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A Cross-Case Comparison of the Academic Integration Human Capital Pre-service Agricultural Educators Retain Prior to Their Teaching Internship

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Abstract

The purpose of this cross-case comparison was to explore agricultural education pre-service teachers' perceptions in regards to integrating academics into agricultural education curriculum. This study included three agricultural education teacher certification programs in the United States. The pre-service teachers queried held similar perceptions regarding the integration of academic related concepts into an agricultural education curriculum. (a) Participants felt agriculture was a natural integration and emphasis vehicle for a range of academic subjects. (b) Participants felt it was important to emphasize the core subject matter inherent to agriculture, but care must be taken to not fundamentally alter the purpose of the agricultural education program. (c) A consensus was reached that lessons should be "hands-on" and relate to real world applications. It was recommended prior knowledge was important for successful integration of core content into an agriculture curriculum. An examination of how many credit hours of mathematics, science, and English pre-service agricultural education teachers are required to take to be effective at integration of core material should occur. Further, collaboration between university faculty of agricultural education and other departments outlining ways to achieve successful integration of academic content was needed.

Keywords: STEM; academic integration; preservice teachers; agricultural education; human capital theory; self-efficacy

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Educational progress vis-à-vis science education in the United States has stagnated (Dickinson & Jackson, 2008; Haynes, Robinson, Edwards, & Key, 2012; National Center for Education Statistics, 2005; Provasnik, Gonzales, & Miller, 2009). Impact on academic improvement has been sought in the form of curricula and instructional approaches, emphasis on engaged thinking and inquiry, and the refinement of critical thinking skills (Carnegie Counsel on Adolescent Development [CCAD], 1989; National Research Council [NRC], 1996). Yet, despite ten years of efforts aimed at improving student achievement in science, technology, engineering, and mathematics (STEM) content, science achievement by students in the U.S. has been underwhelming (Davis, 2002). U.S. students' level of science literacy according to the Program for International Student Assessment (PISA) is discouraging and ranks U.S. students, 23rd among the organization for economic cooperation and development (OCED) and non-OCED countries (Fleischman, Hopstock, Pelczar, & Shelley, 2010).

The report *A Nation at Risk: The Imperative for Educational Reform* (1983) identified that academically U.S. math and science standards have declined, as evidenced by increasingly poor test scores achieved by American youth. As reported by Henry (1997) and O'Sullivan, Reeses, and Mazzeo (1997), scores by U.S. students in the eighth-grade exhibiting below a basic level of proficiency in science were at 40%, while those scoring at a level considered to be proficient were just above 25%. Internationally, during this time frame, student achievement in the United States declined from the fourth to the eighth-grade, further indicating a continued decrease of student math and science scores (National Center for Educational Statistics [NCES], 2001; Schmidt & McKnight, 1998). In 2007, the National Research Council addressed this concern in their document, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.* The NRC postulated, "the scientific and technological building blocks critical to our economic leadership" existed (National Research Council, 2007, p. 3). As such, the National Center for Education and the Economy (2007) and the National Academy of Science (2007) have acknowledged the need for new and innovative approaches to education, more specifically, science education, to counter findings indicating that our standing in science and math competency has degraded, corroborating our need for increased scientific literacy and educational change (NRC, 1996; NRC, 2010).

A considerable amount of political voice has been targeted toward educational programs aimed to improve the achievement of students in academics (Rose, 2007). Sanders (2009) stated ". . . integrative STEM education includes approaches that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects" (p. 21). Conroy and Walker (2000) posited agricultural education provides an educational context ideally suited towards student accomplishment in core academic areas (i.e., mathematics, science, reading, etc.), moreover, delivering relevance between academics and career and technical education, satisfying Perkins integration of academics funding requirements (Myers & Thompson, 2009). As posited by researchers (Myers & Dyer, 2006; Parr, Edwards, & Leising, 2006; Thompson & Balschweid, 2000), students exhibit a higher level of achievement when exposed to science through an integrated approach, more so than those students exposed to more traditional methods of instruction. With the emphasis on academic integration across the curriculum (Sanders, 2009), agricultural education is a natural "fit" for the integration of math and science concepts (Balschweid, Thompson, & Cole, 2000; Young, Edwards, & Leising, 2009).

With the importance of academic integration across the curriculum recognized (Myers & Dyer, 2006; Parr, Edwards, & Leising, 2006; Sanders, 2009; Thompson & Balschweid, 2000), it has been identified that "teacher preparation and in-service education programs must be revised and expanded to develop more competent teachers" (National Research Council, 1988, p. 6-7). The emphasis on the development of more competent pre-service teachers could hold great potential for a more positive and effective impact on their future pedagogical practices, principally during the residency teaching experience (Ginns & Watters, 1998). With a considerable number of teachers lacking support after their first role as an in-service teacher, the chance of a successful novice teacher experience diminishes considerably (Johnson & Birkeland, 2003; Kauffman, Johnson, Kardos, Liu, & Peske, 2002), potentially contributing to high levels of attrition experienced in the profession, especially among first year teachers (Grissmer & Kirby, 1987; Knobloch & Whittington, 2002).

According to Grissmer and Kirby (1987), teacher attrition is described as those educators who leave the teaching profession willingly after a minimum of one calendar year and seek employment in another vocation, explore other educational opportunities, or assume domestic duties in the home; or those teachers who leave involuntarily, either through a denial of tenure or school or budgetary constraints. Attrition is seen as highly correlated with the investment a teacher holds in their position (Grissmer & Kirby, 1987). Increased retention of teachers can be correlated with an accumulation of both monetary and non-monetary capital (i.e., financial incentives, promotion, improved working conditions), thus encouraging further growth of human capital, teacher-efficacy, and student academic success (Czerniak, 1990; Grissmer & Kirby, 1987). What is more, those teachers who have developed a higher teacher-efficacy are more likely to utilize a constructivist approach to their teaching, emphasizing inquiry based learning, as well as additional educational strategies targeted at student centered learning (Czerniak, 1990). With the increased push for agriculture teachers to incorporate academic concepts (Myers & Dyer, 2004), teachers have indicated a need for teacher education programs to provide increased content knowledge and pedagogical training (human capital) deemed necessary for the effective emphasis and integration of science and math in the curriculum (Gill, 2009; Warnick et al., 2004), moreover, providing pre-service teachers the opportunity to gain self-assurance and an increased level of efficacy during their residency teaching experience (Robinson, Krysher, Haynes, & Edwards, 2010).

Theoretical Framework

This study utilized Human Capital Theory (HCT) coupled with Bandura's self-efficacy theory (1986) to serve as the theoretical framework. The theory of human capital states individuals much like other commodities are capable of being developed (Becker, 1993) and implies there is a potential benefit economically to both individuals and the community in which they live (Sweetland, 1996). Methodical investments in individuals through educational opportunities such as pre-service, in-service, or inductive year professional development are viewed positively, inspiring growth and the possibility of professional advancement in an individual (Nafukho, Hairston, & Brooks, 2004). Moreover, these educational opportunities provide a benefit that could potentially decrease the probability of attrition and early career change (Kelsey, 2006). Schultz (1963) posited education is a consistently researched investment in human capital, because of the potential for education to develop an individual not only intellectually, but also economically (Schultz, 1971). With that being said, it is only natural that teacher preparation programs should be developing human capital in their pre-service teachers through courses they believe will . . . significantly enhance the quality of their [pre-service teachers] labor skill . . . " (Beaulieu & Mulkey, 1995, p. 4).

According to Grissmer and Kirby (1987), attrition is seen as interrelated with HCT, as the more value or capital a person holds in their career choice, the less chance of attrition occurring. Knowledge of those factors contributing to satisfaction and dissatisfaction of career choice in teachers (Tippens, Ricketts, Morgan, Navarro, & Flanders, 2013) ". . . could lead to development of programs aimed at helping teachers become more satisfied with specific facets of their jobs" (Cano & Miller, 1992, p. 15).

Self-efficacy as defined by Bandura (1997) ". . . refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). Further, Bandura identified efficacy can indeed have effects that are varied. Efficacy in teachers is "the extent to which teachers believe they can affect student learning" (Dembo & Gibson, 1985, p. 1). The self-efficacy of the agricultural education pre-service teachers' aptitudes to teach science is examined in an attempt to determine pre-service teacher confidence level in their abilities. Real experience gained through successful involvement in a practice, supports the increase of self-efficacy over experiences gained vicariously (Bandura, 1986). It was suggested by Pintrich and Schunk (1996) ". . . self-efficacy beliefs are assumed to be much more dynamic, fluctuating, and changeable beliefs . . ." (p. 93). Pintrich and Schunk's statement lends credence to research identifying teachers who will succeed if they feel confident in their actions, but potentially fail under low levels of self-efficacy (Saklofske, Michaluk, & Randhawa, 1988). With the likelihood for teacher attrition in the beginning years of their careers, efficacious apprentice teachers are more likely to persevere in their chosen vocation (Knobloch & Whittington, 2002). The questions then remain: 1) Does the level of human capital one possesses, affect their self-efficacy? and 2) What human capital are agricultural education majors attaining through their teacher preparation program?

Purpose and Objectives

The purpose of this study was to explore the human capital developed through a teacher education program in regards to integrating academics into an agricultural education curriculum. The following research questions were developed to guide this study:

1. How do pre-service agricultural education teachers define **academic integration**?
2. To what extent do pre-service agricultural education students understand the purpose of **academic integration** in the agricultural education classroom?
3. What strengths and weaknesses do pre-service agricultural education teachers believe they possess in relation to the implementation of **academic integration**?

Methodology

A comparative holistic multiple-case study design was employed for replication purposes (Yin, 2009, p. 46). The context of the case studies was *prior to their internship experience* and the cases being studied were the *agricultural education pre service teachers*. Three separate case studies were conducted by using focus groups coupled with a structured interview format (see Figure 1.1).

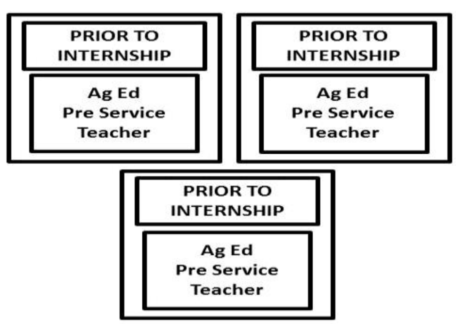

Figure 1.1. Holistic Multiple-case Study Design for Ag Education Pre service Teachers

A multiple case study design was chosen for literal replication: gathering similar results in each case study (Yin, 2009). Structured interviews were used because, "In a structured interview, the problem is defined by the researcher before the interview. The questions have been formulated ahead of time, and the respondent is expected to answer in terms of the interviewer's framework and definition of the problem" (Guba & Lincoln, 1981, p. 155-156). Structured interviews, in a focus group setting, were chosen because we knew "*. . .* what he or she does not know and can therefore frame appropriate questions to find it out. . ." (Lincoln & Guba, 1985, p. 269). The focus groups began with a series of questions and additional questions were asked for further clarification and probing (Merriam, 2009). The following questions were asked during the structured interview:

1. How do you define academic integration?
2. How do you feel academic integration benefits students enrolled in agriculture education?
3. Which core subject do you feel you can integrate strongly into the agricultural education classroom?
4. What "tools" do you believe you will need to regularly integrate academics into the agricultural education curriculum?
5. What barriers do you believe will be present when attempting to integrate core content into the agricultural education curriculum?

A typical purposive sample (N=17) was used for this study. A typical purposive sample is a sample that is selected ". . . because it reflects the average person [pre-service ag education teacher], situation [entering the student teaching internship], or instance in the phenomenon" (Merriam, 2009, p. 78). All participants were agricultural pre-service teachers and met the following selection criterion: 1) they were an agricultural education major, 2) they were pursuing teacher certification, and 3) they were enrolled in the student teaching experience in the Spring 2012 semester.

The first university, focus group one (FG 1), was a southwestern regional university and included six participants. The second university, focus group two (FG 2), was a western land grant university and included seven participants in the group. The third university, focus group 3 (FG 3), was a midwestern regional university and included four participants in the group. Each focus group session was conducted at the respective universities and was approximately an hour in length. A moderator was enlisted at each institution and responses were recorded and transcribed by each of us. When using focus groups, confidentiality must be ensured in the reporting of results, thus responses were coded as FG 1, FG 2, or FG 3 to denote the setting of data collection, but no individual identifiers were used (Merriam, 2009). To ensure trustworthiness of the data, member checks were conducted through the distribution of the transcribed data to the focus group participants, with a request of confirmation of the information provided.

A within-case analysis was performed for each individual case study. We analyzed the data using the constant comparative method described by Glaser and Strauss (1967) that employed unitizing and categorizing of the data. The constant comparative method allowed us to repeatedly compare responses with previous responses in an attempt to discover new relationships (Dye, Schatz, Rosenberg, & Coleman, 2000). Following the unitizing of the data, the data were coded and the codes were included in the results section, in parentheses after the quotations, as part of an audit trail to ensure confirmability (Erlandson, Harris, Skipper & Allen, 1993).

The units of data were sorted into emergent themes of ideas; titles were developed to distinguish each theme from the others (Erlandson et al., 1993). Continual revision, modification, and amendment were used until all units were placed into an appropriate theme. Following analysis of the data we compared our results to the others and a debriefing of the results occurred. Following the within-case analysis, a cross-case analysis was performed comparing the results to establish converging lines of inquiry (Yin, 2009). Matrices were developed to "…allow the researcher to analyze, in a condensed form, the full data set, in order to see literally what is there" (Huberman & Miles, 1994, p. 437). Following development of the matrices, a content analysis of the matrices was conducted to identify converging lines of inquiry across the individual case studies. Conclusions and implications were drawn based on the results of the cross case analysis. Results were reported with rich description using the voice of focus group participants. We kept a methodological and reflexive journal to track the details and nuances of the study as it emerged and to catalogue our reflections including bias. Results of this study are limited to the participants and are not to be generalized. Findings were arranged in the order of the research questions. Converging lines of inquiry based on emergent themes are italicized and quotes from focus group participants are presented.

Findings and Results

How do you define academic integration?

Before pre-service teachers can effectively implement academic integration they must be able to explain the purpose. When asked to define academic integration participants mentioned academic integration is *using more than one subject* in your curriculum to teach students the *application of concepts* both in agriculture and other subjects.

Using more than one subject quotes

- In my agriculture class we had history, math, and English. We did everything. That is what academic integration is to me. Agriculture classes are probably the most beneficial classes you will have because it teaches everything; it doesn't just go with agriculture, just finance, cows, it's everything. You learn everything. (FG 1.2)
- "I'd say it is integrating your basic core classes into everything; using science in other classes, using math problems in your science classes, even. Just integrating and interweaving all of them I guess you would say" (FG 2.2).
- I don't think it is necessarily teaching science or social studies. . . I think it is like showing how your lesson can relate to a prior class that they had in science or social studies or math. (FG 3.3)

Application of concepts quotes

- "Half classroom, half hands-on" (FG 1.1).
- I think integration, in the opposite direction of elected courses, whether it is Vo. Ed. Or it is, you know music classes, that those can be big helps for teachers that are teaching the core classes because [the core teachers] may have a hard time, sometimes knowing the real world applications and we [ag teachers] can help supply some of those applications for them. (FG 2.5)
- "Not necessarily teaching it but showing how it relates to other things" (FG 3.2).

How do you feel academic integration benefits students enrolled in agriculture education?

When exploring to what extent pre-service agricultural education students understand the purpose of academic integration in the classroom, the participants were asked how academic integration benefits students in agricultural sciences. The pre-service teachers stated academic integration engages students in the classroom and *gives meaning to both agriculture and core subject concepts* because academic integration *allows students to apply the concepts through hands-on activities*.

Gives meaning quotes

- "Just being able to apply what you learn in the classroom" (FG 1.9).
- I think [academic integration] definitely helps for your students that are not typical learners; you know, they can go into Ag Shop and do something that is hands-on that they like. They can remember then, as opposed to just learn it out of a book. (FG 2.23)
- Well, let's take the Pythagorean Theorem for example, A-squared plus B-squared equals C-squared. You can tell that to a kid so many times and write it on a board or you can come to an Ag class and apply it, say, we're going to stick a tongue on a trailer and we need it to be centered-dead center. You tell them at the end, by the way, this is Pythagorean's Theorem, heard you guys were doing this in math, and they go: Wow we really are using this stuff!! (FG 2.19)
- "It is relying on concepts that they understand previously or more just because they have a more mechanical mind and they have mechanical knowledge" (FG 2.21).
- I think [academic integration] allows students the opportunity to be engaged that they are able to use the skills they learned in math, they are able to use problem solving skills such like the hypotheses and degree searches they learned in science class. . . (FG 3.6)

Apply concepts through hands-on activities

- "It is a hands-on experience. I think that is the most important part; actually getting to do it" (FG 1.6).
- It is relying on concepts that they understand previously or more just because they have a more mechanical mind and they have mechanical knowledge, so by having to do it with their hands, they can figure this thing out, and when they make this connection to the math application it just makes a deeper connection with them because it is connecting something A) that they care about, and B) that they can manipulate with their own hands and with problem solving methods that they have used for years to mess and tinker with things. (FG 2.21)
- "Students in an ag science class would hopefully get the opportunity to do something physical, thus allowing them another, a different opportunity or another opportunity to learn what they have done in a different setting" (FG 3.14).

When discussing the strengths and weaknesses of pre-service teachers in relation to the implementation of academic integration, three questions were asked: 1) Which core subject do you feel that you can integrate strongly into the agricultural education classroom?; 2) What "tools" do pre-service teachers need to regularly integrate academics into the agricultural education curriculum?; 3) What barriers are present when attempting to integrate core content into the agricultural education curriculum?

Which core subject do you feel you can integrate strongly into the agricultural education classroom?

When asked which core subject they can strongly integrate, much of the conversation centered around their comfort levels with the different core subjects. The converging lines of inquiry were *emphasizing vs. integrating*, *language arts and English*, *science*, *technology*, *engineering and mathematics*.

Emphasizing vs. integration quotes

- "I think it all kind of goes hand in hand, science, technology engineering , mathematics, language arts, you can add them all into it . . ." (FG 1.13).
- "There is science, technology, engineering, and math in everything we do as ag teachers and ag students" (FG 2.25).
- To me, it is not as much integrating [core subjects] it is more emphasizing what is already there. Because all of those subjects are already in ag, but you [as a teacher] just have to emphasize that [core subject concepts] are there, so that students don't kind of just pass over it. (FG 2.30)

Language arts and English quotes

- There are some great agriculture literature if you want kids to read a non-fiction or fiction book and do a report on it, there is some incredible stuff out there that you could easily integrate into subject areas and there is lots of ways to do that as long as you make a point as a teacher to integrate it. (FG 2.29)
- "But language arts like you mentioned, the ag issues class, parli pro, creed speaking, public speaking, extemporaneous speaking. That seems pretty easy to integrate also" (FG 2.39).
- I'd say language arts and English because, I mean, I like to write and I understand why writing is important, and I know that writing is not everything, but that is just what I am strong at and I think it is really important to integrate that into every class. (FG 3.20)

Science quotes

- Science is basically every time you go out to feed your pigs, feed your lambs, if you give them this much, you have to feed them this. Nutrition values, protein, basically all the science stuff. How much you have to walk your animal. (FG 1.12)
- I would say science because it is in there. You have courses like Animal Science, Plant Science, and Soil Science. It is the easiest one to put in there because they are very scientific in nature, so you are basically just teaching science there in a different manner. (FG 2.31)
- And with engines class and mechanics class, there is a lot of science going on with that, like reactions, and you know, to get that weld to stick, a reaction occurs and stuff like that. So I think it applies to a lot of classes. (FG 2.33)
- "I think my lessons are better when I incorporate science in them, but I would consider myself better at science" (FG 3.22).

Technology quotes

- "And technology, they have to be able to use more things. We cannot just limit ourselves to what we have always known. We have to keep expanding and gain more knowledge to get a better result" (FG 1.15).
- The technology you are going to use, we [agriculture] have new technology in reproduction, such as artificial insemination, embryo transfer. Kids these days like to learn about this stuff that is interesting; they can go make a career out of it, so it is easier to sit there and tell them that, than sit in the classroom and tell them. (FG 2.27)
- Yeah there is crazy technology out there in agriculture these days. You might not be able to get all that technology in your class, because it is really expensive, but you can certainly talk about it, find ways to integrate the ideas and that is pretty fun too. (FG 2.48)

Engineering and Mathematics Quotes

- "Well, math, you have welding. You have to cut your metal, measure your metal out" (FG 1.11).
- " I think anything you are going to do in the shop, whatever project they are going to make, they have to come up with the plan for it, or at least an idea, engineer it somehow" (FG 2.53).
- Engineering is a scientific method. My husband is an engineer and all that they do is make a plan, try a plan, figure out what is wrong with the plan, and go back and fix it; which is the scientific method at the same time as engineering. (FG 2.57)
- "Incorporate mathematics, because that is a strong subject" (FG 3. 27).

What "tools" do you believe you will need to regularly integrate academics into the agricultural education curriculum?

After describing the core subjects they believed they could integrate, the pre-service teachers were asked to describe the tools they would need to regularly integrate academics into their agricultural science curriculum. *Administrative support*, *collaboration with core subject teachers*, and *training support* were the converging lines of inquiry identified by the focus groups as tools they would need to be successful with academic integration.

Administrative support quotes

- You have to get support from the administration, because you can't just expect to say, ok this is what I am going to add to my curriculum, are you going to let me do it? You have to come up with a well thought out plan. . . (FG 1.18)
- [Administrators, in some instances] don't know that we [ag educators] integrate all these things and do real life application and that is why we have so many more kids usually come through our programs because they enjoy doing hands-on stuff rather than sitting in classroom and doing book work all day; they actually get to get out and do it, and I think it would be great if every teacher had to come down and sit through an ag class and see exactly what we do and then I think they might be a little more on board. (FG 2.67)
- Need support from administration too; that they understand that agriculture science is just as important as a core science" (FG 3.34).

Collaboration with core subject teachers quotes

- I think you would need the support from the other teachers, because you would have to know what they were teaching at that time, so that you kind of had it aligned with them so that you are teaching the same basic concepts at the same time. (FG 2.63)
- "You need to collaborate with other science teachers to make sure that you are not overlapping too much, but be overlapping enough that it is not completely different material" (FG 3.32).

Training support quotes

- "Training and support from colleges and universities. Basically like a big update for our teachers. Keep them updated on technology and resources they can use to teach their students" (FG 1.19).
- I think opportunities for continuing education would be really helpful as [agricultural educators] move forward because all of these fields are constantly growing and becoming

more complex and it is tough to stay on top of what is happening, and research in our fields. (FG 2.80)
- "More guidance, or guidelines, as far as how to incorporate, or what specifically the state or government feels like needs to be incorporated, so you know exactly what to teach" (FG 3.40).

What barriers are present when attempting to integrate core content into the agricultural education curriculum?

After describing the tools needed to integrate academics into their classroom, the participants were asked to describe the barriers that hinder their abilities to integrate academics. *Financial status*, *lack of support*, and *time* were identified as the converging lines of inquiry from the pre-service teacher focus groups.

Financial status quotes

- "Financial status" (FG 1.22)
- "Funding and support from your administration definitely would make an effect" (FG 2.83).

L**ack of support**

- "You might be taking away somebody else's job. There are other science teachers and you want to integrate their courses. There are English teachers and you cannot just expect them to get full credit for it" (FG 1.25).
- ". . . the science department does not like to share their graduated cylinders and their grand scales and those sorts of things would be important for us to have if we were really going to be able to integrate that science or technology" (FG 2.87).
- "I think for an ag program, community support could be one. If you are doing something in an ag program that just involves kids in a classroom, the community doesn't necessarily see what some kids are able to do. Then your support for the ag program may dwindle. . ." (FG 3.58).

Time quotes

- "Time is very important for teachers" (FG 1.27)
- "When you are in ag ed, you have so much time to take out of classes aside from your own core classes" (FG 3.55).

Conclusions and Recommendations

We found pre-service teachers across different universities expressed similar answers to the questions and have a working knowledge of academic integration within agricultural education. Participants believe there is a natural integration of core academics in the agriculture curriculum. A majority of the participants agreed agriculture courses hold the possibility to integrate a wide range of subjects; with STEM subjects being the most prevalent in the discussion, but other subjects were mentioned. It was important to participants that teachers emphasized the academic concepts needed to teach agriculture rather than teaching academic concepts independent from the agricultural content. Studies by Thompson and Balschweid (2000) corroborated the beliefs of participants who felt it important when integrating science, to keep the lessons "hands-on" and relate the material to real world applications.

Previous research by Myers and Dyer (2006), Parr, Edwards, and Leising (2006), as well as Thompson and Balschweid (2000) support the findings where respondents agreed the integration of academic concepts in agriculture courses would help students with an enhanced recall of material, while the integration of core subject matter was identified as a way to functionally apply math and science skills. The agriculture science classroom was identified by participants as an environment, which reaches a multitude of learners and learning styles, including those labeled "at risk", and therefore integration of academic concepts in agriculture courses will help a larger number of students with academic concepts. In research conducted by Balschwied (2002), participants believed students were more likely to want to learn scientific concepts when being taught in the context of agriculture. Teaching pre-service agricultural education teachers to utilize academic integration in their classroom is one way to help develop Human Capital. The theory of Human Capital states individuals much like other commodities are capable of being developed (Becker, 1993). When applying Human Capital Theory to this study the teacher is viewed as a commodity that is being developed and will provide an ample return, in this case the ample return will be in the form of their ability to utilize academic integration in their classroom.

Overall, participants believed academic integration is more about placing emphasis on those core subject concepts and terminology inherent to the agriculture curriculum, in contrast to incorporating more academic related concepts during instruction. According to participants, the teacher's background ultimately affects which core subject areas teachers emphasize more regularly in their agricultural education curriculum. While some believed it easy to integrate English content when training a Career Development Event team or when teaching leadership lessons, no particular course within agriculture warrants the integration of one subject over another. The study results imply it is important to have support from administrators, core academic teachers, parents, and community stakeholders. Similar to findings by Johnson (1996), barriers to content integration were time, resources, and a lack of administrative support.

The participants indicated academically integrated projects and laboratory activities expand the program of study in agricultural education, providing a student centered learning experience, emphasizing inquiry based learning as suggested by Czerniak (1990). Efforts should be made to ensure Human Capital, in regard to academic integration, should be continuously developed in teacher preparation programs. Developing Human Capital of this nature will help ensure pre-service teachers have a stronger working-knowledge of academic integration; increasing the chance for student academic success before entering the classroom (Sweetland, 1996).

Through an increase in the Human Capital of agricultural education teachers and by modeling the philosophical underpinnings of Bandura (1997), this effort can inspire or sway decisions future teachers have in the way they deliver science instruction within agriculture courses, increasing teacher-efficacy in academic integration. This can be accomplished through an increased number of in-services, instructional materials, and specific courses built around the subject matter. As evident from collected statements, integration of core academics needs to be carefully implemented, ensuring no fundamental change to the purpose of the agriculture program. According to the results of the study it is implied that state leaders and university faculty need to create "buy-in" from future teachers for them to be successful at integrating academic concepts into their curriculum. Additionally, the pre-service teachers alluded to the fact that they, as well as in-service teachers alike need assistance in developing collaborative relationships with administrators and core teachers. We recommend inviting state academic leaders and campus administrators into the classroom to see the advantage of an integrated agriculture science curriculum to assist with increasing the collaboration piece within the schools.

Pre-service teachers appear to be confident and believe strongly in academic integration within agriculture courses. According to the participants, the hands-on (inquiry-based) learning and varied approach to teaching that is equivocally agricultural science is a logical venue for academic integration. It is clear by pre service teacher statements that prior knowledge can have an effect on their ability to integrate core academic courses; identifying a need for scrutiny of how many credit hours of math, science, and English pre service agriculture teachers are required to take. Moreover, justifying the need for evaluation of the core academic classes agricultural education majors are including in their university program plan, corroborating the findings of Warnick et al., (2004) vis-à-vis the effective integration of science and math into their coursework.

We recommend soliciting funding for pre service teachers to attend science integration programs such as the Curriculum for Agricultural Science Education (CASE) to aid in increasing academic integration knowledge and raising the self-efficacy of the pre service teachers in this teaching area. Likewise, the use of academically enhanced textbooks, integrated projects, and other laboratory activities into their college curriculum would allow pre service teachers to add to their agricultural education programs in the future. Instruction of academic integration needs to be delivered through multiple forms of collaborative efforts between agriculture and core academic teachers and those working within the agriscience industry. By providing multiple forms of instruction in the area of academic integration, Human Capital is being created within the pre service teachers. Nafukho, Hairston, and Brooks (2004) mentioned, methodical investments in individuals through educational opportunities are viewed positively, inspire growth, and the potentially help individuals achieve professional advancement.

The findings help stimulate future ideas to further the study. One should examine current in-service opportunities that focus on academic integration. An assessment of how CDEs and SAEs affect academic integration should occur. A question raised is: Does the emphasis of these subjects fit with the provisions of federal funding for career and technology programs like agricultural education? Programs that are exemplary models of academic integration need to be documented and shared with fellow teachers. One of the next steps in this research is identifying the effect of academic integration on student achievement. University faculty in agricultural education should be encouraged to collaborate with faculty from other academic departments for input on successful ways academic content can be integrated. This research sought to gain a more complete understanding of academic integration and its impact on agricultural education.

References

Balschweid, M. A. (2002). Teaching biology using agriculture as the context: Perceptions of high school students. *Journal of Agricultural Education*, *43*(2), 56–67. doi: 10.5032/jae.2002.02056

Balschweid, M. A., Thompson, G. W., & Cole, R. L. (2000). Agriculture and science integration: A pre-service prescription for contextual learning. *Journal of Agricultural Education, 41*(2), 36–45. doi: 10.5032/jae.2000.02036

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura A. (1997). *Self-efficacy: The exercise of control.* New York, NY: W. H. Freeman and Company.

Beaulieu, L. J. & Mulkey, D. (1995). *Investing in people: The human capital needs of rural America.* Boulder, CO: Westview Press, Inc.

Becker, G. S. (1993). 'Nobel lecture: The economic way of looking at behavior'. *Journal of Political Economy, 101*(3), 385–409. doi:10.1086/261880

Cano, J., & Miller, G. (1992). An analysis of job satisfaction and job satisfier factors among six taxon- omies of agricultural education teachers. Journal of Agricultural Education, 33(4), 9-16. DOI: 10.5032/jae.1992.04009

Carnegie Counsel on Adolescent Development (1989). *Turning points: Preparing American youth for the 21st century.* Washington, DC: Carnegie Council on Adolescent Development.

Conroy, C. A., & Walker, N. J. (2000). An examination of integration of academic and vocational subject matter in the aquaculture classroom. *Journal of Agricultural Education, 41*(2), 54–64. doi: 10.5032/jae.2000.02054

Czerniak, C. M. (1990, April). A study of self-efficacy, anxiety, and science knowledge in preservice elementary teachers. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, GA.

Davis, K. S. (2002). "Change is hard": What science teachers are telling us about reform and teacher learning of innovative practices. *Science Education*, *87*(1), 3–30. doi: 10.1002/sce.10037

Dembo, M. H., & Gibson, S. (1985). Teachers' sense of efficacy: An important factor in school im- provement. The Elementary School Journal 86(2), 173–184. doi: 10.1086/461441

Dickinson, G., & Jackson, J. K. (2008). Planning for success: How to design and implement project–based science activities. *The Science Teacher, 75*(8), 29–32.

Dye, J. F., Schatz, I. M., Rosenberg, B. A., & Coleman, S. T. (2000, January). Constant comparison method: A kaleidoscope of data. *The Qualitative Report, 4*(1/2). Retrieved from http://www.nova.edu/ssss/QR/QR4-1/dye.html

Erlandson, D. A., Harris, E. L., Skipper, B. L., & Allen, S. D. (1993). *Doing naturalistic inquiry.* Newbury Park, CA: SAGE.

Fleischman, H. L., Hopstock, P. J., Pelczar, M. P., & Shelley, B. E. (2010). Highlights from PISA 2009: Performance of U.S. 15-year old students in reading, mathematics, and science literacy in an international context (NCES 2011-004). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Gill, B. E. (2009). *Incorporating science, technology, engineering and mathematics (S.T.E.M.) into the pre-service teachers' teaching agricultural mechanics curriculum.* Poster presented at the Annual American Association of Agricultural Education Conference, Proceedings of the American Association for Agricultural Education Research Conference May 19–22, 2009, Louisville, KY. Abstract retrieved from http://www.aaaeonline.org/uploads/allconferences/AAAE_conf_2009/Posters.htm

Ginns, I. S. & Watters, J. J. (1998, April). *Beginning teachers professional growth: Confronting the challenge of teaching elementary school science.* Paper presented at the American Educational Research Association, San Diego, CA.

Glaser, B. & Strauss, A. (1967). *The discovery of grounded theory: Strategies of qualitative research.* London, UK: Wiedenfeld & Nicholson.

Grissmer, D. & Kirby, S. (1987). *Teacher attrition: The uphill climb to staff the nation's schools.* Santa Monica, CA: Rand Corporation.

Guba, E. G. & Lincoln, Y. S. (1981). *Effective evaluation*. San Francisco, CA: Jossey-Bass.

Haynes, J. C., Robinson, J. S., Edwards, M. C., & Key, J. P. (2012). Assesing the effect of using a science-enhanced curriculum to improve agriculture students' science scores: A causal comparative study. *Journal of Agricultural Education, 53*(2), 15–27. doi: 10.5032/jae.2012.02015

Henry, T. (1997, October 22). Most kids have basic, but not working science knowledge. *USA Today*, p. 9D.

Huberman, M. A., & Miles, M. B. (1994). Data management and analysis methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 428-444). Thousand Oaks, CA: Sage.

Johnson, D. M. (1996). Science credit for agriculture: Perceived support, preferred implementation methods and teacher science course work. *Journal of Agricultural Education 37*(1), 22–30. doi: 10.5032/jae.1996.01022

Johnson, S., & Birkeland, S. (2003). Pursuing a "sense of success": New teachers explain their career decisions. *American Educational Research Journal, 40*(3), 581–617. doi: 10.3102/00028312040003581

Kauffman, D., Johnson, S. M., Kardos, S. M., Liu, E., & Peske, H. G. (2002). "Lost at sea": New teachers experience with curriculum and assessment. *Teachers College Record, 104*(2), 273–300. doi: 10.1111/1467-9620.00163

Kelsey, K. D. (2006). Teacher attrition among women in secondary agricultural education. *Journal of Agricultural Education, 47*(3), 117–129. doi: 10.5032/jae.2006.03117

Knobloch, N. A., & Whittington, M. S. (2002). Novice teachers' perceptions of support, teacher preparation quality, and student teaching experience related to teacher efficacy. *Journal of Vocational Education Research, 27*(3), 331–341. doi: 10.5328/JVER27.3.331

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation.* San Francisco, CA: John Willey & Sons, Inc.

Myers, B. E., & Dyer, J. E. (2004). Agriculture teacher education programs: A synthesis of the literature. *Journal of Agricultural Education, 45*(3), 44–52. doi: 10.5032/jae.2004.03044

Myers, B. E., & Dyer, J. E. (2006). Effects of investigative laboratory instruction on content knowledge and science process skill achievement across learning styles. *Journal of Agricultural Education, 47*(4), 52–63. doi: 10.5032/jae.2006.04052

Myers, B. E., & Thompson, G. W. (2009). Integrating academics into agriculture programs: A delphi study to determine perceptions of the national agriscience teacher ambassador academy participants. *Journal of Agricultural Education, 50*(2), 75–86. doi: 10.5032/jae.2009.02075

Nafukho, F. M., Hairston, N., & Brooks, K. (2004). Human capital theory: Implications for human resource development. *Human Resource Development International, 7*(4), 545–551. doi: 10.1080/1367886042000299843

National Academy of Science. (2007). *Rising above the gathering storm*. Washington, DC:

National Academy of Science.

National Center for Education and the Economy. (2007). *Tough choices or tough times.* Washington, DC: National Center for Education and the Economy.

National Center for Education Statistics. (2005). *NAEP state comparisons – data table*. Retrieved from http://nces.ed.gov/nationsreportcard/statecomparisons /withinyear.aspx?usrSelections=1%2cSCI%2c0%2c2%2cwithin%2c0%2c0

National Center for Educational Statistics (2001). *Pursuing excellence: Comparison of international eighth-grade mathematics and science achievement from a U.S. perspective, 1995 & 1999*. Washington, DC: U.S. Department of Education, National Center for Education Statistics.

National Commission on Excellence in Education. (1983). A nation at risk: The imperative for educational reform. *The Elementary School Journal, 84*(2), 113–130. doi: 10.1086/461348

National Research Council. (1988). *Understanding agriculture: New directions for education.*

Washington, DC: National Academy Press.

National Research Council. (1996). *National science education standards.* Washington, DC: National Academy Press. Retrieved from http://www.nap.edu/openbook.php?record_id=4962

National Research Council. (2007). *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, DC: The National Academies Press.

National Research Council. (2010) *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*. Washington, DC: The National Academies Press.

O'Sullivan, C. Y., Reese, C. M., & Mazzeo, J. (1997). *NAEP 1996 science report card for the nation and the states*. Washington, DC: National Center for Educational Statistics.

Parr, B. A., Edwards, M. C., & Leising, J. G. (2006). Effects of a math–enhanced curriculum and instructional approach on the mathematics achievement of agricultural power and technology students: An experimental study. *Journal of Agricultural Education, 47*(3), 81–93. doi: 10.5032/jae.2006.03081

Pintrich, P. & Schunk, D. (1996). *Motivation in education: Theory, research, and applications*. Englewood Cliffs , NJ : Prentice Hall.

Provasnik, S., Gonzales, P., & Miller, D. (2009). *U.S. performance across international assessments of student achievement: Special supplement to the condition of education 2009.* NCES 2009–083: National Center for Education Statistics.

Robinson, J. S., Krysher, S., Haynes, J. C., & Edwards, M. C. (2010). How Oklahoma state university students spent their time student teaching in agricultural education: A fall versus spring semester comparison with implications for teacher education. *Journal of Agricultural Education 51*(4), 142–153. doi: 10.5032/jae.2010.04142

Rose, M. A., (2007). Perceptions of technological literacy among science, technology, engineering, and mathematics leaders. *Journal of Technology Education, 19*(1), 35–52.

Saklofske, D., Michaluk, B., & Randhawa, B. (1988). Teachers' efficacy and teaching behaviors. *Psychological Report, 63*(2), 407–414. doi: 10.2466/pr0.1988.63.2.407

Sanders, M. (Dec 2008/Jan 2009). STEM, STEM education, STEMmania. *The Technology Teacher, 68*(4), 20–26.

Schmidt, W. H., & McKnight, C. C. (1998). What can we really learn from TIMSS? Science, *282*(5395), 1831–1839. doi: 10.1126/science.282.5395.1830

Schultz, T. W. (1963). *The economic value of education.* New York, NY: Columbia University Press.

Schultz, T. W. (1971). *Investment in human capital: The role of education and research.* New York, NY: The Free Press.

Sweetland, S. R. (1996). Human capital theory: Foundations of a field of inquiry. *Review of Educational Research, 66*(3), 341–359. doi: 10.2307/1170527

Thompson, G. W., & Balschweid, M. M. (2000). Integrating science into agriculture programs: Implications for addressing state standards and teacher preparation programs. *Journal of Agricultural Education, 41*(2), 73–80. doi: 10.5032/jae.2000.02073

Tippens, A, Ricketts, J. C., Morgan, A. C., Navarro, M., & Flanders, F. B. (2013). Factors related to teachers' intention to leave the classroom early. *Journal of Agricultural Education, 54*(4), 58–72. doi: 10.5032/jae.2013.04058

Warnick, B. K., Thompson, G. W., & Gummer, E. S. (2004). Perceptions of science teachers regarding the integration of science into the agricultural education curriculum. *Journal of Agricultural Education, 45*(1), 62–73. doi: 10.5032/jae.2004.01062

Yin, R. K. (2009). Case study research design and methods. Thousand Oaks, CA: Sage.

Young, R. B., Edwards, M. C., & Leising, J. G. (2009). Does a math–enhanced curriculum and instructional approach diminish students' attainment of technical skills? A year–long experimental study in agricultural power and technology. *Journal of Agricultural Education, 50*(1), 116–126. doi: 10.5032/jae.2009.01116