (Center for Assessment and Improvement of Learning [CAIL], 2012). The CAT includes 15 short-answer questions based on real-world situations developed by university faculty across the nation to accurately assess important components of critical thinking (CAIL, 2010). The questions (skill areas) are grouped into four overlapping broad categories according to question topic: (a) creative thinking, (b) problem solving, (c) evaluate and interpret information, and (d) effective communication.

ISU faculty scored the CAT assessments for this study under direct supervision of CAIL-trained individuals and used detailed scoring rubrics provided by CAIL to enhance consistency and reliability in evaluations. Inter-rater reliability examinations on the CAT indicated consistency at the level of α=0.82 (CAIL, 2010). Inter-rater reliability was further established by having a minimum of two faculty scorers for each question. Internal consistency was deemed reasonably good by CAIL (2010) at a level of α=0.70. CAIL (2010) explained that the lower internal consistency was due in part to the numerous components of critical thinking evaluated by the instrument.

A modified version of Dillman et al.'s (2009) tailored design method was followed when requesting student participation. Five points of contact with students yielded 75 completed tests, which accounted for 60.48% of the randomly selected senior-level students. Nonresponse error was addressed by comparing respondents' and non-respondents' personal and demographic data to population data (Miller and Smith, 1983). A Pearson's χ^2 analysis yielded no significant difference for gender and a two-sample t test yielded no significance differences for age, cumulative GPA, and ACT score between respondents and non-respondents. However, caution should be used when extrapolating results beyond the population since respondents were representative of a homogenous sample in regard to educational degree pursuit.

Measures of central tendency were used to describe demographic and academic characteristics. A two-sample t test was used to compare academic characteristics according to entry pathway (Gall et al., 1996). University-specific terminology was used to describe academic characteristics. Semester credit hours included the number of credit hours in which the participant was enrolled during the semester of the study. Semester GPA reflected the previous semester's GPA. Cumulative credit hours included the number of credit hours taken at the current university, and cumulative GPA reflected the GPA of these credit hours. Total credit hours completed was defined as the sum of both credit hours taken at the current university and any credit hours that may have been transferred from another institution.

A two-sample t test was used to compare the CAT scores of students who entered the four-year university directly from high school to those of students who transferred from a community college (Gall et al., 1996). A one-sample t test was used to compare participants' scores to CAT national norm data collected from junior and senior-level higher education students across the nation (Gall et al., 1996). Effect sizes quantifying group differences were interpreted using Cohen's (1992) criteria; 0.02 was considered small, 0.15 was medium, and 0.35 was large.

Results and Discussion

Objective one sought to compare selected demographic (Table 1) and academic characteristics (Table 2). Respectively, students who entered the four-year university directly from high school and those who transferred were both primarily white (100%; 100%) males (65.9%; 67.6%) between the ages of 21 and 25 (92.7%; 97.1%). A Pearson's χ^2 analysis yielded no significant difference for gender, and a two-sample t test yielded no significant difference for mean age between the two groups. Students who entered the four-year university directly from high school averaged 17.30 (SD=16.50) transfer semester credit hours, with a transfer GPA of 2.74 (SD=1.37) and a cumulative GPA of 2.90 (SD=0.54). The transfer semester credit hours and GPA of this group were calculated from dual-credit courses transferred to the university from students' high school work. Students who entered the four-year university from community college averaged 63.72 (SD=14.33) transfer semester credit hours, with a transfer GPA of 2.87 (SD=0.61) and a cumulative GPA of 2.66 (SD=0.56). A series of two-sample t tests were conducted to explore potential differences among groups. Resulting in a large effect size, students who entered the four-year university directly from high school had statistically significant higher ACT scores ($p<0.01$; $d=0.76$) and semester GPA ($p<0.05$; $d=0.51$) than transfer students.

Objective two sought to compare the critical thinking abilities of students who entered the four-year university directly from high school to those of transfer students. Table 3 shows results from this comparison ranked by difference in mean. Table 3 also displays the specific skill areas assessed by the CAT categorized by four broad domains: evaluate and interpret information, problem solving, creative thinking, and effective communications.

Table 1. Demographic Information of Direct from High School and Transfer Students (n = 75)

	Direct HS (n = 41)		Transfer (n = 34)	
Demographics	f	%	f	%
Gender				
Male	27	65.9	23	67.6
Female	14	34.1	11	32.4
Age				
Under 20 years of age	2	4.9	0	0.0
21–25 years of age	38	92.7	33	97.1
Over 26 years of age	1	2.4	1	2.9
Race				
White	41	100.0	34	100.0

Each of these four domains is comprised of a portion of the 15 questions of the CAT. Evaluate and interpret information included eight questions, problem solving had eight questions, creative thinking included six questions, and effective communication had nine questions. There were no statistically significant differences in critical thinking abilities between students who entered directly from high school and transfer students.

Objective three sought to compare the critical thinking abilities of students who entered the four-year university directly from high school with national critical thinking norms (Table 4). Resulting in a moderate effect size, these students scored statistically lower (p<0.05) than CAT national norm data in the skill areas of explaining how changes in a problem situation might affect the solution (d=0.39) and identifying additional information needed to evaluate a hypothesis (d=0.39). Resulting in a large effect size, these students scored statistically lower (p<0.01) than national norm data in the skill areas of providing relative alternative interpretations for a specific set of results (d=0.68) and identifying additional information needed (d=0.87). These students' overall critical thinking scores were also statistically lower (p<0.01; d=0.47) than national norm data. The direct-from-high-school students scored sta-

Table 2. Comparison of Academic Information of Direct from High School vs. Transfer Students (n = 75)

Item	Direct HS (n = 41)		Transfer (n = 34)						
	M	SD	M	SD	Diff.[z]	*t*	*Df*	p[y]	Effect size[x]
Cm. H.	94.99	17.98	49.25	16.98	45.74	11.24	73	<0.01**	2.62
ACT	22.41	3.08	19.96	3.40	2.45	3.02	64	<0.01**	0.76
Tr. H.	114.70	17.31	113.32	9.71	0.85	0.25	73	0.80	0.06
Sm. GPA	3.07	0.72	2.72	0.63	0.35	2.19	73	0.03*	0.51
Cm. GPA	2.90	0.54	2.66	0.56	0.24	1.91	73	0.06	0.44
Tr. GPA	2.74	1.37	2.87	0.61	-0.13	0.52	73	0.60	0.13
Sm. H.	14.34	2.60	14.51	2.15	-0.17	0.31	73	0.76	0.07
Tr. H.	17.30	16.50	63.72	14.33	-46.42	12.86	73	<0.01**	3.01

Note: Cm. = cumulative; Sm. = semester; Tr. = transfer; H = hours

[z]Direct from HS minus transfer. [y]Probability of difference. [x]Mean difference divided by pooled group SD (0.1–0.3 = small, 0.3–0.5 = moderate, > 0.5 = large).

* p < 0.05. ** p <0.01

Table 3. T-Test Comparisons of Direct from High School vs. Transfer Students for Each Skill Area of the CAT (n = 75)

E/I	PS	CT	EC		Direct HS		Transfer						
				Skill area assessed	M	SD	M	SD	Diff.[z]	*t*	*df*	p[y]	Effect size[x]
	X	X	X	Identify additional information.	0.98	1.00	1.25	1.05	0.27	1.12	69	0.27	0.30
	X	X	X	Explain how changes might affect a solution.	0.76	0.97	1.02	1.11	0.26	1.09	66	0.28	0.28
		X	X	Provide alternatives for results.	1.24	0.94	1.38	0.74	0.14	0.71	73	0.48	0.14
X	X			Separate relevant from irrelevant information.	3.03	1.12	3.12	0.91	0.09	0.39	72	0.70	0.12
X				Evaluate whether information supports a hypothesis.	0.60	0.50	0.68	0.47	0.08	0.68	71	0.50	0.14
	X			Use basic mathematical skills to solve a problem.	0.76	0.43	0.79	0.41	0.04	0.39	72	0.70	0.07
				Determine whether an inference									
X				is supported by information.	0.56	0.50	0.56	0.50	0.00	0.02	70	0.99	0.03
X				Summarize pattern of results.	0.79	0.41	0.79	0.41	0.00	0.01	70	0.99	0.02
	X	X	X	Identify additional information.	0.32	0.47	0.29	0.46	-0.02	0.21	71	0.83	0.03
		X	X	Provide relevant alternative interpretations.	0.46	0.64	0.35	0.49	-0.11	0.85	73	0.40	0.18
X			X	Evaluate strength of correlational-type data.	1.23	1.19	1.03	1.06	-0.20	0.75	72	0.46	0.17
X	X			Identify solutions for a problem.	1.15	0.86	0.97	0.83	-0.18	0.92	70	0.36	0.21
X	X		X	Identify the best solution.	2.09	1.88	1.84	1.71	-0.25	0.60	70	0.55	0.18
X	X		X	Use/apply relevant information.	1.12	0.75	0.82	0.76	-0.30	1.71	70	0.09	0.40
		X	X	Provide alternatives for spurious associations.	1.73	0.63	1.41	0.82	-0.32	1.86	61	0.07	0.46
				CAT total score	16.55	4.60	16.26	3.59	-0.30	0.32	73	0.75	0.07

Note: E/I = evaluate and interpret information; PS = problem solving; CT = creative thinking; EC = effective communication

[z]Transfer minus direct. [y]Probability of difference at p < 0.05. [x]Mean difference divided by pooled group SD (0.1–0.3 = small, 0.3–0.5 = moderate, > 0.5 = large).

* p < 0.05. ** p <0.01

Table 4. T-Test Comparisons of Direct from High School Students vs. National Means for Each Skill Area of the CAT (n = 41)

E/I	PS	CT	EC		Direct HS		National						
				Skill area assessed	M	SD	M	SD	Diff.[z]	*t*	*df*	p[y]	Effect size[x]
		X	X	Provide alternatives for spurious associations.	1.73	0.63	1.56	0.86	0.17	1.73	40	0.09	0.23
X				Summarize pattern of results.	0.79	0.41	0.67	0.46	0.12	1.90	38	0.06	0.29
X			X	Evaluate strength of correlational-type data.	1.23	1.19	1.21	1.13	0.02	0.08	39	0.94	0.01
X	X		X	Use/apply relevant information.	1.12	0.75	1.11	0.64	0.01	0.10	40	0.92	0.02
X	X			Identify solutions for a problem.	1.15	0.86	1.18	1.03	-0.03	0.22	39	0.83	0.03
	X			Use basic mathematical skills to solve a problem.	0.76	0.43	0.82	0.41	-0.06	0.94	40	0.35	0.15
		X	X	Provide alternatives for results.	1.24	0.94	1.35	1.04	-0.11	0.72	40	0.48	0.11
				Separate relevant from irrelevant									
X	X			information.	3.03	1.12	3.14	0.92	-0.11	0.65	39	0.52	0.11
X				Determine whether an inference is supported by information.	0.56	0.50	0.68	0.41	-0.12	1.52	40	0.14	0.26
X				Evaluate whether information supports a hypothesis.	0.60	0.50	0.73	0.44	-0.13	1.66	39	0.11	0.28
X	X		X	Identify the best solution.	2.09	1.88	2.29	1.81	-0.2	0.67	39	0.51	0.11
	X	X	X	Explain how changes might affect a solution.	0.76	0.97	1.15	1.06	-0.39	2.60	40	0.01*	0.39
	X	X	X	Identify additional information.	0.98	1.00	1.41	1.25	-0.43	2.74	39	0.01*	0.39
		X	X	Provide relevant alternative interpretations.	0.46	0.64	0.93	0.74	-0.47	4.70	40	<0.01**	0.68
	X	X	X	Identify additional information.	0.32	0.47	0.82	0.68	-0.5	6.84	40	<0.01**	0.87
				CAT total score	16.55	4.60	19.04	6.04	-2.49	3.46	40	<0.01**	0.47

Note: E/I = evaluate and interpret information; PS = problem solving; CT = creative thinking; EC = effective communication

[z]Transfer minus direct. [y]Probability of difference at p < 0.05. [x]Mean difference divided by pooled group SD (0.1–0.3 = small, 0.3–0.5 = moderate, > 0.5 = large).

* p < 0.05. ** p < 0.01

Table 5. T-Test Comparisons of Transfer Students vs. National Means for Each Skill Area of the CAT (n = 34)

E/I	PS	CT	EC		Transfer		National						
				Skill area assessed	M	SD	M	SD	Diff.[z]	*t*	*df*	p[y]	Effect size[x]
X				Summarize pattern of results.	0.79	0.41	0.67	0.46	0.12	1.76	33	0.09	0.29
		X	X	Provide alternatives for results.	1.38	0.74	1.35	1.04	0.03	0.26	33	0.80	0.04
X	X			Separate relevant from irrelevant information.	3.12	0.91	3.14	0.92	-0.02	0.14	33	0.89	0.02
	X			Use basic mathematical skills to solve a problem.	0.79	0.41	0.82	0.41	-0.03	0.37	33	0.72	0.06
X				Evaluate whether information supports a hypothesis.	0.68	0.47	0.73	0.44	-0.05	0.66	33	0.52	0.12
X				Determine whether an inference is supported by information.	0.56	0.50	0.68	0.41	-0.12	1.40	33	0.17	0.27
				Explain how changes might									
	X	X	X	affect a solution.	1.02	1.11	1.15	1.06	-0.13	0.69	33	0.50	0.12
		X	X	Provide alternatives for spurious associations.	1.41	0.82	1.56	0.86	-0.15	1.05	33	0.30	0.18
	X	X	X	Identify additional information.	1.25	1.05	1.41	1.25	-0.16	0.91	33	0.37	0.14
X			X	Evaluate strength of correlational-type data.	1.03	1.06	1.21	1.13	-0.18	0.99	33	0.33	0.17
X	X			Identify solutions for a problem.	0.97	0.83	1.18	1.03	-0.21	1.46	33	0.15	0.22
X	X		X	Use/apply relevant information.	0.82	0.76	1.11	0.64	-0.29	2.20	33	0.03*	0.41
X	X		X	Identify the best solution.	1.84	1.71	2.29	1.81	-0.45	1.52	32	0.14	0.26
	X	X	X	Identify additional information.	0.29	0.46	0.82	0.68	-0.53	6.63	33	<0.01**	0.92
		X	X	Provide relevant alternative interpretations.	0.35	0.49	0.93	0.74	-0.58	6.94	33	<0.01**	0.94
				CAT total score	16.26	3.59	19.04	6.04	-2.78	4.53	33	<0.01**	0.58

Note: E/I = evaluate and interpret information; PS = problem solving; CT = creative thinking; EC = effective communication

[z]Transfer minus direct. [y]Probability of difference at p <0.05. [x]Mean difference divided by pooled group SD (0.1–0.3 = small, 0.3–0.5 = moderate, > 0.5 = large).

* p < 0.05. ** p < 0.01

tistically lower (p<0.05) on three of the eight skill areas within the problem-solving domain, on four of the six skill areas within the creative thinking domain, and on four of the nine skill areas within the effective communication domain (Table 4).

Objective four was to compare the critical thinking abilities of students who entered the four-year university via transfer from a community college with national critical thinking norms (Table 5). Of note, transfer students performed statistically lower than national norm data in the skill areas of identifying additional information needed (p<0.01; d=0.92), providing relevant interpretations for a specific set of results (p<0.01; d=0.94), and using and applying relevant information (p<0.05; d=0.41). Further, transfer students scored statistically lower (p<0.05) than the national norm on two of the eight skill areas within the problem-solving domain, on two of the six skill areas within the creative thinking domain, on three of the nine skill areas within the effective communication domain, and on the overall critical thinking score.

This study led to three primary conclusions. First, college entry pathway does not influence critical thinking ability. Although students who entered the four-year university directly from high school had higher ACT scores and semester GPA's, which are known predictors of critical thinking, their critical thinking abilities were not statistically different than those of students who transferred from a community college. Because research claims that GPA (Burbach et al., 2012; Friedel et al., 2008; Ricketts and Rudd, 2005) and standardized college entrance exams (Brahmasrene and Whitten, 2011; Jacobs, 1995) are accurate predictors of critical thinking, we anticipated that direct-from-high-school students' critical thinking abilities would be higher than those of transfer students. However, there were no statistically significant differences between the two groups on any of the 15 specific skill areas assessed by the CAT.

Next, agricultural education students' abilities to identify relevant information and offer alternative interpretations were below expectations. Regardless of entry pathway, students scored statistically lower than CAT national norm data in the skill areas of identifying additional information needed to evaluate a hypothesis and providing relevant interpretations for a specific set of results. This conclusion is of particular importance because an integral aspect of critical thinking is *"addressing questions with incomplete evidence and information for which an incontrovertible solution is unlikely"* (Rudd et al., 2000, p. 5). Numerous critical thinking definitions recognize the importance of identifying relevant information and providing alternative interpretations (Duron et al., 2006; Jacobs, 1995).

Finally, agricultural education transfer students have a greater ability to think creatively than students who entered the four-year university directly from high school. The direct-from-high-school students scored statistically lower than national norms on four of the six skill areas within the creative thinking domain, while transfer students scored statistically lower on only two of the six skill areas within the creative thinking domain. Creative thinking abilities are crucial since students need curiosity and imagination to be successful in higher education (Wagner, 2008). Also, "students with a preference to solve problems by generating many solutions" (Friedel et al., 2008, p. 34) have higher critical thinking dispositions.

Summary and Implications

Conclusions drawn from this study have implications for curriculum development, learning assessment, and future research. Although not generalizable beyond students enrolled in the academic department examined, the implication for curriculum development is worthy of discussion. Since critical thinking ability did not differ according to entry pathway, curricular and instructional approaches for senior-level agriculture education and studies students do not need to differ according to entry pathway. Instead, a directed focus on developing all stu-

dents' abilities to gather additional information required to support a claim and to offer alternative interpretations for results should be integrated into the curriculum. Further, recognizing the importance of creative thinking to student success (Wagner, 2008) and overall critical thinking skill (CAIL, 2012), curriculum and instructional development within agricultural education should focus on intentionally integrating creative and critical thinking. By allowing students to develop unique ideas founded in well-reasoned, logical claims, integration of these two thinking techniques can be accomplished (Bonk and Smith, 1998).

The implication for learning assessment stems from the various assessment instruments available in higher education. This study used an assessment instrument that focuses on evaluating and interpreting information, problem solving, creative thinking, and effective communication. Since critical thinking is a dynamic construct, future assessments should use instruments that explore other components of critical thinking to compare students according to entry pathway. We also recommend continued use of critical thinking assessments that use open-ended responses since multiple-choice exams may not accurately assess critical thinking ability (Bers, 2005). However, researchers should use care when selecting such assessment tools since students' ability to communicate effectively could influence how their critical thinking ability is assessed and scored.

Implications for continued research emerge from the identified differences in creative thinking ability according to entry pathway. Future research should be directed toward thoroughly exploring differences in agricultural education students' critical thinking abilities according to the specific constructs of critical thinking identified by the CAT. Future research conducted at the collegiate level should examine agricultural education curricular differences between the first two years of community college and the first two years at a four-year university. Longitudinal studies conducted at the departmental and/or collegiate level should track agricultural education students' critical thinking development over the span of a four-year degree.

Literature Cited

Bers, T. 2005. Assessing critical thinking in community colleges. New Directions for Community Colleges 2005(130): 15-25.

Bers, T.H., M. McGowen and A. Rubin. 1996. The disposition to think critically among community college students: The California critical thinking dispositions inventory. The Journal of General Education 45(3): 197-223.

Bloom, B. 1956. A taxonomy of educational objectives. Handbook 1: Cognitive domain. New York, NY: McKay.

Bonk, C.J. and G.S. Smith. 1998. Alternative instructional strategies for creative and critical thinking in the accounting curriculum. Journal of Accounting Education 16(2): 261-293.

Brahmasrene, T. and D. Whitten. 2011. Predictors of critical thinking skills of incoming business students. Academy of Educational Leadership Journal 15(1): 1-13.

Brisdorf-Rhoades, E., J. Ricketts, T. Irani, L. Lundy and R. Telg. 2005. Critical thinking dispositions of agricultural communications students. Journal of Applied Communications 89(1): 25-34.

Burbach, M.E., G.S. Matkin, C.E. Quinn and T.P. Searle. 2012. The impact of preparing agriculture faculty to influence student critical thinking disposition. Journal of Agricultural Education 53(2): 1-14. DOI: 10.5032/jae.2012.02001.

Center for Assessment and Improvement of Learning, Tennessee Tech University. 2010. CAT instrument technical information. http://www.tntech.edu/files/cat/reports/CAT_Technical_Information_V7.pdf.

Center for Assessment and Improvement of Learning, Tennessee Tech University. 2012. CAT institutional report.

Cohen, J. 1992. A power primer. http://www.apa.org/pubs/journals/bul/index.aspx. Psychological Bulletin 112(1): 155-159.

Dillman, D.A., J.D. Smyth and L.M. Christian. 2009. Internet, mail, and mixed-mode surveys: The tailored design method. 3rd ed. Hoboken, NJ: John Wiley and Sons.

Duron, R., B. Limbach and W. Waugh. 2006. Critical thinking framework for any discipline. International Journal of Teaching and Learning in Higher Education 17(2) 160-166.

Facione, P.A., C.A. Sanchez, N.C. Facione and J. Gainen. 1995. The disposition toward critical thinking. Journal of General Education 44(1): 1-25.

Friedel, C.R., T.A. Irani, E.R. Rhoades, N.E. Fuhrman and M. Gallo. 2008. It's in the genes: Exploring relationships between critical thinking and problem solving in undergraduate agriscience students' solutions to problems in Mendelian genetics. Journal of Agricultural Education 49(4): 25-37. DOI: 10.5032/jae.2008.04025.

Friedel, C.R., T.A. Irani, R. Rudd, M. Gallo, E. Eckhardt and J. Ricketts. 2008. Overtly teaching critical thinking and inquiry-based learning: A comparison of two undergraduate biotechnology classes. Journal of Agricultural Education 49(1): 72-84. DOI: 10.5032/jae.2008.01072.

Gall, M.D., J.P. Gall and W.R. Borg. 1996. Educational research: An introduction. 6th ed. White Plains, NY: Longman.

Gellin, A. 2003. The effect of undergraduate student involvement on critical thinking: A meta-analysis of the literature 1991-2000. Journal of College Student Development 44(6): 746-762.

Jacobs, S.S. 1995. Technical characteristics and some correlates of the California Critical Thinking Skills Test. Research in Higher Education 36(1): 89-108.

Kuhn, D. 1999. A developmental model of critical thinking. American Educational Research Association 28(2): 16-25.

Miller, L.E. and K.L. Smith. 1983. Handling nonresponse issues. Journal of Extension 21(5): 45-50.

Pascarella, E.T. and P.T. Terenzini. 2005. How college affects student: A third decade of research. Vol. 2. San Francisco, CA: Jossey-Bass.

Ricketts, J.C. and R.D. Rudd. 2005. Critical thinking skills of selected youth leaders: The efficacy of critical thinking dispositions, leadership, and academic performance. Journal of Agricultural Education 46(1): 32-43.

Rudd, R., M. Baker and T. Hoover. 2000. Undergraduate agriculture student learning styles and critical thinking abilities: Is there a relationship? Journal of Agricultural Education 41(3): 2-12. DOI: 10.5032/jae.2000.03002.

Saavedra, A.W. and J.E. Saavedra. 2011. Do colleges cultivate critical thinking, problem solving, writing and interpersonal skills? Economics of Education Review 30(6): 1516-1526.

Tsui, L. 1998. Fostering critical thinking in college students: A mixed-methods study of influences inside and outside the classroom. Dissertation Abstracts International 60(01): 1081A.

Wagner, T. 2008. The global achievement gap: Why even our best schools don't teach the new survival skills our children need and what we can do about it. New York, NY: Basic Books.

Williams, R.L. and S.L. Stockdale. 2003. High-performing students with low critical thinking skills. The Journal of General Education 52(3): 199-255.

Self-Estimates of Performance in Animal Sciences Courses and Factors that Influence Perceived Competence[1]

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Abstract

Individuals tend to over or underestimate their knowledge and abilities. This study assessed the aptitude of students enrolled in beginning, intermediate, and advanced Animal Sciences courses to accurately predict performance on knowledge-based tests. Both easy and difficult knowledge domains were tested, and predication accuracy was determined following manipulation of test order and performance expectation. Actual performance was greatest for the easy knowledge domain. Presenting the easy test second or with a performance expectation of C- resulted in lower actual scores ($P<0.05$). Actual scores for the difficult test did not differ among the testing scenarios; however, students underestimated performance when the difficult test was completed second and overestimated performance when the difficult test was presented first with a performance expectation of B+ ($P<0.05$). Overall, prediction accuracy was improved for tests completed second. Participants were grouped into quartiles according to actual performance and quartile rankings were considered indicative of skill level. Students in the bottom and upper quartiles were most accurate in predicting performance on the easy test. Performance for the difficult test was overestimated when the difficult test occurred first with a performance expectation of C- and underestimated when completed second with a performance expectation of C-. Findings provide evidence that self-assessment of performance is influenced by task difficulty, task order, and performance expectation contributing to bias in self-reported data.

Introduction

A culture of assessment that connects quality teaching practices with the student experience and knowledge development has emerged in higher-education. The end goal is to provide evidence to continually transform the teaching and learning environment and foster student success. Maki (2012) recommends that learning assessment include the use of both direct and indirect measures. Direct measures of assessment consider the evaluation of students' work relative to the intended learning outcomes. Indirect measures assess the value of learning and aim to capture thoughts of knowledge or skill development (Palomba and Banta, 1999). The inclusion of both direct and indirect measures considers a comprehensive assessment strategy to adequately evaluate performance relative to learning goals (Downing, 2003). Indirect measures of assessment, however, are perceived indices of learning that commonly rely on self-reporting through student surveys, which are simple to conduct (Fredricks and McColskey, 2012). However, the accuracy of self-reported knowledge and skill development has been questioned. Indeed, there is a reported bias in self-reporting of one's own skills or abilities, which may compromise the validity of indirect measures for meaningful interpretation and use of assessment data (Heath et al., 2012).

The tendency for individuals to inaccurately estimate their abilities is not new. Extant literature reports many psychological and social phenomena to explain the inability of individuals to accurately recognize their abilities (Larrick et al., 2005; Heath et al., 2012). The work of Kruger and Dunning (1999) suggests that individuals simply lack the competence to understand their proficiencies and deficiencies, an effect most pronounced in individuals that score lowest on knowledge tests. Burson and colleagues (2006) suggest the discrepancy between perceived knowledge and actual knowledge is an effect of task difficulty, with low performing persons showing the greatest discrepancy on easy tasks and high performing persons showing the greatest discrepancy on difficult tasks. Further, such individuals are less capable of reliably forming and using peer comparisons to develop their own abilities (Kruger and Dunning, 1999; Burson et al., 2006). This lack of capability has further long-term implications as social comparison provides a life-long gauge to self-assess competence for continual intellectual and

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skill growth. This research examined the relationship between perceived and actual knowledge across skill level in Department of Animal Sciences students and considers factors that may contribute to self-reporting bias. Findings are of practical importance to better understand and improve accuracy of self-reported data common to assessing student learning outcomes.

Methods

Participants

Students enrolled in beginning, intermediate, and advanced core animal sciences courses during autumn semester 2016 were invited to participate in a survey to examine actual and predicted scores on subject knowledge tests (n=408). One beginning, two intermediate, and two advanced courses were surveyed. Survey participants were invited to participate in the study using email notification. Participation in the survey was voluntary, and an extra-credit incentive was offered to participants.

Design

Self-reporting survey instruments were developed to collect demographic variables, responses to knowledge-based questions, and predictions of subject knowledge. Demographic variables included: gender, academic program, cumulative grade point average (GPA), transfer status, and first-generation status. Knowledge based questions included 21 questions in animal sciences subject matter. Questions were grouped into easy (n=10) or difficult (n=11) domains and within each domain, questions were varied between multiple-choice and fill-in-the-blank to minimize upward biased estimates of performance (Burson et al., 2006). The survey was counterbalanced, with one-half of survey participants invited to complete a survey with the easy questions preceding the difficult questions and the remaining one-half of participants invited to complete a survey with the difficult questions preceding the easy questions. Prior to beginning either easy or difficult subject knowledge tests, participants read a passage that provided context of the questions, expectations for completing the questions, and a predicted performance average score for the questions. Predicted performance scores included an above average (B+) or below average (C-) expectation for performance. Surveys were manipulated so that above average and below average performance expectations were given for both easy and difficult subject knowledge tests for a total of four surveys (Figure 1). After completing each knowledge-based test section, participants were asked to predict the number of questions answered correctly.

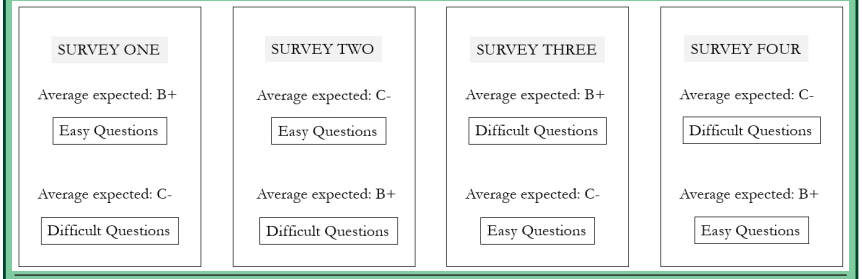
Online survey software and questionnaire applications (SurveyMonkey) were used to deliver the surveys. To ensure anonymity and compliance for research involving human subjects, each primary survey was administered as a subset of three looped surveys. The first subset of looped surveys included the audience invited to participate, the purpose of the survey, the length of time needed to complete the survey, a description of the extra-credit incentive offered, the beginning and end dates for completion of the survey, the required Office of Responsible Research Practices (ORRP) information, and informed consent. By agreeing to provide consent, participants were directed to the second looped survey, which collected data to award the extra-credit incentive. From the second looped survey, participants had the option to decline or continue with participation. Participants that declined were directed to a disqualification page. Participants that continued were directed to the third looped survey that collected the information for the research study variables and was configured so that email addresses and IP addresses were not captured with the response data to ensure data were collected as anonymous data.

Invitation to participate in the survey was through a direct email invite that included an SSL encrypted URL that linked to the on-line survey. Participants recruited from each of the five courses were randomized to receive one of the four surveys (Figure 1). The surveys were available for two weeks, and a reminder email including the original survey invite information was sent one week after the surveys opened. Upon closure of the surveys, responses were retrieved from the survey instruments and stored as anonymous data. The study design and associated surveys were reviewed and determined exempt by The Ohio State University Institutional Review Board.

Data Analysis

The PROC FREQ procedure (SAS version 9.4; SAS, Cary, NC) was used to estimate response frequencies and report student demographic data (gender, academic program, GPA, transfer status, and first-generation status), academic course level, and accuracy of predictions. For students enrolled in more than one participating course, academic level was determined from the highest course level. Accuracy of predictions were defined as very under for predictions 25% or less than the actual score, under as 10-24% less than the actual score, accurate as predictions within 9% of the actual

Figure 1. Framework for assessing actual and perceived performance on knowledge tests.



Participants were given access to one of four surveys. Survey questions were identical among the four surveys, but differed in difficulty. Survey questions were counterbalanced based on question difficulty and manipulated by providing arbitrary performance expectations of B+ (above average) or C- (below average).

score, over as 10-24% greater than the actual score, and very over as 25% or greater than the actual score. Fisher's Exact Test was used to evaluate differences in prediction accuracy between the surveys. Percentile scores for subject knowledge (actual and predicted) were compared using the mixed model (PROC MIXED) procedures of SAS and included instructor as a random effect. The directional inaccuracy of predicted and actual scores, termed miscalibration, was determined by calculating the difference between predicted scores and actual scores for each test item and then computing the mean (Schraw, 2009). Survey and academic level interactions were examined. Quartile estimates for actual and predicted performance scores were determined using the PROC UNIVARIATE procedures of SAS. Data are presented as means ± SE with P≤0.05 considered significant. No identifying information was used in data analysis.

Results and Discussion

Debates of one's accuracy in estimating their ability consider the relationship between actual performance and predicted performance. Self-reported percentile rankings are used as indicators of ability recognition and indirect measures of metacognition, which may be operationalized as the ability of an individual to distinguish between what has been answered correctly versus incorrectly (Kruger and Dunning, 1999). Self-assessments of performance through percentile rankings and metacognitive tasks closely parallel (Burson et al., 2006). The study herein used a metacognitive task to explore the accuracy of judgment of one's abilities.

The survey response rate was 61% overall, with a survey completion rate of 97, 100, 97, and 98% for surveys one through four, respectively. The high participation rate can be attributed to survey elements including participant incentive (Deutskens et al., 2004; Krosnick, 1999). The extra-credit incentive did not require completion of the survey. Nonetheless, high completion rates for each survey were also achieved. The majority of participants were female, with a declared major in Animal Sciences (Table 1). The gender distribution reported herein was in agreement with recent studies of Animal Sciences students (Burk at al., 2013; Peffer, 2011) and reflects the well-known shift in animal science student demographics reported three decades prior (Mollett and Leslie, 1986). In agreement with the findings of Kruger and Dunning (1999), there were no effects of gender on actual or predicted performance. Furthermore, there were no effects of first generation status or academic program on the data presented herein and these variables are not considered further.

There was a positive correlation for actual and predicted performance outcomes between the first and second subject knowledge tests (0.28, P<0.0001 for actual scores between the first and second test; and 0.51, P<0.0001 for predicted scores between the first and second test). An effect of both GPA and transfer student status on knowledge test performance was also found. Outcomes were associated with overall test difficulty, and effects of test manipulation (performance expectations of above average and below average) or academic level (beginning, intermediate, or advanced) were not detected. Actual scores on the easy and difficult tests were greater for students reporting a GPA of 3.00 and above compared to students with a 2.50 to 2.99 GPA (Table 2). It was anticipated that students in the lowest GPA bracket (2.00 to 2.49) would report the lowest actual scores. However, there were no differences in actual scores for students reporting in the lowest bracket compared to the other GPA estimates. Although this result is surprising, GPA data of the current study were self-reported. Gramzow and colleagues (2003) noted that students with low GPA are more likely to exaggerate and report greater than actual GPA to avoid acknowledgement of poor performance. If the findings of Gramzow and colleagues (2003) are extended to the current study, then self-reporting GPA bias may have obscured the relationship between actual test scores

Table 1. Profile of Study Participants

Variable	Number	Percent
Gender (n=254)		
Female	209	82.3
Male	44	17.3
Not Reported	1	0.39
Program of study (n=254)x		
Animal Sciences	207	81.5
Agricultural Communications	7	2.76
Agricultural Systems Management	4	1.57
Biology	13	5.12
Business	15	5.91
Education	3	1.18
Other	5	1.97
Academic level (n=253)y		
Beginning	49	19.4
Intermediate	118	46.6
Advanced	86	34.0
Transfer status (n=250)		
Not applicable	146	58.4
Interdepartmental	5	2.00
OSU affiliated institution	60	24.0
Agricultural Technical Institute	(23)	(9.20)
OSU regional campus	(37)	(14.8)
In-state	19	7.60
Out-of-state	20	8.00
First Generation Student (n=252)z		
No	89	35.3
Yes	163	64.7
Cumulative grade point average (n=236)		
Less than 2.00	3	1.18
2.00 to 2.49	12	4.72
2.50 to 2.99	49	19.29
3.00 to 3.49	77	30.3
3.50 to 4.00	72	28.4
Not determined	41	16.1

[x]Animal Sciences programs of study include: Animal Biosciences and Animal Industries that lead to a B.S. in Agriculture, Animal Nutrition that leads to a B.S. in Nutrition, and Veterinary Technology that is a joint program with Columbus State Community College and leads to an A.A.S. in Veterinary Technology and B.S. in Agriculture; Biology includes Microbiology, Wildlife Biology, and Zoology; Other includes Mathematics, Sports Industry, and majors not identified.

[y]Academic level is defined according to the course of enrollment from which participants were recruited. For participants enrolled in more than one participating course, academic level is defined according to the highest course level of involvement.

[z]First-generation was defined by neither parent having received a degree from a four-year institution.

Table 2. Actual and Predicted Performance on Easy and Difficult Knowledge Tests by GPA and Transfer Status[y]

	EASY			DIFFICULT		
	Actual	Predicted	Miscalibration[z]	Actual	Predicted	Miscalibration[z]
GPA						
2.00 to 2.49	58.8 ± 8.98ab	69.4 ± 8.41	1.48 ± 8.97	52.6 ± 8.11ab	49.4 ± 9.38a	-8.79 ± 7.96
2.50 to 2.99	57.1 ± 7.61b	67.3 ± 7.22	0.57 ± 7.10	45.6 ± 6.61b	47.5 ± 8.10a	-3.44 ± 6.45
3.00 to 3.49	64.1 ± 7.88a	73.0 ± 7.29	-0.55 ± 7.52	53.6 ± 6.89a	55.3 ± 8.14b	-3.78 ± 6.75
3.50 to 4.00	65.4 ± 7.96a	70.1 ± 7.28	-4.17 ± 7.68	56.2 ± 7.02a	56.0 ± 8.13b	-5.48 ± 6.88
Transfer						
None	66.3 ± 7.65a	71.5 ± 7.55	-3.97 ± 8.34a	49.2 ± 6.67	49.5 ± 8.43	-5.41 ± 6.52
ATI	54.4 ± 8.43b	69.5 ± 8.09	5.20 ± 8.30ab	48.5 ± 7.50	48.1 ± 9.03	-6.00 ± 7.36
OSU Regional	58.0 ± 8.32b	73.6 ± 8.12	7.24 ± 8.04b	44.5 ± 7.39	52.1 ± 9.07	1.79 ± 7.23
Ohio	59.9 ± 8.53ab	73.1 ± 8.32	4.23 ± 8.29ab	46.4 ± 7.62	52.2 ± 9.29	0.22 ± 7.45
Out-of-state	59.6 ± 8.50ab	70.4 ± 8.37	1.89 ± 8.29ab	45.2 ± 7.60	52.7 ± 9.35	2.11 ± 7.44
International	54.4 ± 11.8ab	60.9 ± 9.67	-2.14 ± 12.4ab	39.6 ± 11.1	39.0 ± 10.8	-5.90 ± 10.9

[y]Values are means ± SE, n = 247. Labeled means within a column with superscripts without a common letter differ, P < 0.05 for GPA or transfer status.

[z]Miscalibration was calculated as the difference between perceived performance and actual performance, with a negative value representing mean perceived scores less than mean actual scores.

and GPA of the current study. While there were no differences in predicted scores across GPA for the easy test, students reporting a GPA of 3.00 and above reported greater predicted scores for the difficult test compared to students with a 2.99 or less GPA (Table 2). The majority of GPA over-reporting occurs within 0.25 points or less (Gramzow et al., 2003). Accordingly, the greater prediction by higher GPA reported students of their difficult test performance would hold when compared to students reporting the lowest GPA. Although differences in miscalibration were not detected, students with the highest GPA were more likely to underestimate their performance compared to those with the lowest GPA for the easy test. For the difficult test, miscalibration showed negative bias, or underestimation, of performance across all GPA brackets (Table 2).

Calibration is the relationship between actual and predicted performance and is one measure of metacognitive ability (Lin and Zabrucky, 1998). Miscalibration, thus, reflects an inability of one to accurately predict performance. Miscalibration when calculated according to the method of Schraw (2009) provides an estimate of the direction and magnitude for prediction inaccuracy. Negative miscalibration estimates represent predicted scores that are less than actual scores, and positive miscalibration scores represent predicted scores that are greater than actual scores. While individuals are considered to more commonly overestimate performance (Zabrucky, 2010), the direction of estimation is partial to overall knowledge. Individuals that are defined as unskilled or incompetent in the psychology literature will overestimate their performance, and, thus, show positive miscalibration. Conversely, the most skilled or competent will underestimate their performance, and, thus, show negative miscalibration (Kruger and Dunning, 1999). Considering GPA as a measure of competence, the miscalibration for the easy test aligned with the existing literature (Burson, et al., 2006). Cognition tests must provide an individual with a minimum number of questions that can be accurately answered for participants to predict performance (Kruger and Dunning, 1999). When individuals are faced with tasks for which they have no prior knowledge or experience, they are unlikely to overestimate their abilities. The negative bias observed across all GPA brackets for the difficult test may reflect failure of the difficult test to attain a minimum threshold as discussed by Kruger and Dunning (1999). However, overall performance estimates that ranged from 45.6 to 56.2% for a mixed format test suggests that outcomes were beyond chance, and a minimum threshold was achieved (Burson et al., 2006).

Transfer students from OSU affiliated campuses (OSU regional campuses and the Agricultural Technical Institute) reported actual test scores that were 8 to 11 percentage points less than non-transfer students on the easy test (P<0.05; Table 2). Self-efficacy, or confidence in one's abilities, is a predictor of performance. Individuals with lower self-efficacy are more likely to undermine their cognitive success (Coutinho, 2008). A prior study revealed that self-efficacy was lower for subpopulations of transfer students (Peffer, 2016) and may have contributed to the lower performance scores noted for OSU affiliated transfers of the current study. While there were no differences between predicted test scores for transfer associations, the miscalibration estimates for the easy test were -3.97 ± 8.34 for non-transfer students and 7.24 ± 8.04 for OSU regional transfer students (P<0.05). In other words, OSU regional transfer students were more likely to over predict their performance on the easy test, whereas non-transfer students were more likely to under predict their performance on the easy test. Coutinho (2008) suggests that self-efficacy's influence on performance is independent of metacognition. Accordingly, subpopulations of transfer students may perform lower than non-transfer students in part due to individual self-efficacy, but this does not equate to a negative bias when predicting one's performance. It should be noted that the effects of transfer status were confined to the easy test. There were no differences between actual and predicted test scores or miscalibration for transfer affiliation on the difficult test (Table 2). Burson and colleagues (2006) suggest there are systematic biases that influence judgements of one's performance and produce a metacognition pattern that is independent of one's metacognitive abilities. Transfer status may reflect such a bias and findings of the current

Table 3. Actual and Predicted Performance on Easy and Difficult Knowledge Tests by Course Level[y]

	EASY			DIFFICULT		
	Actual	Predicted	Miscalibration[z]	Actual	Predicted	Miscalibration[z]
Beginning	53.2 ± 8.34	65.3 ± 6.96a	2.02 ± 8.34	44.5 ± 6.84	45.8 ± 7.92	-3.98 ± 6.87
Intermediate	62.8 ± 8.49	73.6 ± 7.41b	1.55 ± 8.54	48.3 ± 7.37	50.4 ± 8.43	-3.58 ± 7.18
Advanced	58.5 ± 8.61	75.0 ± 7.74b	6.48 ± 8.70	44.9 ± 7.51	51.3 ± 8.80	0.75 ± 7.31

[y]Values are means ± SE, n = 247. Labeled means within a column with superscripts without a common letter differ, P < 0.01.

[z]Miscalibration was calculated as the difference between perceived performance and actual performance, with a negative value representing mean perceived scores less than mean actual scores.

Table 4. Actual and Predicted Performance and Miscalibration on Knowledge Tests[x]

	SURVEY ONE		SURVEY TWO		SURVEY THREE		SURVEY FOUR	
	Easy (B+)	Difficult (C-)	Easy (C-)	Difficult (B+)	Easy (C-)	Difficult (B+)	Easy (B+)	Difficult (C-)
Actual Score, %[y]	63.2 ± 7.91a	48.0 ± 6.97	55.8 ± 8.14b	44.0 ± 7.20	59.3 ± 8.07ab	47.6 ± 7.11	56.7 ± 8.27b	42.6 ± 7.34
Predicted Score, %	71.7 ± 7.41	47.5 ± 8.28a	67.3 ± 7.43	44.9 ± 8.30a	71.2 ± 7.56	56.0 ± 8.44b	69.1 ± 7.66	47.4 ± 8.55a
Miscalibration[z]	-0.84 ± 7.61	-6.15 ± 6.83a	2.49 ± 7.88	-4.66 ± 7.05a	3.49 ± 7.23	2.82 ± 6.95b	3.18 ± 8.01	-0.82 ± 7.19 ab

[x]Data represent performance when the easy knowledge test was followed by the difficult test and students were given a performance expectation of B+ or C- (Survey One and Two), or performance when the difficult knowledge test was followed by the easy test and students were given a performance expectation of B+ or C- (Survey Three and Four).

[y]Values are means ± SE, n = 247. Labeled means within a row with superscripts without a common letter differ, P < 0.05 for easy or difficult tests.

[z]Miscalibration was calculated as the difference between perceived performance and actual performance, with a negative value representing mean perceived scores less than mean actual scores.

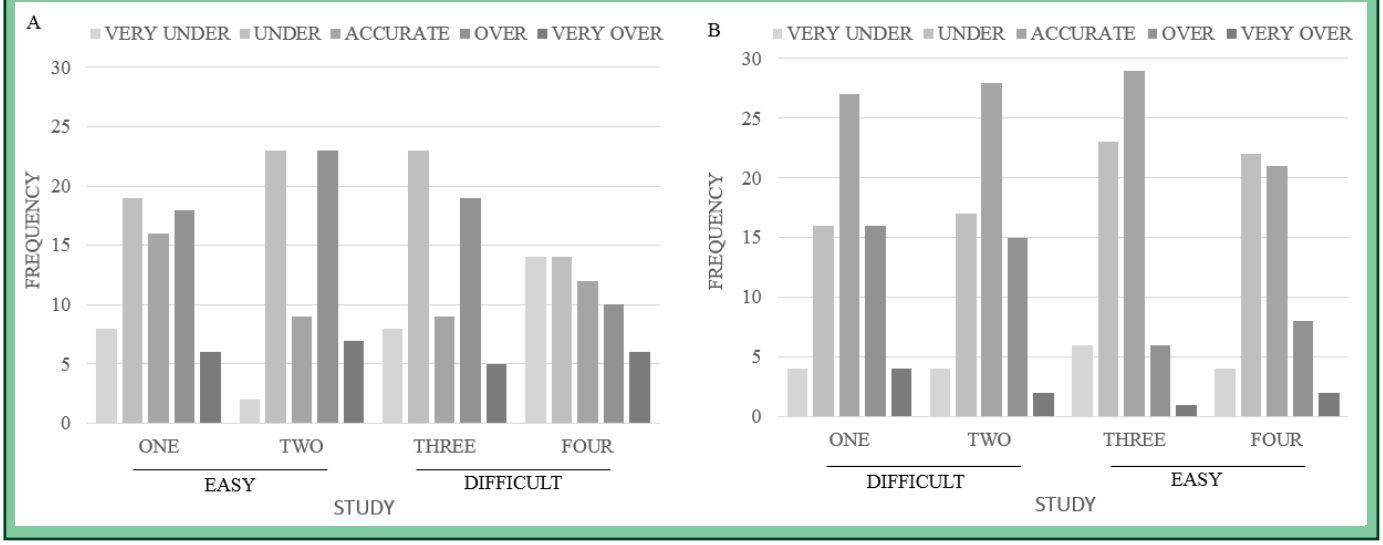
study warrant the consideration of transfer status when examining the association of cognition and metacognition in college student populations.

There were no effects of test manipulation on actual and predicted performance for knowledge tests or miscalibration for academic level (P>0.10). Overall predicted performance on easy knowledge tests was greater for students enrolled in intermediate and advanced courses compared to students enrolled in the beginning course level (P=0.003; Table 3). However, miscalibration did not differ across academic level. Knowledge about a domain confers competence, with the more skilled individuals demonstrating greater accuracy of judging their own performance (Kruger and Dunning, 1999). Accordingly, using knowledge test questions in the field of study from which participants were surveyed was anticipated to lead to greater accuracy of predicting performance with advancing course level. Indeed, students in advanced courses were expected to have greater prior knowledge of the domain as they would need to progress through introductory and intermediate courses to enroll in the advanced level courses. However, advanced students on the easy test over predicted their performance by 16%, whereas beginning and intermediate students over predicted their performance by 12 and 11%, respectively. As noted for transfer status, there were no differences between actual and predicted test scores or miscalibration by academic level on the difficult test (Table 3).

Kruger and Dunning (1999) suggest that one's ability to accurately predict performance is reliant on feedback. Furthermore, when individuals are asked to compare themselves to their peers, lack of knowledge of the peer group leads individuals to select comparisons that would fare worse than themselves, thus inherently ensuring they perform better (Alicke and Govorun, 2005). Without information on how others compare, persons of all skill levels are likely to overestimate their performance (Burson et al., 2006). What is otherwise known as the better-than-average effect is a form of self-protection mediated by a need to maintain self-esteem. The effect diminishes when individuals are provided information that highlights their normalcy relative to their peers (Alicke and Govorun, 2005). In the current study, participants were given a passage and informed what the average expected score was to minimize self-selection of comparison groups and to determine how this feedback affects knowledge self-awareness. Knowledge test performance was greatest when the easy test was presented first and students were given an above average performance expectation of B+ (Table 4). Test manipulation resulted in an 11.7% reduction in actual scores for the easy test when students were given a below average performance expectation of C-, and a 10.3% reduction in actual scores when the easy test was completed after the difficult knowledge test (P<0.05; Table 4). It was not surprising that approaching the difficult test first led to lower performance on the easy test. A common strategy to aid in confidence building during examinations is the recommendation of completing the easy questions first. When faced with the difficult test first, students may lose confidence in their abilities on subsequent test questions regardless of difficulty. However, the influence of feedback on lower actual scores for the easy test was unexpected. It is recognized that feedback can have both positive and negative outcomes and is influenced by self-efficacy and motivation to the task (Hattie and Timperely, 2007).

There were no effects of test manipulation or test order on the actual and predicted scores for the easy knowledge tests or the actual scores for the difficult knowledge test. However, the predicted scores for the difficult knowledge tests were 15.2 to 19.8% greater when the difficult test was presented first, with an above average performance expectation of B+ (P<0.05; Table 4). Furthermore, completing the difficult knowledge test first with an above average performance expectation of B+ led to positive miscalibration estimates, whereas students receiving the difficult knowledge test second underestimated performance (P<0.05; Table 4). Ehrlinger and

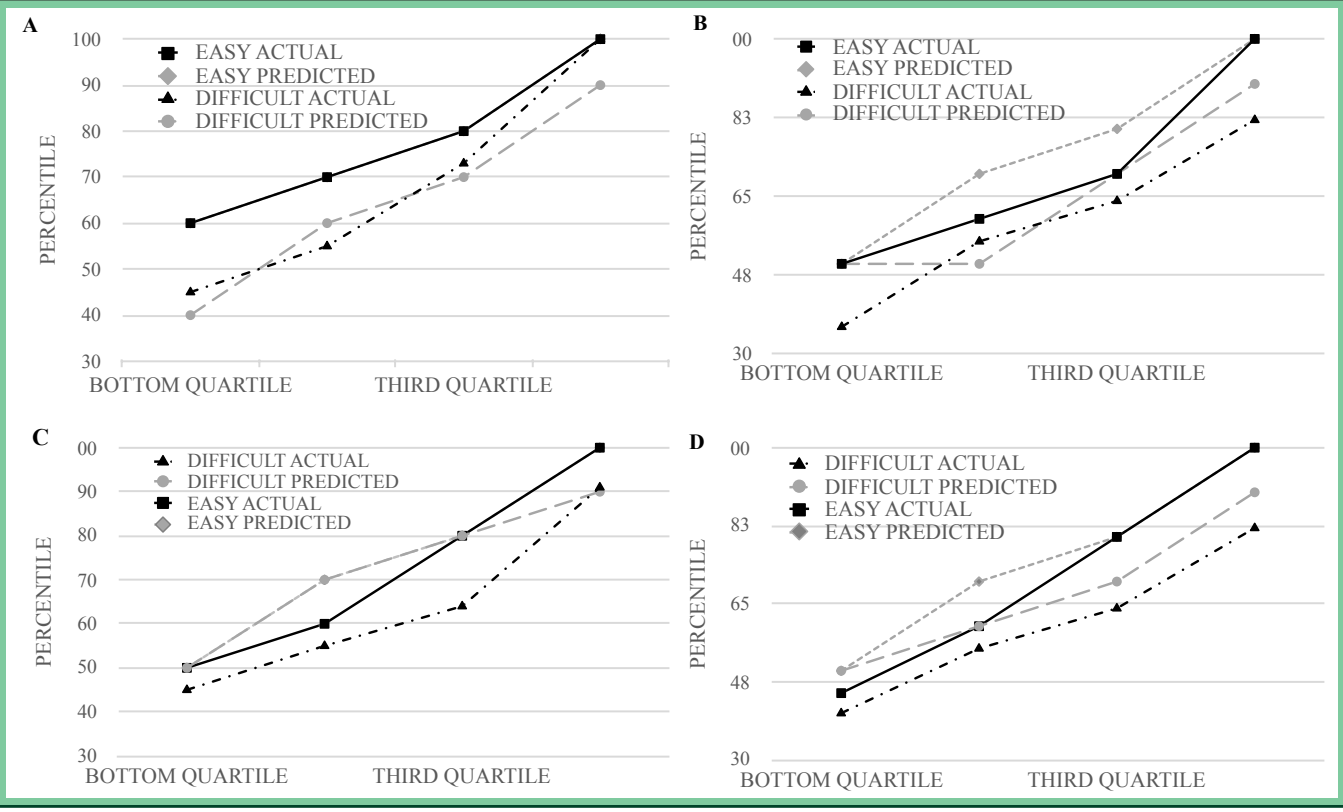
Figure 2. Accuracy of test score predictions for easy and difficult knowledge tests when students were given a performance expectation of B+ (Survey One and Three) or C- (Survey Two and Four) for knowledge test one (A) or a performance expectation of B+ (Survey Two and Four) or C- (Survey One and Three) for knowledge test two (B). Fisher Exact analysis for study within test one and test two P =0.0001. Very under was defined by predictions 25% or less than the actual score, under as 10-24% less than the actual score, accurate as predictions within 9% of the actual score, over as 10-24% greater than the actual score, and very over as 25% or greater than the actual score.



Dunning (2003) reported that views of one's self are important mediators of predicted performance. In fact, self-views may be more important than actual ability on predicted performance estimates. Further, self-views can be manipulated through feedback (Ehrlinger and Dunning, 2003). Applying the concept of self-view to the current study, students receiving a performance expectation of B+ on the difficult test may hold a more favorable view of their capabilities compared to students receiving a performance expectation of C-. However, performance overestimation on the difficult test with a performance expectation of B+ only occurred when the difficult test was completed first. Accordingly, students may adjust self-monitoring of performance and improve calibration over multiple tests (Isaacson and Fujita, 2006), an action that may be further governed by feedback. Indeed, frequency of accurate predictions, defined as estimates that were less than 10% above or below the actual score, increased in the second test (Figure 2A and B).

One's ability to accurately assess competence in a given domain requires the individual to possess the competence in the first place (Burson et al., 2006; Kruger and Duning, 1999; Larrick et al., 2007). In other words, the unskilled lack the ability to gauge their own capabilities (Kruger and Dunning, 1999). Further, metacognitive abilities are related to task difficulty (Burson et al., 2006). Whereas the most skilled are also most accurate in predicting their performance on easy tasks, the converse holds for the least skilled, who are most accurate in predicting their performance on difficult tasks (Burson et al., 2006). In the current study, participants were ranked into quartiles according to actual performance and quartile rankings were considered indicative of skill level (Kruger and Dunning, 1999; Burson et al., 2006). When the easy test occurred first, and the difficult second with performance estimates of B+ and C-, respectively, there were no differences between actual and predicted scores on the easy test (Figure 3A). For the difficult test, predicted performance was within five percentage points of actual performance for students whose scores fell in the first three quartiles; however, students in the upper quartile under estimated performance by 10 percentage points (Figure 3A). The results agree with others who demonstrated that low performers overestimate their abilities and high performers underestimate their abilities (Kruger and Dunning, 1999). The findings are also consistent with Burson and colleagues (2006) who showed that low performers have greater awareness of capabilities on difficult tasks. When order was held constant, but performance estimates were manipulated (C- for the easy test and B+ for the difficult test), again there were no differences between actual and predicted scores on the easy test (Figure 3B). However, students in the bottom and upper quartiles overestimated performance on difficult test questions by 14 and 8 percentage points, respectively. Of interest, Gramzow and colleagues (2003) noted that self-preservation can result in overestimates of one's ability. When faced with an above average performance estimate on a difficult test, the need to conform to the expected feedback performance estimate may have superseded the students' metacognitive abilities. When test order was reversed so the difficult test occurred before the easy test and performance estimates were manipulated, the upper quartile students accurately predicted their performance on both the easy and difficult tests. The bottom quartile students were accurate on their easy test predictions and predicted their outcomes on the difficult test within 5 percentage points (Figure 3C). When the difficult test was given first with a performance estimate of C-, predicted scores for the difficult tests were 5 to 8% greater than actual scores for all quartile rankings (Figure 3D). It should be noted that miscalibration was not confined to

Figure 3. Quartile estimates for actual and predicted performance on easy and difficult knowledge tests. Data represent estimates of performance percentile by quartile when the easy knowledge test is followed by the difficult test and students are given a performance expectation of B+ (A) or C- (B) for the easy knowledge test, or performance percentile by quartile when the difficult knowledge test is followed by the easy test and students are given a performance expectation of B+ (C) or C- (D) for the difficult kn.



students in the top and bottom quartiles. Students with scores in the second and third quartiles overestimated predicted scores on the easy test when a performance expectation of C- was given independent of test order (Figure 3B and C), and students in the second quartile overestimated performance on the easy test by 10 percentage points when the easy test was given second regardless of performance expectations (Figure 3C and D). Kruger and Dunning (1999) also noted calibration inaccuracy among students in the middle quartiles, a phenomenon that is not explained, but warrants further study.

Summary

A substantial body of evidence suggests that students are inaccurate in making judgements of their cognitive abilities (Burson et al., 2006; Isaacson and Fujita, 2006; Kruger and Dunning, 1999; Larrick et al., 2007). Students that fail to recognize their level of knowledge are at greater risk of engaging in self-regulated strategies necessary for life-long learning processes. Studies on the association of cognitive and metacognitive abilities frequently reference psychology students and abstract intellectual knowledge domains. To our knowledge, this was the first study to consider students enrolled in a course within the agricultural field and to consider the knowledge domain directly under study by the reference population.

Our findings agree with the studies of others indicating that outcomes of metacognitive tasks are under the influence of skill level (Kruger and Dunning, 1999), but more importantly accuracy in judgement was greatly influenced by noise and bias as demonstrated previously (Burson et al., 2006). More specifically, error in judgement may stem from task difficulty, task variability (in the case of this study, the order in which easy or difficult tests were administered), and feedback. In addition, views of one's self and views of others likely compromise an individual's insight into their own skills and performance; however, further studies are needed to clarify the relationships of self and environment in metacognition.

Literature Cited

Alicke, M.D. and O. Govorun. 2005. The better-than-average effect. The Self in Social Judgment 1: 85-106.

Burk, S.V., M.G. Rossano, W.J. Silvia, E.S. Vanzant, A.J. Pescatore and R.J. Harmon. 2013. Factors associated with course withdrawal and final course grade in an introductory animal science course. NACTA Journal 57(2): 16.

Burson, K.A., R.P. Larrick and J. Klayman. 2006. Skilled or unskilled, but still unaware of it: How perceptions of difficulty drive miscalibration in relative comparisons. Journal of Personality and Social Psychology 90(1): 60.

Coutinho, S. 2008. Self-efficacy, metacognition, and performance. North American Journal of Psychology 10(1): 165.

Deutskens, E., K. De Ruyter, M. Wetzels and P. Oosterveld. 2004. Response rate and response quality of internet-based surveys: An experimental study. Marketing Letters 15(1): 21-36.

Downing, S.M. 2003. Validity: On the meaningful interpretation of assessment data. Medical Education. 37(9): 830-837.

Ehrlinger, J. and D. Dunning. 2003. How chronic self-views influence (and potentially mislead) estimates of performance. Journal of Personality and Social Psychology 84(1): 5.

Fredricks, J.A. and W. McColskey. 2012. The measurement of student engagement: A comparative analysis of various methods and student self-report instruments. In: Handbook of research on student engagement (pp. 763-782). Springer. US.

Gramzow, R.H., A.J. Elliot, E. Asher and H.A. McGregor. 2003. Self-evaluation bias and academic performance: Some ways and some reasons why. Journal of Research in Personality 37(2): 41-61.

Hattie, J. and H. Timperley. 2007. The power of feedback. Review of Educational Research 77(1): 81-112.

Heath, L., A. DeHoek and S.H. Locatelli. 2012. Indirect measures in evaluation: On not knowing what we don't know. Practical Assessment, Research & Evaluation 17(6): 1-6.

Isaacson, R.M. and F. Fujita. 2006. Metacognitive knowledge monitoring and self-regulated learning: Academic success and reflections on learning. Journal of Scholarship of Teaching and Learning 6(1): 39-55.

Krosnick, J.A. 1999. Survey Research. Annual Review of Psychology 50(1): 537-567.

Kruger, J. and D. Dunning. 1999. Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. Journal of Personality and Social Psychology 77(6): 1121.

Larrick, R.P., K.A. Burson and J.B. Soll. 2007. Social comparison and confidence: When thinking you're better than average predicts overconfidence (and when it does not). Organizational Behavior and Human Decision Processes 102(1): 76-94.

Lin, L.M. and K.M. Zabrucky. 1998. Calibration of comprehension: Research and implications for education and instruction. Contemporary Educational Psychology 23(4): 345-391.

Maki, P.L. 2012. Assessing for learning: Building a sustainable commitment across the institution. Sterling, VA: Stylus Publishing, LLC.

Mollett, T.A. and E.K. Leslie. 1986. Demographic profile of students majoring in animal science. Psychology in the Schools 17: 515-522.

Palomba, C.A. and T.W. Banta. 1999. Assessment essentials: Planning, implementing, and improving assessment in higher education. Higher and Adult Education Series. San Francisco, CA: Jossey-Bass, Inc., Publishers.

Peffer, P.A.L. 2011. Demographics of an undergraduate animal sciences course and the influence of gender and major on course performance. NACTA Journal 55(1): 26-31.

Peffer, P.L. 2016. Motivation of undergraduate animal sciences students. NACTA Journal 60(3): 293.

Schraw, G. 2009. A conceptual analysis of five measures of metacognitive monitoring. Metacognition and Learning 4(1): 33-45.

Zabrucky, K.M. 2010. Knowing what we know and do not know: Educational and real world implications. Procedia-Social and Behavioral Sciences 2(2): 1266-1269.

Recommendations for Recruiting Tomorrow's Horticulture Students

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Abstract

With an opportunity to update the factors that influence a student's decision to pursue a career in horticulture, this study provides insight into possibilities of creating a more effective recruiting strategy. Data collected through a survey of 230 post-secondary horticulture students, plus interviews with horticulture students and institutional staff, helped characterize the who, why and how of horticulture students. Demographic data such as that which identified that 40% of students are female and 48% of students attending two-year institutions are non-traditional (over 25 years old) offers better understanding about who are horticulture students. Likewise, knowing that prior gardening experience influenced 78% of horticulture students or that parents have an impact on students' academic major decision offers some explanation of how they came into horticulture. Recognizing that many students simply have a passion to work outdoors or make a difference in the world unveils why these students chose horticulture. These findings help provide a basis for effective recruitment strategies of new horticulture students. For example, the target audience of these recruiting efforts should not just be students, but also include their parents. Emphasizing the likelihood that job opportunities in horticulture allow the ability to work outdoors and/or help others will help meet current students' career aspirations.

Introduction

It is important to understand and identify college recruitment strategies in order to attract appropriate students to an institution and specific major. Some studies have been conducted to identify factors related to a student's choice of a specific institution including both student characteristics and institutional characteristics (Chapman, 1981; Han, 2014; Hoyt and Brown, 2003; Pampaloni, 2010). Less research has been done concerning recruitment for a college of agriculture (Cole and Thompson, 1999; Herren et al., 2011; Robinson et al., 2007; Shrestha et al., 2011), and until recently few studies had been published regarding a particular major within agriculture such as horticulture (Bradley et al., 2000; Meyer et al., 2016; Rhodus, 1990).

Horticulture is a growing field of employment with a 14% increase in jobs expected by 2022 (U.S. Bureau of Labor Statistics, 2012). However, both academia and industry recognize there are challenges facing the horticulture industry such as declining enrollment in academic horticulture programs (Darnell, 2006; Lawell, 2011; Meyer et al., 2016), lack of skilled labor, and public misperception of the industry (Meyer et al., 2016). Such programs are open to assessing their recruitment efforts to determine how they might correct this negative trend.

To create an effective recruitment strategy, one must know the target audience. By understanding the characteristics of their current students, horticulture programs may be better positioned to effectively recruit future students. Rhodus (1990) found that horticulture

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departments with higher enrollment numbers used career days with K-12 students and interacted with guidance counselors. Very few of the schools surveyed incorporated horticulture-related industry professionals into recruiting efforts. A study by Bradley et al. (2000) focused on the factors that influenced a student's choice of horticulture as a major. They discovered that 74% of students selected horticulture as a major because they enjoyed it as a hobby. The study also showed that a large percentage of students made their decision on the major in high school (26.9%) or during the second year of college (26.3%).

More recently, a study by Meyer et al. (2016) examined the public perception of horticulture and careers in the industry. The public agreed or strongly agreed (94%) horticulture is essential. Low pay (59%) was the top reason respondents thought a student would not choose horticulture as a career and education and awareness (54%) are the biggest challenges for the industry. Positive reasons for working in horticulture included job availability (26%), working outside (25%), and impacting the world (21%). The study also found many people discovered horticulture as a career by gardening with family.

The current study sought to identify the characteristics of students currently enrolled in horticulture more thoroughly in order to provide recommendations to recruit future students. The findings help characterize horticulture students, how they were exposed to horticulture and why they chose it as a career.

Materials and Methods

This study was conducted in three phases, with both quantitative and qualitative methods. The University Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study. The initial phase consisted of a survey distributed to willing students during the career fair of the Professional Landcare Network (PLANET) (now known as National Association of Landscape Professionals) Student Career Days in March of 2014 at Colorado State University, Fort Collins, CO (Table 1). Students took the survey online via Qualtrics, Version 2014, at a booth on computers provided by the researchers (Qualtrics, 2014). The fifteen-item survey requesting information concerning students' interest in horticulture and demographic information was completed by 230 students from institutions across the United States, representing a 29% response rate. Some key questions included: which of the following apply to your pursuit of horticulture as a career? (With an open-ended option available.) When did you decide to major in horticulture? If you were another major prior to horticulture, please list. What type of school do you attend? Are you a traditional or non-traditional student (18-24 years of age and 25 years and older, respectively)? Descriptive statistics were performed on the nominal data using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., 2013).

Table 1. Survey Distributed at the Professional Landcare Network (PLANET, now known as National Association of Landscape Professionals) Student Career Days, March 2014

Question	Responses
Do you wish to participate in this study?	Yes; No
Check all of the following that apply to your pursuit of a horticulture career	Gardened with family
	Talked with parents or other relatives
	Talked with a friend
	High school or grade school teacher influenced me
	Guidance counselor told me about horticulture
	Participated in FFA and/or 4-H
	Gardened as a hobby
	Family owns a business in the Green Industry
	Previously worked in the Green Industry
	Talked with a professional in the Green Industry
	Searched the Internet for jobs/careers in the Green Industry
	Came to campus for a visit
	Attended an on-campus event hosted by the department/college
	Attended an off-campus event hosted by the department/college
	Talked with a recruiter from the college
	Talked with a faculty member from the department
	Talked with a current student in the department
	Talked with an alumnus of the department
	Received a letter and/or phone call from the department
	Received brochures/promotional materials about the department/institution
	Visited the department/institutional website
	Program of interest was available at the institution
	Financial assistance/scholarships were provided to me
	Career opportunities were highlighted by the department
Please describe any other circumstances that might have influenced your pursuit of horticulture.	(Open ended)
In what region of the country do you attend school? (Map provided to distinguish regions)	Northeast; Southeast; Midwest; West
When did you decided to major in horticulture?	Before high school; High school; First year of college; Second year of college; Third year of college; Fourth year of college; Second career
Who was your first contact in the field of horticulture?	Industry professional; Profession; Student Recruiter; Alumni; Student
If you were another major prior to horticulture, please list below.	(Open ended)
What are your plans after receiving your degree in horticulture?	Pursue and advanced degree (check all that apply: BS, MS, PhD); Find a job in the industry (check 'yes' or 'no'); Find a job in another industry (please list area of interest); Not sure at the moment
What type of school are you currently attending?	Two-year; Four-year
What is your current class standing?	Freshman; Sophomore; Junior; Senior; Graduate
What degree type are you currently pursuing?	Associates; Bachelors; Masters; Doctoral
Which best describes your current program?	Landscape design; Landscape management; Landscape architecture; Nursery/greenhouse; Fruit/vegetable; Turfgrass; Other
Which type of student best describes you? (Optional)	Traditional (18-24 years old); Non-traditional (25 or older)
Please indicate your gender. (Optional)	Male; Female
If you would be willing to provide further information for this research, please indicate below.	Yes (contact information captured); No

The second phase of the study was conducted in the fall of 2014. During the initial survey, students were asked if they would be willing to answer follow-up questions. Students from Auburn University (AU), Kansas State University (KSU), Texas A&M University (TAMU), and the University of Kentucky (UK) were contacted for an informal, in person interview, allowing for additional questions to be asked and answered as they arose through discussion that were considered relevant to the study. The interviews were conducted to elicit greater insight pertaining to responses provided in the survey. Seven students participated with three females and four males representing KSU and UK. No students from AU or TAMU chose to participate. After the transcribed interviews were approved by the participants, responses were compared between interviews and the initial quantitative phase data.

The third and final phase was conducted during the fall of 2014 and spring of 2015. Department of horticulture faculty and staff at AU, KSU, TAMU and UK were asked to participate in an informal interview with six total participants representing all four institutions. The questions covered the respective department's enrollment status, its students' characteristics, and department recruitment efforts. After the transcribed interviews were approved by the participants, the responses were compared across interviews and the previous data collected. The last two phases were not extensive enough to draw independent conclusions but provided relevant data to add to the initial quantitative phase.

Results and Discussion

Students participating in the survey represented a diverse population with demographics helping identify horticulture student composition. The sample population represented all four identified regions of the United States – Northeast, Southeast, Midwest, and West – and consisted of 60% males and 40% females (Table 2). While this supports thoughts that horticulture is a male dominated field, it is not male limited. The Southeast and West show more males than females in the major, but the Midwest is more even in the breakdown (52% males, 48% females) and females surpass males in the Northeast (44% males, 56% females).

The sample population also consisted of both traditional (70%) and non-traditional students (30%) (Table 3). Most non-traditional students were attending two-year institutions (73%), while most traditional students were attending four-year institutions (65%). Almost half of the students at two-year institutions were non-traditional (48%). For 37% of the non-traditional students, horticulture was identified as a second career and selected the field beyond high school or post-secondary. This has the potential to be an area of outreach for horticulture recruitment, focusing on non-traditional students who would attend a two-year institution.

Table 2. Gender Distribution of Students in Horticulture by U. S. Regions Based on the Professional Landcare Network (PLANET, now known as National Association of Landscape Professionals) Student Career Days Survey, March 2014

	Region				
	Northeast[z]	Southeast[y]	Midwest[x]	West[w]	Overall
Gender	N = 16	N = 79	N = 88	N = 41	N = 224
Male	43.8%	65.8%	52.3%	73.2%	60.3%
Female	56.2%	34.2%	47.7%	26.8%	39.7%

[z]Northeast states include: CT, DE, MA, ME, NH, NJ, NY, PA, RI, VT

[y]Southeast states include: AL, AR, GA, FL, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV

[x]Midwest states include: IA, IL, IN, KS, MI, MN, MO, ND, OK, SD, WI

[w]West states include: AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY

Table 3. Comparison of Student Demographic Characteristics of Institution and Student Type Based on the Professional Landcare Network (PLANET, now known as National Association of Landscape Professionals) Student Career Days Survey, March 2014 (N=221)

	Institution		
Student Type	2 Year	4 Year	Overall
Traditionalz	24.4%	45.2%	69.7%
Non-Traditionaly	22.1%	8.1%	30.3%
All Students	46.6%	53.4%	

[z]18-24 years of age

[y]25 years and older

For many traditional students, a career in horticulture was determined in high school (41%) or the second year of college (26%). This represents an increase from the data collected by Bradley et al. (2000) of 27% in high school and 26% in second year of college. Students that decided upon horticulture as a major while in college (N=97) came from a variety of majors including business (N=14), liberal arts (N=14), medical (N=12), or architecture (N=11). Faculty and staff representatives from each institution indicated that their students transfer from business, engineering, or liberal arts, which closely resembled student survey responses previously discussed. Upon learning that many students chose horticulture in the second year of college, it was concluded by many of the representatives that a more active approach to seek out students on campus could prove effective. Therefore, recruitment of traditional students could be most effective during their time in high school or early years of college.

Results from the survey resembled those of the study by Bradley et al. (2000) and Meyer et al. (2016) with respect to influences and exposure to horticulture. Seventy-one percent of participants indicated that gardening with a family member and 57% indicated that gardening as a hobby were factors that influenced them to choose horticulture as a major, demonstrating prior gardening experience plays a key role in exposure to horticulture. During the interviews, gardening was also mentioned as influential by four of the seven students. The third greatest factor was talking to a parent or relative (52%). This could be the most insightful influence considering students participating in the interviews expressed that parents' negative perception of the horticulture industry created resistance to students selecting the major. Two students discussed the challenge of convincing their parents that their decision to major in horticulture was a good one. Students also stated that their parents questioned the salary potential of a horticulture career. The idea of low pay is one of the challenges posed by Meyer et al. (2016).

Influences of industry and industry professionals on students' selection of horticulture as a major should not be overlooked. According to the survey, 24% of the students commented that one of their first contacts in horticulture included an industry professional. Of 86 responses to an open-ended survey question about influences on the decision to major in horticulture, 20% of students indicated they had prior experience in the industry. None of the institutions utilized the industry in recruiting efforts in any formal effort, but all mentioned providing opportunities for current students to meet and network with industry professionals. Meyer et al. (2016) addressed the question of what role industry should play in helping promote student interest in horticulture; responses indicated internships and scholarships along with providing hands-on opportunities would be the most fruitful. With a greater industry presence in recruiting efforts, the field of horticulture might not be as uncertain to either students or parents.

An open-ended question on the survey revealed why students pursued horticulture. Two themes that were often mentioned included enjoyment of the outdoors (21%) and seeking to make a difference (15%). These themes emerged during the student interviews as well with responses such as "being outside is something I love" and "help[ing] others understand what plants do." This coincides with the responses Meyer et al. (2016) described regarding what makes horticulture an appealing profession. Those responses included "work[ing] outside… the work could impact the world." Institutional representatives said they highlight the abundance of jobs in the field when talking to prospective students, which Meyer et al. (2016) found to be another reason to recommend horticulture as a career. In the survey, 138 students (62%) responded that they would pursue a career in the field after graduating and 98% of those students were confident they would find a job in the industry.

Recognizing what draws a student into horticulture poses opportunity for recruitment strategies to be tailored toward specific interests. Students with interest in outdoor jobs or careers that have a bigger impact on others and the world could be persuaded to study horticulture, especially with an added benefit of job availability.

Summary

Acquiring current students' insight into their selection of horticulture as a major field of study offers the potential to create effective recruiting efforts, leading to an increase in enrollment numbers and supply of skilled labor, two challenges facing the horticulture industry (Meyer et al., 2016). Students' characteristics and background were considered during this research such as age, academic standing, and influential factors, and future studies could include assessing how geographical status, rural or urban, affects horticulture interests. Multiple recommendations are offered from this study. First, focus on specific student types. With traditional students, recruitment activities would be most effective during high school and the second year of college since those are points in which many choose to pursue horticulture as a major. For non-traditional students, a more effective approach would be from a two-year institution seeking prospective students interested in a second career. Second, it is important to recognize the influence both prior exposure to gardening and family, especially parents, have on a student's decision to major in horticulture. By including parents of prospective students as a target audience and by increasing industry involvement in the recruiting efforts, both students and parents may come to see the field of horticulture in a more favorable light than they do presently. Third, recruiting efforts should highlight the ability to work outdoors and help others, two strong interests of horticulture students.

Literature Cited

Bradley, J.C., T. Kohlleppel, T.M. Waliczek and J.M. Zajicek. 2000. Factors affecting recruitment of horticulture students at major universities. HortTechnology 10(3): 631-636.

Chapman, D.W. 1981. A model of student college choice. The Journal of Higher Education 52(5): 490-505.

Cole, L. and G.W. Thompson. 1999. Survey of current students: Implications for recruitment and retention. NACTA Journal 43(3): 15-20.

Darnell, R.L. 2006. The future of horticultural sciences within academia. Chronica Horticulturae 46(2): 8-9.

Han, P. 2014. A literature review on college choice and marketing strategies for recruitment. Family and Consumer Sciences Research Journal 43(2): 120-130.

Herren, C.D., D.D. Cartmell, II and J.T. Robertson. 2011. Perceptions of influence on college choice by students enrolled in a college of agricultural sciences and natural resources. NACTA Journal 55(3): 54-60.

Hoyt, J.E. and A.B. Brown. 2003. Identifying college choice factors to successfully market your institution. College & University 78(4): 3-10.

IBM Corp. Released 2013. IMB SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

Lawell, C. 2011. The state of horticulture programs. http://www.lawnandlandscape.com/II0911-education-horticulture-programs-decline.aspx. Lawn & Landscape Magazine. June 24, 2015.

Meyer, M.H., D. Needham, J. Dole, B. Trader, J. Fox, M. Conley, M. Neff and J. Shaw. 2016. Importance of horticulture and perception as a career. HortTechnology 26(2): 114-120.

Pampaloni, A.M. 2010. The influence of organizational image on college selection: What students seek in institutions of higher education. Journal of Marketing for Higher Education 20(1): 19-48.

Qualtrics. 2014. Qualtrics software, Version 2014. Copyright © 2017. Provo, UT: Qualtrics.

Rhodus, W.T. 1990. Analysis of recent enrollment trends and recruiting strategies in horticulture. HortScience 25(11): 1443-1446.

Robinson, J.S., B.L. Garton and S.G. Washburn. 2007. The influential factors of first-time enrollees utilize when choosing a college of agriculture. NACTA Journal 51(2): 27-33.

Shrestha, K.M., M. Suvedi and E.F. Foster. 2011. Who enrolls in agriculture and natural resources majors: A case from Michigan State University. NACTA Journal 55(3): 33-43.

U.S. Bureau of Labor Statistics. 2012. National employment matrix. U.S. Bureau of Labor Statistics, Washington, D.C.

Career Intervention Effects on Agricultural Students' Career Development at an 1890 Land-Grant Institution[1]

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Abstract

Social cognitive career theory (SCCT), which is the framework this study and intervention is based on, states that academic interests are developed from beliefs of self-efficacy and outcome expectations and that these two factors should be considered when conducting career counseling and interventions (Brown and Lent, 1996). Currently there is a gap in the literature focusing on African American agricultural students and career development variables. Data was collected and analyzed. Demographics show that the majority of the sample were African American underclassman females who were not first-generation college students. A correlational analysis was conducted between the variables of Science, Technology, Engineering, and Mathematics (STEM) interests, STEM self-efficacy, personal barriers, social supports, technology interests, coping efficacy, and ethnic identity. Our results show low to medium significant correlations between some of the variables. Additionally, a paired samples t-test was conducted to determine differences between pre- and post-test scores following either a control or intervention module; results suggest that supports and technology interests were significantly and negatively impacted from pre- to post-test.

Keywords: SCCT, career development, agricultural students, African American students, minority students

Introduction

This literature review is separated by variables tested in the analyses in this order: Science, Technology, Engineering, and Mathematics (STEM) interests, STEM self-efficacy, personal barriers, coping efficacy, social supports, technology interests, and ethnic identity. Social cognitive career theory (SCCT; Lent et al., 1994), the framework this project was developed on and is based on Albert Bandura's social cognitive theory, stated that academic interests are developed from beliefs of self-efficacy and outcome expectations. Brown and Lent (1996) stated that both self-efficacy and outcome expectations should be cultivated when conducting career counseling and interventions. Students may rule out possible career decisions and paths because of inaccurate self-efficacy beliefs and/or outcome expectations, regardless if they have the interests and skills necessary for these fields. Despite interests, drive, early exposure, and positive feelings African American students are underrepresented in Agricultural majors (Jordan et al., n.d.); agricultural majors comprise of only 3% of bachelor's degrees (Carneval et al., 2016) and only 5-6% of agricultural positions (Food and Agricultural Education Information System, n.d.).

Having an interest in STEM is important in pursuing a STEM major and career for students. Teachers can provide networking opportunities with professionals in the field to foster STEM interests (Jahn and Myers, 2014). Friendships and friendship groups developed during formative years can influence STEM interests (Robnett and Leaper, 2012). Even through these channels, some students think STEM subjects are boring, unwelcoming, and difficult (Hossain and Robinson, 2012). Personal interest in STEM has been found to be the best influence on students' career choices, followed by parents, earning potential, and teachers (Hall et al., 2015; Hossain and Robinson, 2012). Students may not realize their STEM potential at the high school level, and instead may decide at the collegiate level (Hossain and Robinson, 2012). STEM majors and fields are comprised of predominately White males and have fewer numbers of underrepresented minorities who should be prepared for STEM subjects to increase representation in the STEM workforce (Hossain and Robinson, 2012). In fact, STEM interest has been found to be higher in African American than in White students; this interest could lead

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to increased declarations of STEM majors in college (Lichtenberg and George-Jackson, 2013). Females are also underrepresented in STEM subjects (Lichtenberger and George-Jackson, 2013) and females tend to become disinterested in STEM and choose different majors and careers, such as health and medicine careers (Sadler et al., 2012). Su and Rounds (2015) explained this disparity as STEM fields having a things-orientation rather than a people-orientation, which females are more likely to be interested in. Shapiro and Williams (2012) stated that stereotype threat can negatively affect female performance in STEM fields. Stereotype threat is the fear that individuals will confirm negative stereotypes about a part of their identity; sometimes this threat can lead to decreased performance and confirmation of that negative stereotype (Ganley et al., 2013; Rice et al., 2013; Van Loo et al., 2013).

Another crucial aspect to pursuing a STEM degree/career is the belief that one can do well in the subject. Self-efficacy has been found to be a predictor of interests and goals (Lent et al., 2010) and can lead to higher academic performance, since students with higher levels of self-efficacy tend to work towards more difficult goals (Brown et al., 2008). Previous learning experiences predict and are a source of self-efficacy (Schaub and Tokar, 2005). Research self-efficacy can affect intent to pursue graduate school, since belief in ability for conducting graduate level research has been shown to predict active graduate school pursuit (Tate et al., 2014). Personality traits, such as perfectionism, can predict scores of self-efficacy; adaptive perfectionists have higher self-efficacy and grade point averages (GPA) compared to students who are not perfectionists (Rice et al., 2013). Self-efficacy in one sample of African American men was found to be correlated with high school ACT scores, college GPA, and academic persistence (Strayhorn, 2015). Females in STEM majors have been found to have lower levels of STEM self-efficacy when it comes to their thoughts of their abilities and their ability to overcome barriers within the field (Hardin and Longhurst, 2016). When trying to explain high school females' commitment to engineering, Liu et al. (2014) found that beliefs about gender role, self-efficacy about the STEM field, and having female role models all affect play a role in commitment.

Barriers to successful academic careers influences students' STEM career development, such as curriculum, funding issues, lack of qualified teachers, difficulty conducting research, time complaints, as well as difficulty of STEM studies (Hossain and Robinson, 2012). African American STEM students have additional barriers to their career development, such as study skills, ethnic identity, and financial issues (Luzzo, 1993). Furthermore, institutionalized racism can lead to limited sense of self-efficacy, which can impede goal and action development (Raque-Bogdan et al., 2012). Coping efficacy has been defined as the beliefs about a students' ability to overcome barriers on their career path (Tate et al., 2014). Coping styles have a relationship with self-efficacy, which is influenced by social supports and can influence retention in school (Devonport and Lane, 2006). Support from family, friends, and significant others are positively related to coping efficacy (Klink et al., 2008), and coping efficacy can mediate the effect of perceived social status and personal and systemic classism (Thompson, 2012).

Supports are crucial in determining a STEM students' success throughout their academic career. Parents (Raque-Bogdan et al., 2013), teachers, peers, families, and mentors (Falconer and Hays, 2006) are all sources of support for students. Vicarious experiences (seeing other students like the student themselves) can boost self-esteem and self-efficacy; however, if a student sees someone like them going through a judgmental environment, the observers' self-efficacy and esteem could be compromised (Jenson et al., 2011). Peer groups help provide school-life balance and offer encouragements, motivation, and reinforcements, which helps STEM students construct their sense of self-efficacy and persistence (Palmer et al., 2011). Additionally, established networks with STEM professionals produce a strong, nurturing environment, which aids minority students' integration into the STEM field (Stolle-McAllister, 2011). There is a gender difference when it comes to perception of supports. Females perceive more emotional support from their parents than males (Raque-Bogdan et al., 2013) and that females are more likely to perceive family as a support system during school, whereas males see family as a barrier (Inda et al., 2013). Fouad et al. (2010) reported that students identify twice as many supports than barriers when it comes to math and science fields, though there is a decrease of perceived barriers in science and an increase of barriers in math.

Novelty of technology, computers in particular, has transformed over the years, with teachers learning about the computers when computers were newer to students growing up with them and losing the novelty of the mechanics behind it (Swets, 2010). Technology serves to solve problems and expand understanding of our environments; students should use technology as a tool for solving their scientific problems (Grant et al., 2013). Technology interests, especially computer interests, also have a gender bias; females are underrepresented in this field, possibly due to stereotyping, gender bias, and culture (females are not reinforced for technology field; Banerjee and Santa Maria, 2012).

Identity development occurs in stages. Brown et al. (2013) stated that one African American model, Black Racial Identity Development Model, lists the statuses as Preencounter (White culture is idealized while African American identity is devalued), Encounter (challenging of idealization of majority culture), Immersion/Emersion (identification with African American culture, and anger towards White culture may occur), and Internalization (a positive African American identity is developed and meaningful relationships with White people occur). Major events can shape identity formation; President Barack Obama's election helped inspire increases

in exploration of racial identity for African American college students (Fuller-Rowell et al., 2011). However, acculturation stress can be a risk factor for suicidal ideation in African American students, especially those students who were less attached to their identified ethnic group (Walker et al., 2008). Ethnic identity can also be a protective factor; if college students have an affirmation to their ethnicity, then they endorse fewer anxiety and depression symptoms (Brittian et al., 2013), and higher levels of self-worth, self-meaning, and purpose, which can influence social-psychological well-being (Reitzes and Jaret, 2007). Ethnic identity affects career aspiration and development in minorities: Tovar-Murray et al. (2012) found that ethnic identity, including racism and race-related stress, has been shown to be a buffer between racism and career aspirations, and that individuals with stronger ethnic identity have stronger vocational identity.

Purpose of the Study

The purpose of the present study was to explore career development levels among agricultural students at a southeastern 1890 land-grant institution. The following research questions were investigated:

1. What are the demographic characteristics of agricultural students at a southeastern 1890 land-grant institution?
2. What are the relationships between STEM interests, STEM self-efficacy, personal barriers, social supports, technology interests, coping efficacy, ethnic identity, in post-intervention?
3. What was the effect of the intervention on the measures for career development?

Materials and Methods

This study used a quazi-experimental, longitudinal, pre-test/post-test control group design (Cook and Campbell, 1979; Heppner et al., 2016) with students from a southeastern mid-size 1890 land-grant institution's Agricultural Sciences department. The sample was comprised of 30 students who declared a major in the Agricultural Sciences department of the university and who were enrolled in STEM-focused ag classes during the 2012 through 2015 academic years. Validated measures by Lent et al. (2003) measuring STEM career development variables were used, along with the Multigroup Ethnic Identity Measure (Phinney, 1992) to measure ethnic identity. The instruments were accompanied by informed consent and a demographic questionnaire. All the Lent et al. (2003) measures were scored by averaging each subscales, and the higher the number, the more of the tested variable the participant had.

Measures

Interest in a STEM major was measured by a 12-item questionnaire by Lent et al. (2003), which was graded on a five-point Likert scale ranging from 0 (very low interest) to 4 (very high interest). Participants responded to the question "How much interest do you have in…" followed by a list of STEM majors (e.g. "Chemistry," "Computer Science").

To measure STEM self-efficacy, a Lent et al. (2003) 12-item questionnaire was used, which was graded on a ten-point Likert scale, ranging from 0 (no confidence at all) to 9 (complete confidence). The measure presented a list of STEM majors (e.g. "Agricultural Sciences," "Civil Engineering") and asked participants to grade confidence of their ability to complete the major with at least a B average. Cronbach alpha coefficients range between 0.89 - 0.94.

To measure supports and barriers, Lent et al. (2003)'s 38-item questionnaire was used. Scoring was on a five-point Likert scale, ranging from 1 (not at all likely) to 5 (extremely likely). Fifteen items focused on support (e.g., "Feel accepted by your classmates," "Get helpful assistance from your advisor"), and 23 items focused on barriers (e.g. "Receive negative comments or discouragement about your major from family members," "Receive unfair treatment because of your racial or ethnic group"). Supports and barriers were scored separately in this study. Cronbach alpha coefficients range between 0.88 and 0.92 for supports, and 0.90 – 0.94 for barriers.

Interest in technology was measured using a Lent et al. (2003) seven-item questionnaire that was graded on a five-point Likert scale, ranging from 1 (very low interest) to 5 (very high interest). Questions focused on practical behaviors that participants could be doing to build interest in technology (e.g. "Solving practical math problems," "Solving computer software problems"). One study found the coefficient alpha for this scale as α=0.83.

Coping efficacy was measured using a Lent et al. (2003) seven-item questionnaire that was graded on a ten-point Likert scale, ranging from 0 (no confidence) to 9 (complete confidence). Example questions from this section are "Cope with a lack of support from professors or your advisor," and "Find ways to overcome communication problems with professors or teaching assistants in STEM courses." Alpha coefficients range between 0.89 - 0.94.

Ethnic identity was measured using the Multigroup Ethnic Identity Measure (Phinney, 1992), with 20 items graded on a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). An example question was "I have spent time trying to find out more about my own ethnic group, such as its history, traditions, and customs." The final three questions asked about personal and parental ethnic identity with seven options to choose from (such "Asian, Asian American, or Oriental," "Black or African American"). The last three questions are not included in the scoring of the measure. Some items were reversed scored, then summed with the others for a total score. The higher the score, the more the participant identified with their ethnic identity. Cronbach's alpha has been found for the total scale ranges between 0.81 - 0.90.

The demographic survey consisted of questions pertaining to educational level, age, ethnicity, gender, SAT/ACT score, college and major, parental education levels (both paternal and maternal), socioeconomic status, country of origin, years U.S. resident, immigrant status (and reason for immigration, if applicable), and primary language.

Procedure

The grant intervention was conducted over a span of three academic years following IRB approval. Graduate research assistants (GRAs) on the grant conducted brief in-class presentations that explained the purpose of the study and invited students to participate in the survey. GRAs visited selected and approved classes to encourage students to participate. Students were informed that participation is voluntary, and withdrawal could be done at any time without consequences. Pre-test data were collected within the first two weeks of the semester. Data collected were matched by a GRA who did not have contact with participants to ensure confidentiality.

Results

Data cleaning, editing, and statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS, version 24; IBM Corp, 2016). Table 1 summarizes the demographics of the sample. The total number of participants was 30. Most of the sample was either 18-21 years of age. After further analysis, 18 (n=8) or 19 (n=9) year olds comprised over 56% of the sample. The majority of the sample was African American (n=27; 90%), female (n=16; 53.3%), and all were undergraduate students (43.3% freshman, 30% sophomore, 16.7% junior, 10.0% senior). The majority of students self-identified with a middle class socioeconomic status (n=28; 93.4%). Most of the participants (n=19; 63.3%) were not first-generation college students; most fathers (49.9%) and mothers (76.7%) did complete some college or more.

To test the second research question, a correlational analysis was conducted between the variables of STEM interests, STEM self-efficacy, barriers, supports, technology interests, coping efficacy, and ethnic identity. Table 2 shows the correlations. Results showed 9 of 28 correlations were significant, with significant correlations ranging from r=0.26 to 0.66, p<0.05. The strongest correlation, r=0.66, p<0.01 was between STEM Interests and STEM self-efficacy, followed by r=0.61, p<0.01 for STEM interests and technology interests. The lowest significant correlation was between supports and technology Interests, r=0.26, p<0.05.

To answer the third research question, a paired sample t-test analysis was conducted to determine whether the interventions designed for the grant was successful in altering students' perspective on the variables tested. These statistical analyses show a small intervention effect when the group was split into two groups. Students were either in a control (n=19) or an intervention (n=11) group, and both groups were given pre- and post-tests. The intervention consisted of 14-hour classroom-based instruction focusing on career development. Data were compiled over three academic years. The results showed that, from the variables tested, two (supports and technology interests) were significantly different between pre- and post-intervention (Table 3). The researchers further analyzed the data and there was a significant difference for supports pre-intervention (M=3.83, SD=0.69) and post-intervention (M=3.5, SD=0.83); t(10)=3.71, p<0.05. Additionally, there was a significant difference for technology interests pre-intervention (M=2.89, SD=0.89) and post-intervention (M=2.68, SD=0.83); t(10)=2.38, p<0.05. As expected, there were no significant differences in the control group from pre- to post-test.

Table 1. Sample Demographics

Variable		Frequency	Percent
Age	18 - 21	25	83.3%
	22 - 29	3	9.9%
	30 +	2	6.6%
Ethnicity	African American	27	90.0%
	White	2	6.7%
	Multicultural	1	3.3%
Sex	Male	13	43.3%
	Female	16	53.3%
	Missing	1	3.3%
Education Level	Freshmen	13	43.3%
	Sophomore	9	30%
	Junior	5	16.7%
	Senior	3	10.0%
Socioeconomic Status	Lower Class	1	3.3%
	Middle Class	28	93.4%
	Upper Class	1	3.3%
First Generation	No	19	63.3%
	Yes	11	36.7%
Paternal Education	Some High School	5	16.7%
	High School Graduate	6	20%
	Vocational Training	1	3.3%
	Some College	7	23.3%
	Associate's Degree	1	3.3%
	Bachelor's Degree	6	20%
	Post-Graduate	1	3.3%
	Missing	3	10%
Maternal Education	Some High School	3	10%
	High School Graduate	4	13.3%
	Some College	7	23.3%
	Associate's Degree	2	6.7%
	Bachelor's Degree	9	30.0%
	Post-Graduate	5	16.7%

Table 2. Correlations between Variables

	1.	2.	3.	4.	5.	6.	7.
1. STEM Interests	-	0.66**	0.27*	0.14	0.61**	- 0.01	- 0.00
2. STEM Self-Efficacy		-	0.05	0.15	0.50**	0.28*	- 0.20
3. Barriers			-	0.01	0.42**	- 0.12	0.33*
4. Supports				-	0.26*	0.41**	- 0.03
5. Technology Interest					-	- 0.02	0.08
6. Coping efficacy						-	-0.04
7. Ethnic Identity							-
Pre-Test Mean	1.68	5.08	2.12	3.82	2.89	6.24	1.78
Pre-Test SD	0.79	1.96	0.91	0.69	0.89	1.72	0.67
Post-Test Mean	1.75	4.76	2.27	3.50	2.67	5.57	1.86
Post-Test SD	0.88	2.16	1.00	0.82	0.83	2.18	0.71

Note: 1 = STEM Interest; 2 = STEM Self-Efficacy; 3 = Barriers; 4 = Supports; 5 = Technology Interests; 6 = Coping Efficacy; 7 = Ethnic identity. *p < 0.05. **p < 0.01.

Table 3. Paired Samples t-test from Pre/Post Tests

				95% CI			
Pair	$\bar{x}$	SD	SE	Lower	Upper	t	df
1	0.04	0.35	0.11	-0.20	0.28	0.40	10
2	0.67	1.32	0.40	-0.22	1.55	1.67	10
3	0.10	0.62	0.19	-0.32	0.52	0.55	10
4	0.54	0.49	0.15	0.22	0.87	3.71*	10
5	0.27	0.38	0.11	0.02	0.53	2.38*	10
6	0.61	1.84	0.58	-0.64	1.99	1.15	9
7	-0.11	0.24	0.10	-0.36	0.14	-1.14	5

Note: 1 = STEM Interest; 2 = STEM Self-Efficacy; 3 = Barriers; 4 = Supports; 5 = Technology Interests; 6 = Coping Efficacy; 7 = Ethnic identity. *p < 0.05.

Conclusions and Implications

This study examined career development variables in a sample of students who majored in agricultural science at a southeastern 1890 land-grant institution. Concerning demographic variables, most of the sample was between the ages of 18–21 (83.4%), African American (90%), mostly female (53.3%) and underclassmen (73.3%). Most of the participants were not first-generation college students (63.3%) and had fathers (53.3%) and mothers (76.7%) who completed some college and were from middle class socioeconomic background (93.4%). This sample stands out from the current literature because most of the sample were females; greater numbers of males have been represented in the literature for agricultural majors (Labo et al., 2013; Rosch and Coers, 2013). Correlations between variables tested were observed in the current study. To recap, interest in STEM subjects was found to have a high and significant relationship with STEM self-efficacy, barriers, and technology interest. STEM self-efficacy is significantly related to technology interest and coping efficacy. Barriers were significantly related to technology interest and ethnic identity, and supports were significantly related to technology interest and coping efficacy.

It is unsurprising that interest in STEM subjects has a strong and significant relationship with self-efficacy. The more interest a student has in the subject, the more likely they are to do well at the subject, thus leading to feelings of competence and confidence in their ability to excel in the subject. Additionally, STEM self-efficacy and coping efficacy's relationship with each other is understandable; students' belief that they can do well at activities will help them overcome barriers they come across in academia and in future careers. The relationship between supports and technology interest could be explained by the fact that our society is moving towards using technology more and more in both the home and classroom. Additionally, having supports around students can help them overcome barriers, thus explaining the significant relationship between the two variables. The relationship between ethnic identity and barriers has been established in previous literature. African American students tend to receive negative feedback on assignments (Richardson et al., 2015), which could discourage future attempts. Additionally, barriers at home, school, and the community, such as racism, poverty, drug use, and juvenile crime are all risk factors for "at risk" individuals; traditional counseling styles may not be appropriate to help at risk African American students (Fusick and Bordeau, 2004).

Since the sample size was small, the effect size for the intervention was low, so determinations were unable to be made to determine whether the intervention was successful or not in this sample. Preliminary analyses were conducted and found that, of the significant results, supports and technology interests' scores were lower from pre- to post-test measurements. The reason for this is unknown. It is interesting to note that, while not significant, interest in STEM subjects, perceived barriers, and ethnic identity levels increased slightly over the intervention. Future studies should be conducted to explain this phenomenon and to increase power to determine true effects. To make generalizability better, sample sizes should be increased, and groups should be balanced. Since this sample was limited to one agricultural sciences department at a single 1890 land-grant institution, future studies should consider applying both the SCCT measures and the interventions to agricultural departments at other institutions to determine if the phenomena measured in this sample is limited to this sample or is also present at other universities.

Summary

This study found that some career development variables were significantly related to each other when measured in agricultural science students at an 1890-land grant institution. Furthermore, this study found that there was significant change for supports and technology interests from pre- to post-tests, but not on other variables. Further research should be conducted to continue studying this phenomenon in agricultural science students to expand the knowledge base.

Literature Cited

Banerjee, S. and R.R. Santa Maria. 2012. A study of students' perception of computer education: Lack of interest in STEM fields for female students. International Journal of Technology, Knowledge and Society 8(4): 93-106.

Brittian, A.S., A.J. Umaña-Taylor, R.M. Lee, B.L. Zamboanga, S.Y. Kim, R.S. Weisskirch and S.J. Carawa. 2013. The moderating role of centrality on associations between ethnic identity affirmation on ethnic minority college students' mental health. Journal of American College Health 61(3): 133-140.

Brown, S.D. and R.W. Lent. 1996. A social cognitive framework for career choice counseling. Career Development Quarterly 44(4): 354-366.

Brown, S.D., S. Tramayne, D. Hoxha, K. Telander, X. Fan and R.W. Lent. 2008. Social cognitive predictors of college students' academic performance and persistence: A meta-analytic path analysis. Journal of Vocational Behavior 72(3): 298-308.

Carnevale, A.P., M.L. Fasules, A. Porter and J. Landis-Santos. 2016. African Americans college

majors and earnings. https://cew.georgetown.edu/wp-content/uploads/AfricanAmericanMajors_2016_web.pdf. Georgetown University Center on Education and the Workforce.

Cook, T.D. and D.T. Campbell. 1979. Quasi-experimental: Design and analysis issues for field settings. Chicago: Rand McNally.

Devonport, T.J. and A.M. Lane. 2006. Relationships between self-efficacy, coping and student retention. Social Behavior and Personality 34(2): 127-138.

Falconer, J.W. and K.A. Hays. 2006. Influential factors regarding the career development of African American college students. Journal of Career Development 32(3): 219-233.

Food and Agricultural Education Information System (FAEIS). N.d. Breakdown of ethnicity. http://www.faeis.ahnrit.vt.edu/index.php/plotly-test/ Virginia Tech. April 14, 2017.

Fouad, N.A., G. Hackett, P.L. Smith, N. Kantamneni, M. Fitzpatrick, S. Haag and D. Spencer. 2010. Barriers and supports for continuing in mathematics and science: Gender and educational level differences. Journal of Vocational Behavior 77(3): 361-373.

Fuller-Rowell, T.E., A.L. Burrow and A.D. Ong. 2011. Changes in racial identity among African American college students following the election of Barack Obama. Developmental Psychology 47(6): 1608-1618.

Fusick, L. and W.C. Bordeau. 2004. Counseling at-risk Afro-American youth: An examination of contemporary issues and effective school-based strategies. ASCA Professional School Counseling 8(2): 102-115.

Ganley, C.M., L.A. Mingle, A.M. Ryan, K. Ryan, M. Vasilyeva and M. Perry. 2013. An examination of stereotype threat effects of girls' mathematics performance. Developmental Psychology 49(10): 1886-1897.

Grant, D.M., A.D. Malloy and G.P. Hollowell. 2013. Enhancing students' interest in science and technology through cross-disciplinary collaboration and active learning techniques. Journal of Information Technology Education: Innovations in Practice 12: 101-112.

Hall, M.E., R.D. Williams Jr., T.M. Penhollow, K.E. Rhoads and B.P. Hunt. 2015. Factors associated with discrimination among minority college students. American Journal of Health Behavior 39(3): 318-329.

Hardin, E.E. and M.O. Longhurst. 2016. Understanding the gender gap: Social cognitive changes during an introductory STEM course. Journal of Counseling Psychology 63(2): 233-239.

Heppner, P.P., B.E. Wampold, J. Owen, M.N. Thompson and K.T. Wang. 2016. Research design in counseling. 4th ed. Boston: Cengage Learning.

Hossain, M.M. and M.G. Robinson. 2012. How to motivate US students to pursue STEM (Science, technology, engineering and mathematics) careers. US-China Education Review 4: 442-451.

IBM Corp. 2016. IBM SPSS Statistics for Mac. Version 24. Armonk, NY: IBM Corp.

Inda, M., C. Rodríguez and J.V. Peña. 2013. Gender differences in applying social cognitive career theory in engineering students. Journal of Vocational Behavior 83(3): 346-355.

Jahn, J.L.S. and K.K. Myers. 2014. Vocational anticipatory socialization of adolescents: Messages, sources, and frameworks that influence interest in STEM careers. Journal of Applied Communication Research 42(1): 85-106.

Jenson, R.J., A.N. Petri, A.D. Day, K.Z. Truman and K. Duffy. 2011. Perceptions of self-efficacy among STEM students with disabilities. Journal of Postsecondary Education and Disability 24(4): 269-283.

Jordan, C.P., N.R. Brown, S. Sitton, M.C. Edwards, and A. Riggs. n.d. Examining the African American perception of agriculture: Views of students attending an 1862 land-grant institution. https://www.nactateachers.org/images/stories/AB219.pdf. April 3, 2017

Klink, J., A. Byars-Winston and L.L. Bakken. 2008. Coping efficacy and perceived family support: Potential factors for reducing stress in premedical students. Medical Education 42(6): 572-579.

Labo, S.S., K. Jefferson-Moore and C. Turner. 2013. Potential factors contributing to undergraduate enrollment in agricultural economics and agricultural business and management at land-grant institutions. NACTA Journal 57(4): 51-56.

Lent, R.W., S.D. Brown and G. Hackett. 1994. Toward a unifying social cognitive theory of career and academic interest, choice, and performance [monograph].

Lent, R.W., S.D. Brown, J. Schmidt, B. Brenner, H. Lyons and D. Treistman. 2003. Relation of contextual supports and barriers to choice behavior in engineering majors: Test of alternative social cognitive models. Journal of Counseling Psychology 50(4): 458-465.

Lent, R.W., H-B. Sheu, C.S. Gloster and G. Wilkins. 2010. Longitudinal test of the social cognitive model of choice in engineering students at historically Black universities. Journal of Vocational Behavior 76(3): 387-394.

Lichtenberger, E. and C. George-Jackson. 2013. Predicting high school students' interest in majoring in a STEM field: Insight into high school students' postsecondary plans. Journal of Career and Technical Education 28(1): 19-38.

Liu, Y., S. Lou and R. Shih. 2014. The investigation of STEM self-efficacy and professional commitment to engineering among female high school students. South African Journal of Education 34(2): 1-15.

Luzzo, D. 1993. Ethnic differences in college students' perceptions of barriers to career development. Journal of Multicultural Counseling and Development 21(4): 227-236.

Palmer, R.T., D.C. Maramba and T.E. Dancy, II. 2011. A qualitative investigation of factors promoting the retention and persistence of students of color in STEM. The Journal of Negro Education 80(4): 491-504.

Phinney, J.S. 1992. The multigroup ethnic identity measure: A new scale for use with diverse groups. Journal of Adolescent Research 7(2): 156-176.

Raque-Bogdan, T.L., E.A. Klingaman, H.M. Martin and M.S. Lucas. 2013. Career-related parent support and career barriers: An investigation of contextual variables. The Career Development Quarterly 61(4): 339-353.

Reitzes, D.C. and C. Jaret. 2007. Identities and social-psychological well-being among African American college students. Sociological Focus 40(4): 392-412.

Rice, K.G., F.G. Lopez and C.M.E. Richardson. 2013. Perfectionism and performance among STEM students. Journal of Vocational Behavior 82(2): 124-134.

Rice, K.G., F.G. Lopez, C.M.E. Richardson and J.M. Stinson. 2013. Perfectionism moderates stereotype threat effects on STEM majors' academic performance. Journal of Counseling Psychology 60(2): 287-293.

Richardson, J.T.E., B.A. Rivers and D. Whitelock. 2015. The role of feedback in the under-attainment of ethnic minority students: Evidence from distance education. Assessment and Evaluation in Higher Education 40(4): 557-573.

Robnett, R.D. and C. Leaper. 2012. Friendship groups, personal motivation, and gender in relation to high school students' STEM career interest. Journal of Research on Adolescence 23(4): 652-664.

Rosch, D.M. and N. Coers. 2013. How are we educating agricultural students? A national profile of leadership capacities and involvement in college compared to non-agricultural peers. Journal of Agricultural Education 54(1): 83-96.

Sadler, P.M., G. Sonnert, Z. Hazari and R. Tai. 2012. Stability and volatility of STEM career interest in high school: A gender study. Science Education 96(3): 411-427.

Schaub, M. and D.M. Tokar. 2005. The role of personality and learning experiences in social cognitive career theory. Journal of Vocational Behavior 66(2): 304-325.

Shapiro, J.R. and A.M. Williams. 2012. The role of stereotype threats in undermining girls' and womens' performance and interest in STEM fields. Sex Roles 66(3-4): 175-183.

Stolle-McAllister, K. 2011. The case for summer bridge: Building social and cultural capital for talented Black STEM students. Science Educator 20(2): 12-22.

Strayhorn, T.L. 2015. Factors influencing Black males' preparation for college and success in STEM majors: A mixed methods study. The Western Journal of Black Studies 39(1): 45-63.

Su, R. and J. Rounds. 2015. All STEM fields are not created equal: People and things interests explain gender disparities across STEM fields. Frontiers in Psychology 6: 1-20.

Swets, D. 2010. Can the popularity of computer science be restored? Strategies for increasing interest in information technology. The International Journal of Learning 17(6): 55-61.

Tate, K.A., N.A. Fouad, L.R. Marks, G. Young, E. Guzman and E.G. Williams. 2014. Underrepresented first-generation, low-income college students' pursuit of a graduate education: Investigating the influence of self-efficacy, coping efficacy, and family influence. Journal of Career Assessment 23(3): 427-441.

Thompson, M.N. and J.J. Dahling. 2012. Perceived social status and learning experiences in Social Cognitive Career Theory. Journal of Vocational Behavior 80: 351-361.

Tovar-Murray, D., E.S. Jenifer, J. Andrusyk, R. D'Angelo and T. King. 2012. Racism-related stress and ethnic identity as determinants of African American college students' career aspiration. The Career Development Quarterly 60(3): 254-262.

Van Loo, K.J., K.L. Boucher, R.J. Rydell and M.T. Rydell. 2013. Competition in stereotyped domains: Competition, social comparison, and stereotype threat. European Journal of Social Psychology 43: 548-660.

Walker, R.L., L.R. Wingate, E.M. Obasi and T.E. Joiner Jr. 2008. An empirical investigation of acculturative stress and ethnic identity as moderators for depression and suicidal ideation in college students. Cultural Diversity and Ethnic Minority Psychology 14(1): 75-82.

Project-Based Learning for Developing Digital Literacy in Undergraduate Science Communication

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Abstract

Agricultural and environmental science communication undergraduate degree programs must continually implement innovative pedagogical and instructional approaches to best prepare graduates who exhibit problem-solving skills and technology adaptability. Project based learning (PjBL) encourages students to use critical thinking skills to answer questions and create real-world products. The purpose of this study was to explore a PjBL instructional design and teaching model for multimedia skill development in an undergraduate agricultural and environmental sciences communication program. This study sought to: 1) explore students' perceptions and experiences of navigating a PjBL course focused on digital photography and Extension engagement and 2) better understand students' perceptions and experiences related to learning a mobile video application. Course artifacts, such as reflection journals, and in-person interviews served as data sources, which were analyzed using an open coding technique. Emergent themes included: 1) navigating tension and facilitating balance of learner voice and choice in a PjBL design, 2) PjBL design for photography content learning and Extension contextual learning, 3) Undergraduate mobile technology adoption – direct hands-on vs. information consumption learning approaches, 4) and Learner critique and pride of final projects. The PjBL model appeared to be effective, as all students in the course successfully completed photo essay projects about Extension areas.

Introduction

At their core, agricultural and environmental sciences communication undergraduate degree programs must continually prepare students to use new communication models and technologies and teach them how to evolve as professionals in the field of science communication. Contemporary digital media allow for constant access to information from numerous sources. Irani and Doerfert (2013) emphasized the importance of training today's undergraduate students to be successful in transdisciplinary teams by continuing to evolve the agricultural communication discipline through use of innovative ideas, pedagogies and technologies. Kurtzo et al. (2016) further supported this assertion and noted agricultural communication students need to be able to adapt quickly to changes in technologies related to communication and information dissemination.

In addition to adapting to a constantly changing communication landscape, today's competitive graduates must have several additional skills: they must be able to work as individuals or in teams, communicate effectively, exhibit leadership, make complex decisions, solve problems, and maintain established standards of professionalism (Crawford et al., 2011). A critical skillset added to the growing list of 'must haves' for graduates is the ability to quickly learn and employ new technologies proficiently. This digital literacy *"involves more than the mere ability to use software or operate a digital device; it includes a large variety of complex cognitive, motor, sociological, and emotional skills, which users need in order to function effectively in digital environments"* (Eshet-Alkalai, 2004; p. 93). The concept of digital literacy includes building specific digital skills such as multimedia development. Bali (2016) explained the differences in these terms: *"Digital skills focus on what and how. Digital literacy focuses on why, who, and for whom. For example, teaching digital skills includes showing students how to download images from the Internet and insert them into PowerPoint slides or webpages. Digital literacy focuses on helping students choose appropriate images, recognize copyright licensing, and cite or get permissions, in addition to reminding them to use alternative text for images to support those with visual disabilities."*

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While the need to be digitally proficient (to be both literate and possess skills) is increasing, incorporating new technologies and pedagogies into the college classroom does not always keep pace. Although *"a growing number of universities are encouraging faculty to utilize technology in their teaching and learning"* (Drape et al., 2013; p. 24), Edgar et al. (2012) found over a 10-year period, college of agriculture faculty at one institution required students to complete only a limited number of information and communication technology-related tasks courses. Similarly, in an examination of professional development needs of faculty in a different college of agriculture, Rocca (2010) discovered faculty had less interest in training related to teaching technology than in improving non-technology-related instructional skills, despite results identifying faculty professional development needs to master digital teaching technologies.

Meanwhile, students have realized the importance of digital skills and literacy go beyond merely using new learning technologies in the context of online courses (Hall et al., 2013).

In the field of agricultural communication, and more broadly, in science communication, graduates must not only have digital literacy skills, but also be able to develop projects across communication delivery platforms. Digital convergence requires science communicators to research and relay key messages using a variety of media including print, photography, video, graphics, web, and social media (Ibrus, 2016; Wirtz, 1999).

Taking these rapidly changing and converging communication technologies and digital literacy demands into account, it is imperative agricultural communication programs identify innovative pedagogical and instructional design approaches to prepare graduates who can exhibit problem-solving and technology adaptability to "think AND act globally" across communication contexts and platforms (Irani and Doerfert, 2013; p 11). Adoption of PjBL strategies provides opportunities to engage undergraduates in creating real-world projects, while developing and applying digital literacy skills (Loizzo et al., 2016).

Conceptual Framework

The Buck Institute for Education (BIE) (2016) defined PjBL as a teaching method that encourages students to use critical thinking skills to answer questions and solve real-world problems through development of projects. The elements of Larmer and Mergendoller's (2015) PjBL model include: challenging problem or question, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, and public product. The model emphasizes meaningful learning begins with a complex problem or question to challenge the learner; solving the problem or answering the questions then requires learners to engage in inquiry. According to Larmer and Mergendoller (2015), projects should provide authentic real-world experiences and be designed to allow learners to maintain ownership, while determining the processes used to complete the project. Throughout a project, reflection helps learners recognize personal knowledge gain and postulate how to apply knowledge to future experiences. Critique and revision help learners to continually improve projects, which can then be turned into tangible products useful for public audiences.

While a good amount of PjBL research has been conducted in K-12 classrooms (Svinicki and Schallert, 2016; Thomas, 2000), research increasingly supports use of this model in higher education. Because of its innovative approach to teaching strategies and skills critical for success in the 21st century (Bell, 2010), PjBL has been used and studied in several higher education disciplines, including materials science (Stefanu et al., 2013), interdisciplinary studies (Hutchison, 2016), sustainability education (Brundiers and Wiek, 2013), computer and information technology (Svinicki and Schallert, 2016), microbiology (Verran, 1992), engineering education (Mills and Treagust, 2003), and in STEM courses (Caparo and Slough, 2013).

An excellent context in which to situate PjBL experiences at land-grant universities, and more specifically in agricultural communication programs, is an institution's Extension division. Because Extension's modern-day functions are to *"translate science for practical application [and] find answers and encourage application of science and technology to improve agricultural, economic, and social conditions"* (NIFA, USDA, n.d.) students have front row seats to real-world learning in scientific and agricultural contexts. And, at a time when public land-grant universities are faced with deep budget cuts, aligning classroom teaching efforts such as PjBL with Extension efforts, where non-formal university educators and researchers communicate with diverse client bases in a multitude of ways using modern technologies, can serve to not only highlight the work of Extension professionals but also provide students a chance to see real-world career opportunities in science and agricultural communication.

The course used for this investigation focused on digital photography, was designed using the BIE PjBL framework, and is part of an undergraduate agricultural and environmental sciences communication program. The driving question posed to learners in the course was: How can we, as science communicators, develop a project that informs online public audiences about Nebraska Extension? Learners were then given voice and choice, as required in the PjBL model, through topic selection, design, and development of the photo essay project, with the instructor serving as expert and facilitator to guide learning. Table 1 outlines how course features were designed to follow the PjBL model.

The research was also guided by the International Society for Technology in Education's (ISTE) standards for students, which emphasize skills and qualities needed by today's students to engage in a digitally connected world. ISTE standards for students include: 1) creativity and innovation, 2) communication and collaboration,

3) research and information fluency, 4) critical thinking, problem solving, and decision making, 5) digital citizenship, and 6) technology operations and concepts. The standards were designed for use by educators at any academic level with a goal to cultivate these skills through students' academic careers (ISTE, n.d.). The ISTE standards informed the course design for fostering agricultural and environmental sciences communication students' digital literacy skill development through activities such as utilization of digital databases and websites for researching and defining photo essay topics, working with subject matter experts, use of digital cameras for photography techniques, problem solving, critical thinking, and creativity in explaining Extension topics via a photo essay for online audiences. Additionally, learners were asked to use a new mobile video application for visual storytelling about Nebraska Extension, which required the students to develop strategies for learning how to use the new technology with the support of online tutorials and their instructor.

Table 1. Essential Project-Based Learning Design Elements from Larmer and Mergendoller (2015) Mapped to Digital Photography Course Design

Project-based Learning Elements	Digital Photography Course Design
Challenging Problem or Question	How can we, as science communicators, develop a project that informs online public audiences about Nebraska Extension?
Sustained Inquiry	Research topic and interview an Extension educator from an Extension identified critical needs area
Authenticity	Extension critical needs areas: Food, Nutrition, and Health, Crops and Water, The Learning Child, Community Vitality, Beefy Systems, 4-H Youth Development, and Community Environment
Student Voice and Choice	Select individual topic and Extension subject matter expert
Reflection	Complete nine reflection journal entries responding to instructor-led prompts and give project updates throughout the semester
Critique and Revision	Peer review rough cuts of photo essays and revise
Public Product	Present final projects to public audience of peers, faculty, Extension professionals, and department head; Final projects posted to university and Extension YouTube channel and websites

The purpose of this study was to explore a PjBL instructional design and teaching model for multimedia skill development in an agricultural and environmental sciences communication undergraduate program at the University of Nebraska-Lincoln. Underpinning the model was the need to help students develop 21st century digital literacy skills in the context of real-world challenges. Therefore, this study sought to: 1) explore students' perceptions and experiences of navigating a PjBL course focused on digital photography and Extension engagement and 2) better understand students' perceptions and experiences related to learning a multimedia video application (learning and employing a subset of digital literacy skills). Research questions included:

1. What are students' experiences in a new digital photography course based on a PjBL instructional design and teaching approach?

1a. What do students perceive as positive and challenging aspects of learning in this format?

2. How can Extension be implemented as a real-world context in PjBL design for a digital photography course? And what might students learn about Extension?
3. How do students go about learning and using a new mobile video application?
4. What are students' perceptions of their final project outcomes in the digital photography course?

Methods

As part of an undergraduate agricultural and environmental sciences communication program, this course was designed by the lead researcher and followed the BIE PjBL model to help students learn basic digital photography skills such as camera functions and photo framing techniques through development of photo essay projects covering student-selected Extension-related topics. ISTE's digital literacy standards also informed the course design in regard to having students use critical thinking, problem-solving, communication skills and more for creating their projects, as well as learning how to use a new mobile video application.

Students used Videolicious, a mobile "app" downloaded to iPhone and Android devices for basic video editing intended for users with little to no video editing experience; the app was selected for use in the course for that reason. The course instructor established an enterprise agreement with Videolicious, enabling students to use the app free of charge and with full functionality. The app runs in a linear fashion and is not as complex as professional video editing software such as Final Cut Pro and Adobe Premier. Users can perform tasks such as simple edits, transitions, and add music with touch screen features, then share the video via social media or email. Despite the app's ease of use and simplicity, as with any new tool, a learning curve exists for becoming familiar with available features and functions, terminology, and workflow.

Twelve students were enrolled in the course during fall 2015, and six consented to participate in this research (Table 2). The University of Nebraska-Lincoln's Institutional Review Board approved the study protocol and participants provided written informed consent prior to interviews. Pseudonyms are used for anonymity.

A qualitative methodology was used for this study and data were collected through interviews, reflection journals, and final project artifacts. The third author recruited participants in-person at the end of class time, the lead researcher conducted interviews, and all three researchers participated in data analysis. The potential exists in this study for bias, as the lead researcher conducted participant interviews. However, qualitative researchers often fulfill many roles in the

Table 2. Participants

Pseudonym	Class	Gender
Alexandra	Sophomore	Female
Christina	Sophomore	Female
Haley	Junior	Female
Jared	Junior	Male
Lucy	Junior	Female
Megan	Junior	Female

data collection and analysis process. A dilemma faced in conducting participant interviews in any study is whether to have an "insider" or "outsider" conduct the interviews; both types potentially influence participant responses, but in different ways (Hesse-Biber, 2017). In this study, the decision was made to conduct interviews with an insider, the course instructor and lead researcher, to establish familiarity and trust with participants through the shared experience of participating in the PjBL designed course. Additionally, this choice served to improve and strengthen the lead researcher's PjBL pedagogical approach.

The semi-structured interviews lasted 20-30 minutes, were conducted after course grades were posted, and included project-focused questions such as: What was your photo essay topic? Why did you choose it?, What did you learn about it?. Questions focused on the mobile video application were also included, such as: How did you learn to use the tool? What did you like/not like about it? Were there any major challenges/useful features within the tool?

Research team members subsequently and separately open-coded interview transcripts for emergent categories and came together to identify themes (Saldaña, 2016). During the second round of axial coding, data were reviewed and coded for categories that emerged from open-coding (Saldaña, 2016). Researchers established confirmability by coding independently, comparing codes, and reaching consensus about final themes found in the data (Hesse-Biber, 2017). Researcher bias exists inherently in qualitative work. However, to mitigate biases, course artifacts and reflection journals were collected as additional data sources and used for triangulation. Researchers coded these data separately and subsequently compared codes to arrive at themes. To further enhance trustworthiness, member checking was used throughout the interview process (Lincoln and Guba, 1985). A lack of participation among students in the course can be considered a limitation to this study.

Results

Themes from participant interview transcripts and course artifacts included: 1) PjBL facilitation balance and tension of learner voice and choice in a PjBL design, 2) PjBL design for photography content learning and Extension contextual learning, 3) Hands-on vs. information consumption approaches for mobile technology adoption, and 4) Learner critique and pride of final projects. Table 3 outlines how the themes address the research questions.

Table 3. Research Questions and Themes

	Research Question	Theme
1	PjBL facilitation	Learner voice and choice – freedom
		Learner voice and choice – structure
2	PjBL content and context	Photography skill development
		Extension context
3	Mobile technology adoption	Hands-on approach
		Information consumption approach
4	Final projects	Learner critique
		Learner satisfaction

The themes are expanded with discussion and supporting participant quotes in the following sections.

Theme One: Navigating Tension and Facilitating Balance of Learner Voice and Choice

The first theme that emerged from participant transcripts addressed research question one about learners' experiences navigating PjBL instructional design and teaching. Within this theme, it appeared students valued the "voice and choice" component of the PjBL framework, as they had freedom within the context of Nebraska Extension to choose their photo essay topics. Yet students also expressed having time management challenges and experiencing stress as a result of having the agency to organize, set, and meet deadlines to complete individual projects.

A majority of participants chose project topics based on their own background knowledge, prior experiences, interests, and curiosity about Extension. For example, Lucy's photo essay featured the 4-H Youth and Development component of Nebraska Extension. She noted, *"I chose it because basically, it led me to where I am today. Without 4-H, I wouldn't have been an ag major…so that's really what I wanted to get across in my video, just to show how much it has impacted my life…"* Haley also had a prior connection to Extension, via her family's ranching operation, and developed a photo essay about Extension's Beef Systems work. Haley said, *"I love cattle, and I love where I grew up and the research that Extension does has actually helped our ranch a lot."* Conversely, Christina had no prior connection to Extension, but appreciated the opportunity to explore a topic she was interested in learning more about. She stated, *"The topic that I chose was the Youth Nutrition Education Program classes. I chose that one because I thought it would provide really good photos, but also because I'm really interested. I'm a big foodie person, so I thought that would be cool."*

While the voice and choice PjBL component was favored among participants in interviews, it also provided some instructional and learning challenges. Allowing students to choose their own topics in a real-world context lent itself to practical time constraints and obstacles such as unresponsive subject matter experts and seasonal issues such as the need for planting photos about a topic, when the course occurred in the fall semester. It became crucial for the course instructor to consciously not take control of project topics and timelines, and thus the instructor's role became one of "guide on the side" rather than "sage on the stage", stepping into provide support to students when projects ran into various obstacles. For instance, Alexandra had several topics and subject matters fall through. The instructor stepped in to suggest Alexandra feature and work with an Extension publication called Crop Watch for story ideas and content expert contacts. Alexandra explained in her interview, *"I did Crop Watch and then, I did the sugar beet process which you helped me find that article, so I kind of went off of that. And that really*

helped narrow it down because I think I was making it a little bit too broad at first and kind of freaking myself out."

Freedom for students to determine their own project timelines based on individual project contexts appeared to overwhelm some participants. While the syllabus and instructor provided guidelines and suggested dates for completion of each step of the project, some participants described a preference for more structured and prescribed deadlines, with specific deadlines issued by the instructor. Christina said, *"I think if we had a set plan where our photos have to be done by a certain date, and we have to talk to these people by a certain date, it might run smoother."* Alexandra recommended, *"Maybe if you would just make it stricter, like this is when you need to do this, and this is this. And maybe make it more of like a grade to have all of your photos done or something like that. But I also feel like you've [the student] got to take responsibility for it as yourself, too."* In his interview, Jared discussed the student's role in PjBL to take control of his own project planning and development deadlines as similar to that of a communication professional: *"You literally have to force yourself to make a deadline which you're [the instructor] very good about encouraging setting a timeline because on the syllabus you have, 'I need photos for these weeks.' If you [the student] truly follow that, I think you'd be very successful in the class. But, people who might not have done that until, like, this is not a class you want to wait until the night before in order to do your whole project because that's just impossible."*

The tension and balancing between student voice and choice appeared to permeate learners' experiences in the course. As outlined, students appeared to appreciate the opportunity to have a voice in their own learning, which motivated them to engage in topics of personal interest. However, many learners still craved systematic structure with specific deadlines for each step of the final project, and the opportunity to set their own deadlines to reach a final outcome was overwhelming to them.

Theme Two: PjBL for Photography Content Learning and Extension Contextual Learning

PjBL proved to be a successful approach in this study, not only for engaging students in content learning about photography, but also in learning contextually about Nebraska Extension. Participants had varying degrees of photography experience before taking the course. Two participants owned professional cameras and reported having taken photos for clients, while the remaining students had limited experience taking photos.

In their interviews, students with limited photography experience described learning the craft or 'button pushing' of photography such as shutter, aperture, etc. Lucy described the photography knowledge she gained from the course, *"knowing how to work the camera and knowing the different parts of it. Because for me, I needed to learn those basic skills. I didn't know any of them."* Christina said, *"I learned a lot about the editing process and Photoshop and Lightroom and the technical aspect behind cameras and photography."* Jared had previous experience using photography equipment and taking professional quality photos. He explained how the course expanded his understanding of photography composition techniques, *"...being able to look through what people think is a good composed picture and different shots that are good to have. Now, you [the student] can look at a picture that's hanging on the wall and say, 'Oh, that's leading lines.' or 'That's this.' to grasp true fundamentals behind photography."*

In addition to learning photography fundamentals, the PjBL approach required the course final project to be situated in a real-world context, in this case by exploring areas of Nebraska Extension. Students were charged with creating photo essays about an area of Extension that interested them such (e.g. nutrition, beef, youth, community vitality). Christina had no prior experience with Extension, and the course project raised her awareness about the service. She said, *"I didn't know Extension even existed until last year, and I thought it was mostly agriculture based. So, when I saw they had environmental stuff and food stuff, I thought I'd see what that is and learned more about that, which I really enjoyed".*

Haley had limited previous knowledge of Extension, but described how the final project expanded her thinking, *"I didn't realize all the areas Extension was involved in because obviously coming from a ranch, I knew they were involved in that kind of stuff, but I didn't understand the community vitality part and all that involvement with people who aren't necessarily agriculture, you know, aren't on the farm or ranch. They're a different part of agriculture."* Megan was amazed at the depth and breadth of topics Extension educators cover. She stated, *"I didn't know everything that Extension educators do… I didn't know a lot about Extension other than 4-H... But, I learned a lot that there are a lot of events you can go to, and they sponsor a lot of stuff, and they're really involved on campus, and I just didn't know enough about Extension that now I know."*

Engaging students in science communication skill building, as well as expanding knowledge of agricultural and environmental programs, services, and groups is crucial. It is imperative for developing 21st century agricultural and environmental science communication professionals to be able to engage with subject matter experts such as scientists and Extension educators to deliver content through multimedia such as, in the case of this study, photo essays for online audiences. The PjBL instructional approach appeared to be successful for fostering this type of meaningful skill-based and contextual learning.

Theme Three: Hands-On vs. Information Consumption Approaches for Mobile Technology Adoption

This theme addressed RQ 3, how students went about learning and using the mobile video application

Videolicious to edit the photo essay project. Students reportedly used a mixture of individual approaches to learn the app, including a direct approach where they jumped in and began pushing buttons (hands-on approach), and a more indirect approach such as taking time to watch online training videos provided by the app developer (information consumption approach). During class time, the instructor also provided demonstrations and tips for using the app.

Megan reported taking a hands-on approach to learning the app and did not use in-app or online training tutorials. She explained her use of a hands-on strategy: *"I guess the fact that it was so simple. It didn't have complex things, like the shifting of the picture. I couldn't figure out how to make it not do that."* This statement illustrates her view of the app as easy to use but contrarily noted her difficulty in not being able to turn off a particular effect she did not want to use. Clearly, some of the app's features were not obvious to students and were not easily located using this direct, "jump-in, hands-on approach" for implementation.

Haley and Christina also used a direct approach to use the new tool, yet reported struggles with figuring out the workflow of recording narration and editing sound bites in chunks to make the photo essay easier to edit, rather than recording narration all in one take. Christina described, *"I wish I would be able to take apart soundbites because that would be easier for me. I could mess up and just delete the parts that I messed up and just move on from there."* Haley said: *"I like it when apps have buttons that do specific things, whereas in Videolicious, you can do a lot of these things, but it's not necessarily on the app - like the video clips, you wouldn't know you can just import clips into there. If there was a specific button, or if it went through it a little more when you opened the app."* Videolicious did indeed have the ability to break clips into smaller sound bites, contrary to Haley and Cristina's statements, but students reported being unable to perform these tasks using their hands-on strategy of applying the app to their final projects. This hands-on, dive-in method to learning the app is a somewhat aggressive approach for employing a new tool and can result in misunderstanding or misusing the app's features. From these reports, it appeared students expected the app to perform the tasks they wanted immediately and meet their project needs without their having to invest much initial time in learning the app's functions and capabilities.

Other participants reported taking a more informed approach to learning how to use Videolicious. Lucy explained: *"I watched tutorials and stuff, and it [the app] definitely has more features than I thought it did, after looking at all the tutorial videos. And I didn't realize that in Videolicious you could cut off some of your video right into the app. That's kind of nice because I thought I was going to have to do that separately and then upload it. So things like that, it was definitely better than I thought it was."* Once Christina realized she was struggling to learn how to use the app through her original button-pushing approach, she made time to review the tutorials. She said, *"I know a lot of people had problems with it and stuff, but I really like it because if you watched the videos, it was easy to use. I really liked it for the final project because I went through my iPad and recorded each chunk that I had, and I could just bring it in and just watch it."* Jared reflected that while Videolicious may not have been as advanced as he would have liked, it is important to be open to learning new technologies, as communication tools are constantly changing. He said, *"I think it's extremely important for students like myself and others in the program to be able to learn things on the fly and not be afraid to say no to projects."*

Students who reported an information consumption approach to learning the app by studying tutorials to learn workflow nuances, interface, and features of Videolicious appeared more successful and satisfied with their final photo essays. Those who focused on the direct, pushing buttons within the app approach reported being more unsatisfied with the tool and believed its functionality was limited. This finding highlights a growing need for instructors to guide students to an understanding of technology adoption and active implementation strategies for effectively using new technologies for communications product development.

Theme Four: Learner Final Project Critique and Satisfaction

In response to the final question, RQ 4, regarding students' perceptions of their final projects, students expressed a mixture of self and project criticisms, yet discussed a sense of satisfaction and accomplishment with their learning and work overall. Upon reflection, most students identified specific details of the photos essays they would have improved having known what they knew by the end of the course, as well as their personal performance throughout the semester. For instance, Lucy focused noted about her experience *"The only thing I would have changed was maybe just thinking about it more throughout the semester, that's been my biggest stressor was not getting on my proposal [planning her final project] in the beginning of the semester."* In a critique of her final project, Haley expressed being pleased with her work overall but was particularly critical of her narration: *"I really like the pictures that I took. I like how they turned out, and I think they're a great representation of where I come from and that area and what not. What I don't like is that I don't have much experience with video, and I don't like how my voice sounds. So, I don't like recording my voice and listening to it."* Megan described concerns about the quality of her photos aligning with her content. She said, *"I'm worried I used stills for too long of a time and then, I used others for a short amount of time."* Megan's worry demonstrated she ultimately developed an understanding of timing and pacing in digital storytelling.

The PjBL process appeared to help some students shift from uncertainty to a sense of confidence and accomplishment. Alexandra described her concerns:

"I was very worried about how to start [the photo essay], how to wrap it up, and so, going with the approach of introducing Extension and wrapping up with Extension. I kind of liked that. So, I don't know, I was kind of impressed with myself because I didn't think I would be able to do it." While Alexandra felt insecure about her photo production process and initially lacked confidence in her ability, she arrived at a photo essay that she was proud of and that demonstrated she does have the knowledge and skills to create a finished project.

Per the PjBL design of the course, students presented final photo essays before an audience of university administrators, professors, Extension, and communication professionals. Jared noted about the experience, *"I enjoyed being able to make a final presentation and interacting with people who are actually doing things now and making connections I think are very important."* Students expressed some nervousness about sharing their work publicly, but the presentations appeared to increase students' overall satisfaction with their work and help them clearly see their projects connected to real-world contexts, stakeholders, and potential mentors.

Discussion and Implications

This research is an initial step in exploring PjBL for undergraduate agricultural and environmental sciences communication programs. Results from this investigation indicated PjBL is an effective approach for engaging students to explore real-world contexts such as Extension, and it allows students to take control of their learning for deeper understanding of agricultural and environmental issues, communication and digital skills development, and development of projects for real-world audiences.

Results indicated tension and instructional challenges existed for facilitating this PjBL course. Some students were successful and thrived on having the freedom of voice and choice (Larmer and Mergendoller, 2015) in their learning. Contrastingly, other students struggled to identify topics and establish contacts with Extension educators. To more effectively balance learner voice and choice element of PjBL, a need exists to scaffold learning in the course more clearly so learners are not overwhelmed by working through real-world constraints. For instance, one course assignment required students to develop and submit a photo essay treatment (a large production document defining target audience, key messages, topic research, images needed, interview questions, etc.) and project timeline for planning their photo essays by the mid-point of the semester. It might be more effective to scaffold the assignment into less daunting chunks, such as: assignment one - topic and subject matter expert research, assignment two - interview question and photo list development, and assignment three - photo essay rough script and timeline development. Bell (2010) stated learners should set timelines, agendas, and goals for their learning in PjBL. So, in addition to scaffolding photo essay development assignments, it may be beneficial to incorporate content related to goal setting, so students are able to take greater ownership of their learning by establishing measurable and achievable goals for managing their time, allowing them to successfully complete each step of the final photo essay project.

This study also supported prior findings from Loizzo and Lillard (2015) where Extension was shown as an effective context for PjBL science communication and helped learners describe having expanded their views of Extension to include more than 4-H programs (Loizzo and Lillard, 2015). Learner engagement with Extension topics and educators increased the awareness of learners' who had no prior connection to Extension. It also broadened participants' understanding of Extension programming and educators' duties. Extension is an ideal context for PjBL, as it gives science communication students the opportunity to learn about and communicate agricultural and environmental research from a land grant university to public audiences, much like Extension professionals do in their daily work.

In the present study, most participants described struggling to learn to effectively use the mobile video application. Most jumped directly into button-pushing within the app, while only two students mentioned taking the more time-intensive but ultimately more useful strategy of watching the instructional tutorials to help learn to use the technology. It appears from these results it may be beneficial to incorporate specific lessons and discussion in future PjBL courses employing new technologies where there are direct explanations of strategies for learning new technologies. For example, an opportunity exists for PjBL instructors to openly discuss and define digital literacy, multi-platform communication convergence, and outline steps for new technology adoption and implementation. An excellent way to do this is to introduce Roger's (2010) Diffusion of Innovation model to students to illustrate how adoption of new technologies create barriers and opportunities for professional communicators. High expectations exist for agricultural and science communication graduates to become professionals who are able to innovate, exhibit early adopter characteristics, and quickly learn and implement new technologies ahead of the societal diffusion curve.

Limitations and Future Research

This study's main limitation included a small voluntary sample size of six student participants from the identified digital photography course. In efforts to address this, researchers collected student reflection journal entries and final projects as course artifacts to accompany participant interviews and observations to obtain rich data about each learner's experience required by qualitative methodology. Another limitation was having the lead researcher also serve as the course instructor and interviewer. Qualitative research often involves researchers functioning as outsiders or insiders in the research situation, and in this case, the

researcher functioned an insider. To minimize potential for researcher bias, all three members of the research team conducted open and axial coding of data and arrived at agreed-upon emergent themes ensuring the results presented were not solely a result of the lead researcher's lens.

Recommendations for future research include examining a PjBL approach across multiple courses in the curriculum with additional real-world project contexts such as developing videos and podcasts with agricultural and natural resource scientists about critical issues impacting the public. The authors of this study have begun developing a series of PjBL courses through which students contribute photo essays, videos, and podcasts to an overarching real-world project Streaming Science (https://streamingscience.com/), designed to be used by middle and high schools, after school, and Extension programs to increase science literacy. A need also exists to better define digital literacy competencies and standards across agricultural and environmental sciences communication curricula to aid undergraduates developing skills for successful careers in the technology-rich, constantly evolving field of science communication.

Literature Cited

Bali, M. Knowing the difference between digital skills and digital literacies, and teaching both. https://www.literacyworldwide.org/blog/literacy-daily/2016/02/03/knowing-the-difference-between-digital-skills-and-digital-literacies-and-teaching-both. International Literacy Association Blog. February 3, 2016.

Bell, S. 2010. Project-based learning for the 21st century: Skills for the future. The Clearing House 83(2): 39-43.

Brundiers, K., and A. Wiek. 2013. Do we teach what we preach? An international comparison of problem- and project-based learning courses in sustainability. Sustainability 5: 1725-1746. DOI: 10.3390/su5041725.

Buck Institute for Education. 2016. What is project-based learning? http://bie.org/about/what_pbl.

Capraro, R. and S.W. Slough. 2013. Why PBL? Why STEM? Why now? An introduction to STEM project-based learning: An integrated science, technology, engineering, and mathematics (STEM) approach. In: R.M. Capraro and S.W. Slough (eds.) Project based learning: An integrated science technology engineering and mathematics (STEM) approach: 1-6.

Crawford, P., S. Lang, W. Fink, R. Dalton and L. Fielitz. 2011. Comparative analysis of soft skills: What is important for new graduates? www.aplu.org/document.doc?id=3414. Washington, D.C.: Association of Public and Land Grant Universities.

Drape, T., D. Westfall-Rudd, J. Guthrie and P. Mykerzei. 2013. Technology integration in an agriculture associate degree program: A case study guided by Rogers' diffusion of innovation. NACTA Journal 57(1): 24-35.

Edgar, L.D., D.M. Johnson and C. Cox. 2012. A 10-year assessment of information and communication technology tasks required in undergraduate agriculture courses. Computers and Education 59(2): 741-749. DOI: 10.1016/j.compedu.2012.03.008.

Eshet-Alkalai, Y. 2004. Digital literacy: A conceptual framework for survival skills in the digital era. Journal of Educational Multimedia and Hypermedia 13(1): 93-106.

Hesse-Biber, S.N. 2017. The practice of qualitative research. 3rd ed. Thousand Oaks, CA: Sage Publications.

Ibrus, I. 2016. Web and mobile convergence. Convergence: The Journal of Research into New Media Technologies 22(2): 147-161. DOI: 10.1177/1354856514545708.

Irani, T.A. and D.L. Doerfert. 2013. Preparing for the next 150 years of agricultural communications. Journal of Applied Communications 97(2): 6-13.

International Society for Technology in Education. 2007. ISTE standards for students. https://www.iste.org/standards/standards/for-students-2016.

Kurtzo, F., M.J. Hansen, K.J. Rucker and L.D. Edgar. 2016. Agricultural communications: Perspectives from the experts. http://journalofappliedcommunications.org/images/stories/issues/2016/jac_v100_n1_article2.pdf. Journal of Applied Communications 100(1).

Larmer, J. and J.R. Mergendoller. 2015. Gold standard PBL: Essential project design elements. http://bie.org/blog/gold_standard_pbl_essential_project_design_elements.

Lincoln, Y.S. and E.G. Guba. 1985. Naturalistic inquiry. Newbury Park, CA: Sage Publications.

Loizzo, J., A. Borron, A. Gee and P.A. Ertmer. 2016. Teaching convergence in 21st century undergraduate agricultural communication: A pilot study of backpack multimedia kits in a blended, project-based learning course. Journal of Applied Communication 100(2): 100-118.

Loizzo, J. and P. Lillard. 2015. In the field: Increasing undergraduates' awareness of Extension through a project-based multimedia course. http://www.joe.org/joe/2015february/rb3.php. Journal of Extension 53(1).

Mills, J.E. and D.F. Treagust. 2003. Engineering education – Is problem-based or project-based learning the answer? http:www.aaee.com.au/journal/2003/mills_treagust03.pdf. Australasian Journal of Engineering Education 2003-3004.

National Institute for Food and Agriculture, U.S. Department of Agriculture. n.d. Extension. https://nifa.usda.gov.

Ng, W. 2012. Can we teach digital natives digital literacy? Computers and Education 59(3): 1065-1078. DOI: 10.1016/j.compedu.2012.04.016.

Rocca, S. 2010. Determining the professional development needs of faculty in a college of agriculture. NACTA Journal 54(1): 69-75.

Rogers, E.M. 2010. Diffusion of innovations. 5th ed. New York, NY: Simon and Schuster.

Saldaña, J. 2016. The coding manual for qualitative researchers. 3rd ed. Thousand Oaks, CA: Sage Publications.

Stefanu, C., J.D. Stolk, M. Prince, J.C. Chen and S.M. Lord. 2013. Self-regulation and autonomy in problem- and project-based learning environments. Active Learning in Higher Education 14(2): 109-122. DOI: 10.1177/1469787413481132.

Svinicki, M.D. and D.L. Schallert. 2014. Learning through group work in the college classroom: Evaluating the evidence from an instructional goal perspective. In: M. B. Paulsen (ed.) Higher Education: Handbook of Theory and Research 31: 513-558. Switzerland: Springer International Publishing. DOI: 10.1007/978-3-319-26829-3_10.

Thomas, J.W. 2000. A review of research on project-based learning. http://www.autodesk.com/foundation.

Verran, J. 1992. A student-centered learning project: The production of leaflets for 'live' clients. Journal of Biological Education 26(2): 135-138.

Wirtz, B.W. 1999. Convergence processes, value constellations and integration strategies in the multimedia business. International Journal on Media Management 1(1): 14-22.

Investigating Agricultural Communications Students' Educational Experiences and Identity Development at a Co-Curricular Activity

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Abstract

The purpose of this qualitative content analysis was to explore agricultural communications students' educational experiences and identity development at a co-curricular activity. We analyzed reflection data using a qualitative content analysis. We conducted an analytic induction with Chickering and Reisser's (1993) theory of education and identity serving as an analysis framework. Their theory outlined seven vectors of students' psychosocial development supported by environmental influences (e.g., co-curricular activities). Although the conference facilitated development in all seven vectors, students' development more closely aligned with developing competence, developing mature interpersonal relationships, and developing purpose. Attending the National Agricultural Communicators of Tomorrow (NACT) Professional Development Conference (PDC) facilitated students' movement toward becoming career-ready graduates as they sought to gain networks, define their purpose and goals, and explore interests and opportunities. They used their PDC experience to connect their coursework, personal values, and sense-of-self—initiating development of their professional identity. PDC was an example of an educationally-sound environment, which included structured and unstructured learning opportunities designed to promote students' networking and skill development and prepare them for the workforce. Further research needs to be conducted to determine if students' participation in professional development activities impacts their career success and achievement in the workforce.

Keywords: professional development, psychosocial development, ACT

Introduction

The U.S. labor force is expected to reach 167 million by 2018 (Bureau of Labor Statistics, 2013) as a result of the growing population and influx of millennials. The 46 million Americans classified as millennials "are predicted to be the next great generation" (Pardue and Morgan, 2008, p. 74). They are confident, conventional, team-oriented (Howe and Strauss, 2000), optimistic, accustomed to structure, and accepting of authority (Johnson and Romanello, 2005). Yet, even with successful workplace characteristics, college instructors and employers negatively stereotype the millennial generation (McLester and McIntire, 2006). For example, Eckleberry-Hunt and Tucciarone (2011) noted college instructors labeled millennials as lazy and selfish, wanting a career and work life that fits their personal schedule, while lacking work ethic and self-motivation in the classroom. Further, employers noted millennials entering the workforce lack career readiness and professionalism (McLester and McIntire, 2006).

Career readiness and professionalism "seem[s] to be intertwined" with identity development (Lairio et al., 2013, p. 116) and can be enhanced through outcomes-based instruction, focusing on the big picture and demonstration of knowledge (McNeir, 1993). At the center of outcomes-based instruction is the application of soft skills (McNeir, 1993), a characteristic employers seek when hiring entry-level employees (McLester and McIntire, 2006). Thus, focusing more on hands-on experiences and the application of skills in real-world settings would more effectively prepare graduates to meet employers' expectations (Hart, 2007).

Outcomes-based instruction is ever-present in agricultural communications. Instructors use outcomes-

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based instruction to unite theory with application when "prepar[ing] students to effectively enter the workforce" (Doerfert and Miller, 2006, p. 28). Doerfert and Miller (2006) argued instructors should consider the changing communication needs of the industry stakeholders, the increase of scrutiny in the agricultural industry, and the decrease in response time allocated for communication-related activities. From a different perspective, freshmen agricultural communications students sought theory and application-based courses as part of their curriculum. Teamwork, communication, conflict resolution, and writing topped the list of skills they saw as important to their course portfolios, which could be more fully developed with learning opportunities outside of the classroom (Watson and Robertson, 2011).

A component of outcomes-based education is professional development— *"facilitated teaching and learning experiences that are transactional and designed to support the acquisition of professional knowledge, skills, and dispositions as well as the application of this knowledge in practice"* (National Professional Development Center on Inclusion, 2008, p. 3). Employers seek graduates who have engaged in professional development activities (Hart, 2007) because such opportunities help students see skills in action and make connections to the real world. Carraway and Burris (2016) noted that professional development workshops should "engage students in learning" and "assess student knowledge" (p. 31). As an example, agricultural communications students can engage in professional development activities by attending academic career fairs, completing internships, and participating in student organizations. In a 2000 study, Sagen et al. found a positive relationship between involvement in professional development and employment success. In a Gault et al. (2000) study, students were more likely to have higher starting salaries and secure jobs after college if they participated in at least one internship. Professional development is a large component of undergraduate curriculum, so much so that student development theorists (e.g., Chickering and Reisser, 1969, 1993; Erikson, 1968; Perry, 1970) have included such co-curricular activities in their understanding of students' psychosocial development.

Theoretical Framework

"Where do I fit?" and "What is my purpose?" are questions plaguing college students (Branand et al., 2015). The essence of college student development is students' ability to undergo different experiences, learn from the results, and positively act on them (Sanford, 1968). Theorists (e.g., Astin, 1984, 1993; Bilodeau and Renn, 2005; Chickering and Reisser, 1969, 1993; Erikson, 1968; Perry, 1970; Zambrana and Dill, 2009) have studied college student development throughout decades and have noted the significance of a college education on students' psychosocial development. Psychosocial development, as defined by Brown (2004), is the *"what (content) of development and refers to the issues, tasks, and events that occur throughout the life span, the given pattern or resolution of these issues and tasks, and the adaptation to these events"* (p. 143).

Chickering and Reisser (1993), authors of Education and Identity studied students' psychosocial development as seven vectors aiding in "the discovery and refinement of one's unique way of being" (p. 35). The environment influences the vectors— (1) developing competence, (2) managing emotions, (3) moving through autonomy toward interdependence, (4) developing mature interpersonal relationships, (5) establishing identity, (6) developing purpose, and (7) developing integrity—that span several aspects of development (Evans et al., 2010). The environmental influences cause students to experience the vectors at various stages of their development (Chickering and Reisser, 1993; Evans et al., 2010).

Developing Competence

Developing competence, in the context of psychosocial development, is tri-modal—intellectual, physical and manual, and interpersonal (Chickering and Reisser, 1993)—and is "essential to the possession of purpose" (Green, 1981, p. 544). Students demonstrate intellectual competence as they acquire "a repertoire of skills to comprehend, analyze, and synthesize [information]" (Chickering and Reisser, 1993, p. 45), develop physical and manual skills through "artistic and manual activities" (Evans et al., 2010, p. 67), and establish interpersonal competence through communication and interaction (Chickering and Reisser, 1993). Students' competence depends on public recognition of their skills, feedback from their influencers (Green, 1981), and confidence in their abilities (Chickering and Reisser, 1993), all of which are enhanced through continuous reflection (Scott et al., 2015). Confident students are more likely to have a "strong[er] sense of competence" than students who are not confident (Coombs, 2013, p. 2). Yet, competence is more than being good at something—it is also *"one way of determining the kinds of persons we are and, therefore, the kinds of purposes we may adopt"* (Green, 1981, p. 545).

Managing Emotions

The college environment forces students to manage and process emotions— positive and negative— accompanying life's challenges and successes (Chickering and Reisser, 1993). Students moving through vector two learn to acknowledge, accept, and respond to positive and negative emotions alike (Evans et al., 2010). The managing emotions continuum begins with "little control over disruptive emotions" and continues to "flexible control and appropriate expressions" of emotions (Coombs, 2013, p. 2). While students move along this continuum, they become more aware and accepting of their emotions and develop the "ability to integrate feelings with responsible action" (p. 2). An emotionally intelligent individual has the *"ability to monitor one's own and others' emotions, to discriminate among them, and to use the information to guide one's thinking and actions"*

(Mayer and Salovey, 1993, p. 433). Learning to properly embrace emotions will ultimately aid in students' overall identity development (Chickering and Reisser, 1993).

Moving Through Autonomy Toward Interdependence

In college, students move through autonomy—*"developing self-sufficiency, taking responsibility for one's personal goals, and being less swayed by the opinions of others"*—toward *"interdependent relationship[s] between equal partners"* (Foubert et al., 2005, p. 463). Students who show development of interdependence have moved past emotional dependence and gained "freedom from continual and pressing needs for reassurance" (Coombs, 2013, p. 2). An interdependent student has established a "balance between serving the needs of the self and depending upon others" (Foubert et al., 2005, p. 463). Development in vector three requires students to experience emotional and instrumental independence (Chickering and Reisser, 1993), which is evident through students' aptitude to solve problems with "inner direction, persistence, and mobility" (Coombs, 2013, p. 2). An essential component of becoming interdependent is recognizing and accepting its role in the development of identity (Coombs, 2013). Learning to be interdependent involves *"learning to get from one place to another without having to be taken by the hand or given detailed directions, and to find the information or resources required to fulfill personal needs and desires"* (Chickering and Reisser, 1993, p. 47). Fluid movement through the vector signifies students' self-sufficiency, responsibility, and confidence without the influence of others (Chickering and Reisser, 1993).

Developing Mature Interpersonal Relationships

The development of healthy and unhealthy relationships significantly impacts students' identity achievement (Chickering and Reisser, 1993; Erikson, 1968; Muuss, 1996). Relationships fostering deep connections are extremely crucial to one's development of their sense-of-self (Evans et al., 2010), and students often use professional conferences to network and develop relationships with others (Arnold et al., 2011). Interpersonal loyalties evolve as a part of self-authorship, which is an instrumental college achievement (Kegan, 1994; King and Baxter Magolda, 2005). For example, one student in a Robinson and Glanzer (2016) study noted *"the relationships and the experiences you have in college determine what you want and don't want to happen again. And you try to draw your life around that"* (p. 5). Early in the meaning-making process, students "defer … to others in relationships" (Baxter Magolda et al., 2008, p. 18) because they lack the ability to internally understand relationships. Students experience mature interpersonal relationships they accept others, respect and appreciate their differences, and ignore stereotypes (Chickering and Reisser, 1993).

Establishing Identity

Development of identity depends on one's sense of self—a person's self-concept, self-confidence, self-esteem, and stability (Chickering and Reisser, 1993)—and one's ability to take responsibility for his or her thoughts and actions. Socially constructed, identity is *"one's personally held beliefs about the self in relation to social groups (e.g., race, ethnicity, religion, sexual orientation) and the ways one expresses that relationship"* (Daniels and Brooker, 2014, p. 577). Students' sense of identity is a major academic outcome (Astin, 1993; Benjamin and Hollings, 1997) and is shaped, modified, and adapted throughout the undergraduate experience (Daniels and Brooker, 2014). For example, sense of identity is positively correlated with GPA (Lounsbury et al., 2005a) and life and college experience satisfaction (Lounsbury et al., 2005b) but negatively correlated with students' desire to withdraw from college (Lounsbury et al., 2004). Thorough reflection and confidence enhances students' ability to be open and honest with themselves and others about their personal identity, leading to *"clarity and stability and a feeling of warmth for this core self as capable, familiar, [and] worthwhile"* (Chickering and Reisser, 1993, p. 50).

Developing Purpose

Students seek life's purpose (Hodges and Denig, 2014), and they use college to develop purpose related to "avocational recreational interests, style of life, and vocational interests" (Coombs, 2013, p. 75). Higher education is designed to facilitate career readiness and professionalism, but students often overlook the significance of life skills gained and the importance of college in their quest to become lifelong learners (Chickering and Reisser, 1993). College *"enables students to become practitioners with a sense of self and purpose both as members of a given community and as global citizens"* (Trede and McEwen, 2012, p. 27). Foubert et al. (2005), in their longitudinal study, found students showed significant development of purpose during their freshman year even though developing purpose was an important component throughout their college experience. College offers students a variety of ways to develop purpose. Some students use college to gain networks, define their purpose and goals, and explore interests and opportunities (Coombs, 2013). Students who develop purpose have the ability to be intentional in seeking career options, clarify goals, commit to achieving career and personal goals, and be conscious of their actions throughout the process (Chickering and Reisser, 1993).

Developing Integrity

Chickering and Reisser (1993) believed students develop integrity as their values become congruent with society's values and they seek responsibility for themselves and others. Shivpuri and Kim (2004) identified integrity as a top performance dimension employers seek when hiring new graduates. Establishing a sense

of integrity is an important component of self-awareness (Komives et al., 2005). The demonstration of developing integrity may be as simple as understanding core concepts within a discipline or making the right decision when faced with moral issues (Daniels and Brooker, 2014). But, as students get closer to graduation and move along the continuum of developing integrity, their values and integrity decisions will be more aligned with learning outcomes and successful "graduate attributes" (Daniels and Brooker, 2014, p. 73). In a humanized value system, students must move past dualistic thinking and rigid beliefs and become more congruent and authentic (Chickering and Reisser, 1993; Evans et al., 2010). Development in vector seven results from students' development of congruence, in which their *"values and actions become congruent and authentic as self-interest is balanced by a sense of social responsibility"* (Evans et al., 2010, p. 69).

Instrumental to students' fluid movement through the seven vectors is the educational environment (Evans et al., 2010), "a system or a totality of interacting parts" (Chickering and Reisser, 1993, p. 279). An educationally sound environment encompasses co-curricular activities (Chickering and Reisser, 1993), which are the activities extending beyond the degree being pursued (Andrews, 2013). Students engaging in co-curricular activities, such as professional development, have the resources for lifelong learning (Chickering and Reisser, 1993).

Purpose and Research Questions

This qualitative study used Chickering and Reisser's theory of education and identity (1993) to explore agricultural communications students' educational experiences and identity development at the 2015 National Agricultural Communicators of Tomorrow (NACT) Professional Development Conference (PDC).

Three research questions guided this study:

1. How did students begin to develop purpose to become career-ready graduates?
2. How did students begin to develop their professional identities?
3. How did students make meaning of their experience?

Context of Study

NACT is a "leading collegiate organization" designed to provide agricultural communications students with "professional growth opportunities and educational programs" extending beyond the classroom setting (NACT, 2015, para. 1). As such, NACT hosts nationwide events throughout the year to provide its members with networking and skill development opportunities (NACT, 2015). Because knowledge and skills gained through hands-on experiences are equally, if not more, important than knowledge gained in the classroom (Hart, 2007), students participating in ACT activities may be more career-ready than students who have not participated in professional development activities.

The Texas A&M University ACT Chapter is an extension of NACT, has between 50 and 70 members each year, and seeks to *"build relationships among agricultural communication professionals, college students and faculty; to provide professional and academic development for members; and to promote agriculture through communication efforts"* (Texas A&M University, 2015, para. 2). Students pay dues to the local and national organization to have the opportunity to participate in local, regional, and national professional development conferences, fundraisers and internships. Therefore, to attend national events, students must be registered members of the local and national chapter. As registered members, students receive scholarships to offset costs for attending professional development conferences, such as PDC.

The 2015 PDC, "Make mAGic happen!" was hosted by the University of Florida in Orlando, Florida. The conference activities ranged from "Speed Dating with Professionals" to group games facilitating interaction between students to tours showcasing Florida agriculture. Throughout the activities, students networked with agricultural communications industry leaders and participated in hands-on experiences (tours of an alligator farm, strawberry farm, nursery, winery, and citrus processing plant). In addition, students attended the business meeting and three 45-minute professional development sessions. These activities facilitated students' development of skill and professional identity and laid the foundation for networking and developing connections with professionals.

Method

Qualitative research methodologies rely on the researcher as the human instrument used to explore phenomena (Lindolf and Taylor, 2011). The effectiveness of qualitative analysis largely depends on the "human factor" defined by Patton (2002) as *"the great strength and the fundamental weakness of qualitative inquiry and analysis—a scientific two-edged sword"* (p. 276). Researchers conduct qualitative research studies to understand human experience because such lived experiences can only be provided by participants within a specific context of reality (Bradley, 1993). Thus, we chose qualitative research paradigms to explore Texas A&M University's students' experiences and development at the 2015 NACT PDC, a co-curricular activity. The Texas A&M University Institutional Review Board approved the study protocol.

Population

The population for this study included undergraduate and graduate students who attended the 2015 PDC (N=19). All students were active members of the Texas A&M University ACT Chapter. Most students were females (n=17) studying agricultural communications and journalism. Of the 19, 17 were undergraduate students (two freshmen, six juniors, and nine seniors) and two were graduate students. The participants were

diverse in the sense that they represented a large agricultural communications program and ACT Chapter. All the students had participated in at least two professional development activities before attending PDC. Many of them did not grow up in the agricultural industry and, prior to the conference, had not been exposed to agricultural commodities and practices beyond Texas. Furthermore, many students were not seeking jobs within the agricultural industry before attending PDC.

Procedures

We investigated students' experiences and development using preflection and reflection exercises. The week before attending the conference, students completed a preflection exercise in Qualtrics. The questionnaire included open-ended questions that related to the students' professional development experience before the conference and their expectations of the conference. For example, we asked students about their learning objectives for the experience, how they intended to connect the experience to their academic coursework, the challenges they expected to face, and the skills they planned to use at the conference. When students returned from the conference, they completed a reflection exercise in Qualtrics. The questionnaire included open-ended questions related to students' experience and development at PDC and were developed based on Gavigan (2010). For example, we asked the students if they accomplished their learning objectives, what activities connected to their academic coursework, what activities challenged their views of diversity, what challenges they faced, how they handled the challenges, if they connected with individuals from other institutions, and how they plan to maintain their skills.

Students' responses to the preflection and reflection exercises served as this study's data. Prior to data analysis, we downloaded the students' responses from Qualtrics and removed their identifying information. After removing identifying information from students' responses, we randomly assigned each participant a number (01 to 19). Using an Excel spreadsheet (one for the preflection data and one for the reflection data), we divided students' responses to the open-ended questions into units. Each unit consisted of two sentences. For the analysis, we numbered each unit consecutively (01 to 25) depending on the number of units per student (Merriam, 2009). In addition, we assigned the preflection responses a code of 01 and the reflection responses a code of 02. For example, 01.01.01 represented the first unit (two sentences) of student one's preflection response. For the reporting, we noted the exemplars in the narrative with the student number (01 to 19) and the preflection and reflection response number (pre (01) and post (02) data). Therefore, an exemplar from the reflection of student eight would be noted as 08.02.

We analyzed the reflection exercises using a qualitative content analysis—an indirect way to study students' behavior (Fraenkel et al., p. 405), an unobtrusive way to make "inferences by systematically and objectively identifying special characteristics of messages" (Holsti, 1968, p. 68), and a way to understand an author's perspectives (Berg, 2001). Using a content analysis, we made sense of and reduced the data into "core consistencies and meanings" (Patton, 2002, p. 453). Documents, such as students' reflection exercises in this study, must be interpreted within the context, which Hodder (1994) labeled as contextualized interpretation.

The content analysis occurred in two stages using analytic induction— *"generating and proving an integrated, limited, precise, universally applicable theory of causes accounting for a specific phenomenon"* (Glaser, 1965, p. 438). A priori we identified the seven vectors of Chickering and Reisser (1993) as the themes for data analysis because we wanted to identify students' educational experiences and identity development through the lens of a well-known theory. During the first stage, we (two faculty members and one masters' student in agricultural communications) met as a group and read the units of analysis to interpret and analyze the data using the seven vectors of Chickering and Reisser's (1993) theory of education and identity development. Second, we met in a follow-up meeting to review the analyzed data and to ensure we interpreted the data accurately and according to each vector. If the data did not align with the original vector, we reanalyzed the data and assigned it to a more accurate vector. We removed 54 (n01=23; n02=31) units of data after analysis. We removed 34 units because they consisted of single words or phrases that we could not interpret within the context or categorize by Chickering and Reisser's (1993) vectors. Additionally, we removed 20 units because two questions in the preflection exercise asked students to document specific events or activities that they had participated in as professional development experiences. Therefore, theirs answers to these questions could not be analyzed in the context of Chickering and Reisser (1993). Selected quotes from the exercises provided the framework narrative.

Lincoln and Guba (1985) noted trustworthiness—established through credibility, transferability, dependability, and confirmability—is important when analyzing qualitative data. Credibility, assurance findings are reality, was achieved through a reflexive journal (Merriam, 2009). Dependability, certainty that results and data are consistent, was achieved through data triangulation using Chickering and Reisser's (1993) theory, circulation of peer debriefing memos amongst the research team, and documentation of analysis trail, which served as the interpretive framework (Merriam, 2009). Transferability, or applicability beyond the research setting, was achieved through thick description of the research results. Last, confirmability, assurance of objectivity, was established through reflexive journals, triangulation, and peer debriefing memos (Merriam, 2009).

Findings

Data illustrated that the 19 students who participated in this study experienced psychosocial development in

Table 1. Frequency of Responses (N = 353) by Vector and Reflection

Vector	Preflection (n = 122)	Reflection (n = 231)
Developing competence	25	52
Managing emotions	13	18
Moving through autonomy toward interdependence	15	15
Developing mature interpersonal relationships	19	44
Establishing identity	7	25
Developing purpose	43	68
Developing integrity	0	9

all seven vectors while participating in the 2015 NACT PDC, which was evident in 353 units of data (Table 1). Much of the 19 students' development aligned more closely with developing purpose, developing mature interpersonal relationships, and developing competence as their experiences strengthened their networks, helped them clarify goals, and prepared them to be more effective agricultural communicators. As noted in the method section, we noted the exemplars in the narrative with the student number (01 to 19) and the preflection and reflection response number (pre (01) and post (02) data). Therefore, an exemplar from the reflection of student eight would be noted as 08.02.

PDC provided students with "a real-world outlet and motivation to learn" about agricultural communications, thereby, helping them make connections to their coursework (02.01; 14.02). Through interactions with the industry leaders, one student confirmed what she had "been taught in the classroom or read in the literature" and believed she was more prepared to enter the workforce after the conference (09.02).

Developing Purpose at a Professional Development Conference

How did students begin to develop purpose to become career-ready graduates? As students moved through vector six, developing purpose, they developed professional identity because they were intentional about selecting activities to further their career goals. One student "enter[ed] each session with an open mind and a desire to gain something" (15.01). Being open minded helped other students "become familiar with the different jobs available" and gain a glimpse into future career options (10.01; 14.01). Through the "abundant" networking opportunities offered at PDC, students "develop[ed] a network" of individuals with similar interests and practiced their networking skills (16.01; 17.01). Students also expressed commitment to networking and professional development by seeking professionals' advice and implementing their advice immediately (15.01).

An important aspect of developing purpose is clarifying goals and understanding career interests (Chickering and Reisser, 1993; Coombs, 2013). Central to the experience was the opportunity to "have a better understanding" of career and workforce preparation (18.01). Prior to attending the conference, some students found themselves unaware of the many career options but realized networking prior to graduation was as important as becoming familiar with the industry and its practices (14.01). However, because of the conference, one student planned to broaden skill sets and seek out diverse career options (09.02) while another gained courage to navigate the job-hunting process and secure a full-time position focused on specific career interests (04.02). The career preparation activities and networking opportunities impacted students' future career choices and strengthened their career endeavors (06.02; 14.02). Interacting with industry professionals helped one student understand her career options and gave another confidence to stick with her plan and move forward in her college career (10.02; 14.02).

Developing Professional Identities at a Professional Development Conference

How did students begin to develop their professional identities? Making connections facilitated students' professional identity development and forced them realize what it takes to be a professional (04.02). As a result of PDC, students began connecting coursework to the conference activities to reach interdependence in their academic careers (03.01; 04.02). One student noted flexibility and adaptability simplified learning to become interdependent (03.01).

Developing self-sufficiency is the core value of moving through autonomy toward interdependence (Chickering and Reisser, 1993). Students sought to develop their professional identities by learning to be self-sufficient and adjusting to challenges (03.01; 09.01). Although some students struggled to communicate with others, being self-sufficient allowed them to open up and be themselves (06.02; 12.01). A characteristic of being self-sufficient is becoming comfortable with traveling and gathering resources for personal needs (Chickering and Reisser, 1993). Time management, travel preparations, early flights, and packing for a variety of weather conditions were travel challenges facilitating self-sufficiency (08.02; 09.01; 16.01). Courage, self-confidence, and preparation were the elements for overcoming challenges and enjoying the PDC experience (02.02; 09.01; 14.02; 18.02).

Developing a sense of self, an aspect of Chickering and Reisser's (1993) establishing identity, was evident during the students' experience (01.02). One student faced challenges in finding where she fit in, but other students stepped out of their "comfort zone[s]" to meet new people and internalize their sense of self (01.02; 09.01). Internalizing sense of self was apparent for one student by "paying more attention to" her behavior—body language, facial expressions, and words—when meeting new people (01.02). Meeting new people encouraged self-acceptance and inspired passion and appreciation for agricultural communications (05.02; 07.02).

Appreciation of culture further enabled students to establish identity. Prior to attending PDC, one student was unaware of the importance of agriculture beyond Texas (19.02). Agriculture "takes on many shapes and forms, and each are crucial to our nation" (17.02). Not only is agriculture different in each state, but it is also

diverse (01.02). Thus, one student attended PDC to "better understand production agriculture in other states" and obtain resources to be an effective advocate and communicator across state lines (03.01).

"Connect[ing]" agriculture to their community and personal values supported the development of integrity, the alignment of values and socially responsible behaviors (18.02; Chickering and Reisser, 1993). Students were fully engaged throughout the farm tours and believed the tours connected to their personal values "because of the honest practices used by the farmers" (10.02). The general PDC activities connected with one student's personal values of "hard work and learning from others" and forced another student to consider "unanimous" values of academic integrity expressed by academic professionals across university systems (06.02; 19.02). Therefore, students developed their professional identity by connecting their values to socially responsible behavior and placed importance on academic integrity and professionalism.

Making Meaning at a Professional Development Conference

How did students make meaning of their experience? Prior to the experience, students believed the experience would be valuable because they could improve their speaking and social networking skills (10.01; 14.01). To accomplish this, they remained engaged to gain new skills and hone old skills (10.02; 14.02; 15.02).

Participating in the farm tours was pivotal to students' development of competence and meaning making during the experience. Hands-on participation facilitated students' realization of farmers' roles in production agriculture and their contributions to the success of the industry (09.02; 14.02). For example, the farm tours prompted one student to "get the story behind production" and allowed her to witness consumers' reactions to food production and animal care (16.02). Such PDC activities "confirmed" students' prior knowledge and provided them with "practical information" (01.02; 06.02; 09.02). One student was excited about the farms tours in hopes of "bridg[ing] a gap" to his current academic coursework (16.01). After the experience, students claimed the farm tours and speaker sessions helped them connect their academics with their experience, contributing to the intellectual aspect of developing competence (09.02; 16.02; Chickering and Reisser, 1993). Looking ahead, the farmer tours encouraged one student to enroll in a "wide variety of classes" to improve skills needed to be an effective communicator (02.02).

Making meaning and appreciating the differences of others is enhanced through developing mature interpersonal relationships (Chickering and Reisser, 1993). Students attended PDC to interact with others from "all over the nation" who had similar interests, despite the difficultness and awkwardness that comes with meeting new people (09.02; 15.01). Some students were "most excited" to work with individuals they met during the conference, realizing that "making connections" provided the opportunity for fresh perspectives and expansion of knowledge (13.01; 17.01). Additionally, movement toward the development of mature interpersonal relationships challenged participants' views of diversity (19.02). "Differences" among participants at the conference were obvious, impacting students' desire to "consider others' needs" when developing relationships (03.01; 05.02). For example, participating in PDC helped one student realize how different the participants were and, yet, they shared a common interest in wanting to make a difference in the agricultural industry (01.02).

Additionally, students managed emotions to overcome challenges. For this study, managing emotions was divided into two categories: challenges faced, and emotions felt. The main challenge students faced prior to attending PDC was "talking to people," even though one student believed PDC would facilitate networking without fear (06.01; 07.01). Students planned to overcome this challenge through "confidence" and realizing uncomfortable situations can turn out to be "wonderful experience[s]" (06.01; 09.02). Even so, some students fear of "meeting and connecting" with strangers and fellow members of their local chapter persisted throughout the conference (01.02; 05.02). Letting down their guard and reaching out was how fearful students overcame this challenge (01.02). In addition to facing challenges, students felt deep emotions toward challenges. Students felt positive emotions—excitement, enjoyment, confidence, and relaxation—throughout the experience and negative emotions—nervousness, shyness, and fear—before the experience (07.01; 09.02; 15.02; 17.01; 17.02; 18.01; 19.01). Students' negative emotions felt prior to the experience were pre-conceived and assumed. However, in the end, positive emotions outweighed the negative, and students enjoyed attending PDC (01.02; 09.02). They refused to let the challenge of meeting others and negative pre-conceived emotions stop them from enjoying the experience.

Discussion

Based on the perceptions of the 19 students participating in this study, they began to develop professional identity and to become more prepared, career-ready graduates through PDC activities. As Chickering and Reisser (1993) predicted, students expressed psychosocial development in all seven vectors—developing competence, managing emotions, moving through autonomy toward interdependence, developing mature interpersonal relationships, establishing identity, developing purpose, and developing integrity. However, most of their development aligned closely with developing purpose, mature interpersonal relationships, and competence.

Although attending PDC facilitated students' movement toward becoming career-ready graduates, it is important to recognize that the conference was just one activity along a continuum of developmental activities that contributed to their professional identity. Yet, students used the experience to gain networks, define their

purpose and goals, and explore interests and opportunities, which aligns with Coombs (2013). As Chickering and Reisser (1993) noted, students used the co-curricular activity to be intentional in developing a network and seeking career options. Essentially, students built a strong network and learned about the many career options that align with their interests, which is central to their quest of finding life's purpose in their community and their world (Trede and McEwen, 2012).

Students used their PDC experience to connect their coursework, personal values, and sense-of-self—initiating development of their professional identity. Overcoming obstacles related to travel promoted students' movement toward interdependence (Chickering and Reisser, 1993) and their development of sense-of-self, self-acceptance, and mobility (Coombs, 2013). In establishing their identity, students sought to understand their beliefs about and appreciation for agriculture and ACT in relation to the larger social group (Daniels and Brooker, 2014). This appreciation was achieved first by becoming aware of their values and second by connecting them to socially responsible behavior—an aspect of developing integrity (Chickering and Reisser, 1993).

Students made meaning of their experience by participating in hands-on experiences, seeking networking opportunities, and facing challenges. Students developed interpersonal and intellectual skills through hands-on PDC activities, e.g., farm tours, which is an important aspect of developing competence (Chickering and Reisser, 1993). Because competence is instrumental in determining purpose (Green, 1981), students used hands-on experiences to confirm their purposes and understand agriculture. Furthermore, development of interpersonal skills provided students with self-confidence and allowed them to network comfortably, a key aspect of developing mature interpersonal relationships (Chickering and Reisser, 1993). Through this experience, students identified networking and developing relationships as instrumental parts of college and of co-curricular activities (Robinson and Glanzer, 2016). Throughout their experience, students continually interacted with their peers, learned to embrace diversity, managed emotions, and faced the challenges of meeting new people without fear.

Perhaps, students began to develop their professional identity at PDC and gained confidence in their communication abilities because of the educationally sound environment (Chickering and Reisser, 1993). Providing students with environments inclusive of professional development opportunities promotes psychosocial development. Doerfert and Miller (2006) noted theory- and skills-based curriculum is important when preparing career-ready graduates, which should extend into planning co-curricular activities. For example, PDC, a co-curricular activity, was an educationally sound environment that promoted psychosocial development.

Recommendations

Because this study was conducted using the perceptions of 19 students from the Texas A&M University ACT Chapter, findings are only applicable to the study population. Yet, it is important to consider how the findings could be applied to future professional development opportunities and contribute to further research. For example, academic programs in agricultural communications could begin to require students to attend a set number of professional development conferences during their program, which would be like internship requirements. This would provide students an understanding of how to navigate conferences and how to interact with others. Recognizing that funding is an issue, we recommend conference attendance becomes part of a course to allow instructors to charge a field trip fee. Doing so would allow students to pay conference expenses using their financial aid. At a local level, faculty serving as ACT advisers could include professional development opportunities throughout the semester. Such opportunities could include business and industry tours, guest speakers, career preparation workshops, and community service. Additionally, understanding why millennials attend professional development events can provide guidance for the creation of appropriate promotional materials and help host universities design sessions and workshops that engage participants.

From an industry perspective, millennials and their predecessors enter the workforce every day and continue to encourage change because of their diverse backgrounds and interests. Employers can use the findings of this study as a base to design and deliver professional development workshops that serve the purpose of the organization and engage the participants. The days of daylong sessions with a presenter and a listener are over. New graduates seek interactive, hands-on sessions that confirm their prior knowledge, provide networking opportunities, and help them gain an appreciation for culture and diversity.

Additionally, future research should include a similar study that includes a sample of students participating in PDC. The sample would include students from various cultures and backgrounds to explore the types of students who seek professional development opportunities. Also, a follow-up study with graduates who engaged in PDC, or similar ACT activities, is needed to determine if their perceptions of their experiences align with their real-world application of such experiences and if their experiences have long-lasting effects. Another follow-up study could determine their application of the experience to the workforce, which could include a longitudinal study tracking graduates periodically for several years. Little evidence was found indicating a correlation between participating in professional development activities and career success and achievement, even though Hart (2007) concluded employers seek graduates who have engaged in professional development opportunities.

Summary

Career-ready graduates who have interacted with professionals and understand the industry are important to agricultural communications. However, many professional development experiences are rooted in practice and developed based on personal experience, rather than well-documented theory that promotes changes in students' thoughts, behaviors, feelings, values, and relationships. Therefore, looking at professional development through the lens of a well-documented theory not only focuses on students' psychosocial development but also provides students with greater opportunities for career success and achievement.

Literature Cited

Andrews, M. 2013. Why our students need co-curricular, not extra-curricular, activities. http://www.theguardian.com/higher-education-network/blog/2013/jan/22/student-development-university-curriculum-design. The Guardian. August 10, 2016.

Arnold, S., J. Miller and C. Igo. 2011. Adding value to AAAE professional conferences for agricultural education graduate students. NACTA Journal 55(2): 14-20.

Astin, A.W. 1984. Student involvement: A developmental theory for higher education. Journal of College Student Development 40: 518-529.

Astin, A.W. 1993. What matters in college? Four critical years revisited. Vol. 1. San Francisco: Jossey-Bass.

Benjamin, M. and A. Hollings. 1997. Student satisfaction: Test of an ecological model. Journal of College Student Development 38(3): 213-28.

Berg, B.L. 2001. Qualitative research methods for the social sciences. Needham Heights, MA: Allyn & Bacon.

Bilodeau, B.L and K.A. Renn. 2005. Analysis of LGBT identity development models and implications for practice. New Directions for Student Services 2005(111): 25-39.

Bradley, J. 1993. Methodological issues and practices in qualitative research. The Library Quarterly 63(4): 431-449.

Branand, B., D. Mashek, L. Wray-Lake and J.K. Coffey. 2015. Inclusion of college community in the self: A longitudinal study of the role of self-expansion in students' satisfaction. Journal of College Student Development 56(8): 829-844.

Brown, S.C. 2004. Learning across the campus: How college facilitates the development of wisdom. Journal of College Student Development 45(2): 134-148.

Bureau of Labor Statistics. 2013. www.bls.gov. United States Department of Labor. August 10, 2016.

Carraway, C. and S. Burris. 2016. Research internships: A useful experience for honing soft and disciplinary skills of agricultural majors. NACTA Journal 61(1): 27-32.

Chickering, A.W. and L. Reisser. 1969. Education and identity. San Francisco, CA: Jossey-Bass Publishers.

Chickering, A.W. and L. Reisser. 1993. Education and identity. 2nd ed. San Francisco, CA: Jossey-Bass Inc.

Coombs, L.J. 2013. Developing purpose in college: A mixed methods study to investigate how first-year and senior students developed purpose at a large research Midwestern university. Master's Thesis Dept. of Educational Administration. University of Nebraska, 141 Teachers Hall, Lincoln, NE.

Daniels, J. and J. Brooker. 2014. Student identity development in higher education: Implications for graduate attributes and work-readiness. Educational Research 56(1): 65-76.

Doerfert, L.D. and P.R. Miller. 2006. What are agriculture industry professionals trying to tell us: Implications for university-level agricultural communications curricula. Journal of Applied Communications 90(3): 17-31.

Eckleberry-Hunt, J. and J. Tucciarone. 2011. The challenges and opportunities of teaching "Generation Y." Journal of Graduate Medical Education 3(4): 458-461.

Erikson, E.H. 1968. Identity. Norton Publishers.

Evans, N.J., D.S. Forney, F.M. Guido, L.D. Patton and K.A. Renn. 2010. Student development in college: Theory, research, and practice. 2nd ed. San Francisco, CA: Jossey-Bass.

Foubert, J., M.L. Nixon, V.S. Sisson and A.C. Barnes. 2005. A longitudinal study of Chickering and Reisser's vectors: Exploring gender differences and implications for refining the theory. Journal of College Student Development 46(5): 461-471.

Fraenkel, J.R., N.E. Wallen and H. Huyn. 2014. How to design and evaluate research in education. 9th ed. New York, NY: McGraw-Hill.

Gault, J., J. Redington and T. Schlager. 2000. Undergraduate business internships and career success: Are they related? Journal of Marketing Education 22(1): 45-53.

Gavigan, L. 2010. Connecting the classroom with real-world experiences through summer internships. Peer Review 12(4).

Glaser, B.G. 1965. The constant comparative method of qualitative analysis. Social Problems (12)4: 436-445.

Green, T.F. 1981. Acquisition of purpose. In: Chickering, A.W. and Associates (eds.). The modern American college: Responding to the new realities of diverse students and a changing society. San Francisco, CA: Jossey-Bass.

Hart, P.D. 2007. How should colleges prepare students to succeed in today's global economy? Washington, DC: The Association of American Colleges and Universities.

Hodder, I. 1994. The interpretation of documents and material culture. In: Denzin, N.K. and Y.S. Lincoln (eds.) Handbook of qualitative research. Thousand Oaks, CA: Sage Publishing.

Hodges, S., S. Denig and A. Crowe. 2014. Attitudes of college students towards purpose in life and self-esteem. International Journal of Existential Psychology & Psychotherapy 5(1): 124-131.

Holsti, O.R. 1968. The handbook of social psychology. Reading, MA: Addison-Wesley.

Howe, N. and W. Strauss. 2000. Millennials rising: The next great generation. New York, NY: Vintage Books.

Johnson, S.A. and M.L. Romanello. 2005. Generational diversity: Teaching and learning approaches. Nurse Educator 30(5): 212–216.

Kegan, R. 1994. In over our heads: The mental demands of modern life. Cambridge, MA: Harvard University Press.

King, P.M. and M.B. Baxter Magolda. 2005. A developmental model of intercultural maturity. Journal of College Student Development 46(6): 571-592.

Komives, S.R., S.D. Longerbeam, J.E. Owen, F.C. Mainella and L. Osteen. 2006. A leadership identity development model: Applications from a grounded theory. Journal of College Student Development 47(4): 401-418.

Lairio, M., S. Puukari and A. Kouvo. 2013. Studying at university as part of student life and identity construction. Scandinavian Journal of Educational Research 57(2): 115-131.

Lincoln, Y.S. and E.G. Guba. 1985. Naturalistic inquiry. Newbury Park, CA: SAGE Publications, Inc.

Lindolf, T.R and B.C. Taylor. 2011. Qualitative communication research methods. 3rd ed. Thousand Oaks, CA: SAGE Publications, Inc.

Lounsbury, J.W., B.C. Huffstetler, F.T.L. Leong and L.W. Gibson. 2005a. Sense of identity and collegiate academic achievement. Journal of College Student Development 46(5): 501-514.

Lounsbury, J.W., R.A. Saudargas and L.W. Gibson. 2004. An investigation of Big Five and narrow personality traits in relation to intention to withdraw from college. Journal of College Student Development 45(5): 517-534.

Lounsbury, J.W., R.A. Saudargas., L.W. Gibson and F.T. Leong. 2005b. An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. Research in Higher Education 46(6): 707-729.

Mayer, J.D. and P. Salovey. 1993. The intelligence of emotional intelligence. Intelligence 17(4): 433-442.

Merriam, S.B. 2009. Qualitative research: A guide to design and implementation. San Francisco, CA: Jossey-Bass.

Muuss, R.E. 1996. Theories of adolescence. New York, NY: McGraw Hill.

McLester, S. and T. McIntire 2006. The workforce readiness crisis: We're not turning out employable graduates nor maintaining our position as a global competitor—Why? Technology & Learning 27(4): 22.

McNeir, G. 1993. Outcomes-based education. Research Roundup 10(1).

National Agricultural Communicators of Tomorrow. 2015. Vision. http://nactnow.org/about/. September 8, 2017.

National Agricultural Communicators of Tomorrow Professional Development Conference. 2014. About. https://actpdc2014.wordpress.com/. August 1, 2016.

National Professional Development Center on Inclusion. 2008. What do we mean by professional development in the early child- hood field? Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.

Pardue, K.T. and P. Morgan. 2008. Millennials considered: A new generation, new approaches, and implications for nursing education. Nursing Education Perspectives 29(2): 74-79.

Patton, M.Q. 2002. Two decades of developments in qualitative inquiry a personal, experiential perspective. Qualitative Social Work 1(3): 261-283.

Perry, W.G. 1970. Forms of intellectual and ethical development in the college years. New York, NY: Holt, Rinehart and Winston.

Robinson, J.A. and P.L. Glanzer. 2016. How students' expectations shape their quest for purpose during college. Journal of Student Affairs Research and Practice 53(1): 1-12.

Sagen, H., J. Dallam and J. Laverty. 2000. Effects of career preparation experiences on initial employment success of college graduates. Research in Higher Education 41(6): 753-767.

Sanford, N. 1968. Where colleges fail: The study of the student as a person. San Francisco, CA: Jossey-Bass.

Scott, M., A.S. Whiddon. N.R. Brown and P.P. Weeks. 2015. The journey to authenticity: An analysis of undergraduate personal development. Journal of Leadership Education 14(2): 65-81.

Shivpuri, S. and B. Kim. 2004. Do employers and colleges see eye-to-eye? College student development and assessment. NACE Journal 65(1): 37-44.

Texas A&M University. 2015. TAMU Chapter of Agricultural Communicators of Tomorrow. https://stuactonline.tamu.edu/app/organization/profile/public/id/367. August 1, 2016.

Trede, F. and C. McEwen. 2012. Developing a critical professional identity: Engaging self in practice. In: Higgs, J., R. Barnett, S. Billett, M. Hutchings and F. Trede (eds.). Practice-based education: Perspectives and strategies, Rotterdam, Netherlands: Sense Publishers.

Watson, T. and J.T. Robertson. 2011. Perceptions of agricultural communications freshmen regarding curriculum expectations and career aspirations. Journal of Applied Communications 95(3): 6-20.

Zambrana, R.E and B.T. Dill. 2009. Conclusion: Future directions in knowledge building and sustaining institutional change. In: Dill, B.T. and R.E. Zambrana (eds.). Emerging intersections: Race, class, and gender in theory, policy, and practice. New Brunswick, NJ: Rutgers University Press.

Changing Demographics in College of Agriculture and Life Sciences Students

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Abstract

The purpose of this study was to describe the pre-collegiate experiences of new students in the College of Agriculture and Life Sciences at Iowa State University. New students to the college completed an on-line questionnaire about their home residence and personal and social experiences. Survey data were matched with university records to make comparisons based on demographic characteristics (i.e., gender, race, high school class rank, and college major). The results of this study indicate more students were from farms than from any other demographic variable. Students who chose a major related to production agriculture were no more likely to report a higher family income from farm or agri-business than those that chose majors not tied to production agriculture. The highest percentage of pre-collegiate involvement in extracurricular activities was athletics. This study was guided by the collegiate outcomes model, which was adapted from the collegiate leadership development model.

Keywords: socio-economics, academic preparation, pre-collegiate experiences

Introduction

Millennial students have created a new set of challenges for higher education. These students have a closer relationship with their parents, increased focus on grades, highly involved in extracurricular activities, and are technologically savvy (Howe and Strauss, 2003). Educational reforms have addressed such issues and created a paradigm shift, encouraging more focus on learning and less on teaching (Huba, 2000).

The changing demographics have created additional challenges for higher education. The Western Interstate Commission for Higher Education (WICHE) has noted the nation is projected to produce fewer high school graduates in graduating classes between 2014 and 2023, (WICHE, 2016). According to WICHE (2016), "*The pending national plateau is largely fueled by a decline in the White student population and counterbalanced by growth in the number of non-white public-school graduates – Hispanics and Asian/Pacific Islanders in particular. Overall, there will be consistent declines in the number of White public high school graduates and robust growth in the number of public school graduates of color in the coming years* (p. 1)" In specific ethnic areas the population is expected to do the following:

- White public high school graduates are expected to decrease by 14% between 2014 and 2030.
- Hispanic high school graduates are expected to increase by 50% between 2014 and 2025.
- Asian Pacific Islander high school graduates are expected to increase by 30% between 2013 and 2030.
- Black public high school graduates are expected to decline by 6% between 2013 and 2030.
- American Indian/Alaskan Native public high school graduates are expected to decline each year.

The number of high school graduates will vary from region to region. In 2013, the Midwest had 22% of the nation's high school graduates and is projected to have 19% by 2030. Likewise, the northeast region is expected to decrease from 18% of the total high school graduates in 2013 to 16% in 2030. The western region accounted for 22% of high school graduates in the early 2000s and is expected to peak at 30% in 2024 and drop back to 28% by 2030. In the southern region high school graduates are projected to increase to 47% in 2025 and by 2030 high school graduates will decrease slightly to 45%.

This shift in demographics has also been noted by Buchanan (2008) who studies the area of animal science. The shift in demographics is towards more women, more diverse students and students who are from non-rural communities will continue to increase. According to the United States Census Bureau (2015), the US is projected to become more racially and ethnically diverse. Specifically, dramatic changes are expected to be seen in the Hispanic (Latino) population with it expected to grow from being 17.4% in 2014 to 28.6% in 2060. In 2014, 48% of the population identifies as Hispanic and it is expected by 2060, 64.4% of people under the age of 18 will identify as being Hispanic. Hoover

(2013) in The Chronical of Higher Education shared that a "*sharply increasing diversity will soon hit many states and institutions with freight-train force* (paragraph 11)." She also shared, "*as these changes take hold, meeting the needs of minority students, especially those from underrepresented groups, will place a greater role in defining institutional success* (paragraph 15)."

In addition to dealing with changing demographics, higher education's funding streams have shifted significantly and, in many cases, caused institutions to look at different budgeting resource models. Cuts in state and local appropriations after the 2001 recession resulted in an increased percent of total operating revenues of public institutions coming from student tuition (Baum, 2012). In fact, "*the steadiest source of new revenue between 1998 and 2008 was from tuition*" (Baum, 2012, p. 14). For many institutions, these demographic changes and economic pressures have resulted in an increased attention in out-of-state recruitment to maintain enrollment and meet demands for a well-educated workforce.

For example, Iowa State University has experienced the same issues. In 1999, 12.7% of the college enrollment was non-resident, compared to 28.2% in 2016 (Iowa State University, 2016). In addition, the college has become more ethnically diverse. In 1999, 2.9% of the college undergraduate population was non-white, and in 2016, 9.01% of the undergraduate population was non-white (Iowa State University, 2016). The college has also seen changes in the gender make-up of the college. In 1999, 41.6% of the college enrollment was female, compared to 50.68% in 2016 (Iowa State University, 2016).

Research has highlighted the importance of demographics and pre-collegiate experiences when examining college experiences (Dugan and Komives, 2007; Foreman and Retallick, 2012). Dyer et al. (2000) found that students who lived in a rural setting were more likely to complete a degree in a college of agriculture than students without those experiences. Results of previous research indicated that these trends have changed in the College of Agriculture and Life Sciences at Iowa State University. Between 1985 and 2003, the percent of students who reported living on a farm decreased from 52% to 46%, while students who reported living in a town over 2500 or an urban setting increased from 38% to 44% (COA, 1996 and 2003; Scofield, 1992). Slightly less than two-thirds of the students stated they were enrolled in a high school agricultural science program. In Texas, almost 60% of the responding students reported that their immediate family is not involved in agriculture or life sciences (Rayfield et al., 2013). Research conducted in California showed that students who were exposed to agriculture at the high school level were more likely to choose an agriculture major in college than those without exposure (Swan and De Lay, 2014).

Similar trends were found when looking at extracurricular activities. Members of 4-H and FFA were more likely to complete a degree in a college of agriculture than students without those experiences (Dyer et al., 2000). However, trends show less student involvement in these activities traditionally viewed as related to College of Agriculture students (COA, 1996 and 2003; Scofield, 1992). In 1985, 49% of new students were involved in FFA and 52% were involved in 4-H, compared to 2003 where 42% were involved in FFA and 43% in 4-H. During the same period, other activities, such as music and athletics increased.

There are several factors that influence a student's decision to decide what to major in once they enroll in college. Students who had experience within the agriculture industry and FFA and 4-H experiences prior to college enrollment have shown to be the highest ranked influencing factor (Swan et al., 2014). Rayfield et al. (2013) found that parents or guardians were reported as the person to have the most influence on the respondent's decision to major within the College of Agriculture and Life Sciences.

Conceptual Framework

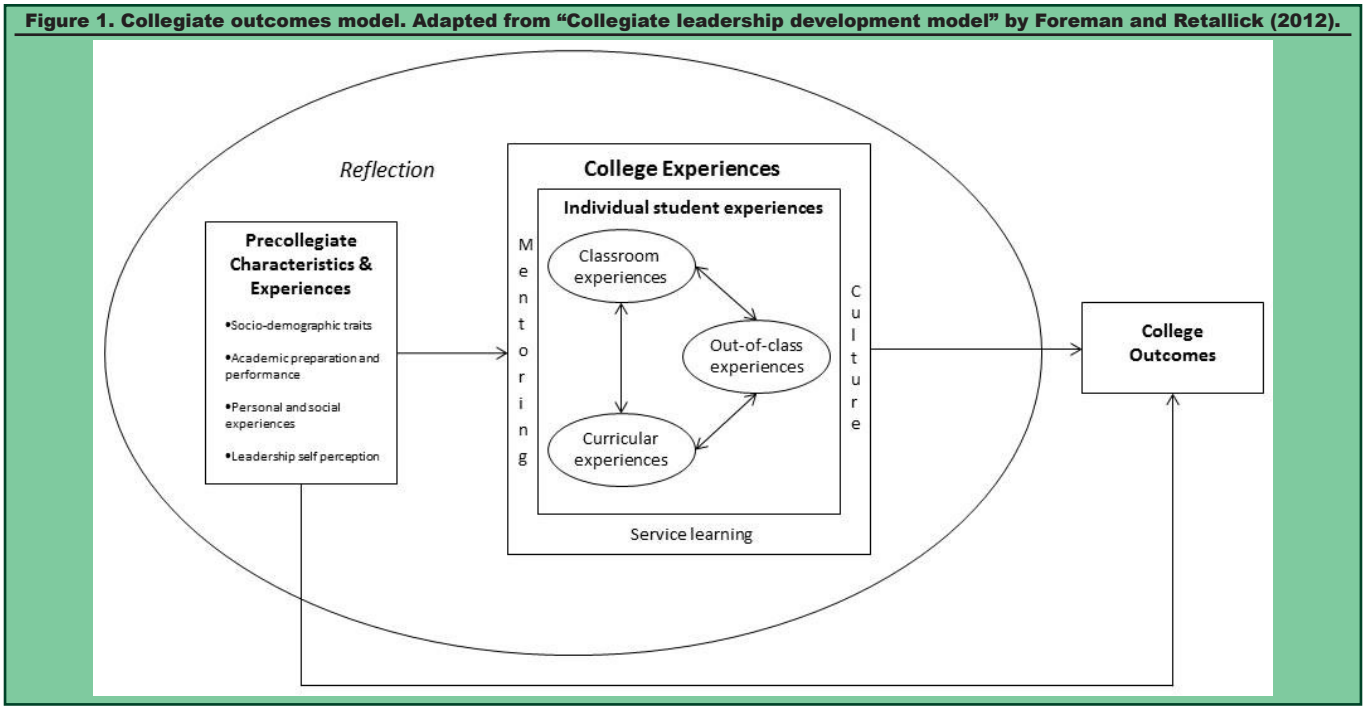
The Input-Environment-Output (E-I-O) model (1993) focuses on the need to understand student qualities and characteristics when entering an educational institution. The model focuses on the nature of the educational environments with which the student comes into contact and the qualities and characteristics as they leave an institution. The model contends that the outcomes in student development are determined by the inputs and learning environments. The inputs are also the influence outcomes, which the environment in the model serves as a mediator. Astin (1993) explains the relationship between environment and student outcomes cannot be understood without considering student inputs. In applying the I-E-O Model (1993), researchers have developed a conceptual framework that consider the importance of pre-collegiate experiences in reaching college outcomes (Foreman and Retallick, 2012; Renn and Reason, 2013). "*What students came to college with largely explained how they developed in college. Eighteen or more years of experience provided a strong foundational grounding on which college experiences built*" (Dugan and Komives, 2007, p.13). Renn and Reason (2013) went so far as to suggest that some pre-collegiate characteristics may be as important in reaching college outcomes as the college experience.

An adaptation of the Collegiate Leadership Development Model (Foreman and Retallick, 2012) was used as the conceptual framework for this model. The model includes the role of pre-collegiate characteristics and experiences and college experiences to reach college outcomes (Figure 1). This study focused on the role pre-collegiate characteristics and experiences has on the college recruitment process.

Purpose and Research Questions

Changing demographics and income generated by tuition dollars has increased the attention on recruitment and retention of undergraduate students and resulted

Figure 1. Collegiate outcomes model. Adapted from "Collegiate leadership development model" by Foreman and Retallick (2012).



in a need for additional information about incoming students. The purpose of this study was to describe the pre-collegiate characteristics and experiences of all incoming College of Agriculture and Life Science students.

Three research objectives guided this study:

- Describe the socio-demographic traits of new students in the College of Agriculture and Life Sciences and determine if there are socio-demographic differences based on choice of major and residence (e.g. in state versus out-of-state).
- Describe the academic preparation and performance of the new students in the College of Agriculture and Life Sciences and determine if there are differences in academic preparation and performance based on choice of major and residence.
- Describe pre-collegiate personal and social experiences of the new students in the College of Agriculture and Life Sciences and examine differences in pre-collegiate personal and social experiences based on choice of major.

Methods

This study was a part of a larger study designed to examine the pre-collegiate characteristics and experiences of incoming students and identify the factors that influence students' decisions to attend the College of Agriculture and Life Sciences at Iowa State University. Incoming full-time students (N=1010) were surveyed. The Institutional Review Board approved the study protocol and all participants were provided modified informed consent.

Instrumentation

The university database and a researcher-designed questionnaire were used to meet the research objectives of this study. Demographic and academic information was collected from student records received directly from the university registrar's office (i.e., gender, race, high school class rank, and college major). The researchers chose to obtain this information from official student records to reduce the length of the on-line questionnaire and ensure the accuracy of the data.

Researcher-designed questions were used to collect data about pre-collegiate characteristics and experiences. Students were asked to indicate their home residence and were given six categories from which to choose (i.e., farm, rural, urban <2,500, urban 2,500–10,000, urban 10,000-25,000, and urban over 25,000). Respondents were asked if their family was involved in a farming or agriculture-related business. Respondents who indicated their family was involved in farming or agriculture-related business were asked a follow-up question to learn if the farm or agriculture-related business was family owned. In addition, students were asked what percent of their total family income was derived from farming or agriculture – related business.

To learn more about student involvement in high school extracurricular activities, students were given a list of extracurricular activities and asked to select the ones in which they participated. Based on their responses, follow-up questions were asked to gather information about the extent of their participation.

Validity

A group of faculty, staff, and administrators reviewed the instrument for face validity. In addition, the instrument was field tested for content validity by a group of continuing College of Agriculture and Life Sciences students. Based on the feedback of these two groups, changes to content, question format, and data collection procedures were made to improve the validity of the instrument.

Data Collection and Analysis

As subjects completed the survey, Qualtrics (Qualtrics Labs, Inc, Provo, UT) recorded the responses. E-mail addresses were used to match students' university record information with survey results. All identifying information was removed before data analysis began. SPSS (Version 18) was used to analyze the data.

The researchers modified Dillman's (2007) five-step data collection approach. Foreman and Retallick (2012) suggested that undergraduates would view pre-notice as junk mail and would be less likely to respond favorably to follow-up e-mails. The first e-mail described the purpose of the study, explained general consent, and included the survey link. The distribution list obtained from the university registrar's office contained 1010 subjects. Subjects were contacted one to five times via e-mail over a fourteen-day period to reduce non-response. Those who responded were removed from the e-mail list and not contacted again. This process resulted in 597 responses (50.11% response rate). Early and late respondents were compared to control for non-response error (Linder et al., 2001) and the analysis showed no differences based on gender or majors.

Two continuous variables were recoded into categorical variables for analysis. The residence variable was recoded into three categories: 1) in-state, 2) contiguous states, and 3) non-contiguous states. The major was recoded into two categories: 1) production agriculture majors (i.e., Agricultural Studies, Agricultural Education, Agricultural Business, Agronomy, Animal Science, and Agricultural Systems Technology) and 2) non-production agriculture majors (i.e., Agricultural Biochemistry, Animal Ecology, Biology, Culinary Science, Diet and Exercise, Dietetics, Environmental Science, Food Science, Forestry, Genetics, Global Resource Systems, Horticulture, Industrial Technology, Microbiology, Nutritional Science, and Public Service and Administration in Agriculture).

Research question one used university records data to describe the socio-demographic characteristics of new students. A t-test using the recoded major variable as the independent variable and type of residence (i.e., farm, rural acreage, and urban) as the dependent variable was calculated to determine whether the type of residence where students grew up influenced whether they chose a major closely related to production agriculture. A similar t-test was calculated to determine if the percent of total family income derived from farm or agribusiness influenced major. An ANOVA using the recoded residence variable as the independent variable and type of residence as the dependent variable was calculated to see if there were differences in where a student grew up based on whether they were from in-state, contiguous states, or non-contiguous states.

Research question two addressed academic preparation and performance. Class rank of students was gathered from university records and used to describe the pre-collegiate academic preparation and performance. A t-test using the dichotomous major variable and high school class rank as the dependent variable was calculated to determine if students there were differences in high school class rank based on the college major they selected. An ANOVA using residence as the independent variable and high school class rank as the dependent variable was calculated to determine whether there was a relationship between the state of home residence and high school class rank.

Research question three focused on pre-collegiate personal and social experiences. Descriptive statistics were used to describe students' pre-collegiate extracurricular involvement. A Chi-squared statistic was calculated to determine if there was a difference in whether or not students with production agriculture majors were more or less likely to have participated in various pre-collegiate activities.

Results

University enrollment statistics indicated 1010 new full-time College of Agriculture and Life Sciences undergraduate students enrolled in fall 2012, of which 481 (47.6%) were male and 526 (52%) were female. Multicultural students made up 10% (101 students) of the new student college enrollment. Seventy-six percent of the students were residents, 23% were non-resident students, and 1% were foreign students. Of the 597 students who responded to the survey, 61.2% (365 students) were female and 38.4% (229 students) were male. Five hundred and thirty-one respondents were white (89.1%) and 66 respondents (10.9%) were non-white.

Socio-Demographic Traits and Differences

Home residence was assessed using six categories (i.e., 1=farm, 2=rural, 3=urban <2,500, 4=urban 2,501–10,000, 5=urban 10,001–25,000, and 6=urban over 25,000). The results of this study indicated more students (30.9%) were from farms than from any other demographic variable. The second largest place of res-

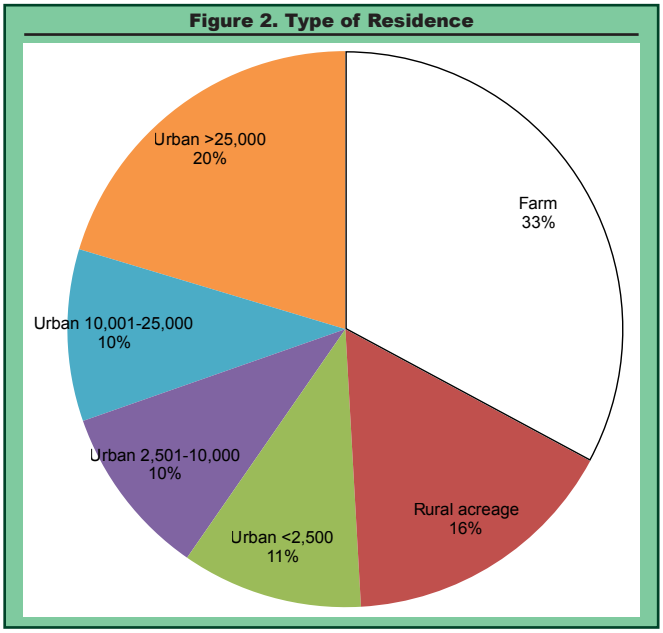
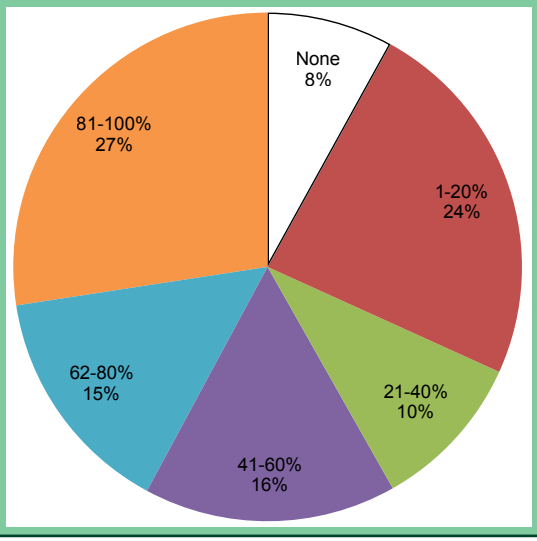


Figure 3. Percent of Total Family Income Derived from Farm or Agriculture Business



idence was urban, over 25,000 (19.1%) (Figure 2). Students who chose majors related to production agriculture (M=2.78, SD=2.18) were more likely to grow up on a farm or rural area and less likely to grow up in an urban area than those who chose majors not related to production agriculture (M=4.29, SD=2.34, t(558)= -7.85, p=0.000). In addition, 308 students (51.7%) indicated that their family was involved in farming or an agriculture-related business, of which 87.9% were family owned. Eighty-two students indicated that 81%-100% of their family income was derived from a farm or agribusiness. In contrast seventy-one students indicated that 1 to 20% of their family income was derived from a farm or agri-business, and twenty-four students indicated that none of their family income came from farm or agri-business sources (Figure 3).

Students who chose a major related to production agriculture (M=3.91, SD=1.69) were no more likely to report a higher family income from farm or agri-business than those that chose majors not tied to production agriculture (M=3.79, SD=1.87, t(117.22)=0.51, p=0.61). ANOVA results showed statistically significant differences based on residence (i.e., in-state, out-of-state contiguous, and out-of-state non-contiguous) and whether a student reported being from a farm or rural area (Table 1). Because the ANOVA provided significant results, a Tukey post hoc test was conducted to compare and contrast differences between groups. Significant differences were found between each of the three groups (i.e., in-state, contiguous states, and non-contiguous states) (Table 2).

In-state students were more likely to report being from a farm or rural area than out-of- state students. Of the out-of-state students, those from contiguous state were from more rural backgrounds than those from non-contiguous states.

Academic preparation

High school class rank ranged from 19 to100 percentile. Thirty-four students (5.7%) were ranked under 50%. Two-hundred and sixty-two (43.9%) ranked above the 80 percentiles, with 72 (7.1%) of those students ranking between the 95 and 100 percentile. A t-test revealed no difference in high school class rank based on whether a student chose a major related to production agriculture (M=63.54, SD=32.53) or one not related to production agriculture (M=65.65, SD=32.72, t(518.61)= -0.77, p=0.44). Students from contiguous states had the highest class rank and in-state students had the lowest class rank. ANOVA results showed a difference in high school class rank based on residence (Table 3). A Tukey post hoc was conducted to compare and contrast mean differences between groups. Significant differences in high school class rank were found between in-state students and students from contiguous states (Table 4).

Pre-collegiate personal and social experiences

Students were involved in a wide variety of extracurricular organizations. Seventy-six percent were involved in athletics, 50% were involved with National Honor Society, 45.8% were involved in music, 40.8% were involved in FFA, 37.2% were involved in 4-H, and 35.2% were involved in faith-based organizations (Table 5).

Table 1. Analysis of Variance for Residence and Type of Residence

Dependent variable	Groups	SS	df	MS	F	P	η2
	Between	433.76	2	216.88	44.91	0.000*	0.138
	Within	2690.02	557	4.83			
	Total	3123.78	559				

Note. *p < 0.05

Table 2. Tukey HSD Post Hoc Results for State of Residence and Home Residence

Test	(I) State of Residence	(J) State of Residence	Mean differences (I-J)	SE	P	Cohen's d
	in-state	Contiguous	-1.53	0.25	0.000*	4.35
		non-contiguous	-2.88	0.36	0.000*	
	contiguous	in-state	1.53	0.25	0.003*	8.48
		non-contiguous	-1.35	0.41	0.000*	
	non-contiguous	in-state	2.88	0.36	0.000*	3.95
		Contiguous	1.346	0.413	0.003*	

Note. *p < 0.05

Table 3. Analysis of Variance for High School Class Rank and Residence

Dependent variable	Groups	SS	df	MS	F	P	η2
	Between	10869.46	2	5434.73	5.19	0.006*	0.017
	Within	619085.18	591	1047.52			
	Total	629954.64	593				

Note. *p < 0.05

Table 4. Tukey HSD Post Hoc Results for Residence and High School Class Rank

Test	(I) State of Residence	(J) State of Residence	Mean differences (I-J)	SE	P	Cohen's d
	in-state	Contiguous	-10.39	3.55	0.010*	0.38
		non-contiguous	-8.71	5.06	0.198	
	contiguous	in-state	10.39	3.55	0.010*	1.81
		non-contiguous	1.68	5.80	0.955	
	non-contiguous	in-state	8.71	5.06	0.198	1.46
		Contiguous	-1.77	5.79	0.955	

Note. *p < 0.05

Table 5. Pre-collegiate Involvement in Extracurricular Activities

Organization	Frequency	Percent
Athletics	455	76.60
National Honor Society	298	50.17
Music	273	45.96
FFA	243	40.90
4-H	222	37.37
Faith/Religious-based	210	35.53
Student Government/Council	171	28.79
Drama/Speech	154	25.93
Newspaper/Yearbook	64	10.77
Boy's State/Girl's State	53	8.92
Academic Bowl	45	7.58
Scouts	43	7.23
FCCLA	30	5.05
FBLA/BPA	20	3.37
DECA	8	1.34

Pearson Chi-squared revealed significant differences in pre-collegiate extracurricular activities based on whether the student chose a major related to production agriculture. Students with production agriculture majors were significantly more likely to have been involved in athletics ($\chi^2(1,N=594) = 4.82$, $p=0.018$), student government ($\chi^2(1,N=594) = 4.86$, $p=0.017$), music ($\chi^2(1,N=594) = 5.75$, $p=0.010$), FFA ($\chi^2(1,N=594) = 44.74$, $p=0.000$) , and 4-H ($\chi^2(1,N=594) = 36.071$, $p=0.000$). While, students with majors not related to production agriculture were more likely to be involved in scouts ($\chi^2(1, N=594) = 7.33$, $p=0.006$). No significant differences based on college major were found in any of the other activities listed in table 5.

Summary

Higher education has faced new challenges with millennial students. Changing demographics and shifting higher education funding streams have caused institutions to examine recruitment strategies of in-state and out-of-state students to maintain enrollments and meet workforce demands. The results of this study indicated socio-demographic traits (i.e. type of residence and percent of family income derived from farm or agriculture business), academic preparation and pre-collegiate extra-curricular activities provided differences between in-state and out-of-state students. Therefore, as institutions create plans to recruit and retain millennial students, they should take into consideration socio-demographics, academic preparation and pre-collegiate experiences in their recruitment and retention plans of undergraduate students. Colleges of agriculture will no longer be effective approaching recruitment and retention with a one size fits all approach. If institutions review the WICHE reports by region intentional recruitment efforts need to take place to recruit high school graduates from the various regions.

As the student demographics continue to change and become more diverse, more effort will be needed to develop an inclusive college environment and curriculum. Colleges must be prepared for shifts in enrollment to majors that are more broad and diverse, especially beyond the traditional production-oriented majors. Production majors will see an increase of students who have little to no production background and, as such, colleges will need to re-evaluate both the curriculum as well as the appropriate instructional methods.

While these results are limited to the students who participated in this study, the process of learning more about pre-collegiate experiences in an effort to increase the effectiveness of recruitment is important. We recommend colleges conduct research to customize recruitment efforts and not rely solely on traditional recruitment efforts (i.e. FFA, agricultural educators, and extension professionals). For example, based on the findings of this study, effort should be made to differentiate recruitment efforts based on whether or not you're recruiting within or outside the state.

It is important to not make assumptions about backgrounds of students when planning visits and preparing printed materials. For example, talking about university opportunities, such as intramural sports and music opportunities could be just as important in helping prospective students feel that they "fit" at an institution as talking about departmental clubs and organizations.

A limitation of this study includes the data only being from one College of Agriculture and Life Sciences institution. The analysis of data offers significant insight for other intuitions who wish to focus on the changing demographics relating to socio-demographics, academic preparation and pre-collegiate experiences.

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Literature Cited

Buchanan, D.S. 2008. Animal science teaching: A century of excellence. Journal of Animal Science 86(12): 3640-3646.

College of Agriculture (COA). 1996. College of Agriculture New Student Questionnaire: Summary 1995-1996 Data. Unpublished report.

College of Agriculture (COA). 2003. College of Agriculture New Student Questionnaire: 2003 Summary Data. Unpublished raw data.

Dugan, J.P. and S.R. Komives. 2007. Developing leadership capacity in college students: Findings from a national study. A report from the Multi-Institutional Study of Leadership: College Park, MD: National Clearinghouse for Leadership Programs.

Dyer, J.E., L.M. Breja and P.S. Haase. 2000. Predictors of student retention in colleges of agriculture. Proceedings of the 27th Annual National Agricultural Education Research Conference. San Diego, CA.

Foreman, E.A. and M.S. Retallick. 2012. Undergraduate involvement in extracurricular activities and leadership development in college of agriculture and life sciences students. Journal of Agricultural Education 53(3): 111-123. DOI: 10.5032/jae.2012.03111.

Hoover, E. 2013. Minority applicants to colleges will rise significantly by 2020. Chronicle of Higher Education 59(19): A16-A17.

Huba, M.E. and J.E. Freed. 2000. Learner-centered assessments on college campuses. Needham Heights: Allyn & Bacon.

Rayfield, J., T.P. Murphrey, C. Skaggs and J. Shafer. 2013. Factors that influence student decisions to enroll in a college of agriculture and life sciences. NACTA Journal 57(1): 88-93.

Scofield, G.G. 1992. Summary 1992 Data College of Agriculture New Student Questionnaire. Unpublished report.

Strauss, W. and N. Howe. 1993. Millennials go to college: Strategies for a new generation on campus. American Association of Collegiate Registrars and Life Course Associate. Washington, DC.

Swan, B.G. and A.M. De Lay. 2014. Agricultural experiences and factors of undergraduates who enroll in a college of agriculture. NACTA Journal 58(4): 330-334.

United States Census Bureau. 2015. Projections of the size and composition of the U.S. Population: 2014 to 2060: Population estimates and projections. http://www.census.gov/content/dam/Census/library/publications/2015/demo/p251143.pdf?eml=g-d&utm_medium=e-mail&utm_source=gov-delivery (http://www.census.gov/2010census/data/).

Western Interstate Commission for Higher Education. 2016. Knocking at the college door: Projections of high school graduates. http://www.wiche.edu/pub/16556.

The Impacts of a Short-Term Study Abroad on Critical Thinking of Agriculture Students

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Abstract

Today's college graduates must be prepared to think critically about complex global issues. Study abroad programs can be a great learning opportunity for students. The purpose of this study was to explore the impacts a short-term study abroad experience had on students' critical thinking. A reflective journaling process was implemented while on a study abroad program in Belize guided by the conceptual framework proposed by Roberts et al. Results revealed participation in a short-term study abroad program to Belize focused on agricultural issues resulted in expression of critical thinking, although students did not demonstrate all types of critical thinking. Based on these results, recommendations for future short-term study abroad programs are provided.

Introduction

As large agricultural organizations and agencies are becoming more multinational in the scope of their of day-to-day operations, finding employees who are culturally competent and adaptable (Gorchels et al., 1999; Hart Research Associates, 2010; Hunter et al., 2006) and can think critically and solve problems (Bisdorf-Rhoades et al., 2005; Crawford et al., 2011; Rudd et al., 2000) is becoming increasingly important. Research has indicated the growing need for American university curricula to place more emphasis on international topics and globalization, in general (Acker, 1999; Fugate and Jefferson, 2001; Moore and Woods, 2003; Northfell and Edgar, 2014).

One way of preparing college graduates to think more critically about complex global issues is through international learning experiences (Bunch et al., 2013). International learning experiences can take many forms, including infusing college course content with a global context, international internships, and in-class discussions with people who have international experience (Bunch et al., 2013). One specific international learning experience is study abroad programs, which provide students with opportunities to visit other countries and learn about other cultures (Harder et al., 2015). Employment recruiters in agriculture and natural resources sectors indicated they would give more attention to prospective employees who had a study abroad experience (Harder et al., 2015). However, for international learning experiences such as study abroad programs to be educational and rewarding to students, students must be physically, psychologically, and emotionally engaged in the experience (Bunch et al., 2013). However, there is very limited research documenting best practices for study abroad programs in the agricultural sciences. Agricultural issues present rich context to explore the interaction between social and natural sciences while focused on practical problems being faced by real people.

The purpose of this study was to explore the impacts of short-term study abroad experience on students' critical thinking using a reflective journaling process while on a study abroad program in Belize. Today's society is one of constant change, increasing complexity, and growing global interdependence. Professionals in the workforce need skills that include technical understandings, cultural awareness, and critical thinking (Lamm and Irani, 2011; Roberts et al., 2013).

This study specifically used the Conceptual Framework for Studying Globally Integrated Education Activities (Figure 1) proposed by Roberts et al. (2013), which supports key developmental opportunities for participants. Because a study abroad can have a wide range of impacts on participants it was important to employ a model that was holistic in nature. The model incorporates learner attributes (knowledge, attitude, skills, aspirations [KASA]), personal variables (intercultural competence, technical competence, and critical thinking) with emphasis on a globally integrated education activity (study abroad experience). A key element of the globally integrated education activity is its emphasis on reflection and the making of meaning that participants have with

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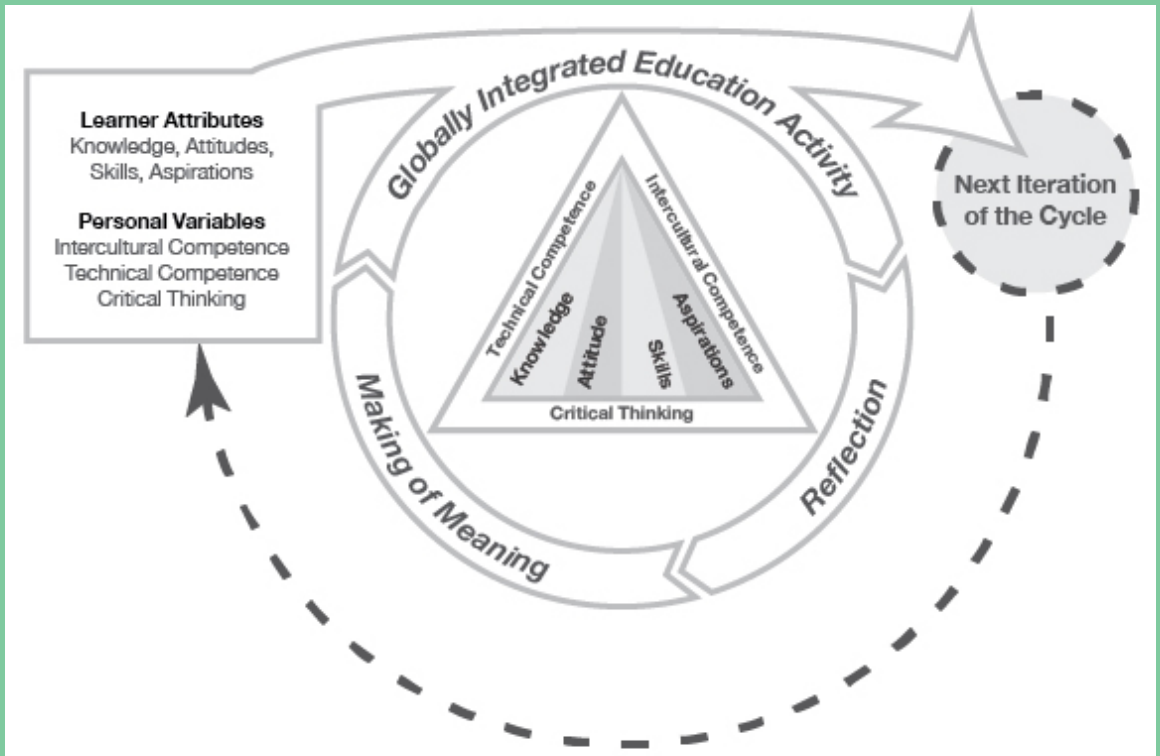
Figure 1. A conceptual framework for studying globally integrated education activities (Roberts et al., 2013).



respect to specific outcomes related to development in technical competence and intercultural competence, both which incorporate critical thinking and directly influences their personal KASA.

By grounding the framework in experiential learning (Kolb, 1984; Roberts, 2006), the experience becomes cyclical, providing participants with an opportunity to reiterate elements of each experience into the next. This includes experiences within experiences as is seen with many study abroad trips. Students move through the experience, building each day on the previous day's experiences and interactions. This development means students on day 10 of a study abroad are much different than they were on day 1. Ritz (2011) purported that when study abroad experiences were designed pedagogically, even a short-term experience (defined as two weeks or less) could also be experiential learning.

Perry et al. (2012) identified through their short-term study abroad research that the critical moment in transformative learning happens when "reflection and critical reflection become imperative to the learning process" (p. 682). They found even short-term study abroad experiences can bring about great transformation in participants if designed with intention. Intentional planning on the part of the educator can help maximize student learning.

Reflective journaling has been shown to be an effective way to engage students and help nurture critical thinking skills (Lamm et al., 2011; Sankey Rice et al., 2014; Thorpe, 2004) and can also be a tool to foster active learning (Thorpe, 2004). However, students have reported reflective journaling practices, over time, are difficult to sustain without instructor direction (Harri-Augstein and Thomas, 1991). Journaling has been used for students to reflect on study abroad experiences (Lamm et al., 2011; Northfell and Edgar, 2014; Sankey Rice et al., 2014). Lamm et al. (2011) found students who took part in a study abroad to Costa Rica preferred to gain new knowledge through the experiential learning experience, which included the process of reflection. Northfell and Edgar (2014) recommended study tour programs should require daily reflections "to encourage meaningful and engaged learning experiences" (p. 39). Lamm et al. (2011) also recommended educators use multiple methods of reflective practice.

Critical Thinking

Since the early 1990s, scholars have challenged existing perspectives providing insight into the breadth and depth that is critical thinking. Facione (1990) embarked upon a Delphi study, which framed critical thinking as *"the purposeful, self-regulatory judgment which results in the interpretation, analysis, evaluation, and inference as well as the explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which the judgment is based"* (Facione, 1990, p. 2). The Delphi study also provided scope and parameter to critical thinking disposition and skill.

The more holistic approach to critical thinking development engages both an individual's disposition to think critically and his/her developed skill. In order to produce true critical thinkers, educators must provide opportunities for the development of both disposition and skill

(Facione et al., 1995). Through the Delphi process Facione (1990) also facilitated consensus on the skill development of critical thinking. The consensus descriptions include the skill and sub-skill. There are six recognized skills and fifteen sub-skills. Interpretation (categorization, decoding significance, clarifying meaning) focuses on one's ability to *"comprehend and express the meaning and significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria"* (Facione, 1990, p. 6). Analysis (examining ideas, detecting arguments, analyzing arguments) is the second recognized skill and promotes an individual's ability to, *"identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions"* (Facione, 1990, p. 7). The third identified skill, evaluation (assessing claims, assessing arguments), emphasizes one's ability to *"assess the credibility of statements or other representations which are accounts or descriptions of a person's perceptions, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intend[ed] inferential relationships among statements, descriptions, questions or other forms of representation"* (Facione, 1990, p. 8). Inference (querying evidence, conjecturing alternatives, drawing conclusions) indicates that an individual should be able to *"identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation"* (Facione, 1990, p. 9). Explanation (stating results, justifying procedures, presenting arguments) recognizes that one must be able to, *"state results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments"* (Facione, 1990, p. 9). The sixth skill, self-regulation (self-examination and self-correction) provides that one must *"self-consciously [sic] monitor one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results"* (Facione, 1990, p. 10).

Methods

During the University of Florida's 2015 spring semester, three Agricultural Education and Communication (AEC) faculty members led eight undergraduate students through a ten-day study abroad program focused on exploring agricultural issues. One faculty member had prior experience in Belize and took the lead on planning the study abroad. A different faculty member taught the on-campus version of the course and took the lead on the academic portions of the study abroad experience. She adapted the syllabus to fit the study abroad experience in Belize. The third faculty member has interest in co-leading this program in the future and volunteered to assist to learn the program and content.

Student recruitment concluded in December 2014 when final approval was given by the university International Center for the eight qualified students who had applied to participate. Five of the students were Agricultural Education and Communication majors (1 male, 4 females; all white; ages 18-22); two students were Plant Science majors in (1 white male, age 23; 1 white female age 62), and the remaining student was a Microbiology (1 multicultural – Hispanic/Pakistani female, age 25).

The class had three 1-hour meetings before the 10-day trip. Students selected and researched an agriculture or natural resources-related issue impacting Belize and presented it to the rest of the students and faculty team before the trip to Belize. Issues were approved by the faculty. Students were asked to complete that assignment in pairs, so there were four pairs/issues. Students could stray from the original issues they researched if they wished and each were asked to choose one issue individually he/she were interested in and collect information on while in Belize.

The study abroad experience itself consisted of visits to several farms and cultural locations, including cacao and vegetable farms, Maya archaeological sites, local farmers' markets, and a coastal snorkeling excursion. At the end of each day, students gathered with the faculty team for debriefing sessions, where each student reported back to the group on what they observed about their chosen issue. During that time, all the students could provide input on each issue and could begin to connect overlapping parts of the various issues. The goals of the group's time in Belize were to provide students with as many opportunities as possible to interact with Belizeans, to find out about the issue that students were researching, and to learn about Belizean culture.

While abroad, students were also asked to take photos and were given a set of questions to use for recording journal entries about their experience in Belize. There were three 1-hour post-trip class meetings in which students formalized the data they had collected and shared their experiences through blogs they had created about what they had learned. Each blog was uniquely designed by each student, allowing for freedom of creativity, and contained photographic and written components.

Data Collection

The University of Florida's Institutional Review Board approved all activities in this study. Data were collected through reflective journaling. As a part of the course, during the study abroad, participants were required to journal daily by responding to a series of

prompting questions. Participants were provided time each evening to complete their journaling. After the study experience, the students were also asked to respond to a similar set of questions. Participants submitted their journals in electronic format to the instructors within two weeks of the end of the study abroad. The daily (D) journal prompting questions were:

D1: What were your observations about the culture today?
D2: Did your perceptions change today? How?
D3: Which activity from today had the greatest significance to you? Why?
D4: What did you learn today? How will it affect you professionally?
D5: What did you see or learn today that challenged or changed your previous thinking? Why did it challenge or change your thinking?
D6: What do you hope to learn tomorrow?

The summary (S) journal prompting questions were:

S1: Overall, what were your observations about the culture?
S2: Did your perceptions change over the course of the study abroad experience in Belize?
S3: Which activity had the greatest significance to you? Why?
S4: What did you learn from the study abroad experience? How will it affect you professionally?
S5: What did you see or learn from the study abroad experience that challenged or change your previous thinking? Why did it challenge or change your thinking?
S6: How does the issue you selected to research in Belize compare or contrast with that issue in the home state?

The daily journal prompts (D1 to D6) and summary questions (S1 to S6) were derived from the Conceptual Framework for Studying Globally Integrated Education Activities (Roberts et al., 2013). Prompts were designed to help students reflect on intercultural competence (D1, D2, D3, S1, S2, S3), technical competence (D2, D3, D4, S2, S3, S4, S6), and critical thinking (D5, S5, S6). Prompt D6 was designed to help students process their experiences of the day and mentally prepare for the next day. The order of the daily prompts was based on previous experiences of the researchers with student reactions on study abroad programs. The summary questions were ordered in a way to match the daily prompts. This article reports the results from the critical thinking analysis. A companion article focused on the technical and intercultural analysis.

Data Analysis

Each student's individual journal entries were moved into a single document, and all identifying information was removed. Each student was assigned a participant number (P1 through P8). Line numbers were inserted in the data file to allow referencing specific quotes or information. All data were coded by one researcher who attended the study abroad and then verified by two additional researchers who also attended the study abroad as a form of member checking to establish trustworthiness in the research (Lincoln and Guba, 1985).

Data was analyzed using a basic thematic analysis (Boyatzis, 1998). Coding for critical thinking used the existing categorization from the Critical Thinking Delphi Report (Facione, 1990), which are (a) interpretation; (b) analysis; (c) evaluation; (d) inference; (e) explanation; and (f) self-regulation. In many cases, multiple related ideas were observed in sub-themes. In these cases, the ideas are indicated by italicized labels.

Results

Interpretation

One participant (12.5%) showed interpretation in her journal. Interpretation was expressed through applying their own meaning on what they experienced in Belize in comparison to the U.S. For example, P1 used a judging statement when referring to the poor living conditions in Belize compared to her experiences in the U.S.

Analysis

Analysis was evident in journals by all our participants and typically expressed through participants examining their own ideas about what they saw and heard. Participant 1 wrote about the housing conditions and presumed income level of the people who lived in those houses. Participants also clarified their ideas about how land is allocated compared to the U.S. (P6), about the development (modernization) of a community – specifically referring to the progressive Mennonite community of Spanish Lookout (P6), the general cleanliness of villages in Belize in comparison to other villages (P6, P1), and the condition of the roads (P2). Participant 4 observed people walking and biking places, instead of using motorized transportation.

Participants also expressed ideas about Belizean people. Participant 3 shared how mothers working outside the home have impacts on children, while P5 believed women and men have equal status in Belizean society. In referencing the culture, P7 shared how they live balancing the ancient Mayan culture and modern culture. Participant 2 expressed her belief that Belizean people are resourceful and hard-working, while seemingly in contrast, P4 discussed a leisurely lifestyle in Belize. We were in Belize close to a national election and based on her observations, P1 believed the people of Belize have a powerful voice in their future.

Because of our visits to several education institutions, participants were able to clarify their own understanding of those institutions. Participant 1 used her knowledge of the U.S. system to understand the Belizean system, and P4 acknowledged the Belizean system was more advanced than originally thought.

Given our focus on agricultural issues, participants clarified their own meanings on many food and agri-

cultural subjects. Participant 1 enjoyed learning about "typical" foods. Many comments focused on agricultural production. Ideas expressed by participants included the opportunity to scale up production (P1), increase exports (P1), the safety of the food supply (P3), organic production techniques (P8), and the notion of farming as a hobby (P6). In reference to farmers, Participant 2 concluded farmers have great soil, but little technical support. Participant 2 expressed her new understanding of how farmers in the U.S. do not have it as tough as they think. In thinking about the long-term importance of agriculture, P8 shared how our visit to the Mayan ruins made him see how agriculture can affect a civilization.

In addition to making meaning out of their own observations, participants also analyzed what they heard from the people. Examples included P7's analysis of her interactions with the staff at the University of Belize on their plans for continuous improvement of the facilities and curriculum. Also, at the University of Belize, P3 was particularly impressed with her conversation with a young female student. One of the more interesting people we met was "Mr. Pop," a farmer in southern Belize. Based on his time with us, P6 believed he was "truly one of the most happiest, joyful people I have ever met" (line 1738).

Inference

All our participants expressed inference through making assessments and drawing conclusions based on what they saw and heard. Every participant made conclusions about Belizean people. Several participants focused on culture. Participant 2 concluded the Mayan culture is alive and well in Belize and P8 said different cultures have different ways of interacting. Overall, a general sentiment was Belize is very accepting of cultural differences (P7). Another common set of conclusions focused on the friendliness of the Belizean people. Participant 1 said all Belizeans were friendly, and P6 referenced the van driver talking with everyone he saw as an indicator of friendliness. Participant 4 concluded friendliness can open doors. Related to friendliness, P2 shared that happiness was everywhere. Another theme about Belizean people focused on their work ethic and approach to their work. Participant 1 concluded Belizeans like doing things by hand, and P6 said the Belizeans showed people can accomplish anything they put their mind to. Belizeans think anything is possible (P1), and regardless of background, hard work can help an individual achieve much (P5).

Another theme focused on the Belizean people's approach to their life situation. Some examples were people do not see themselves in poverty (P1), people are connected to the Earth (P2), Belizeans are prideful people (P3), people are adaptive (P2), people need to look for new ways (P1), people are involved in change (P1), people desire to make a positive impact in their communities (P1), and Belizeans do not like to waste (P1). Participant 1 concluded there are problems in Belize, but there are also people who can solve those problems. Participant 3 believed innovators will change their country. Referencing family unity, Participant 6 concluded Belizean families stick together.

Another inference theme focused on learning and education. Participant 3 concluded people can learn anything at any age. Learning about the past is important to the future (P7). Related to agriculture, Participant 3 concluded it is important to educate all people about agriculture. In terms of educating farmers, contrasting views emerged. Participant 4 concluded home state farmers could teach Belizean farmers, while P7 concluded Mr. Pop's (a Belizean farmer) ideas would be good for American farmers.

Related to agricultural production, participants concluded Belizean production was more capable than originally thought (P1). Similarly, P5 said Belize is a small country that provides on a global scale. Referencing the type of agricultural production, P8 concluded low-cost, practical solutions are needed everywhere. Several participants focused on organic and sustainable farming practices. Some common conclusions were their production practices are focused on sustainable techniques (P2) and organic production in Belize was not a fad (P3). Participant 4, however, did acknowledge organic farming is difficult. Related to gender, P3 concluded women were not viewed as equal in agriculture in the U.S. In terms of agricultural awareness, Belizeans believed more people should be involved in agriculture (P7).

Another set of inferences focused on food security. Participant 1 concluded Belize was not as food insecure as she had originally believed. She also came to understand community gardens could be a solution for food insecurity (P1). Another participant (P4) concluded small family stores were important.

Two participants drew conclusions about medicinal plants. Participant 5 believed medicinal plants are part of Belize's national authenticity. Participant 7 concluded Belizeans take pride in their plants, but Americans know very little about plants.

Several participants drew inferences on a much larger scale, referencing a more holistic view. For example, P5 said everything in Belize is based on the whole. Participant 2 concluded Belize is larger than life and "we are truly one world, one people."

Self-Regulation

Self-regulation focuses on someone monitoring his or her own thinking on a given subject. All our participants were very self-regulated in their thinking. Seeking information was one example, with P1 realizing the need to develop internal questions, and P5 needing to ask more specific questions.

Another set of self-regulating behaviors dealt with biases. Several participants realized their preconceived ideas might influence their interpretation of an event. Participant 1 realized her assumptions might not be correct, and P5 concluded he should watch his own biases. Participant 6 concluded her biases influence how she interacts with other people. Participants learned

they should not rely on preconceived notions (P5), and they must have an open mind (P6). Participants planned to change the way they think based on what they learned (P1) and question why they do things a certain way (P4).

Another example of self-regulation was the importance of hearing multiple perspectives.

Participant 5 summed it up best when he said every story has multiple perspectives. Participants said that it is important for individuals to be open-minded (P5) and a person cannot assume everyone knows everything (P6). Participants 2 and 7 both agreed it is essential to gain perspectives of others. Participant 2 recognized that the study abroad participants had not heard from a specific group of people (progressive Mennonites), which meant the study abroad students were missing a valuable perspective. When gaining perspectives of others, P1 concluded interaction with people is better than observation.

Participants also monitored their own thinking about culture. Participant 4 realized a need to learn more about her own culture and her home state. Participants also realized a need to be more aware (P8) and more conscious (P4) of people's cultures. Participants also expressed desires for changes in their future behaviors, such as the need to be open to other cultures (P6), the need to accept other people's differences (P3), and a general understanding that diversity is good (P6).

Self-regulation was also displayed through a desire to make a difference. Participants 2 and 3 indicated their need to learn how to make a difference in the world. Participant 2 also said she now believes a few people can make a big difference. A need for passion about a given issue was also deemed important (P1, P3). Participant 6 reflected that people can accomplish anything they put their mind to.

Participants also learned the relativity of their own assumptions. Participant 4 realized how good she has it at home. Participant 1 realized her conditions at home were not as bad as she once thought. Participant 7 now understands what she considered as poor may not be the same as what other people think. Participant 2 compared herself to a girl she met and said "I, need not complain about how hard it is to plant or do something."

Another self-regulation theme was the recognition of the importance of certain issues for each participant. In general terms, Participant 4 said she now realizes what is important to her. More specifically, Participant 2 found an increased love for agriculture and the land. Participant 4 now realized the importance for her to be more positive and create good energy. Participant 8 said it is important for him to think beyond plants and look at the people in the local communities; to consider multinational stakeholders when working on an issue; and, in general, to appreciate everything more. Participant 4 said she should be more conscious about important things.

Participants also expressed self-regulation in their thinking about global awareness. Participant 3 probably said it best when she said, "There is more to the world than just my little bubble" (Line 796). Participant 5 realized her prior assumptions about other countries were not correct and was reminded that all countries are not full of big cities. Participant 1 now understands the interconnectedness of the planet.

Participants also thought about the value of sharing this experience with others. Participant 4 acknowledged a need to share what she learned with others and P1 saw the importance in sharing with others. Participant 5 was looking forward to using his experiences to teach others.

Conclusions

Participation in a short-term study abroad program to Belize focused on agricultural issues allowed students to exhibit critical thinking, especially analysis, inference, and self-regulation. However, students seldom demonstrated interpretation and did not exhibit evaluation or explanation.

Instructors of short-term study abroad courses should be encouraged to integrate strategies that help students apply critical thinking skills to process their educational experiences. Assigning prompts in a reflection journal resulted in students in this study applying skills within interpretation, analysis, inference, and self-regulation. However, there was not enough data to support the consistent use of evaluation or explanation skills. Evaluation is the application of skills to assess the credibility and claims made by someone (Facione, 1990). The lack of evidence for evaluation and explanation implies students failed to question the validity of the information they were told by the various individuals with whom they met; this is a concern that needs to be addressed. Explanation requires students to provide evidence of their reasoning to draw a specific conclusion (Facione, 1990). Again, this is a concern, as students wrote a multitude of conclusive statements in their journals but failed to provide systematic evidence of how they reached those conclusions. Course assignments should be structured to require students to demonstrate evaluation and explanation skill sets; a variety of strategies exist for doing so (Cottrell, 2011).

The evidence from this study supports the ability for study abroad courses to develop students' critical thinking skills. Course objectives, focus of international activities, and assignment requirements can influence the extent to which students develop in all three areas. Instructors are encouraged to be intentional in their design to maximize the potential value of the study abroad experience for students. As a starting place, instructors should remember that all learning builds on previous learning and individuals construct their own meaning based on their experiences (Kolb, 1984; Roberts, 2006). Instructors should develop their study abroad programs based on thinking about how these experiences will create transformative changes in their students (Yorks and Kasi, 2006). Study abroad learning experiences are very different than classroom learning,

and instructors should think more holistically about the experiences they wish to create for their students. Yorks and Kasi (2006, p. 43) presented a good model that emphasizes "whole-person" learning and the importance context plays in learning.

Literature Cited

Acker, D.G. 1999. Improving the quality of higher education in agriculture globally in the 21st century: Constraints and opportunities. Journal of International Agricultural and Extension Education 6(2): 47-52. DOI: 10.5191/jiaee.1999.06206.

Bisdorf-Rhoades, E., J. Ricketts, T. Irani, L. Lundy and R. Telg. 2005. Critical thinking dispositions of agricultural communication students. Journal of Applied Communications 90(2): 17-28.

Boyatzis, R.E. 1998. Transforming qualitative information: Thematic analysis and code development. Thousand Oaks, CA: Sage.

Bunch, J.C., A.J. Lamm, G.D. Israel and M.C. Edwards. 2013. Assessing the motivators and barriers influencing undergraduate students' choices to participate in international experiences. Journal of Agricultural Education 54(2): 217-231. DOI: 10.5032/jae.2013.02217.

Cottrell, S. 2011. Critical thinking skills: Developing effective analysis and argument. 2nd ed. New York, NY: Palgrave-Macmillan.

Crawford, P., S. Lange, W. Fink, R. Dalton and L. Fielitz. 2011. Comparative analysis of soft skills: What is important for new graduates? Perceptions of employers, alum, faculty and students. East Lansing, MI: Michigan State University, College of Agriculture and Natural Resources.

Facione, P.A. 1990. Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Executive Summary "The Delphi Report". Millbrae, CA: California Academic Press.

Facione, P.A., C.A. Giancarlo, N.C. Facione and J. Gainen. 1995. The disposition toward critical thinking, Journal of General Education 44(1): 1-25.

Fugate, D.L. and R.W. Jefferson. 2001. Preparing for globalization. Do we need structural change for our academic programs? Journal of Education for Business 76(3): 160-167.

Gorchels, L, T. Jambulingham and T.W. Aurand. 1999. Executive insights: International marketing managers: A comparison of Japanese, German, and US perceptions. Journal of International Marketing 7(1): 97-105.

Harder, A., A. Andenoro, T.G. Roberts, N. Stedman, M. Newberry, S.J. Parker and M.T. Rodriguez. 2015. Does study abroad increase employability? NACTA Journal 59(1): 41-48.

Harri-Augstein, E.S. and L.F. Thomas. 1991. Learning conversations: The self-organized learning way to personal and organizational growth. London, UK: Routledge.

Hart Research Associates. 2010. Raising the bar: Employers' views on college learning in the wake of the economic downturn. http://www.aacu.org/leap/documents/Re8097abcombined.pdf.

Hunter, B., G. White and G. Godbey. 2006. What does it mean to be globally competent? Journal of Studies in International Education 10(3): 267-285.

Kolb, D.A. 1984. Experiential learning: Experience as the source of learning and development. Upper Saddle River, NJ: Prentice Hall.

Lamm, A.J., K.J. Cannon, T.G. Roberts, T.A. Irani, L.J. Unruh Snyder, J. Brendemuhl and M.T. Rodriguez. 2011. An exploration of reflection: Expression of learning style in an international learning context. Journal of Agricultural Education (52)3: 122-135. DOI: 10.5032/jae.2011.03122.

Lamm, A.J. and T. Irani. 2011. UFCTI manual. Gainesville, FL: University of Florida.

Lincoln, Y.S. and E.G. Guba. 1985. Naturalistic inquiry. Newbury Park, CA: Sage.

Moore, E.A. and M.D. Woods. 2003. Internationalization of agricultural education and related disciplines: A review of research. Paper presented at the National Agricultural Education Research Conference (NAERC), Orlando, FL.

Northfell, A.N. and L.D. Edgar. 2014. Using reflective journals to compare an international faculty-led study tour and student internship experience. Journal of Applied Communications 98(4): 28-41.

Perry, L., L. Stoner and M. Tarrant. 2012. More than a vacation: Short-term study abroad as a critically reflective, transformative learning experience. Creative Education 3(5): 679-683.

Ritz, A. 2011. The educational value of short term study abroad programs as course components. Journal of Teaching in Travel and Tourism 11: 164-178.

Roberts, T.G. 2006. A philosophical examination of experiential learning theory for agricultural educators. Journal of Agricultural Education 47(1): 17-29. DOI: 10.5032/jae.2006.01017.

Roberts, T.G., N.L.P. Stedman, A. Harder, J.L. Gouldthorpe and N. Coers. 2013. Conceptual framework for studying globally integrated education activities. Gainesville, FL: Global Education Lab.

Rudd, R., M. Baker and T. Hoover. 2000. Undergraduate agriculture student learning styles and critical thinking abilities: Is there a relationship? Journal of Agricultural Education 41(3): 2-12. DOI: 10.5032/jae.2000.03002.

Sankey Rice, L., D. Foster, M. Miller-Foster and K. Barrick. 2014. Discovering global competencies of agriculture education students through reflective journaling. NACTA Journal 58(4): 324-329.

Thorpe, K. 2004. Reflective learning journals: From concept to practice. Reflective Practice 5(3): 327-343.

Yorks, L. and E. Kasi. 2006. I know more than I can say: A taxonomy for using expressive ways of knowing to foster transformative learning. Journal of Transformative Education 4(1): 43-64. DOI: 10.1177/1541344605283151.

Faculty Perceptions of Incorporating Service-Learning into Landscape Horticulture Courses

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Abstract

Service-learning incorporates community-based projects with reflection and assessment for promoting deeper student learning. The purpose of this study was to assess service-learning incorporated in landscape horticulture programs in the U.S. An on-line survey was emailed to 132 faculty members at 2- and 4-year schools and 41 completed surveys were returned for a 32% response rate. Fifty-six percent of respondents included community or service-learning projects in their courses, but 59% reported that there was no service-learning training available at their institution. Eighty-one percent of respondents indicated they have not participated in service-learning training. Seventy-two percent of respondents who were engaged in service-learning rated its assessment as very or extremely important, however they rarely performed pre- and post-learning assessment. Forty percent of respondents indicated that they had received recognition or awards for their community or service-learning projects and 12% had performed Scholarship of Teaching and Learning (SoTL) research related to service-learning. However, 70% of respondents reported that they did not receive credit for service-learning projects in their yearly performance evaluation. As institutions of higher education emphasize civic engagement, campus communities may wish to examine service-learning efforts already underway in landscape horticulture programs and determine effective ways to train faculty on service-learning methodologies.

Introduction

Service-learning is a pedagogical method shown to increase engagement and promote deeper learning among students (Grossman et al., 2013; Ross, 2012; Waliczek and Zajicek, 2010), and much of the development and implementation of service-learning has been seen in colleges of agriculture (Stephenson et al., 2013). Eyler and Giles (1999) use a definition of service-learning that highlights the role community service plays in student learning. While service-learning aims to connect the classroom with the community (Speck 2001), service-learning and community service are not synonymous (Stephenson et al., 2013). Rosenberg (2000) notes that service-learning builds from classroom experiences to student empowerment, providing a structure within which students take ownership of real-world endeavors to develop their personal and professional abilities.

Research provides evidence that service-learning improves student learning and development. For example, integrating service-learning increases students' knowledge and understanding of course-related concepts (Waliczek and Zajicek, 2010; Garner, 2011). With this deeper understanding of content, students have also reported a greater sense of confidence in their professional skills (Grossman et al., 2013) and improvements in their ability to write and think critically, as well as increases in their overall grade point averages (Astin et al., 2000). The value of service-learning to students is maximized when they reflect upon the experience in a meaningful way (Ash, 2003).

As an increasing number of colleges and universities work to build stronger connections between the institution and community, it is also important to recognize the contribution service-learning makes toward that goal. Bringle and Hatcher (2000) discuss how service-learning can contribute to colleges and universities fulfilling the service aspects of their institutional missions.

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Through service-learning, students have demonstrated their ability to transfer their knowledge to the community (Garner, 2011). The scope of service-learning impact has also been connected to alumni giving and civic engagement. Prokopy et al. (2014) report that college students who completed service-learning experiences came away with a feeling of responsibility to help others, and a desire to become involved in their communities. Initial findings in a study by Knauft et al. (2013) reveal that alumni who participated in a college service-learning course were more likely to volunteer in the community, remain engaged, and contribute to the college than those alumni who did not participate in service-learning.

Karasik (2005) identifies several challenges associated with integrating service-learning, such as designing effective assessment strategies, addressing student resistance, and balancing the needs of the community partner with the curriculum goals. Berle (2006) suggests that one way to address these challenges is to start slowly and add complexity over time when integrating a service-learning component into the curriculum. With regard to students, the work of Diambra et al. (2009) asserts the importance of addressing student concerns and expectations prior to the start of a service-learning project, as it helps mediate student resistance to the experience. Furco (2001) contends that successful implementation of service-learning can be best achieved via institutionally-supported faculty with an intrinsic motivation toward enhancing student learning through service. O'Byrne (2001) describes several common faculty misconceptions on college campuses that hinder the adoption of service-learning, including the perspectives that existing internships and field experiences already constitute service-learning, that service-learning is synonymous with community service and therefore assigning credit for service-learning amounts to a watering down of academic rigor, that competing demands on their time render faculty unable to build service-learning into their curricula, and that service-learning will not help them advance in their careers. O'Byrne (2001) and Furco (2001) offer several suggestions for dispelling these myths, including clearly defining service-learning and differentiating it from community service, using service-learning as a strategy to accomplish other university goals (i.e., student retention), and encouraging faculty to utilize service-learning in their research activities.

Successful service-learning projects address the needs, motivations and outcomes of the multiple stakeholders associated with those projects, including faculty, students, community, and educational institutions. A significant aspect of service-learning research involves assessing both short and long-term service-learning impacts for those stakeholders. Studies by Driscoll et al. (1996) and Holland (2001) affirm the importance of utilizing multiple means of analysis to measure the impact of service-learning and support an inclusive analysis of the impacts on each of those stakeholders. Therefore, a robust model for assessing service-learning impact would include analysis of course syllabi, reviews of faculty vitae for evidence of related scholarship of teaching and learning (SoTL) activities, classroom observations, interviews and reflections with student feedback, focus groups and interviews with community partners, and examination of campus strategic plans and mission statements.

Given what is commonly understood about the benefits of service-learning to student development and engagement, the purpose of this study is to determine if, and how, service-learning is incorporated in the curricula of two and four-year landscape horticulture programs in the U.S. In addition, this study aims to identify the scope of assessment efforts for service-learning activities, the level of institutional support for service-learning, and the perceived barriers and benefits to employing this teaching method.

Materials and Methods

In consultation with Iowa State University's Institutional Review Board (ISU-IRB), a 27-question survey instrument was developed that included both closed- and open-ended questions addressing university/college program and instructor demographics, instructors' implementation of service-learning, perceived benefits of service-learning, barriers to implementing service-learning, the assessment of service-learning, and how assessment results have been reported and used. The study was deemed exempt under federal regulation 45 CFR 46.101(b) by the ISU-IRB. The survey was created in Qualtrics (Qualtrics, Provo, UT), and the pool of study participants was compiled from a list of 2- and 4-year programs offering a degree and/or certificate in landscape horticulture, which is maintained by the National Association of Landscape Professionals (NALP), Herndon, VA (formerly PLANET). This population was chosen for the study because faculty members on this list are those whose students participate in the National Association of Landscape Professionals National Collegiate Landscape Competition, an indication that these individuals are already engaged in going beyond typical classroom activities and therefore service-learning may be of interest to them. A link to the survey was sent to the 143 faculty members on that list on 5 August 2013. A reminder email was sent to survey recipients on 12 August 2013, and the survey remained open until 19 August 2013. Of the 143-survey links that were sent, eleven were returned due to invalid email addresses, yielding a potential respondent pool of 132 individual faculty members. Qualtrics was used to compile summary statistics from completed surveys.

Results and Discussion

Demographics

A total of 41 surveys were received from a potential respondent pool of 132 recipients, for a 32% response rate. Forty of those respondents provided information about the type of degrees offered by their programs.

Table 1. Open-ended responses to the question "What is your definition of service-learning?" by 2- and 4-year landscape management faculty (N = 17).

Activities that combine teaching students concepts and techniques with some form of outreach outside the classroom that is designed to improve the local community of help individuals or groups in need.
Any activity that involved serving others without pay.
Allowing students to complete a community or campus service while learning skills they need to complete that type of project.
Incorporation of a service project into a course so that the project will be meaningful to the students and the organization where the project is performed (ex: building a retaining wall at a local park of a landscape construction class).
The students learning about their field while working on a real project in the community. They are then helping someone and gaining real world experiences. Both benefit greatly.
Incorporating hands-on projects that tie into the course objectives so that students have experience in that area and that the project benefits the community.
An authentic hands-on project in the community.
Students must work on a project that benefits the university and/or the community; tree planting, drainage swale management, habitat restoration, etc. This is done on their time, usually a Saturday.
Live projects used as a course assignment, as well as paid and/or unpaid industry work experience.
Doing a project in the community that relates to the content covered in the course. It requires the students to think about what they have done and how they have applied what they have learned in the course to the project.
Cooperative services performed by the students with local business.
Student participation in real world projects that benefit an underserved population or non-profit group.
When you empower students by getting them involved in community-based activities that directly connect to curriculum. When there is a tangible end goal with a purpose, students retain information better and become more engaged in the activity.
Projects that enable students to provide service to the community while learning or practicing professional skills.
A project in which students gain valuable knowledge while providing a service to the community.
Provide service for the community.
What do you mean by service-learning? Learning by doing in labs, community service, or in student internships?

Twenty respondents were from landscape horticulture programs offering a 2-year degree, 16 were from programs offering a 4-year degree, and four were from programs offering both a 2- and a 4-year degree. The average teaching load was reported as 6.3 courses per year, with an average of 5.5 courses each year that had a laboratory component. Respondents reported an average of 16.4 years of college/university teaching experience, with a range of 1 to 33 years. Those who indicated that they were not doing service-learning in their courses were forwarded to the end of the survey, and therefore the remainder of the analysis herein focuses on the twenty-eight respondents who reported that they were currently engaged in service-learning with their courses.

Implementation of and Support for Service-Learning

Table 1 illustrates the responses provided to the open-ended question: "What is your definition of service-learning?" Seventeen responses were received to this question; common themes emerged such as serving the community, applying classroom teaching in a meaningful way, and moving students toward accomplishing a task that benefits others. As shown in Table 2, 56% of respondents included community service projects in their laboratory experiences.

Table 2. Activities incorporated into laboratory components of courses taught by 2- and 4-year landscape management faculty.

Activity (N = 39)	Number of Responses	%
Experimentation in an indoor laboratory	21	54
Activities in a campus greenhouse	29	74
Outdoor activities on campus	35	90
Tours of professional businesses	33	85
Projects on private residential property	16	41
Community service projects	22	56
Case study exercises	15	38
Others? Please specify [z]	3	8

[z]Responses included: outdoor labs at local arboreta; a designated area on campus for design, installation and maintenance laboratory activities; plant quizzes at public and private gardens.

Table 3. Aspects of service-learning in which 2- and 4-year landscape management faculty are comfortable with their own knowledge and level of training.

Aspect of Service-learning (N=26)	Number of Responses	%
Identifying projects relevant to course learning objectives	4	15
Identifying & contacting community partners	5	19
Finding sources of funding for service-learning projects	18	69
Developing projects which fit into the class/laboratory time available	10	38
Developing student reflection techniques	10	38
Developing assessment of service-learning outcomes	9	35
I feel confident in my service-learning knowledge	7	27

Table 4. Responses of 2- and 4-year landscape management faculty to questions regarding departmental, college, and institutional support of service-learning.

Survey Questions	Number of Responses	Mean Ranking[z]	SD [y]
How would you rate your department's level of support toward service-learning?	27	6.59	2.90
How would you rate your college's level of support toward service-learning?	26	6.62	3.06
How would you rate your university's level of support toward service-learning?	19	6.74	3.14

[z]Scale ranking varied from 1 = minimally supportive to 10 = highly supportive

[y]SD = standard deviation

Most respondents (59%) reported that, to their knowledge, their institutions did not offer faculty training on how to develop and implement service-learning projects in their courses. Further, 81% indicated that they have not taken part in any such training. One survey question listed several aspects of service-learning and asked respondents to identify aspects they felt they could use more knowledge or training in. Table 3 illustrates that while seven respondents indicated that they felt confident in their knowledge of service-learning, "Finding sources of funding for service-learning projects" was the most frequently-reported training need (69% of respondents).

Results indicate that the number of service-learning projects completed per year decreased among the survey respondents, from a mean of 7.15 projects annually five years prior to the survey, to a mean of 3.06 projects annually in the year preceding dissemination of the survey.

Using a 10-point Likert scale (1=minimally supportive; 10=highly supportive), respondents rated departmental, college, and university support toward service-learning at a mean of 6.59, 6.62, and 6.74, respectively (Table 4).

Using a 5-point Likert scale (1=not important at all; 3=neither important nor unimportant; 5=extremely import-

Table 5. Ranking of the importance of aspects of service-learning in their courses by 2- and 4-year landscape management faculty.

Aspect of Service-learning	Importance of Aspects of Service-learning (% respondents) 1. Not important	2. Very unimportant	3. Neither important nor unimportant	4. Very important	5. Extremely important	Mean Ranking	SD[z]
Importance of service-learning to your teaching [y]	0	0	20	56	24	4.04	0.68
Importance of service-learning to student learning [y]	0	0	12	44	44	4.32	0.69
Importance of service-learning to students finding employment [y]	0	8	8	64	20	3.96	0.79
Developing unique service-learning projects [x]	0	0	63	29	8	3.46	0.66
Relating service-learning projects to course objectives [y]	0	0	8	56	36	4.28	0.61
Involving students in the planning of service-learning projects [y]	0	8	24	52	16	3.76	0.83
Increasing the civic engagement of your students [y]	0	0	8	60	32	4.24	0.60
Assessment of service-learning [x]	0	4	25	58	13	3.79	0.72
Reporting service-learning outcomes [y]	0	4	32	64	0	3.60	0.58
Creating time for student reflection exercises [y]	0	0	56	36	8	3.52	0.65

[z] SD = standard deviation
[y] N = 25
[x] N = 24

ant), respondents rated the importance of ten service-learning aspects. "Importance of service-learning to student learning" (4.32) and "relating service-learning projects to course objectives" (4.28) were considered the two most important attributes, with "creating time for student reflection exercises" (3.52) and "developing unique service-learning projects" (3.46) rated as the least important (Table 5). Respondents were asked to estimate how much time they invested in developing their service-learning projects, and the number of in-class or out-of-class hours spent working with students to complete those projects. As described in Table 6, the mean values were 11-15 hours, and 16-20 hours, respectively.

Table 6. Responses of 2- and 4-year landscape management faculty to the time required to develop and complete service-learning projects in their courses.

Survey Statement	Response rate (%) 0-5 hours	6-10 hours	11-15 hours	16-20 hours	5. 21-25 hours	6. >25 hours
Please estimate how much time it takes you to develop and prepare for a service-learning project [z]	12	24	16	20	16	12
Please estimate how much time it takes you to complete a service-learning project[y]	4	25	21	13	8	29

[z]N = 25, mean = 3.40
[y]N = 24, mean = 3.83

Respondents also ranked the difficulty of seven aspects of incorporating service-learning projects into their courses (1=most difficult; 7=least difficult). "Finding funding for transportation, equipment, and materials" (2.46) and "finding enough class time to complete service-learning projects" (2.75) presented the greatest challenges, with "relating course learning to service-learning activities" (4.83) and "developing student reflection exercises for service-learning (5.13) were the least challenging (Table 7).

Respondents were presented with a list of possible funding sources for service-learning projects and were asked to indicate which of those sources had funded their projects. Sixty-three percent of faculty reported using departmental/institutional funding, and 50% indicated they had received funding from the beneficiaries of their projects. Course fees and grant funding were each selected by 20% of respondents. The survey allowed respondents to list funding from other sources not included in the question and these included student fundraisers and utilizing funds from their institution's horticulture club.

Recognition for Service-Learning

Seventy percent of respondents reported that they did not receive credit for service-learning projects in their yearly performance evaluation. It is impossible to know whether an individual faculty member's teaching evaluation is helped implicitly by his or her service-learning activities, but these results suggest that the extra work involved in planning and executing these projects it not explicitly acknowledged in many institutions' faculty evaluation framework. However, 40% did indicate that they had received recognition or awards for their projects (i.e. local press coverage and community service awards). Additionally, 12% of respondents completed SoTL research related to their service-learning projects, with that work being published in peer-reviewed journals or presented at professional conferences.

Assessment of Service-Learning

As shown in Table 5, 72% of respondents rated assessment of service-learning as very important or extremely important. Further questions asked about faculty members' assessment of service-learning in their courses. Using a 5-point Likert scale (1=never; 3=sometimes; 5=all of the time), faculty indicated that they tended to establish and share with their students clear learning objectives for service-learning (3.52), but that they rarely performed pre- and post-learning assessment (2.16), nor did they write up a summary documenting learning outcomes or assessments of service-learning (2.36) (Table 8).

Table 7. Ranking of challenges associated with incorporating service-learning into courses for 2- and 4-year landscape management faculty (N=24).

Service-learning Challenge	Mean Ranking [z]	SD [y]
Finding project ideas & community partners	4.46	2.47
Finding funding for transportation, equipment and materials	2.46	1.67
Finding enough class time to complete service-learning projects	2.75	1.51
Relating course learning objectives to service-learning activities	4.83	1.52
Assessing service-learning projects	4.00	1.64
Developing student reflection exercises for service-learning	5.13	1.62
Follow-through when the course is over	4.38	1.97

[z] Scale ranking varied from 1 = most difficult to 7 = least difficult
[y] SD = standard deviation

Table 8. Establishment of objectives and assessment of service-learning in courses by 2- and 4-year landscape management faculty.

	Importance of Aspects of Service-learning (% respondents)						
Aspect of Service-learning (N=25)	Never	Rarely	Sometimes	Often	All the Time	Mean Ranking	SD[z]
Establish clear learning objectives and share them with your students	0	12	32	48	8	3.52	0.82
Perform pre- and/or post-learning assessment	12	68	16	0	4	2.16	0.80
Write up or summarize learning outcomes and assessments	24	36	28	4	8	2.36	1.15

[z] SD = standard deviation

Additionally, virtually all survey respondents (96%) reported that they did not include specific questions on their end-of-semester course evaluations related to the courses' service-learning activities. Those who did write assessments of their service-learning activities shared them most frequently with their department or college administrators (63%). Additionally, respondents shared their service-learning assessments with stakeholders (31%), clients (25%), and via peer-reviewed journals (19%). For faculty members at institutions that use standardized end-of-semester course evaluations, adding items specifically addressing service-learning activities may be impossible. However, the use of pre- and post-learning assessments outside of the typical course evaluation system may provide illustrative feedback on the value of service-learning that could then be shared with stakeholders and clients to further strengthen the relationship between the landscape horticulture programs and their community partners.

Summary

Service-learning is widely used in both two- and four-year landscape horticulture programs. Faculty recognize this pedagogical approach makes an important contribution to teaching, student learning, and student career development. Faculty members persist in developing and implementing service-learning opportunities despite the common challenges of funding, time commitment, and lack of recognition of service-learning in their annual performance evaluations. Our results show there has been a marked decrease in the number of service-learning projects completed annually in recent years by the survey respondents. While our results do not identify the cause of this decline, one possible explanation is the combination of the time required to develop and implement service-learning, together with the lack of credit given to faculty members for service-learning in their yearly performance evaluation, leading to a reduction in the number of projects individual faculty members are willing to pursue in a given year. Future research may explore in detail the reasons behind the recent decline of service-learning in landscape horticulture curricula. In general, our results support what is reported in the literature, which suggests that the lack of professional development and institutional recognition, together with the challenges of project funding, limits faculty involvement in service-learning. Institutions can support faculty members in their service-learning pursuits in a variety of ways such as training, incentivizing, and recognition. As civic engagement initiatives become more common on college and university campuses, institutions may look to landscape horticulture programs for service-learning models to emulate.

Literature Cited

Ash, S.L. 2003. Integrating service-learning into a college-level nutrition course. Journal of Nutrition Education and Behavior 35(3): 161-163.

Astin, A., L.J. Vogelgesang, E.K. Ideda and J. Lee. 2000. How service learning affects students. Higher Education Research Institute. University of California: Los Angeles, CA.

Berle, D. 2006. Incremental integration: A successful service-learning strategy. International Journal of Teaching and Learning in Higher Education 18(1): 43-48.

Bringle, R.G. and J.A. Hatcher. 2000. Institutionalization of service learning in higher education. Journal of Higher Education 71(3): 273-290.

Diambra, J.F., T. McClam, A. Fuss, B. Burton and D.L. Fudge. 2009. Using a focus group to analyze students' perceptions of a service-learning project. College Student Journal 43(1): 114-122.

Driscoll, A., B. Holland, S. Gelmon and S. Kerrigan. 1996. An assessment model for service-learning: Comprehensive case studies of impact on faculty, students, community, and institution. Michigan Journal of Community Service Learning 3(1): 66-71.

Eyler, J. and D. Giles, Jr. 1999. Where's the learning in service-learning? Jossey-Bass, San Francisco, CA.

Furco, A. 2001. Advancing service-learning at research universities. New Directions in Higher Education 114: 67-78.

Garner, L.C. 2011. Meeting learning objectives through service-learning: A pomology case study. HortTechnology 21(1): 119-125.

Grossman, J., M. Schroeder-Moreno, K.S.U. Jayaratne and S. Smith. 2013. Application of service-learning in two courses for a hands-on, minds-in and hearts-felt educational experience. NACTA Journal 57: 34-35 (abstract).

Holland, B.A. 2001. A comprehensive model for assessing service-learning and community-university partnerships. New Directions in Higher Education 114: 51-60.

Karasik, R.J. 2005. Whispers and signs: The unwritten challenges of service-learning. To Improve Academy 23: 236-253.

Knauft, D., S. Brackmann, S. Wilder and D. Berle. 2013. Post-graduation community engagement habits of service-learning course participants. NACTA Journal 57: 26 (abstract).

O'Byrne, K. 2001. How professors can promote service-learning in a teaching institution. New Directions in Higher Education 114: 79-87.

Prokopy, L.S., R. Williams, L. Bowling and A. Thompson. 2014. Service learning in natural resources classes: Measuring the impacts on university students. NACTA Journal 58(3): 202-207.

Rosenberg, L. 2000. Becoming the change we wish to see in the world: Combating through service learning learned passivity. Academic Exchange Quarterly 4: 6-11.

Ross, M.E.T. 2012. Linking classroom learning to the community through service learning. Journal of Community Health Nursing 29: 53-60.

Speck, B.W. 2001. Why service-learning? New Directions Higher Education 114: 3-13.

Stephenson, T.J., N. Peritore, K. Webber and J. Kurzynske. 2013. A learner-centered teaching model integrating undergraduate research and service learning. NACTA Journal 57(3): 40-46.

Waliczek, T.M. and J.M. Zajicek. 2010. The benefits of integrating service teaching and learning techniques into an undergraduate horticulture curriculum. HortTechnology 20(5): 934-942.

Using Images to Engage Online and On-Campus Students in Meaningful Reflection

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Abstract

This study employed an exploratory, mixed methods design to investigate the impact of visual representations when used as reflection on students' perceptions of a graduate level Research Methods in Agriculture class. Qualitative data suggested visual reflections were well received by students. Six themes were identified: novelty of visual reflections, visual reflections were a positive addition to the class, visual reflections had a positive impact on students' course performance, visual reflections had a positive impact on students' management of their stress, visual reflections had a positive impact on student-instructor connectedness, and visual reflections had a positive impact on student-student connectedness. However, there were no statistically significant differences in students' perceptions of the instructor's verbal immediacy, affective learning, or academic stress between those that engaged in visual reflections and those that did not. Although the quantitative findings of this study were not significant, the qualitative findings suggest visual representations can provide a well-received method of reflection for students.

Introduction

Researchers have long regarded reflection as a crucial part of the learning process (Boud et al., 2013); however, the mode of reflection can vary. While some students may prefer written reflections, others may prefer verbally reflecting in a classroom setting (Lamm et al., 2011). Additionally, "one form of reflective practice may not fit the needs of all students" (Lamm et al., 2011, p. 132). According to Lamm et al. (2011), it is most important that students are provided with reflection opportunities that "accommodate a variety of learning styles" (p. 132). The mode of reflection may influence an individual's attitude regarding the value of the reflective practice, which could in turn negatively impact the reflective experience (Dewey, 1933); *"the attitudes an individual brings to bear on the act of reflection could either open the way to learning or abstract it"* (Husu et al., 2008, p. 39).

The brain can process information via two modes: semantic processing, which involves linguistic expression, and nonlinguistic processing, which involves the construction of images of information (Marzano, 2010; Paivio, 1990). Learning through nonlinguistic representations, which requires students to process information by constructing representations of information and then explaining those representations to others, allows students to explore their perceptions and understanding about a concept without reliance on language (Marzano, 2010). Students who learn through nonlinguistic representations generate greater brain activity, as they store knowledge both linguistically and visually (Bamalli, 2014). The positive impacts of nonlinguistic representations on K-12 students' learning have been well documented – Haystead and Marzano (2009) found that, across 129 action research studies with one class employing nonlinguistic strategies and another employing linguistic strategies to learn the same content, students engaging in nonlinguistic learning strategies experienced a 17 percentile point gain in student achievement on average.

While nonlinguistic representations have been used to assist students in learning content, little information is known about the impact of nonlinguistic representation as a means of reflection. The benefits of nonlinguistic representations and necessity for reflection in the learning process warrant investigation into the impact of nonlinguistic representations in reflection on student success.

When used as a learning tool, nonlinguistic representations can take on many forms, including *"graphic organizers, sketches, pictographs, concept maps, dra-*

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matizations, flowcharts, and computerized simulations, to name a few" (Marzano, 2010, p. 84). Marzano (2010) issued five characteristics of nonlinguistic representations, recommending teachers keep these in mind when employing nonlinguistic representations as a means of processing content. First, they come in many forms, and teachers should select the form of the nonlinguistic representation based on time available and content addressed. Next, they must identify crucial information; *"nonlinguistic representations that fail to focus on crucial information can have little or no positive effect on student learning"* (Marzano, 2010, p. 85). Third, students should explain their nonlinguistic representations. This explanation can assist students in drawing linguistic understanding from their nonlinguistic representations of the content. Nonlinguistic representations can take quite a bit of time when students are constructing them – teachers should consider this characteristic when utilizing this learning tool. Lastly, students should revise their nonlinguistic representations as they gain deeper understanding about a topic, similar to the way in which they would add to or correct their notes in class.

The act of reflection is more focused on the processing of information in relation to oneself. Dewey (1933) defined reflective thought as a controlled approach to thinking that allows the thinker to be more aware of the link between actions and consequences. Reflection, after taking action and experiencing the subsequent effect, "reveal[s] forgotten choices" and "expose[s] hidden alternatives", which may be considered when taking future action (Lynch, 2000, p. 36). Rodgers (2002) summarized Dewey's recommendations on quality reflective practice into four criteria. First, reflection is a process by which a learner moves from one experience to the next with a deeper understanding of how the experience is connected to other people's experiences and ideas. Next, reflection consists of several phases: spontaneous interpretation of an experience, identification of the problems or questions that result from the experience, generating possible explanations for the problems or questions, developing and testing the explanations, and efforts to solve the problems posed. Reflection also needs to include interaction with others. *"This is crucial because expressing one's ideas or thoughts to others with sufficient clarity for them to understand, reveals both the strengths and weaknesses of one's thinking"* (Husu et al., 2008, p. 38). Lastly, reflection requires the individual to acknowledge the value of one's own personal and intellectual growth, as well as the growth of others.

Purpose and Objectives

This study employed an exploratory, mixed methods design to investigate the impact of visual representations when used as reflection (hereafter referred to as visual reflections) on students' perceptions of a graduate level Research Methods in Agriculture class. The qualitative component of the study occurred in the fall semester of 2015 and was designed with the purpose of understanding students' perceptions of visual representations when used as a reflective exercise. Objectives were to describe students' perceptions of 1) the nonlinguistic reflection assignments; and 2) the assignments' impact on their experience within the course and with the instructor. The quantitative component of the study occurred in the fall semester of 2016 and was designed with the purpose of determining the impact of visual representation assignments when used as reflective exercises on students' affective learning, academic stress, and perceptions of teacher immediacy. The dependent variables of the quantitative study were developed as a result of the themes that emerged from the qualitative study. Objectives were to 1) describe the affective learning, academic stress, and perceptions of teacher immediacy among students who did not engage in weekly visual reflections during a research methods course and those that did; and 2) determine the differences in mean scores of each variable between the two groups. The University of Arkansas Institutional Review Board approved both components of the study and all participants provided written informed consent prior to participation in the study.

Methods

Qualitative Component

The qualitative component of the study was carried out in a graduate level Research Methods class in the College of Agriculture, Food, and Life Sciences at the University of Arkansas. This course was delivered in a combined face-to-face and online format. All students in the class (N=30) were asked to complete weekly visual reflections regarding their feelings related to the course content. The visual reflection assignment was designed to align with the criteria for visual representations (Marzano, 2010) and reflection (Rodgers, 2002) as they intersected with one another. Each week, the assignment instructions read:

Through an internet search, find one image that accurately portrays your relationship with this class. Essentially, you should be finding an image that shows how you feel about embarking on this adventure in learning about research methods. Copy the image to a word document. Below the image, type one paragraph explaining why you selected this image and how it represents your feelings. There are no wrong answers, so be honest! Your honesty will help classmates who might feel the same way and will help me adjust instruction to meet your needs, strengths, and concerns. These images will be discussed each Thursday during our class meeting, so be sure to submit by Wednesday night.

Visual reflections were highlighted each week, with between eight and 12 students' reflections being highlighted. Those that were highlighted were selected by the instructor according to level of detail in the students' provided explanations; reflections that suggested careful selection of an image to display the student's thoughts were selected to be highlighted. The number of reflections selected each week was dependent upon

Figure 1. Student visual reflection. Students provided their visual reflections along with an explanation justifying their image selection. Visual reflections were intended to depict a student's feelings regarding the class at the time.

the amount of time the instructor anticipated other course content would require; the course was scheduled for 90 minutes. Students were given the opportunity to verbally explain their image and how it represented their feelings toward the class to the other students. The online students participated in discussion via an online meeting room each week. Dialogue regarding images and explanations, including statements of agreement, appreciation of the use of specific images, and content-related assistance occurred naturally among the class throughout these presentations each week. An example of a student submission is displayed in Figure 1, accompanied by the student's explanation:

The student explained, *"just taking a moment to survey the task in front of me, but also admiring where I have come so far. I feel like I have learned new things about research that I had not seen before, but also apprehensive of the mountain of work in front of me. I will be successful, but not without a workout!"*

At the end of the visual reflection discussion, the instructor would share her own visual reflection in response to the students' reflections. An example of one of the instructor's visual reflections is shared in Figure 2, with the explanation below:

During the second week of class, after most students had submitted visual reflections that displayed their nervousness about the next 14 weeks. In response, I, as the instructor, shared this visual reflection with them, explaining, *"In the Polar Express, the children aren't sure what's in store for them. Some are worried. The mountain they're climbing is pretty scary looking. But the conductor has done this a million times. He's not worried or nervous. The train he's got them on is warm and safe. I'm the conductor – I've helped many students conquer the mountain of research methods. Just stay on the train with me, and it will be a great ride!"*

Typical case sampling was used to recruit students from the population (Flick, 2006) for data collection; students were selected using simple random sampling from among those who earned overall course grades above the lowest quartile. Because the qualitative component of this study was designed to inform the subsequent quantitative component, participants were recruited one at a time until data saturation was reached. Students' responses yielded very uniform data, leading to a sample of four. Data was collected via one-on-one interviews conducted face-to-face for on campus students (n=1) and via an online meeting system for students taking the course online (n=3). An interview protocol was approved by the University's Institutional Review Board and used to ask respondents about their image selection process, their perceptions regarding the visual reflection assignments' impact on their stress management, feelings toward the class and content, focus on the course modules, and feelings toward other classmates and the instructor. Questions also asked students to speculate on their performance in the class, had the visual reflection assignments not been part of the class. All data were transcribed verbatim into Microsoft Word and analyzed via the constant comparative method (Glaser and Strauss, 1967). Rigor was established using Lincoln and Guba's (1985) evaluative criteria. Credibility was established through member checking, as all respondents were given copies of their interview transcripts and the themed data and asked to respond with any edits they had. Transferability was established via the description of the course, assignments, and students. Dependability

Figure 2. Sample of instructor's visual reflection. Visual reflections were provided to students with explanation regarding the selection of the image following the students' sharing of their visual reflections.

and confirmability were established via triangulation with the subsequent quantitative portion of the study.

Quantitative Component

Online and face-to-face students enrolled in the fall 2016 graduate-level Research Methods course (N=31) were randomly assigned to a control (n=16) or treatment group (n=15), in which the treatment group submitted weekly visual reflections with the same instructions as in the qualitative portion. For the weekly assignments, students were asked to search for an image that represented their feelings regarding the course content for the week and include a justification for their selection. Again, the images were used to spur discussion during the treatment group's weekly classes.

While not found within the literature, themes uncovered in the qualitative portion led to the quantitative measurement of teacher immediacy, affective learning, behavior intentions, and academic stress. Teacher verbal immediacy was evaluated using Gorham's (1988) survey of verbal immediacy. While immediacy can be measured via verbal and nonverbal cues, the online nature of the class limited evaluation to only include verbal immediacy, as students did not have an opportunity to see the professor's nonverbal cues. One item ("Is addressed by his/her first name by students") was removed, as the university has an established culture of addressing teachers by "Doctor". Gorham initially calculated internal consistency using split-half and the result was 0.94. Nonverbal immediacy was not assessed because of the online class setting. The pilot test (n=13) of undergraduate agricultural education students led to a Cronbach's ∞ of 0.88. Affective learning, including both attitude and behavioral intention, was measured using instrumentation created by McCroskey et al. (1985). The instrument measured attitude toward course content and instructor utilizing 7-step bipolar scales. The scales ranged from bad to good, worthless to valuable, unfair to fair, and negative to positive, with an internal consistency of 0.98 on the pilot test. Behavioral intention was measured to assess the likelihood of attempting to engage in behaviors recommended, likelihood of enrolling in another course of similar content, and the likelihood of enrolling in another course with the instructor. Scales ranged from unlikely to likely, impossible to possible, and improbable to probable with an internal consistency of 0.94 in the pilot test. Academic stress was measured by Lakaev's Academic Stress Response Scale (2006). The instrument assesses university students' stress in four domains: physiological, behavioral, cognitive, and affective. The pilot test yielded internal consistency scores of 0.67 for affective stress, 0.76 for behavioral stress, 0.86 for cognitive stress, and 0.89 for psychological stress. The instruments were combined to create one electronic instrument which was constructed using Qualtrics and distributed to students via email.

Per the protocol approved by the University Institutional Review Board, students in each group were asked to complete the full instrument via a link in an email sent after the final exam for the course. A response rate of 96.8% (n=30) was achieved.

Results and Discussion

Qualitative Portion

Largely, data suggested visual reflections were well received by students. Data yielded six themes: novelty of visual reflections, visual reflections were a positive addition to the class, visual reflections had a positive impact on students' course performance, visual reflections had a positive impact on students' management of their stress, visual reflections had a positive impact on student-instructor connectedness, and visual reflections had a positive impact on student-student connectedness.

Novelty of Visual Reflections

All four respondents noted they had not experienced any assignment similar to the visual reflections in previous classes. This novelty was viewed positively by one respondent, who stated, *"it was nice to do something that was kind of out of the ordinary for courses. I'd never done anything like that before and it was kind of nice."* (P1, lines 16-17). The other three respondents were wary about the assignments because of their novelty. One student stated they were "hesitant at first" (P. 3, line 8), adding, *"when we first started the course, I was not all that enthused about [the visual reflections]. I thought it was going to be kind of a waste of time"* (P3, lines 3-4). Another student worried the assignments might be busy work because they were *"unsure of the reason behind [the visual reflections] at first…it was the first time I had ever done anything like that in a class."* (P4, lines 9-10, 4). The final respondent shared their angst with the terminology used in the assignment: *"I used to hate the word 'reflection'. It was like torture"* (P2, line 149). They shared that this initial distaste for reflection, based on previous experiences, led them to wonder about whether the additional assignment would be valuable: *"I know I'm going to have homework, I know I'm going to have this stress now, so I don't know if I'm going to love it or hate it. I'm thinking, 'oh god, what did I get myself in to?'"* (P2, lines 43-44).

Visual reflections were a positive addition to the class.

While the novelty of the visual reflection assignments was not met with much enthusiasm, students' perceptions of their value changed by the end of the course. One student stated, *"at the beginning, I thought it was going to be a waste of time, but once I got into it after two or three weeks, I was like, 'alright, I enjoy this."* (P3, lines 80-81). They added, *"the visual reflections were my favorite part of the course, and so I think I would have had a less positive attitude throughout the course [if they weren't included in the course]."* (P3, lines 53-54). P4, who originally thought the assignments might be busy work, stated, *"it was a really positive thing. If I ever went into higher ed, or just education in general, as a teacher*

[the visual reflections] would be something that I would want to incorporate, just because I do feel like it had a positive impact and was something that helped me along the way" (lines 114-117).

The respondent who hated reflection *"actually started implementing it in [their] biology class."* (P2, line 27). For the student who viewed the novelty of the assignment as a positive attribute, that novelty continued to positively impact their views of visual reflection (P1, lines 56-58).

Visual reflections had a positive impact on students' course performance.

All respondents noted the positive impact the visual reflection assignments had on their course performance. This impact occurred as a result of the timing of weekly assignments and the self-evaluation required by the assignment. P1 summarized the weekly deadlines, noting the regularity as a positive attribute:

"It gave me a point in the middle of the week that I was like, 'okay, it's due on Wednesday and I know I need to get it done at that point.' And it was nice to be able to have that structure along with the Thursday articles and the Sunday commends and the components that were due on Sunday. It was nice to have that mid-week structure" (lines 39-42). One respondent noted, *"the way the class was set up, you basically had to be on at least three times a week, with the visual reflections and other components. As opposed to waiting till the last minute and just doing everything at once. It did help me continue to be checked in and always looking at the course"* (P3, lines 29-33).

P3 noted how this impacted their course performance: *"I would have had a lower grade, had it not been for the visual reflections…I probably would not have checked in as much."* (lines 58-59, 61). Similarly, P4 said that while the visual reflections were the first thing that was due each week, they actually did them last, so they could *"think about what I had read, what I had seen, and it just kind of helped tie everything all together."* (lines 52-53). While other assignments were due later, P4 used the earlier deadline of the visual reflections to avoid procrastination on the other assignments. Alternately, P2 used the visual reflections to set the pace for the rest of the week: *"I would do [the visual reflections] on Monday knowing that we have the article critiques to do and another component coming up."* (lines 76-77). Finally, P1 said the visual reflections helped them with their understanding of the content: *"If I realized I didn't quite understand a component, or a specific element of the curriculum, I would go back and reread or relisten to some audio lectures or relisten to some classes. I would do that a lot, just go back and relook to make sure I took the correct notes and understood it thoroughly…I'm not necessarily sure that I would have gone and evaluated myself as much [without the visual reflections]"* (P1, lines 73-75, 79 80).

Visual reflections had a positive impact on students' management of their stress.

Students noted the visual reflections helped them manage their course-related stress because they were able to acknowledge and define their feelings, express them in a productive manner, and then move on each week. P4 described the visual reflections as a *"good outlet to express myself"* (line 6). This student noted the actual process of finding an image to express their exact feelings made them more aware of exactly what they were feeling. When describing how they selected an image after entering a keyword into a search engine, they said, *"I kind of always had a general idea of what I wanted, but then seeing [the images], I was like, 'that doesn't really convey what I want…that's closer…' and then, 'ding ding ding! This is what I'm saying!'"* (P4, lines 43-45). P2 expressed similar feelings regarding the cathartic effect of the practice of selecting an image: *"It was an easy way to kind of sum up how I was feeling or how something kind of racked my brain a little bit. I was able to go on online and pick a picture and say, 'this is exactly how I was feeling'"* (lines 3-5).

P1 and P3 stated that the fun they experienced when completing the assignment lowered their stress. P3 stated, *"I was looking for funny little images and it kind of made me giggle inside and brightened up my Wednesday before heading home"* (lines 39-40). P1 noted, *"I just think looking for kind of pictures that reflected my feelings was kind of fun, so it probably lowered my stress level."* (lines 53-54). This student shared a particular instance when the visual reflection assignment allowed them to overcome their stress: *"I think it was right after the midterm, and I chose a cat with its head falling over, and at the time it was kind of like, 'ok, my brain is done for the moment.' But at the same time, it almost made me laugh enough to go, 'ok, that was kind of fun. I did it, I'm done with it, and now we can move on'"* (P1, lines 28-30).

Three of the four students noted that the visual reflections eased their stress because they were able to express their feelings to a person who could support them (the instructor) in a passive manner. P2 stated, *"[the visual reflections] let me release stress a little bit because I was able to say how I was feeling, and get it off my shoulders…I was able to put it down on paper, knowing that [the instructor wasn't going to take it in terms of 'oh, she doesn't like me'"* (lines 61-63).

This student also noted that, without the visual reflections, they would not have actively sought out a way to relieve that stress: *"I don't think that I would have gotten a chance to get it off my shoulders. I happen to be a person who sometimes internalizes things, so even if it's bothering me, I'll just kind of hold it in until someone finally asks about it and then I will explode. So those visual reflections gave me the chance each week to just let it out. Even if I was having that stress, I don't necessarily know if I would have went directly to [the instructor] and been like, 'ok, here's my email, this is what's going on'"* (lines 104-109).

P4 echoed similar sentiments regarding the ease with which the assignments allowed them to share their stresses with the instructor: *"I was able to express my feelings without having to send someone twelve thousand emails that said, 'oh my gosh, I'm freaking out, this is terrible!'"* (lines 101-102).

Visual reflections had a positive impact on student-instructor connectedness.

While not as prevalent as other themes, three of the students noted that the visual reflections had a positive impact on the connection they felt to the instructor. When discussing the visual reflections shared by the instructor, P4 said, *"it helps to see the instructor's opinions, because [they] understand where we're coming from, [they] understand what we are feeling, and it's ok to feel that way"* (lines 81-83). P2 stated that the act of sharing reflections with the instructor acted as a safety net: *"[the instructor] is looking at our visual reflections each week and kind of sees which ones of us were maybe struggling a little bit more than the others…I think it was a way for [the instructor] to kind of spot check for us"* (lines 110-111,122).

P3 also appreciated the assignments as a *"great way to kind of check in with the instructor"* (line 5). However, P2 also suggested that the instructor's shared images also have them more relatable human qualities in an online class. They shared, *"I know that [the instructor] is a mom and has other things going on too, so I was like, 'I know she's going to understand and get this, and this is how I feel'"* (lines 65-66). Further, when reflecting on the instructor's shared images, P2 stated she could frequently relate to the instructor's feelings.

Visual reflections had a positive impact on student-student connectedness.

All of the respondents acknowledged the visual reflection assignments' role in connecting them with other students, particularly between on-campus and online students. Each of the students noted their appreciation when they could see that other students were going through similar emotions as they were. P3 noted, *"it was nice seeing some of the students were on the same page…We're all going through this thing together even though we are 30 to 1,000 miles apart"* (lines 44, 48). P4 described a similar feeling, stating, *"you miss that connection with people. Being a distance learner and learning where other people are from and how they're feeling and that we're all in the same boat, we're all dealing with the same feelings, and it's ok"* (lines 86-89). They also stated that seeing other students' visual reflections made them know, *"I'm not alone in this, someone else feels the same way"* (lines 64-65). P2 expressed similar notions, but also added that the selected images and explanations shared by classmates also *"let me see the personality of our fellow classmates, even though I couldn't physically see them, just by the graphics they were choosing, I was like, 'oh, ok, this person could be very similar to myself…this person has a very similar humor style as I do'"* (lines 99-101, 92).

Quantitative Portion

Perceptions toward the Instructor's Verbal Immediacy

Visual analysis of the data's histogram indicated one outlier, so a Mann-Whitney U Test was run to determine if there was a difference in perceptions of the instructor's verbal immediacy between those that engaged in visual reflections and those that did not. Distributions of scores for the groups were similar as assessed by visual inspection. Median perceptions of verbal immediacy for the treatment group (Mdn=69) and control group (Mdn=67) were not statistically significant, U=115, p=0.87, using an exact sampling distribution for U (Dineen and Blakesley, 1973). The maximum score possible on the Verbal Immediacy Scale was 80 (see Table 1).

Affective Learning

Again, outliers warranted use of a Mann-Whitney U test to determine if there was a difference in affective learning, as indicated by attitudes and behavioral intentions, between those in the control and treatment group. Median scores regarding students' attitudes toward the content were within half a point of one another, and, at most, 1.5 points away from the maximum possible score (see Table 1). No significant difference was found between the median scores of the treatment and control groups, U=84.5, p=0.79. With regard to students' attitudes toward the content and attitudes toward the instructor, both groups held maximum possible scores as median scores, obviously indicating no significant difference between the groups in either construct (see Table 1). Students' behavioral intentions with regard to the content yielded scores that were slightly higher among the control group, though not high enough to yield a statistically significant difference between the two groups, U=94.5, p=0.95 (see Table 1). Students' scores measuring behavioral intentions regarding the behaviors recommended by the instructor were within one-half a point of one another, and at most, 1.5 points below the maximum possible score (see Table 1). No signif-

Table 1. Median Scores of Treatment (students completing visual reflections) and Control (students not completing visual reflections) Groups and Maximum Possible Scores on Each Assessment

	Median		Maximum Possible Score
	Treatment	Control	
Perceptions of Instructor Verbal Immediacy	69.0	67.0	80.0
Affective Learning			
Attitude toward Content	26.5	27.0	28.0
Attitude toward Behaviors Recommended	28.0	28.0	28.0
Attitude toward Instructor	28.0	28.0	28.0
Behavior toward Content	24.5	26.0	28.0
Behavior toward Behaviors Recommended	26.5	27.0	28.0
Behaviors toward Instructor	28.0	28.0	28.0
Academic Stress			
Affective Stress	5.5	6.0	25.0
Behavioral Stress	13.0	11.0	40.0
Cognitive Stress	6.0	5.0	15.0
Physiological Stress	6.5	6.0	30.0

icant differences were found between groups, u=95.5, p=0.98. As was displayed with students' scores regarding their attitudes toward the instructor, both groups' behavioral intentions toward working with the instructor in the future yielded median scores that were the maximum possible score.

Academic Stress

Visual identification of outliers once again warranted use of a Mann-Whitney U test to determine if any differences in scores of academic stress between the two groups were statistically significant. Median scores for affective stress between the treatment and control groups differed by one-half of a point, and were not found to be statistically significant, U=98.5, p=0.88. Scores yielded a two-point difference in behavioral stress, with the treatment group indicating the higher level of behavioral stress; however, this difference was not significant, U=134, p=0.34. Questions related to cognitive stress yielded scores within one point of each other, again with the treatment group indicating the slightly higher stress load, although the difference was not significant, U=110, p=1.0. Finally, students in the treatment group yielded a slightly higher median score for psychological stress (0.5 points); again, the difference was not statistically significant, U=118.5, p=0.47.

Discussion/Recommendations

Findings from the qualitative portion of this study suggested the visual reflection assignments were perceived to be a positive addition to the class - students actually stated they preferred having the additional assignments over not having them. These findings not only support the notion that reflection is beneficial for students (Boud et al., 2013), but also suggest that students can be aware of the value of reflection when engaging in the practice themselves. While Dewey (1933) and Husu et al. (2008) posited students' initial attitudes regarding reflection could skew the benefits of the reflection, the students in the qualitative portion of this study actually experienced a change in perception regarding reflection as a result of the visual reflection assignments. Three of the four respondents were initially hesitant about the benefit of the additional assignments; however, rather than experiencing a lack of benefit, their perceptions regarding the value of the reflections improved as they completed more reflection assignments. This change of perception suggests that by shifting the mode of reflection to accommodate learners' preferences, learners' attitudes toward the reflective exercise may become more positive, which could in turn, improve their utility.

While the qualitative portion of this study yielded positive perceptions among students, when the outcomes they stated were assisted by the visual reflections were quantitatively measured, no differences in scores were found between students who completed visual reflection assignments and those who did not. These findings conflict with others using visual representations at the K-12 level (Haystead and Marzano, 2009); however, those studies utilized visual representations as part of the learning process rather than as part of the reflection process, as was carried out in this study. These findings yield recommendations for both future research and for practitioners.

The quantitative measures indicated median scores that were frequently within less than two points of the maximum possible score. The data suggests a ceiling effect may have been present; essentially, the instruction delivered through the course, regardless of the visual reflections, yielded high perceptions of affective learning and of the instructor's verbal immediacy. Similarly, both groups' academic stress scores were low, suggesting a possible floor effect (as lower scores are more desirable on the Academic Stress Scale). Essentially, these findings support the notion that quality courses yield favorable scores with regard to instructors' verbal immediacy, students' affective learning, and students' affective stress. While we reviewed the literature to identify quantitative instruments aligning with the qualitative themes that were found, the ceiling and floor effects, combined with the conflicting data between the qualitative portion (the visual reflections were impactful) and the quantitative portion (the visual reflections made no impact), suggest that either the instruments were not varied enough in their range of scores, or the instruments measured constructs outside of the realm of the visual reflections' impact. We recommend researchers interested in assessing the impact of visual reflections seek out instruments that may offer greater ranges or other constructs.

The visual reflections, which added an additional 16 assignments to the students' workload, did not negatively impact the students' perceptions of any measured aspect of the course in either the quantitative or qualitative portion of the study. In fact, the qualitative portion of the study indicated students held favorable opinions of the visual reflections and perceived them to positively impact their performance in the course, academic stress, and relationships with the instructor and other students. Dewey (1933) noted that the mode of reflection can influence students' value of the reflective process, and these findings support his position. The data imply that while the visual reflection assignments may not yield a measurable difference on students' learning, they may improve the students' overall course experience in ways that have yet to be measured. Therefore, we recommend practitioners implement visual reflection assignments as a regular component of courses wherein academic stress may be high. The students in the qualitative portion of the study indicated their initial hesitation due to the novelty of the assignments, so we urge instructors to maintain consistency and regularity when implementing visual reflections; students indicated greater value in the visual reflections after they were comfortable with them and experienced benefits from them over the course of the semester.

Summary

Reflection continues to be a heavily-utilized component of the educational experience, and as one respondent in the study mentioned, its regular use can become tedious to students. However, the visual reflections added a sense of novelty to a learning practice with which the students were already familiar, renewing their interest in reflecting on their learning. While adding additional work to students' loads in a rigorous course can seem counterintuitive when seeking to improve students' experience in the course, the visual reflection assignments proved to be either a positive or neutral addition to the Research Methods course for two separate semesters. The low cost and low effort of the assignments, paired with the lack of findings implying any negative outcome of their addition, suggest instructors would serve their students well by exploring the prospect of implementing visual reflections. By altering the mode through which students reflect, teachers can guide students in finding value in productive reflection.

Literature Cited

Bamalli, H.S. 2014. Competencies and strategies for the teaching of 21st century learners in vocational home economics education. International Letters of Social and Humanistic Sciences (08): 50-55.

Boud, D., R. Keogh and D. Walker. 2013. Promoting reflection in learning: A model. Boundaries of Adult Learning 1: 32.

Dewey, J. 1933. How we think. Buffalo, NY: Prometheus Books.

Flick, U. 2006. An introduction to qualitative research. 3rd ed. Thousand Oaks, CA: Sage Publications.

Glaser, B. and A. Strauss. 1967. The discovery of grounded theory: Strategies for qualitative research. New York: Aldine De Gruyter.

Gorham, J. 1988. The relationship between verbal teacher immediacy behaviors and student learning. Communication Education 37(1): 40-53. DOI: 10.1080/03634528809278702.

Haystead, M.W. and R. J. Marzano. 2009. Meta-analytic synthesis of studies conducted at Marzano Research Laboratory on instructional strategies. Englewood, CO: Marzano Research Laboratory.

Husu, J., A. Toom and S. Patrikainin. 2008. Analysing the internal structure of teacher reflection from examination of portfolio texts. Educational Research and Evaluation 14.

Lakaev, N. 2006. Development of a stress response inventory for university students. Manuscript. Queensland University of Technology. Carseldine.

Lamm, A.J., K.J. Cannon, T.G. Roberts, T.A. Irani, L.J. Snyder, J. Brendemuhl and M.T. Rodriguez. 2011. An exploration of reflection: Expression of learning style in an international experiential learning context. Journal of Agricultural Education 52(3): 122-135. DOI: 10.5032/jae.2011.03122.

Lincoln, Y. and E. Guba. 1985. Naturalistic Inquiry. Newbury Park, CA: Sage Publications.

Lynch, M. 2000. Against reflexivity as an academic virtue and source of privileged knowledge. Theory, Culture and Society 17(3): 26-54.

Marzano, R.J. 2010. Representing knowledge nonlinguistically. Educational Leadership 67(8): 84-86.

McCroskey, J.C., V.P. Richmond, T.G. Plax and P. Kearney. 1985. Power in the classroom V: Behavior alternation techniques, communication training and learning. Communication Education 34: 214-226.

Paivio, A. 1990. Mental representations: A dual coding approach. New York: Oxford University Press.

Rodgers, C. 2002. Defining reflection: Another look at John Dewey and reflective thinking. Teachers College Record 104(4): 842-866.

Complex Social Contexts: Students' Perceptions of Addressing Social Justice Topics in the Classroom

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Abstract

Integrating diversity into the curriculum is important to colleges and teachers of agriculture; however, many faculty are wondering how to best incorporate these topics into the curriculum. Within colleges of agriculture, these topics are particularly relevant to management and leadership education. This study investigated student perceptions of addressing social justice in the nonprofit management classroom in general and of two specific teaching strategies employed in two nonprofit human resources classrooms (one graduate, one undergraduate). Findings indicate students (a) are very interested in addressing these topics in the classroom, (b) believe these topics to be relevant to the coursework, (c) found the topic to be of pedagogical value and the specific teaching strategies tested in this study to be beneficial for learning, and (d) are not clear about how else, in general, they would like to see these topics addressed. These findings support educators' efforts to address these topics within the curriculum.

Key words: social justice, equity, nonprofit management, nonprofit education, human resources

Introduction

Integrating diversity into the curriculum is important to colleges and teachers of agriculture for at least three reasons. First, in the United States, the population and, consequently, workforce is increasingly varied across many factors including race, gender, gender identity, sexual orientation, and ability (See, for example, Henig, 2017; Livingston, 2017). To succeed, students must know how to operate in such a diverse professional environment. Second, food systems (from production to consumption) affect all segments of the population, and different groups can have radically different experiences as it relates to food access and labor. Students who have a strong understanding of the broader social, historical, and cultural contexts in which they operate may have an increased capacity to make effective, ethical decisions within complex environments. Third, the science, technology, engineering and math professoriate—like that of many other disciplines—does not reflect the population at large. Many universities and institutions are attempting to change this fact. For example, the Association of Public and Land-Grant Universities is currently operating the APLU Includes project to diversify the STEM professoriate (Association of Public and Land-Grant Universities, n.d.). Integrating diversity into the curriculum is one way of ensuring all voices are valued in the classroom—a commitment that is critical to the long-term goal of diversifying the professoriate.

Diversity in general and social justice in particular can be challenging, uncomfortable, and emotionally charged subjects (Harvey, 2016; Iverson, 2007; Thomason, 2015; Tindell et al., 2016). Not only is there a great deal of scholarly debate about definition of and approach to social justice in general (North, 2006), but the topic itself is deeply personal and rooted in individuals' worldviews (Koltko-Rivera, 2006) and lived experiences. One reason people may pull away from the topic is that it may mean confronting inequalities, privilege, stereotypes, and oppression (Iverson, 2007; Pena, 2015; Solomona et al., 2006; Tindell et al., 2016).

Addressing the subject within the classroom is particularly challenging for many reasons. To be effective, faculty members must create an environment that is (a) respectful of the experiences of all students and faculty, (b) safe for students to take cognitive and emotional risks, and (c) rooted in dialogue rather than debate or discussion (Iverson, 2007; Nagda et al., 2008; Pena, 2015; Tindell et al., 2016). This is no easy task in a college of agriculture (Parsons and Johnson, 2001; Tindell et al., 2016). In fact, faculty and students—even those with a strong desire to hold these conversations—may resist discussing diversity. Additionally, the conversation must be at least somewhat relevant to the curric-

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ulum and course objectives. While an argument can be made that the conversation is relevant to all disciplines, in colleges of agriculture and life sciences, this topic is particularly relevant to course objectives in the leadership, organizational management, and nonprofit management curricula. This study addresses the latter.

Relevance to Nonprofit Management Education

Diversity and social justice are relevant in the nonprofit management classroom for two key reasons. First, many of the issues nonprofit organizations seek to address—issues such as poverty, access to affordable healthcare, and food insecurity—are issues that are related to and inseparable from issues of social justice; and managers and leaders attempting to solve social ills must be aware of deeper historical forces. For students who will eventually become nonprofit professionals, situating the problem of poverty into the nation's broader historical context can offer new perspectives and potentially more effective intervention approaches.

The second reason the topic of diversity and social justice is relevant to the nonprofit sector is that the sector itself is a part of the nation's social and cultural experience and, consequently, the sector perpetuates many of the very same concerns it attempts to address. Two examples of this are that (a) despite much discussion about diversity, nonprofit boards of directors are overwhelmingly white (Board Source, 2015), and (b) although the pay gap appears to be shrinking, pay varies by gender (See, for example, Faulk et al., 2012; Lindsay, 2016; Mesch and Rooney, 2008). It would be highly valuable, therefore, for nonprofit management students, where appropriate, to be trained to situate their missions within a broader social and historical context and recognize the relationship between the day-to-day management of nonprofit organizations and macro issues of equity. This is not to say that management is subset of equity but, rather, that the macro issues of equity are manifest through and inextricable from micro-level decisions and behaviors. Students who cannot do this risk perpetuating inequity.

Despite the growing body of literature about nonprofit management education (Blankenberger and Cantrell-Bruce, 2016; Carpenter, 2014; Mirabella, 2007; Mirabella et al., 2007), despite the growing awareness of the long-term career value of diversity conversations to students (Day and Glick, 2000; Hart Research Associates, 2013), and despite the direct relevance of diversity and social justice conversations to nonprofit management (Weisinger et al., 2016), little research has been done about how to best integrate these conversations in nonprofit management education or, equally important, how students respond to such efforts. This paper addresses this gap by (a) describing two different methods of addressing these issues within a nonprofit classroom and (b) presenting the findings from a student perception survey. The specific context for this study is one undergraduate and one graduate nonprofit human resource management class at the University of Florida, a large public university in the Southeastern United States.

Materials and Methods

This study involved two different pedagogical activities implemented in the summer of 2016 and designed to introduce diversity and social justice issues in a nonprofit human resource management class. One course was comprised of 33 undergraduate students who met in-person for 75 minutes a day, five days a week, for six weeks. The second course, which included 31 graduate students from a variety of disciplines, was conducted online and lasted 13 weeks. A different, level-appropriate pedagogical activity was incorporated into each class. These activities—and, consequently, the follow-up perceptions survey presented here—focused on social justice rather than general diversity education. This pedagogical focus was a direct response to students' request that faculty in our department better integrate topics related to social justice. This study was approved by the Intuitional Review board at the University of Florida. This section of the paper will describe the pedagogical activities and the survey that was developed to gather data about students' perceptions.

Pedagogical Activities

The pedagogical activity incorporated into the undergraduate classroom was conducted in three distinct phases: guest lectures, follow-up quizzes, and the development of a class "cheat sheet" on workplace inclusion. On two separate occasions, guest speakers were invited into the classroom to address complex issues. One speaker presented data about the LGBT population in the United States, explained commonly misunderstood terms, and shared their personal experience as a transgender person. The second guest lecture was presented by a multi-racial team that included three leaders from the university's multicultural programs. These three individuals introduced the concept of implicit bias, conducted an interactive exercise related to stereotypes and bias, and led the students in an activity to better understand the many facets of identity.

In the second phase of this activity, the students were asked as part of their weekly quiz to identify three ways they could use the information to create a more inclusive work environment. In an effort to improve the quality of answers, students were given the wording of this question in advance, and they were encouraged to be thoughtful and creative. Finally, the ideas from students' quizzes were compiled into a "cheat sheet" of student-generated ideas. The class met in small groups to review the cheat sheet, ask each other questions about the ideas included on the sheet, and suggest any changes. The final cheat sheet was then distributed to the students for use throughout their career.

The pedagogical activity incorporated into the master's class was more deeply integrated into the course material. Specifically, the course was divided

into two halves. In the first half of the class, the students studied the fundamentals of human resource management and, in the second half, the students studied what the professor called "applied human resources in complex social contexts." In this second half, the students worked in teams to address one of four pre-designated topics: implicit bias in hiring, gender equity in pay, LGBT inclusion, and nonprofit wages. Teams were also allowed to select their own topic if they so choose. Information about each topic, including about 10-20 references, were provided via the online course website. Each team was required to produce a research-based paper written for an audience of nonprofit human resource professionals. These papers were divided into four sections: what is the problem (e.g., what is implicit bias), how does it manifest in the nonprofit sector, what are the potential solutions to this problem, and what are the challenges that arise with those potential solutions. Students were required to provide academic references for each section of the paper. In writing these papers, students became quasi-experts in their chosen area. To encourage cross-training, students peer-reviewed papers from other teams.

The Logic behind the Pedagogical Activities

Readers will note that both the undergraduate and graduate pedagogical strategy (a) focused on issues of social justice rather than general diversity, and (b) culminated in projects that were oriented to action (e.g., a cheat sheet or practitioner's guide). This was intentional. Just as students across the country have asked that universities better integrate issues of social justice, the students of the department from which these courses were offered had also made such a request. In this request they specifically asked faculty to go beyond a nod to diversity and, instead, provide a deeper integration of social justice issues into the curriculum. The development of projects oriented to action was in keeping with students' requests and, also, offered students a great deal of autonomy in how they approached these deeply personal subjects. The development of implementable recommendations and, for the graduate students, the evaluation of those ideas, is also aligned with higher stages of Bloom's (1956) taxonomy of learning and with students' development the practical skills needed to exercise effective leadership in the nonprofit sector. In short, these projects were designed to address the students' direct concerns, offer autonomy, and to further their learning as it relates to nonprofit sector leadership.

Pedagogical Activities and the Role of Choice

It is important here to recognize the role of choice in the classroom as it relates to this study. Students who are offered choices in the classroom report higher intrinsic motivation, feel more competent, and perform better (Patall et al., 2010). Therefore, to increase the potential for learning, the teaching strategies investigated here offered students choices, wherever possible. For example, in the undergraduate class, students had the option of taking the Implicit Associations Test as extra credit. It was not required. In the graduate class, students were allowed to choose their own topic (from a pre-developed list) or choose a topic outside of the pre-developed list.

In addition to the traditional benefits of choice in the classroom, these choices were offered because social justice is an emotionally charged topic. It is likely that students enter the classroom with many different experiences and viewpoints, and some students may not be ready or interested in engaging in deep, reflective conversations. There needs to be room for those students within the confines of the classroom. For graduate students, the peer review process was created in part to ensure that even those students who chose not to go as deep with the material as the others would have an opportunity to review their peers' work and be exposed to the material.

More about the Sample

The students included in the sample came from a variety of programs within the university. Of the undergraduate students, fourteen (48%) were part of the Family, Youth, and Community Science (FYCS) major, the home department of professor. Other majors include marketing, anthropology, public relations animal science, journalism, sociology, nutrition, and nursing. Eight students (28%) were enrolled in the nonprofit leadership minor. Other minors included disabilities in society, international development and humanitarian assistance, educational studies, innovation, and communication studies. The undergraduate students were juniors (31%) and seniors (66%) with one student declining to state. The graduate students also came from a variety of programs, including the master's degree in FYCS (39%), the graduate certificate in FYCS (29%), and other master's or Ph.D. degrees across campus (26%). Some students (6%) declined to state. It is worth noting that the graduate certificate students and many of the students from other degree programs across campus were professionals employed full-time in the nonprofit sector.

Survey Assessment and Data Collection

A survey was administered to identify students' perceptions about addressing social justice issues in class in general and the aforementioned activities in particular. The survey was administered during the last week of classes and students received 10 points (out of 1,000-point class) for completing the survey. All students received the points for clicking through the survey regardless of whether they responded to the questions. To protect their right to informed consent prior to participating in a research study, students were given the option of having their results be used for teaching only or for teaching and research. Of the 33 undergraduate students, 29 consented to have their responses used for research (a response rate of 88%). Of the 31 graduate

students, 30 consented to have their responses used for research (a response rate of 97%).

The survey consisted of a series of open and closed-ended questions, and it was divided into three sections. In the first section, questions were asked about students' perceptions related to addressing social justice issues in the classroom in general. In the second section, students were asked about the specific activities incorporated into their course. In the final section, students were asked to provide limited demographic data about their degree programs.

Data Analysis

Data analysis varied by type of question. Open-ended questions were coded using an emergent coding process. Specifically, codes were derived from the data and not the researchers' theoretically-informed or otherwise preconceived ideas (Saldaña, 2009). The patterns that emerged are presented in the results section below. In many cases, we have present our analysis of open-ended data in both a qualitative and quantitative fashion. For example, when presenting themes, we provide both sample quotes and, also, a percentage of the students whose responses fit that theme. The percentage explains the prevalence of this theme and the quote offers a window into its nuances. The close-ended questions were analyzed using descriptive statistics to, for example, calculate the class average or the total percentage of students from one or both classes responding in a specific way. This level of analysis provided an overall description of the results as was appropriate for this sample size. These data are also provided in the next section.

Members of both the undergraduate and graduate classes contributed to the interpretation of these data. First, the teaching assistant for the undergraduate course happened to be enrolled in the master's course. She participated in the analysis of the data and, in doing so, provided what anthropologist describe as an emic, or insider's perspective. To protect the confidentiality of her fellow students, the survey data was de-identified before she was allowed access. She is listed as the second author on this paper. Second, five of the undergraduate students who were also enrolled in the professor's fall semester course were invited to review a draft of this paper and provide feedback. Two of those students provided feedback, and their input was incorporated into the paper.

Results

The findings will be presented in three sections: students' general perceptions about these issues, students' perceptions about the undergraduate class, and students' perceptions about the graduate class. As previously described, the undergraduate and graduate classes differed significantly in their intervention and, consequently, in the survey questions designed to understand their perspective. The presentation of these data is as consistent as possible given the variation between the two classes.

Students' General Perceptions of Addressing Social Justice Issues in the Classroom

This section reports findings from the first two questions of the survey where all students were asked (a) how important it is to them to discuss issues of social justice in the classroom (Figure 1, Table 1), and (b) the extent to which they agreed with four statements related to the relevance of social justice in the classroom (Table 2 and 3).

Data suggest students highly favor an integration of social justice topics in the classroom (Figure 1). Specifically, 73% of all students reported this was very or extremely important. Graduate students were slightly more likely than undergraduates to consider addressing these issues was very or extremely important (83% of graduate students as compared to 62% of undergraduates).

Students were asked in an open-ended question to explain their responses to the question of importance. These responses were analyzed thematically. The three key themes emerged and were consistent across the

Figure 1. How important is it to you to discuss social justice in the classroom?

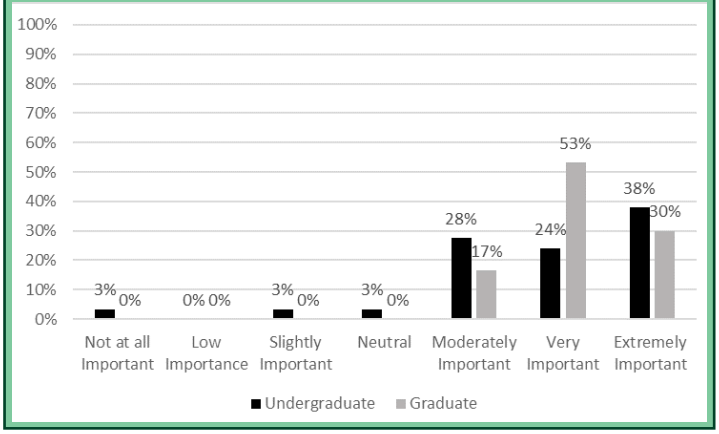


Table 1. Students' Perceptions on the Importance of Discussing Social Justice in the Classroom

Key Themes	Undergraduate Sample Response	Graduate Sample Response
This discussion is relevant to my career.	"It's extremely important because the non-profit sector as a whole is directly involved in social justice and has an impact on the way students interact with those issues moving forward in the work force."	"Social injustices create the need for nonprofits. When looking further into practices, there are many ways in which nonprofits miss the mark or create further injustices."
This discussion is relevant to understanding current trends in society.	"It is an important issue in society, today; therefore, it should be discussed in class."	"Social justice is a world-wide concern. There are a lot of civil rights movements happening now and it is extremely important to me to address them and how they effect [sic] the world. "
The classroom is an important place for these discussions.	"The classroom is where students are the most open-minded. Discussing social justice adds a sense of validity to other people's identities and experiences with discrimination and prejudice."	"Social justice issues permeate all aspects of life and I believe it is the responsibility of higher education to provide all students with the avenues to explore these issues from a scholarly perspective."

two classrooms (Table 1). Students indicated that discussions of social justice were relevant to their career, were relevant to understanding current trends in society, and that the classroom was an important place to hold these conversations.

Additionally, one graduate student pointed out the pedagogical value inherent in well-facilitated dialogue. This person wrote, *"social justice inherently denotes controversial topics, which I believe are imperative to a classroom of 'dialogue'. No matter the subject, discussing social justice can encourage critical thinking, problem solving, collaboration, while also promoting social justice."*

While most students were supportive of integrating social justice conversations into the classroom, a few students expressed concern or apathy. For example, one graduate student wrote *"perhaps at my age my ideas about social justice aren't likely to change much anyway."* Six undergraduate students expressed concern about how these conversations are handled and the potential for conversations to get out of hand. This concern underscores the need for faculty to create a respectful yet brave classroom environment and, in particular, to distinguish between debates, discussion, and dialogue (Nagda et al., 2008).

Students were then asked about the relevance of social justice to the study of nonprofit leadership in general and human resources in particular. These results (Table 2) suggest students find social justice to be a highly relevant topic: 93% of students either agree or strongly agree that social justice is relevant to the study of nonprofit leadership, and 95% agree or strongly agree that it is relevant to the study of human resources in particular. No student disagreed with these statements to any degree.

In addition to inquiring about the general relevance of social justice issues to the study of nonprofit leadership, the students were asked (a) if they believed social justice issues should only be discussed in the classroom when it is relevant to the course material, and (b) to what extent these issues are relative to most of their course material (Table 3). There is less consensus among students on the first of these points. Combining both undergraduates and gradates, 58% of students agreed, 38% of students disagreed, and seven percent were neutral on whether social justice issues should only be discussed in the classroom when it is relevant to the material. This suggests that while most students (58%) would like there to be a direct connection to the course material in general, many (38%) would like to see social justice issues addressed regardless. Regardless of whether they would in general like there to be a direct connection, most students felt there was in fact a connection. Specifically, 83% of students stated that social justice issues were relevant to most of their coursework.

Table 2. Students' Perceptions on Relevance of Social Justice to Nonprofit Leadership

	Issues of social justice are relevant to the study of nonprofit leadership.		Issues of social justice are relevant to the study of human resources.	
	Undergraduates	Graduates	Undergraduates	Graduates
Strongly Disagree	0%	0%	0%	0%
Disagree	0%	0%	0%	0%
Somewhat Disagree	0%	0%	0%	0%
Neither Agree nor Disagree	0%	0%	0%	0%
Somewhat Agree	7%	7%	7%	3%
Agree	39%	30%	43%	43%
Strongly Agree	54%	63%	50%	53%

Table 3. Students' Perceptions on Relevance of Social Justice to Course Material

	Social justice issues should only be discussed in the classroom when it is relevant to the course material.		Issues of social justice are relevant to most of my coursework.	
	Undergraduates	Graduates	Undergraduates	Graduates
Strongly Disagree	7%	7%	0%	0%
Disagree	14%	30%	0%	0%
Somewhat Disagree	11%	7%	7%	10%
Neither Agree nor Disagree	11%	3%	11%	7%
Somewhat Agree	18%	13%	18%	27%
Agree	29%	27%	46%	43%
Strongly Agree	11%	13%	18%	13%

Undergraduate Students' Perceptions

The pedagogical activity incorporated into the undergraduate class was comprised of three distinct yet interrelated steps: guest lectures on implicit bias and LGBT inclusivity, a quiz where students identified ways to use information from the lectures to create a more inclusive work place, and the development of a class cheat sheet that summarized students' ideas. Overall, students appreciated the way social justice was incorporated into the curriculum. Eighty-nine percent of students indicated that yes, these sort of lectures should be included in future classes.

The LGBTQ Lecture

Students were asked in an open-ended question what, specifically, they learned from each speaker. These responses were coded thematically. Sixty-nine percent of students reported learning new vocabulary about the LGBT population, 41% reported learning

Table 4. Key Lessons from Guest Speaker on LGBTQ Inclusivity

Core Learning	Percentage of Students	Sample Student Quote
Vocabulary and Definitions	69%	"I learned that it's important to ask everyone what their preferred pronouns are because you never know how someone identifies. I also learned that more gender neutral terms have developed more recently, and I want to start using those in my vocabulary."
General Knowledge about Heteronormativity and Discrimination	41%	"I've also learned that the LGBTQ community is especially vulnerable in the workforce and will strive to comfort and build understanding relationships with them."
General Knowledge about the LGBTQ Population	21%	"I learned that the largest concentration of people identifying as LGBT+ are in the South, and until this lecture I always imagined them being in the Northeast and California."

about heteronormativity and discrimination in general, and 21% reported learning about the LGBTQ population in general (beyond terminology). These results (presented in Table 4) suggest that while this cohort of students did come of age in more progressive era, these same students do not necessarily understand LGBTQ terminology or have an accurate understanding of the LGBTQ community.

Students were not prompted in this question to describe any specific changes they wished to make or actions they wished to take. However, 55% of students identified in their response a specific change in their behavior they plan to make as a result of this lecture and 34% identified how they might use this information in the workplace.

The cheat sheet developed by the students following this lecture contained a variety of suggestions that ranged from trainings, to policies, to more subtle considerations such as how an inclusive dress code might be developed. This cheat sheet was titled "Addressing LGBTQ+ Inclusion in the Workplace." Of the students who responded, 71% indicated they planned to use the cheat sheet, 14% indicated they did not plan to use the cheat sheet, and 14% were neutral.

The Implicit Bias Lecture

Students were asked the same question—what, specifically, did you learn—about the guest lecture on implicit bias. These open-ended responses were also coded thematically, and two key ideas emerged. Students' reported increased self-awareness as it relates to bias and increased general knowledge about bias and discrimination (Table 5).

Like the feedback from the LGBTQ lecture, 52% of students expressed in these open-ended responses an unprompted commitment to behavior change as a direct result of the implicit bias lecture. These behaviors were largely related to monitoring their own personal biases. A few students, however, seemed to not fully understand the concept of implicit bias (i.e., unconscious bias). For example, one wrote, that they learned *"Nothin [sic] and think I do a good job not being implicitly biased or stereotypical."*

As with the prior lecture, a cheat sheet was developed by the students and, like the prior cheat sheet, this one included trainings, policies, and programs. It also included opportunities for dialogue. Of the students who responded, 75% indicated they planned to use the "Addressing Stereotypes and Bias in the Workplace" cheat sheet, 14% indicated they did not plan to use the cheat sheet, and 11% were neutral.

Extra Credit

Students had the option of completing for extra credit the Implicit Associations Test (Greenwald et al., 1998; Project Implicit, 2011). Of the sample reported here, 52% had completed the Implicit Associations Test. Seventy-three percent of those who took it reported that the test changed the way they thought about their own biases and 27% reported no change. Approximately half of the students who took the test said it should be required and half said it should not be required.

Looking Ahead

Undergraduate students were also asked how else, if at all, they would like to see issues of social justice might be incorporated into the curriculum. This was asked first as an open-ended question (so as to avoid prematurely layering the researcher's bias). An analysis of students' written responses indicated students were interested in (a) discussing current events related to social justice, (b) reviewing case studies and documentaries related to social justice issues, and (c) engaging in more in-depth discussion with their peers.

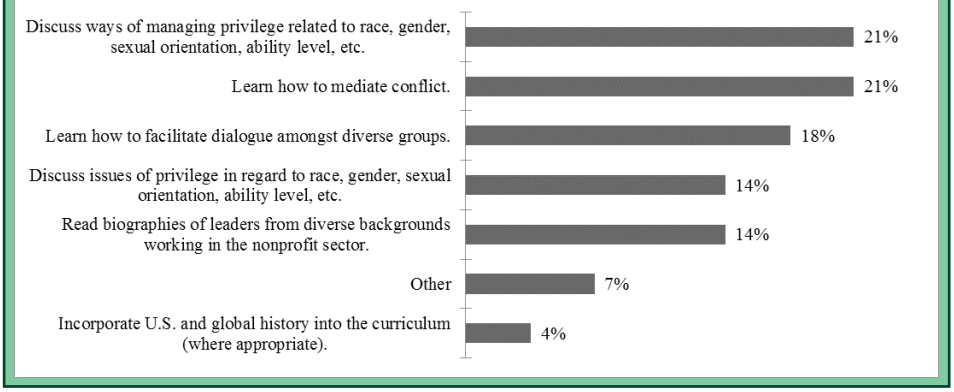
Next, the same question was as a closed-ended question with specific response options (Figure 2). Students' responses to the close ended question suggest that they are interested in learning how to discuss manage privilege, mediate conflict, and facilitate dialogue (Figure 2).

In conclusion, the undergraduate students highly valued the activities incorporated in this particular class. There was no consensus as to whether the Implicit Association Test should be required or what other pedagogical activities might also be helpful.

Table 5. Key Lessons from Guest Speakers on Implicit Bias and Stereotyping

Core Learning	Percentage of Students	Sample Student Quote
Self-Awareness	45%	"From this presentation, I really learned how everyone does have implicit biases and how it is important to ensure those biases do not reflect in one's life, specifically in the work environment. It is natural to have implicit biases from family members, social media, etc. However, it is good to understand when those implicit biases are coming out in a negative manner. I will always check others and myself when approaching situations where biases may come out and step up if I notice something wrong. "
Different Types of Bias and Discrimination	31%	"Building off of what is normal, I thought it was very important to understand that just because I am heterosexual, identity [sic] with my assigned gender and am able-bodied... it does not mean that I am 'normal' and referring to myself as such marginalizes so many people who are just as "normal" as I am."

Figure 2. Students' preferences on incorporating social justice into the curriculum



Graduate Students' Perceptions

The pedagogical activity incorporated into the graduate class was deeply integrated into the course material. In the first half of the class students learned the fundamentals of human resources. In the second half of the class they prepared a well-referenced paper on one issue of their choice. The students' choices (and number of teams that selected that choice) were as follows: gender equity in pay (one team), implicit bias in hiring (one team), LGBT inclusion (two teams), issues related to nonprofit wages (two teams), and two teams selected additional self-determined topics (board member retention and social media).

Students were asked in an open-ended comment box to explain why they selected their particular topic. The responses fell into two broad categories, with some responses incorporating aspect of both categories. Students generally reported they chose this topic because (a) it was relevant to them personally or professionally or (b) it represented an opportunity to learn something new (Table 6).

Table 6. Students' Reason for Selecting Topic for Final Project

Reason for Selecting Topic	Percentage of Students	Sample Student Quote
It was personally or professionally relevant.	73%	"Allows me to think about things I don't normally address in day to day life (shelter medicine/animal nonprofits), but something that is important to me on a personal level" "As a professional woman I read books such as 'Lean In' and 'Know Your Value' and wanted to learn more about how this paradigm worked in nonprofit"
It was an opportunity to learn something new.	40%	"This topic put me out of my comfort zone and I wanted to expand that boundary in this class to learn something new." "It was the topic I knew the least about."

Students were asked about their initial impressions of the project and to what extent they were surprised by how much they learned. In regard to the initial impressions, students had mixed reviews. Thirty-seven percent of students were not excited about the project initially, 33% were excited, and 30% were neutral. Despite this initial reluctance of about a third of the class, it appears that this was indeed a learning experience: Ninety-three percent of students reported they were surprised by how much they learned. When asked in an open-ended question what, specifically they learned, 57% of students reported an increase in knowledge about their topic of focus and 30% of students identified specific action items or solutions. Others reported learning about other students' topics through the peer-review process or learning about how to work in teams, a particularly challenging task in an online, asynchronous class.

Perceptions on the Peer Review Process

At the end of the course, students were required to review papers from two other teams. The professor actively managed this process, ensuring that (a) students reviewed papers on topics other than what they had studied, and (b) students who studied a non-social justice topic read social justice-oriented papers. Students were asked in an open-ended question what, if anything, did they learn from conducting a peer review of another group. Of the 22 students that responded to this question, 77% identified an increased knowledge in content, 9% identified accesses references they may need in the future, 9% identified an enhanced appreciation for quality writing, and 5% indicated they learned how to give constructive, professional feedback (See Table 7).

Table 7. Key Lessons Learned from Peer Review Process

Lessons Learned through Peer Review Process	Percentage of Students	Sample Student Quote
Content Knowledge	77%	"I learned alot [sic] from the implicit bias paper and learned to remember to check any judgment towards another employee based in stereotypes." "I learned quite a bit about the LGBTQ issues - I had little to no previous exposure."
References to Access Later	9%	"The thing I will get the most out of moving forward is probably the other groups' references - will keep these to be able to look back on in the future"
Writing and Presentation Skills	9%	"[T]he design and organization of the other teams' projects made me think about how to present such a document in a professional-friendly way, as opposed to a more academic design."
How to Give Constructive, Professional Feedback	5%	"It was a good exercise of reviewing other individuals' views and suggestions, considering them, and then providing my views and opinions in a professional and respectful way."

As previously discussed, teams had the option of choosing a topic outside of the four pre-designated topics. One student who chose an outside topic found that reviewing other students' papers made them regret that decision. That student wrote, *"I wish that our project had included more of a social justice angle after reading my peers' papers. I was impressed by their work. I might have approached the project with more of a social justice angle if given the opportunity again."* This statement suggests that perhaps more can be done to encourage those who are hesitant to embrace the challenge. Alternatively, there may be value in regret if it influences how they handle future invitations to step outside their comfort zone.

Looking Ahead

Students were somewhat conflicted about whether this activity should be incorporated into future classes. Fifty percent indicated that it should be incorporated, and fifty percent were "unsure". No student said no, it should not be included. All students were invited to provide written comments explaining their responses. The "unsure" students did not provide written feedback. The "yes" students provided feedback. Their reasons for suggesting it be included in future classes are that the project develops research skills, improves students' ability to work with teams, encourages perspective-taking, and invites students to step out of their comfort zone. Students reported they would like more potential topics to study, a more formal rubric for the peer review process, the ability to choose which topic for which they provided a peer review, and the option to work as individuals rather as teams.

Discussion

This paper first described two teaching strategies employed in two nonprofit human resource management classrooms to address social justice. Then, it reported the results of a student perception survey about these strategies in particular and the incorporation of social justice in the curriculum. The findings indicate nonprofit management students at this institution (a) are very interested in addressing these topics in the classroom, (b) believe these topics to be relevant to nonprofit management education, (c) found the specific teaching strategies tested in this study to be beneficial for learning, but (d) are not clear about how else, in general, they would like to see social justice addressed. This section discusses differences in perspectives noted between graduate and undergraduate students, the pedagogical benefits of these sorts of activities, and how faculty might interpret students' ideas on how to move forward.

Differences in Perspective: Graduate versus Undergraduate Students

Students in both classes reported an interest in addressing social justice in the classroom; however, graduate students were more likely than undergraduates to see it as very or extremely important (83% as compared to 62%). There are a number of reasons why this might be the case. First, graduate students in a Master of Science program are academically socialized to ask questions—the essence of a science degree is, after all, rigorous training in the scientific method and in research strategies. This socialized curiosity might play a role in their ability to perceive the relevance of social justice issues to nonprofit management education and, thus, consider it important. Second, most, if not all graduate students have more life experience than undergraduate students in that they are usually older and, in some cases, have full-time work experience in a variety of industries. Consequently, graduate students may have more experience wrestling with these sorts of issues professionally or personally. One piece of evidence pointing to this hypothesis is that 73% of graduate students reported they selected their paper topic because it was personally or professionally relevant. Third, the coursework completed in during undergraduate studies may prepare students for a deeper dive in graduate school. One piece of evidence supporting this idea is that, in reflecting on her experience in the graduate course and on the findings presented here, the second author on this paper (a graduate student) recalled that she had learned about implicit bias as an undergraduate but did not fully understand the concept until graduate school. If this is true for other students, then a faculty members' attempt to discuss topic of social justice in an undergraduate classroom could be approached as part of a larger scaffolding process that, eventually, allows the student to fully integrate these complex ideas.

Student Learning: The Multiple Benefits of Addressing Social Justice

Addressing social justice in the classroom can help students develop critical thinking skills, leadership skills, and the ability to relate concepts across disciplines. This is particularly true of the teaching activity developed for the graduate classroom: To create their final project, students had to analyze information from different disciplines (minimum 15 research articles), integrate it with course material on human resource management, and develop appropriate applications for real-world, nonprofit contexts. There is evidence to suggest at least some students were aware of this: One graduate student wrote *"Addressing issues of diversity and social justice can hold pedagogical value above and beyond the content. Deep dialogue on sensitive topics can potentially increase students' critical thinking skills, perspective-taking capacity, and ability to work in diverse teams."*

Additionally, the process of engaging in difficult conversations can develop students' leadership skills. Almost by definition, addressing social justice in the classroom puts the faculty member and students out of their comfort zones, and this in and of itself is a valuable leadership skill. There is evidence to suggest that at least some students recognize the value of this challenge. For example one undergraduate student wrote, *"Implicit bias was an incredibly difficult and uncomfortable lesson to go through because you got to see just how vulnerable everyone in the classroom truly was. However, this was also one of my favorite lessons because of its transparency and authenticity with the students."*

This response suggests at least some students appreciate the opportunity to challenge themselves and rise to the occasion. However, as previously reported, there were a few other responses from undergraduates that suggest they are concerned about the potential for discussions to become volatile or disruptive. Faculty are encouraged to learn the facilitation skills and self-management practices necessary to create an environment conducive to deep learning.

What Now? Student Perceptions on Moving Forward

Data suggest that, while students were clearly interested in addressing social justice in the nonprofit classroom, there was less consensus about how to best do so. Graduate students' ideas on improving the process generally focused on more structure (e.g., improved peer review rubric) or an expanded list of topics. Undergraduates were interested in discussing current events, reviewing case studies and documentaries, and engaging in more in-depth discussion. The undergraduates also selected from a predetermined list of ways social justice might be incorporated into the classroom (Figure 2). Their responses to that list suggest they are interested in hands-on, action-oriented strategies. For example, the most highly rated options were discussing ways of managing privilege, learning how to mediate con-

flict, and learning how to facilitate dialogue. They were less interested in understanding the historical context. While all of these responses provide valuable options for faculty, none of these options were overwhelmingly touted by the students. Indeed, it seems there is little consensus about how to best incorporate this topic. One way to think about students' lack of consensus is that they may be unable yet to reflect upon the topic with sufficient depth to know how to incorporate social justice into the classroom. This is an interesting finding. If the anecdotal evidence is true, and increasing numbers of student are in fact calling for faculty to address issues of social justice in the classroom (Thomason, 2015; Wong, 2015), this study suggests that nonprofit management students, at least, are also still waiting for faculty to take the lead on where and how.

Limitations

The generalizability of this study is limited by its sample size (two classrooms, 59 students) and its location (a large public university in the Southeastern United States). Further research will need to identify to what extent these findings are like or different from student perceptions in other areas, including countries outside the United States.

The study must also recognize a less explicit sort of bias—that of the professor and principle investigator. Many would argue that the willingness to address this topic is, in and of itself, evidence of bias. However, there are ways to mitigate bias. Specifically, this study mitigated potential faculty member bias by: (1) focusing students' attention on evidence-based information and (2) offering choices to students in what and how they approached the topic. In short, the students were in the driver's seat as much as possible.

Conclusion

Despite these limitations, this article makes many important contributions. This article is among the first—if not the first—study of student perceptions of the integration of social justice topics in nonprofit management education and, as such, can provide insight into how such topics can be approached in other classes, including agriculture leadership and management. Student perceptions are an important source of data for educators and, in this case, may be even more so. If, as news reports suggest, the broader integration of social justice into classrooms is driven in large part by students, it is important to monitor and respond to student perceptions of this integration. Additionally, the study of student perceptions can alert faculty to student experiences that may otherwise go unnoticed or unaddressed. The specific activities implemented here have pedagogical value above and beyond the content. Students practice thinking critically, integrating interdisciplinary concepts, and developing leadership skills. Despite a myriad of difficulties that can be associated with discussions of social justice in the classroom, these finding indicate nonprofit management educators can and should rise to the challenge.

Literature Cited

Association of Public and Land-Grant Universities. n.d. APLU Includes: Diversifying STEM Faculty. http://www.aplu.org/projects-and-initiatives/stem-education/aplu-includes/ June 30, 2017.

Blankenberger, B. and T. Cantrell-Bruce. 2016. Nonprofit education: Evaluating and assessing the skill sets our students learn. Journal of Nonprofit Education and Leadership 6(3): 243-253.

Bloom, B.S. 1956. Taxonomy of educational objectives, handbook I: Cognitive domain. New York: David McKay.

Board Source. 2015. Leading with intent: A national index of nonprofit board practices. Washington, D.C.: Board Source.

Carpenter, H.L. 2014. A look at experiential education in nonprofit-focused graduate degree programs. Journal of Nonprofit Education and Leadership 4(2): 114-138.

Day, N.E. and B.J. Glick. 2000. Teaching diversity: A study of organizational needs and diversity in higher education. Journal of Management Education 24(3): 338-352.

Faulk, L., L.H. Edwards, G.B. Lewis and J. McGinnis. 2012. An analysis of gender pay disparity in the nonprofit sector: An outcome of labor motivation or gendered jobs? Nonprofit and Voluntary Sector Quarterly 42(6):1268-1287.

Greenwald, A.G., D.E. McGhee and J.L.K. Schwartz. 1998. Measuring individual differences in implicit cognition: The Implicit Association Test. American Psychological Association 74(6): 1464-1480.

Hart Research Associates. 2013. It takes more than a major: Employer priorities for college learning and success. Liberal Education 99(2). https://www.aacu.org/publications-research/periodicals/it-takes-more-major-employer-priorities-college-learning-and.Association of American Colleges & Universities. June 27, 2017.

Harvey, W.B. 2016. How many protests will it take to finally diversify our campuses? The Chronicle of Higher Education 62(24): A28.

Henig, R.M. 2017. How science is helping us understand gender. National Geographic. http://www.nationalgeographic.com/magazine/2017/01/how-science-helps-us-understand-gender-identity/ June 30, 2017.

Iverson, S.V. 2007. Camouflaging power and privilege. Educational Administration Quarterly 43(5): 586-611. DOI: 10.1177/0013161X07307794.

Koltko-Rivera, M.E. 2004. The psychology of worldviews. Review of General Psychology 8(1): 3-58.

Lindsay, D. 2016. Women on the rise? The Chronicle of Philanthropy.

Livingston, G. 2017. The rise of multiracial and multiethnic babies in the U.S. Pew Resource Center. http://www.pewresearch.org/fact-tank/2017/06/06/the-rise-of-multiracial-and-multiethnic-babies-in-the-u-s/. June 30, 2017.

Mesch, D.J. and P.M. Rooney. 2008. Determinants of compensation: A study of pay, performance, and gender differences for fundraising professionals. Nonprofit Management and Leadership 18(4): 435-463.

Mirabella, R.M. 2007. University-based education programs in nonprofit management and philanthropic studies: A 10-year review and projections of future trends. Nonprofit and Voluntary Sector Quarterly 36(4): 11S-27S.

Mirabella, R.M., G. Gemelli, M. Malcolm and G. Berger. 2007. Nonprofit and philanthropic studies: International overview of the field in Africa, Canada, Latin America, Asia, the Pacific, and Europe. Nonprofit and Voluntary Sector Quarterly 36(4): 110S-135S.

Nagda, R., P. Gurin, J. Rodriguez and K. Maxwell. 2008. Comparing debate, discussion, and dialogue. http://www.gcorr.org/wp-content/uploads/2016/06/comparing_debate_discussions_dialogue-3.pdf. Program on Intergroup Relations, Conflict and Community (IGRC), University of Michigan. June 27, 2017.

North, C.E. 2006. More than words? Delving into the substantive meaning(s) of "social justice" in education. Review of Educational Research 76(4): 507-535.

Parsons, G.M. and B.B. Johnson. 2001. Does teaching ethics make a difference? A preliminary study using an outcome assessment process. NACTA Journal 45(1): 51-57.

Patall, E.A., H. Cooper and S.R. Wynn. 2010. The effectiveness and relative importance of choice in the classroom. Journal of Educational Psychology 102(4): 896-915.

Pena, O. 2015. Diversity education at land-grant universities from the perspective of a female student of color. Journal of Agriculture, Food Systems, and Community Development. Advance online publication. DOI: http://dx.doi.org/10.5304/jafscd.2015.054.020.

Project Implicit. 2011. Project Implicit preliminary information. https://implicit.harvard.edu/implicit/. Project Implicit. June 27, 2017.

Saldaña, J. 2009. The coding manual for qualitative researchers. Thousand Oaks, CA: Sage Publications, Inc.

Solomona, R.P., J.P. Portelli, B. Daniel and A. Campbell. 2005. The discourse of denial: How white teacher candidates construct race, racism and 'white privilege. Equity and Excellence in Education 8(2): 147-169.

Thomason, A. 2015. Students are protesting racism on college campuses. What are their demands? http://chronicle.com/blogs/ticker/students-are-protesting-racism-on-college-campuses-what-are-their-demands/106721. Chronicle of Higher Education. June 27, 2017.

Tindell, S., L. Young, E. O'Rear and P. Morris. 2016. Teaching assistant perspectives on a diversity and social justice education course for collegiate agriculture students. NACTA Journal 60(2): 158-166.

Weisinger, J.Y., R. Borges-Méndez and C. Milofsky. 2016. Diversity in the nonprofit and voluntary Sector. Nonprofit and Voluntary Sector Quarterly 45(IS): 3S-27S.

Wong, A. 2015. The renaissance of student activism. https://www.theatlantic.com/education/archive/2015/05/the-renaissance-of-student-activism/393749/. The Atlantic. June 27, 2017.

June 1968

Diversity of NACTA Resources and Unifying Objectives

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The Constitution of the National Association of Colleges and Teachers of Agriculture describes the purposes of the organization as follows:

1. "To provide for all colleges a forum for discussion of questions and problems related to improvement of college level instruction in agriculture.
2. "To seek to improve higher education in agriculture through examination and discussion of curricula, course organization, teaching techniques, facilities, and materials.
3. "To encourage and promote the general availability of instruction in agriculture and research supporting this instruction."

The constitution further indicates eligibility for membership as follows:

> "Active membership shall be composed of regularly employed teachers of agricultural subjects in a university, college, or junior college who have paid the annual membership fee."

and under the heading — Institutional Membership — the constitution states, "An institutional membership will entitle all faculty members concerned with agricultural instruction at a college level to active membership."

On first consideration these statements seem to be a very fine declaration of idealistic and worthwhile purposes that would join together a group of people working for the same objective. On closer examination, however, it is seen that the constitutional invitation to membership in the society brings together a group of people of such heterogeneity that there seems to be little of common interest to bind them together. To illustrate this point, let me ask—: what are the common interests that might provide a bond between a teacher of horticulture and a teacher of dairy husbandry? Would not the horticulturist find more of common interest with his colleagues within the Department of Botany in Liberal Arts College than he would with his friends within the Agriculture Department teaching dairy husbandry? We might also ask the question whether or not the agricultural economist would find more of common concern with colleagues in a Department of Economics than he would with those teaching soil science within an agricultural program.

The heterogeneity of NACTA membership is even more striking when you consider that universities, colleges, technical schools and junior colleges are all invited to institutional membership. The variation in objectives of mission, of educational philosophy, and of curricula is so great among member institutions that one wonders again what common denominator do we have. On some occasions speakers at our national conventions have expressed ideas from their background in one type of institution which have been completely unacceptable to faculty members from institutions with other types of goals and objectives.

In the early years of NACTA there was discussion of accreditation so that there might be some standard of excellence established for institutions teaching agriculture. After long discussion the idea of accreditation within NACTA was abandoned because of the great variety of missions and purposes of the institutions concerned. The general feeling among the membership was that each institution would have to evaluate itself in terms of excellence in accomplishment, of its own individual mission and purposes.

Many people who have been writing and speaking about higher education in agriculture have not really considered the great variety of institutions in the broad area called higher education in agriculture and the special missions that they have been given. For example, I would like to quote from the recent book, *The College of Agriculture: Science in the Public Service*, written by Dr. Charles E. Kellogg and David C. Knapp. Under the general heading *Challenge in Education*, the authors state:

> "Our ways of doing things are also changing at an accelerated rate. The 'half-life' of most technology is short. Perhaps one-half of it, on the average, is replaced in about four to five years. Thus people realize that the education that is given should be as basic as possible. Only with basic training and good reading ability can young men and women keep their education up to date as conditions change. Indeed, both are needed even to continue at the same relative level, to say nothing of relative advancement."

A little further the authors continue as follows:

> "Higher education is far more than training for jobs. Many are now taking a new look at the social problems of people. They see tensions within this country, within other countries, and between countries. No doubt science, engineering, and economics can help reduce the causes of some of these tensions. But science is unprepared to deal with some of the causes. Since tensions arise from conflicts about ideas of God, of man's relationship to other men, of his notions of justice, and of what enchants the heart, the understanding of these conflicts requires high scholarship in history, philosophy, comparative religion, and the arts."

Once again I must say that I agree with the authors: a general education with a broad base is highly desirable for students in every field. Nevertheless, I feel inclined to ask, does every student need the same curriculum or should he be able to select one according to his own special interests and abilities. Dr. Kellogg goes on to say:

> "A strong argument can be made for having basic mathematics, including calculus, required of all agricultural students during the first two years. Without it, the student will be unable to take the best advanced courses in physical chemistry, biochemistry, physiology, and statistics. Thus, if the students lack calculus, physical chemistry, and plant physiology, advanced courses in horticulture, crop science, animal science, soil science, agricultural economics, and the other specialties need to be watered down."

There are few people who would not agree that a lovely dinner would be composed of hors d'oeuvres, soup and salad, the entree with appropriate vegetables, some kind of appropriate drink for the occasion and, of course, dessert. But what about the person who really wants only a hamburger?

In June of 1966 Mr. George T. Poppic gave a very interesting presentation before the California Agricultural Teachers Association. Let me give a few of his ideas to you as they were published in the NAC News and Pesticide Review.

"'Bug Chaser', 'Field Tramper', 'Insect Distributor', 'Manure Salesman', these are all good-humored nicknames for a position of great responsibility. These people offer more advice and direct more decisions as to farm practices than do the university or the farm advisors or the county commissioners. The 'why' of it is very simple. They are basically 'salesmen' but have the dual responsibility of paying their way for their employers as well as to serve farmers with responsible technical knowledge. They are in constant contact with growers five days per week. Therefore, men of sufficient knowledge to practice this responsibility in a professional manner must be placed in the field.

"The position of this individual might be considered as a 'nurse' among 'doctors', or a 'brother' among 'priests'—a position of dedication to service of the farm community yet perhaps short on the highly technical aspects of the industry being serviced. In my opinion, and in the opinion of others, it is not necessary to have a Bachelor of Science degree to sell agricultural chemicals or to make recommendations for their use. However, it is vitally important that within each geographically defined agricultural area a certain number of 'nurses' or 'brothers' be available to the farm community with both formal and local knowledge of surrounding agriculture. This training program rightfully falls upon vocational institutions and particularly upon Junior Colleges.

"What do manufacturers and suppliers of pesticides and fertilizers desire in farmer contact salesmen? Needed are young men who are agriculturally oriented, of pleasing personality, of clean, neat appearance, and of such integrity that their services in any direction will be unquestioned. Equally important, each man must have formal knowledge in the area of effort for which he has been employed. The teachers of this prospective employee can prepare him for a task that could lead him to a pleasant economic position.

"The pertinent areas of vocational education are, in order of importance:

1. Economic Entomology
2. Biology
3. Soils
4. Agricultural Mechanics of Pest Control
5. General Chemistry.

These courses should offer prospective salesmen the necessary field of knowledge to obtain employment with area formulators and pest control operators.

"The finesse required of a salesman must also be considered. Suggested are courses in General Salesmanship and General Psychology.

"To foster inquisitiveness and an understanding of farm problems additional courses should be: Business Law; Elementary Accounting; Principles of Economics; Public Speaking; and Governmental Agencies and their responsibilities."

Many people would disagree with Mr. Poppic. I personally know of agricultural chemical firms who want personnel with at least a Bachelor of Science degree and would prefer the Master's degree. I also know of many agricultural chemical firms who agree completely with the idea that the B.S. degree is not necessary. All this means that there is a place for people with different kinds of training and, therefore, a place for different kinds of training programs.

In recent years members of the Commission on Education in Agriculture and Natural Resources of the National Academy of Sciences has done a great deal to bring about an exchange of ideas and a continuing dialogue between institutions teaching agriculture, between administrators of these higher education program, and between teachers of various agricultural science courses. The work of this Commission has done a great deal to improve the general level of agricultural education in this country. Conferences and discussions have brought people together to reexamine the objectives of their educational programs. Individual instructors have been brought together to reevaluate their courses and instructional methods. In my opinion, the work of this committee has been one of the most constructive developments in higher education in agriculture for several decades. Yet I must say that some of the conferees on panels assembled by the Commission for discussion at conferences have sometimes failed to see the great diversity of missions and programs within the various institutions teaching agriculture. Some of the recommendations, therefore, appear too idealistic to be broadly accepted.

In my opinion, one of the great strengths of higher education in agriculture in the United States is the fact that we have great diversity of purposes among institutions engaged in this educational program. We have those that devote themselves to preparing scientists genuinely interested in agriculture—people who can devote themselves to research and creative thinking within this field. Other institutions or other curriculums within the same institution may have as their objective the preparation of technologists who are qualified to work in production and management or the agricultural service industries. Some institutions have specialized in combining technical understanding with practical skills necessary to work within the industry. All of these various programs are important to the extent that they serve the agricultural industry well. And if I might draw a parallel from an ancient writing, "The eye can not say unto the hand, I have no need of thee. Nor again the head to the feet, I have no need of you."

If we recognize the great diversity of institutions participating in higher education in agriculture, with their diversity of purposes and missions, then we can discover the unifying objectives that make the National Association of Colleges and Teachers of Agriculture a genuine service to its members.

It is, in fact, the recognition of the diversity of programs at our various institutions that makes our organization so important and its purposes meaningful. All of us serving in our own way need to come together frequently to get an over-all view of the vast educational programs of which we individually are only a part. We need this organization,

1. "To provide for all colleges a forum for discussion of questions and problems related to improvement of college level instruction in agriculture.
2. "To seek to improve higher education in agriculture through examination and discussion of curricula, course organization, teaching techniques, facilities, and materials.
3. "To encourage and promote the general availability of instruction in agriculture and research supporting this instruction."

Improving Student Writing Through Modeling

Introduction

Asking students to write in college classrooms can cause frustration on both ends. As instructors, often what we ask students for and what they give us do not add up. It's easy to view their less than stellar work as a reflection of apathy for the class or a lack of understanding. Students can feel apprehensive and overwhelmed at the thought of writing in a college setting, leading to procrastination and other avoidance behaviors that result in poor quality submissions. Instructors can help students overcome anxiety and support them in the writing process using modeling.

Modeling is a pedagogical method to help students understand the thinking needed to answer a question completely and concisely. Providing instruction on reading and writing at the post-secondary level may seem counter-intuitive, but it makes a difference. Though students may have developed general reading and writing skills by the time they get to your classroom, if you want students to be successful with you, they need a refresher in how to read and write in technical disciplines.

Students view each class as a separate entity. The skills they learned in one class, for example, English, are completely separate from other classes and are not generally transferred (Moje, 1996). They may not make connections between classes as easily as experienced faculty. Additionally, agriculture is a technical subject area, which requires a completely different literacy skillset than those used in English classes (Buehl, 2010). Students may not have had the chance to develop literacy skills needed for a technical discipline. By modeling how to read, process, and respond to a writing prompt, you can help set your students up for success.

How It Works

Modeling gives insight into the thinking surrounding a task. To help increase student motivation and buy-in, select a prompt from an upcoming writing task and use a well-developed rubric.

1. Show the prompt on the board and read it aloud to your students. Ask them to identify the key action verbs they need to address. Have students circle and underline on their own copy of the prompt. If you ask students to highlight the parts of the prompt they need to respond to, they will highlight the entire passage and lose sight of the specifics. By asking them to isolate the action verbs, students must read and process each individual sentence.
2. After discussing the key terms indicated by students, reread the prompt aloud and verbalize your thinking. An example statement might be, *"This isn't technically a question, but addressing this in my answer would really help strengthen the response."*
3. Show an example response to your students, one of fair-to-good quality works the best. If possible, and with permission, use previous student work for the examples. Ask students to read the response and discuss the type of feedback they would give the writer. Did they fail to answer all of the questions in the prompt? Is the writing unclear? How could this answer be improved? etc. Have students share and discuss with a partner. Encourage students to use their rubric for scoring and feedback. Giving feedback and discussing with a partner is an important strategy to build cognition and critical thinking. It allows them to start scaffolding the necessary components of a high-quality answer. Discuss responses as a class after the pairs are done.
4. Show an exemplar response. Again, ask the students to score it and give the author some feedback. This time, discuss what the strengths of the response are, why it is more effective than the previous response, and what elements can be translated into their response.
5. Give students a few minutes to begin outlining their response to the prompt. They will need time to generate a substantive answer. They might also need to be prompted that good technical writing is thorough and concise — wordiness does not make a better response. It is important to remind them good writing takes time and several drafts.

Why It Works

Modeling may seem simplistic and elementary to college faculty, but students respond positively. As faculty, we are experts at reading and writing in our discipline. We have complex processes we use regularly to help decode information. Students do not have a skillset as developed as ours. By taking the time to breakdown our processes and show them to the students, we can help build their knowledge and understanding. Showing students how we read and write in our technical fields is an important step to help them build connections to the knowledge and skills they already have.

A little extra effort up front and a few reminders throughout the semester can have a positive benefit on the students' work and self-esteem. Once they have been shown how to read and write in your discipline, they can feel empowered and confident in their skillset. The 15-20 minutes it takes to complete a modeling activity is an investment that pays off all semester.

References

Buehl, D. 2011. Developing readers in the academic disciplines. Newark, DE: International Reading Association.

Moje, E.B. 1996. "I teach students, not subjects": Teacher-student relationships as contexts for secondary literacy. Reading Research Quarterly 31(2): 172-195.

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Enhancing Agricultural Mechanics Laboratory Awareness with Snapchat: A Snapshot of Agricultural Mechanics Safety Concerns

Introduction

The agricultural mechanics laboratory provides students with an environment where they can engage in hands-on learning (Wells et al., 2013). However, learning cannot take place unless agriculture teachers provide a safe learning environment for students to develop agricultural mechanics-related skills (McKim and Saucier, 2011). Phipps et al. (2008) indicated that agriculture teachers are responsible for identifying safety hazards, providing daily safety instruction, and maintaining safe working conditions for students. McKim and Saucier (2011) further suggested that accidents in agricultural mechanics laboratories can be reduced ensuring that the teachers who oversee those facilities are competent in laboratory management. Could the use of Snapchat help secondary agriculture teachers become more competent in identifying and reducing hazardous conditions as they emerge?

Snapchat has been a popular social media tool used among teenagers and young adults, and often used to share pictures and videos among friends (Poltash, 2013). However, Snapchat need not be limited to social use only and can be used by agriculture teachers in the post-secondary classroom, specifically the agricultural mechanics laboratory to enhance laboratory awareness. This innovative idea aligns with the American Association for Agricultural Education 2011- 2015 Research Priority Areas Technologies, Practices and Products as well as Efficient and Effective Programs (Doerfert, 2011).

How it Works

Agriculture teachers can use Snapchat to actively engage students to begin analyzing snapshots or videos of potential safety concerns in the agricultural mechanics laboratory. The teachers can post a snapshot or video to the "my story" section of their Snapchat account. Students are then able to respond to the "story" and identify the potential safety concerns contained in the snapshot or video. The snapshots and video can be archived within the camera roll of the users' smart phone. This allows the teacher to keep a copy of the photos and videos shared for identifying potential safety concerns. Students can screenshot pictures so that they may retain a copy as well. Students do not have the capability of saving the teachers' videos. Table 1 outlines the process needed to create a Snapchat account and begin engaging students to identify potential safety hazards in the agricultural mechanics laboratory.

Results to Date

This innovative idea was field tested in an agricultural mechanics teaching methods course at Iowa State University. The instructor and teaching assistant looked for any safety violations being committed by students as well as setting up potentially hazardous situations for students to recognize. A picture is taken of those violations to be shared with class members later and the safety issues are then rectified. If the hazardous situation has the potential for immediate danger to the operator or others, then the picture will be skipped, and proper safety procedures will be followed. The students have actively participated in the Snapchat stories and have added laboratory management and safety discussions that have been overlooked in previous classes. The students have mentioned that at times it can be difficult to see the picture that is being shared due to the size of their smartphone screens.

Future Plans/Advice to Others

Safety and privacy of users should always be considered when using the internet. Users can only receive snaps from users that they add. Similarly, users can adjust settings within Snapchat so that "friends" are the only ones who can view their stories. The researchers

Table 1. Steps to Snapchatting in the Agricultural Mechanics Laboratory

Step	Activity	Description
Step 1	Create username and password	Users will create a username and password to gain access to Snapchat's features.
Step 2	Add the instructor and fellow students	Once logged in, students must friend the instructor and fellow students to share 'snaps' for the course.
Step 3	Set snap timer	Instructor and students will set their snap timer to 10 seconds to allow ample time to view pictures.
Step 4	Snapchats within the lab	Instructor will take a picture or video highlighting a skill being performed in the agricultural mechanics laboratory and post to their "story" so all students can view.
Step 5	Student responses	Students must respond to the instructor with a picture or video response that identifies the potential safety hazards.
Step 6	Instructor grading	The instructor will analyze student responses. A snap back with a thumb up or down will indicate a right or wrong answer.

are considering partnering with beginning teachers to share pictures and videos of potentially hazardous conditions that the teachers are have encountered at their schools.

Costs/Resources Needed

Participants wanting to utilize this product must have a smartphone, or other tablet with wireless connectivity. Beyond the cost associated with owning a smartphone or tablet all the additional costs associated with this educational technique are minimal. Snapchat is available at no cost to smartphone users but requires an active email address. Additional costs may incur if smart phone technology is utilized, as individuals would be subject to additional charges from their service providers. The researchers and participants utilized smartphones and/or tablets for this project. However, an iPod touch can also be used for Snapchat.

References

Doerfert, D.L. (ed.) 2011. National research agenda: American Association for Agricultural Education's research priority areas for 2011-2015. Lubbock, TX: Texas Tech University, Department of Agricultural Education and Communications.

McKim, B.R. and P.R. Saucier. 2011. Agricultural mechanics laboratory management professional development needs of Wyoming secondary agriculture teachers. Journal of Agricultural Education 52(3) DOI: 10.5032/jae.2011.03075.

Phipps, L.J., E.W. Osborne, J.E. Dyer and A.B. Ball. 2008. Handbook on agricultural education in public schools. 6th ed. Clifton Park, NY: Thomson Delmar Learning.

Poltash, N. 2013. Snapchat and sexting: A snapshot of baring your bare essentials. Richmond Journal of Law and Technology 19(4): 1-24.

Wells, T., D.K. Perry, R.G. Anderson, M.J. Shultz and T.H. Paulsen. 2013. Does prior experience in secondary agricultural mechanics affect pre-service agricultural education teachers' intentions to enroll in post-secondary agricultural mechanics coursework? Journal of Agricultural Education 54(4): 222-237. DOI: 10.5032/jae.2013.04222.

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Pin It! Using Pinterest in the Agricultural Mechanics Laboratory

Introduction

Pinterest, an online bulletin board, is surpassing Twitter and even Facebook in social media website popularity (Falls, 2012). A hit among hobbyists and do-it-yourselfers, Pinterest is an online storage space for crafts, recipes, and ideas. Individuals, after creating a profile and becoming an official "pinner," can re-pin previously posted ideas to their personal page under customized boards for future reference. According to the Pinterest website, *"Browsing pinboards is a fun way to discover new things and get inspiration from people who share your interests."* In addition, pinners can also upload their own ideas/projects to share with other Pinterest users.

Pinterest has been a popular education tool among elementary teachers, and often used to locate creative lesson ideas, and also share original ideas with others in the profession. However, Pinterest need not be limited to elementary teachers and can be used by agricultural educators in the secondary classroom, specifically the agricultural mechanics laboratory. This innovative idea aligns well with the American Association for Agricultural Education 2011- 2015 Research Priority Areas Technologies, Practices and Products as well as Efficient and Effective Programs (Doerfert, 2011).

How it Works

Agricultural educators can use Pinterest in the agricultural mechanics laboratory to search for new, unique, affordable agricultural mechanics projects that they can integrate into their curricula. The teachers are also able to share a large collection of projects with their students. The teachers can also use Pinterest as a virtual filing cabinet to store agricultural mechanics projects for future reference. The teachers are also able to upload current agricultural mechanics projects to share other teachers/professionals. The instructors also can connect with individuals within the same

Table 1. Steps to Pinning in the Agricultural Mechanics Laboratory

Step	Activity	Description
Step 1	Create log-in name and edit personal profile.	A pinner's personal profile will be displayed when fellow pinners search for them specifically or others within their discipline.
Step 2	Follow pinners with similar interests and career objectives	Following agricultural instructors and mechanics professionals allows one to browse pins and boards most like their own and in line with their own interests.
Step 3	Create boards based on interests, subjects taught	Creating boards, or general topic areas such as "Metal Ideas", "Woodworking Projects" or "Electricity", allows the Pinterest user the opportunity to organize pins for easier access later.
Step 4	Search for project ideas	Using the search bar, Pinners can look for projects specific to their needs, such as metals, woods, welding, autos, etc.
Step 5	Re-pin project ideas for future use	Re-pinning projects to the customized boards created in step 3 allows pinners to organize and store ideas for future reference and easy access.
Step 6	Upload personal projects for other Pinners' reference	Projects completed in your own shop can be uploaded onto Pinterest and shared with other agricultural mechanics instructors.

discipline and with similar interests. Table 1 outlines the process needed to create a Pinterest account and begin collecting projects.

Results to Date

The researchers have used the website to pin projects that fall into several content areas within agricultural mechanics. Thus far they have created the following categories within agricultural mechanics: welding, electricity, woods, and plasma cutting. The researchers have also created categories for projects that can be constructed out of pallets, horseshoes and other miscellaneous materials. In addition to those categories, the researchers have also created a category for projects that can be constructed for free which was intended to assist teachers who are on a limited budget. This category is also an excellent resource for teachers who have students from low socio-economic backgrounds who want a project of their own. This category will also allow students to explore their creativity with projects constructed out of refurbished materials thus the students are enhancing their higher order thinking skills with the adoption of these projects. The researchers also created folders for projects that fall into other content areas such as horticulture and agricultural science. Researcher #1 has pinned 419 projects and has 41 active followers. Researcher #2 has over 25 projects pinned and has 9 followers to date. The researchers were unable to locate any functions on the website that tracked the number of people who visited our project sites but did not pin the project or followed us.

Future Plans/ Advice to Others

Safety and privacy of users should always be considered when using the internet. The teachers will have to work with administrators if firewalls prevent them from gaining access to the Pinterest website. Teachers should allot at least one hour of time during the initial visit and set up of their Pinterest page. To navigate quickly through the website, the researchers suggest using the key word search option to focus on the areas of interest desired. The researchers also highly suggest making several folders within agricultural mechanics to maintain an organized wall that is easy to navigate through. A study should be conducted to assess student learning objectives that could emerge from that projects being utilized.

Costs/Resources Needed

Costs associated with this educational technique are minimal. Pinterest is available at no cost to users but requires an active email address. Teachers will need internet access to access Pinterest as well as to collect projects. Additional costs may incur if smart phone technology is utilized, as individuals would be subject to additional charges from their service providers.

References

Doerfert, D.L. (ed.). 2011. National research agenda: American Association for Agricultural Education's research priority areas for 2011-2015. Lubbock, TX: Texas Tech University, Department of Agricultural Education and Communications.

Falls, J. 2012. How Pinterest is becoming the next big thing in social media for business. http://www.entrepreneur.com/article/222740. Entrepreneur.

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Team-Based Learning: A Professional Development Model for Training the Trainer

Introduction

In secondary agricultural education, in-service training offers an essential component to maintaining teachers' proficiency beyond their initial certification (Abolaji and Reneau, 1988). Applying problem-based learning, creating lessons that develop higher order thinking skills, and developing teamwork and collaboration among students were among the top areas of in-service needs identified by North Carolina teachers (Davis and Jayaratne, 2015). Team-Based Learning (TBL) utilizes group work through the vast majority of class time (Michaelsen and Sweet, 2008). Group cohesiveness developed through TBL is one of the key principles driving TBL's success in classrooms (Michaelsen et al., 2002). By applying TBL strategies to professional development, participants are not only exposed to new, field appropriate content, but are able to experience firsthand how they can incorporate an interactive and analytical teaching strategy into their classroom (McMahon, 2010). Utilizing TBL situations that require students to assume an active role in the learning environment not only aids students in mastering new content (Michaelsen and Sweet, 2014), but can also give educators participating in professional development events an opportunity to practice teaching their new knowledge.

Our institution hosts professional development workshops focusing on agricultural mechanics topics one Saturday (8:00 am-4:00 pm) per month during the school year. The workshops are open to both secondary agricultural education and industrial technology teachers. We offer graduate credit and continuing education credit options for renewal of their teaching licensure. Due to the popularity of our workshops, we draw a wide range of participants with varying levels of knowledge and skills. In order to maintain a high level of engagement for all participants, the presenters utilized TBL to design and implement the workshops.

How it Works

The instructors sent the participants a short pre-reading on the primary content area. The participants then completed an Individual Readiness Assurance Test (IRAT) and Team Readiness Assurance Test (TRAT) at the beginning of the workshop. Based on the results of both the IRAT and TRAT, a short clarifying lecture immediately followed. Upon completion of the clarifying lecture, the participants (remaining seated in their teams) transitioned into the application exercise. In this case, they were learning how to design a nameplate using Computer Aided Design (CAD) software. Once the participants received training on the CAD software, the first application exercise required them to become instructors and work together in their teams to coach a student through the design process. In this case, we used graduate students to serve as the "students". The "students" acted as though they had never used the CAD software before and needed very detailed instruction to properly design the nameplate. Teams used the notes and experience they gained from the initial instruction to strengthen their familiarity with the CAD software during the mock teaching application exercise. Following this activity, the participants were tasked with designing individual fire pits on the CAD software, with the aid of their teammates and the workshop facilitators. The role of the professional development facilitator was to lead a discussion on projects, applications, and teaching methods.

Table 1. Steps designed to implement TBL into professional development workshops.

Step	Activity	Description
Step 1	Distribute pre-reading	Pre-readings focusing on the workshop content are emailed to participants to prepare them with basic content knowledge.
Step 2	Participants complete IRAT	IRATs are given to assess individual knowledge gained from personal experience and the pre-reading.
Step 3	Teams complete TRAT	Teams meet to discuss the answers of the TRAT. This discussion places students in the role of the teacher and requires them to discuss effectively to determine correct answers.
Step 4	Follow up lecture	The instructors evaluate the immediate results of the IRATs and TRATs to identify content knowledge gaps. A short lecture covering only those knowledge gaps follows.
Step 5	Application activity	The main activity for the workshop is designed for groups to work together using their knowledge to complete an activity related to the content.

Results to Date

The teachers had no prior knowledge of TBL before participating in this workshop. Anecdotally, the teachers were highly engaged during the IRAT and TRAT that lead to quality discussion. The workshop participants were so enthusiastic about TBL, 45 minutes of discussion revolved around answering questions regarding TBL. All of the teachers enrolled in the workshop requested additional information on TBL and continued to ask questions about TBL throughout the day. The facilitators also noted that the teams generated impactful discussion on how to use the software, applications and activities that can be implemented with the software and multiple teaching methods that can be utilized to deliver the content.

In past workshops, the instructors found it was difficult to keep the teachers who possessed more knowledge and skills engaged in the content than their peers. Conversely, we struggled to keep the teachers with little to no knowledge progressing through the content without feeling overwhelmed due to the knowledge gap. Using TBL as a model for training teachers, we were able to spread the varying knowledge and skill levels evenly across teams, where the teachers were able to work as a team through the learning process.

Future Plans/ Advice to Others

For future workshops, we would like to collect a short survey from the participants that rate their experience levels. Creating diverse groups helps bring different perspectives to the team, bringing out greater team success (Michaelsen and Sweet, 2008). In short, one-day workshops, it is beneficial to keep team sizes small, approximately four to five participants per team, to help accelerate team cohesiveness.

References

Abolaji, G. and F.W. Reneau. 1988. In-service needs and problems of agricultural science teachers in Kwara State, Nigeria. Journal of Agricultural Education 29(3): 43-49. DOI: 10.5032/jaatea.1988.03043.

Davis, R.J. and K.S.U. Jayaratne. 2015. In-service training needs of agriculture teachers for preparing them to be effective in the 21st century. Journal of Agricultural Education 56(4): 47-58. DOI: 10.5032/jae.2015.04047.

McMahon, K.K. 2010. Team-based learning. An Introduction to Medical Teaching. pp. 55-64. Springer Netherlands.

Michaelsen, L.K., A.B. Knight and L.D. Fink. 2002. Team-based learning: A transformative use of small groups. Greenwood Publishing Group.

Michaelsen, L.K. and M. Sweet. 2011. Team-based learning. New Directions for Teaching and Learning 2011(128): 41-51. DOI: 10.1002/tl.467.

Michaelsen, L.K. and M. Sweet. 2008. The essential elements of team-based learning. New Directions for Teaching and Learning (116): 7-27. DOI: 10.1002/tl.330.

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