AN ASSESSMENT OF AGRICULTURAL LITERACY: WHAT INCOMING FRESHMEN AT OKLAHOMA STATE UNIVERSITY KNOW ABOUT THE FOOD AND FIBER SYSTEM

By

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AN ASSESSMENT OF AGRICULTURAL LITERACY:

WHAT INCOMING FRESHMEN AT OKLAHOMA STATE UNIVERSITY KNOW

ABOUT THE

FOOD AND FIBER SYSTEM

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Title of Study: AN ASSESSMENT OF AGRICULTURAL LITERACY: WHAT INCOMING FRESHMEN KNOW AT OKLAHOMA STATE UNIVERSITY ABOUT THE FOOD AND FIBER SYSTEM?

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Abstract: Throughout the past three decades, numerous efforts have existed to increase the agricultural literacy of not only K-12 students, but also adult U.S. citizens. The purpose of this census study was to assess the agricultural literacy levels of incoming freshmen at Oklahoma State University in the Fall semester of 2012. Respondents completed a 25-item test, modified from the Food and Fiber Systems Literacy (FFSL) examination, and responded to demographic questions. Overall, students from the College of Agricultural Sciences and Natural Resources (CASNR) earned the highest scores followed by students in the College of Engineering, Architecture, and Technology (CEAT). Participants from the College of Arts and Sciences (A&S) had the lowest mean scores. Comparisons of agricultural literacy scores were made between males and females; home community sizes (i.e., city, suburb, town, and rural); agriculture courses taken at the high school level; participation in FFA and 4-H in high school; perceptions of previous agricultural knowledge; and between the five thematic themes of the FFSL Framework. Male students outscored female students. Students from a town outscored students from home community size of rural, suburb, or city. Those students who took agriculture courses in high school outscored those who did not. Likewise, students who were members of FFA or 4-H outscored those who were not. Students who perceived their previous knowledge of agriculture to be *above average* outscored those who indicated *average,* and students who perceived their previous agricultural knowledge as *below average* scored lowest. CEAT students outscored CASNR students in thematic area 1 - Understanding Agriculture, while CASNR outscored A&S, College of Education (COE), and College of Human Sciences (CHS) in thematic areas 2 - History, Geography, and Culture and thematic area 3 - Science, Technology, and Environment. No statistically significant differences were found between colleges in thematic area 4 - Business and Economics. Regarding thematic area 5 - Food, Nutrition, and Health, CASNR students outscored A&S and COE students. Given the low agricultural literacy scores of students in all colleges, it is recommended that Oklahoma State University offer a general education course for students over the food and fiber system.

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CHAPTER I

INTRODUCTION

In the spring of 2012, an online article was released, which pinned agriculture as the most useless collegiate degree an undergraduate student could receive (Loose, 2012). Further, the article highlighted the uselessness of degrees specific to animal science and horticulture (Loose, 2012). This article was on the front page of Yahoo.com and went viral causing many from the agricultural field to respond and refute the article's assertions. However, the article's allegations were already in the hands of the public. Consequently, another misrepresentation was released into "a society [that] can be described as ignorant about agriculture" (Blackburn, 1999, p. 1). In a recent report, "72 percent of consumers know nothing or very little about farming or ranching" (U.S. Farmers & Ranchers Alliance [USFRA], 2011, para. 8). With such a disconnect, the agricultural industry needs to focus on ways to educate its consumer base more efficiently and more effectively.

"Consumers think about food production constantly, yet know very little about how food is brought to the dinner table" (USFRA, 2011, para. 5). Further, "people in the United States generally do not worry about the supply of high quality, low cost agricultural products" (Blackburn, 1999, p. 1). This gap between topical awareness and a deeper understanding of the food and fiber system is important to research to form a bridge of understanding for consumers, which is an escalating imperative considering the world's growing population.

It is predicted that the world population will increase to more than 9 billion by 2050 (Hodges, 2005; Johnson & Jorgenson, 2006; Sayers, 2011). In addition to the expanding population, the world faces critical problems and issues including climate change, diminishing natural resources, evolving infectious diseases, and loss of biodiversity (Johnson & Jorgenson, 2006). Therefore, efforts must exist to not only increase agricultural yields to feed the growing population, but also to increase social development and education of people (Blackburn, 1999; Hodges, 2005; Johnson & Jorgenson, 2006). Currently, more than 50% of the population lives in urban areas and does not produce their own food (Sayers, 2011); further, it is projected that more than 65 percent of the world population will live in urban areas in 2050 (Johnson & Jorgenson, 2006).

Increased "modernization and urbanization" has created a disconnect between the population and agriculture (Powell & Agnew, 2011, p. 155). Subsequently, people lack basic knowledge of their food and fiber system (Blackburn, 1999; Frick, Birkenholz, Gardner, & Machtmes, 1995; Kovar & Ball, 2013). Frick, Kahler, and Miller (1991) conducted a Delphi study with 100 panelists to identify agricultural concepts that all citizens should know. The panel identified 11 subject areas:

> (a) agriculture's important relationship with the environment, (b) processing of agricultural products, (c) public agricultural policies, (d) agriculture's important relationship with natural resources, (e) production of animal products, (f) societal significance of agriculture, (g) production of plant products, (h) economic impact of agriculture, (i) marketing of agricultural products, (j) distribution of agricultural products, and, (k) global significance of agriculture. (Frick et. al., 1991, p. 50)

Research Priority 1 of the National Research Agenda (NRA) of the American Association

for Agricultural Education (AAAE) encourages educating the American public about agriculture so informed choices can be made regarding the use of agricultural and natural resource products (Doerfert, 2011). Currently, public perceptions of the agricultural industry are based on brief, hands-on experiences with agriculture, or sometimes inaccurate representations of the industry (Turnbull, 2002).

Less than two percent of the U.S. population lived on a farm in 1988 (National Research Council). In the second decade of the 21st century, with "less than 1% [of U.S. citizens] claim farming as an occupation," it is crucial that additional efforts be made to educate the public about agriculture and natural resources (Environmental Protection Agency, 2012, para. 1). "Access to information is vital. The quality and accessibility of public information and data are key determinants in the success of social accountability mechanisms" (Johnson & Jorgenson, 2006, p. 20). When a population is educated, it is able to understand and make better decisions on economic, political, social, and environmental issues affecting agriculture and living standards (Foster et al., 1990; Kovar & Ball, 2013; NRC, 1988; Pense & Leising, 2004).

A large portion of research on agricultural literacy has focused on K-12 students and their educators (Kovar & Ball, 2013). Doerfert (2003) analyzed 41 research studies that focused on agricultural literacy. Of the 41 studies, only seven examined the agricultural literacy levels of adults, and the majority of the studies utilized educators and students as their target populations (Doerfert, 2003). With the challenge of educating adult citizens about agriculture, it is critical to evaluate not only how much they know currently, but also the various ways agricultural information should be taught and distributed (Colbath & Morrish, 2010; Frick, Birkenholz, & Machtmes, 1995; NRC, 1988; Pense & Leising, 2004).

Although K-12 education has been emphasized in the literature, educating people across all age groups about agriculture is imperative (NRC, 1988). Braverman and Rilla (1991) stated

that educating adults to be agriculturally literate is a main concern for the agricultural industry. They indicated that U.S. citizens are required more frequently to make decisions about serious issues in agriculture such as food safety, land use, and water policy (Braverman & Rilla, 1991). Scarcity of agricultural literacy equates to an uninformed civic majority who are involved in important policy decisions affecting the agricultural industry's ability to operate well in an increasingly competitive world market (Hess & Trexler, 2011; NRC, 1988). "These decisions are often made without regard to economic stability or security and how these decisions will affect the general American public" (Richard, 2009, p. 42). Richard (2009) emphasized that agricultural literacy should be considered a "threat" rather than a "growing concern" (p. 42).

One avenue for educating adults about agriculture is through land-grant institutions. The land-grant system is a natural place for agricultural knowledge to be shared (Renne, 1960). The land-grant institution's original mission directed its efforts to provide a practical education to a broad segment of the population, which would have application to peoples' daily lives (National Association of State Universities and Land-Grant Colleges [NASULGC], 2008). Three functions serve as the foundation of the land-grant institution: education, research, and extension (NASULGC, 2008). "The public needs knowledge based research and analysis to serve as their foundation for public policy and choice" (Richard, 2009, p. 41). It is important that the research occurring at land-grant institutions is communicated to the general public (Fribourg, 2005; Nordstrom et al., 2000; Sandmann, 1991).

Therefore, because of its mission and dedication to educating people about agriculture, practically, this study focused on the agricultural knowledge of incoming freshmen at Oklahoma State University (OSU), a land-grant university (LGU). As a LGU, it may be necessary for OSU to increase its efforts to educate all students about basic agricultural concepts (NRC, 1988). To evaluate the need for such initiatives, this study focused on the agricultural literacy level of all incoming freshmen at OSU in the 2012-2013 academic year by their completing a criterion-referenced test (Pense & Leising, 2004).

Problem Statement

"The steady rise of urbanization has transferred the future of agriculture to a group of people with an overwhelming lack of support for agricultural issues" (Kovar & Ball, 2013). With less than one percent of the U.S. population claiming farming as an occupation (Environmental Protection Agency, 2012), it is crucial that additional effort be made to educate the public about agriculture and natural resources (Doerfort, 2011; NRC, 1988). A population who is agriculturally knowledgeable is able to understand, support, and make better economic and political decisions affecting agriculture (Leising, et.al., 2003; Pense & Leising, 2004; NRC, 1988).

Overall, agricultural literacy efforts over the past 20 years have focused on elementary students and educators (Balschweid, Thompson, & Cole, 1998; Kovar & Ball, 2013; Meischen & Trexler, 2003). Further, many of the agricultural literacy programs operate on a small scale reaching a reduced population (Kovar & Ball, 2013). Finally, it is important for researchers, educators, and extensions agents to determine areas of knowledge scarcity and continue to concentrate on those efforts in future programs (Frick, 1993; Kovar & Ball, 2013).

Although there has been an increased effort to integrate agriculture into elementary and secondary school curriculum, little has been done to enhance agricultural literacy in the post-secondary setting (Colbath & Morrish, 2010; Leising et al., 2003). Bellah, Dyer, and Casey (2004) stated that it is the role of agricultural education departments to not only focus on preparing future agriculture teachers but also boost the agricultural literacy efforts beyond those activities supported solely by grants. Therefore, this study explored the agricultural literacy levels of incoming freshmen at a land-grant university.

Purpose and Objectives

The purpose of this census study was twofold: 1) assess the agricultural literacy of all incoming freshmen (N = 4,081) at Oklahoma State University in the Fall semester of 2012, and 2) compare students' scores on an agricultural literacy test against their selected personal characteristics. Three objectives guided the study.

1. Describe the personal characteristics, such as gender, age, ethnicity, home state, home community size, participation in high school youth organization, number of agricultural education courses taken, and perceptions of agriculture, of incoming freshmen.
2. Determine the agricultural literacy levels of incoming freshmen across all disciplines.
3. Determine the relationships between selected personal characteristics of the students and their levels of agricultural literacy.

Terminology

Agricultural Literacy—possessing knowledge and understanding the food and fiber system by being able to synthesize, analyze, and communicate fundamental information about agriculture (Frick et al., 1991).

Benchmark—"a point of reference against which something may be measured" (Harvey, 2004, para. 1).

City— "Territory inside an urbanized area inside a principal city with a population of 100,000 or greater" (National Center for Education Statistics [NCES], 2013, para. 38).

College/university incoming freshmen—"A new freshman is a degree-seeking undergraduate student with fewer than seven hours of college credit earned before his/her first semester at OSU" (Institutional Research and Information Management [IRIM], 2012, p. 85).

Criterion-referenced measurement (test)—"measurement in which an individual's score is interpreted by being referenced to a defined body of learner behaviors" (Wiersma & Jurs, 1990, p. 400).

Discipline—The academic college that a student associated with on their questionnaire (Lechuga, 2008).

Food and Fiber Systems Literacy—term used synonymously with the term agricultural literacy (Igo, 1998).

Food and Fiber Systems Literacy Framework—a curriculum frame with five thematic areas outlining what a person should know to be agriculturally literate. Included are explanations of each theme's standards, and accompanying grade-grouped benchmarks (Igo, 1998).

Food and Fiber Systems—a term used synonymously with agriculture (Igo, 1998).

Infusion—"connecting core academic knowledge to Food and Fiber Systems Literacy Standards" (Leising, 1998, p. 9).

Literacy—mastering "a set of learning objectives" and utilizing that understanding to engage at the local level "amid changing and unpredictable circumstances" (Dale & Newman, 2005, p. 355).

Rural—"Territory that is more than 10 miles from an urban cluster (town) and more than 25 miles from an urbanized area" (NCES, 2013, para. 38).

Standard—describes what a student should know or understand relative to Food and Fiber Systems (Igo, 1998).

Suburb—"Territory outside a principal city and inside an urbanized area" (NCES, 2013, para. 38).

Town—"Territory inside an urban cluster that is less than 35 miles from an urbanized area" (NCES, 2013, para. 38).

Assumptions

The following assumptions were made regarding this study:

1. Participants checked their electronic mail (email) on a regular basis.
2. Participants answered honestly and accurately both the criterion-referenced test and personal characteristics information of the questionnaire to the best of their ability.
3. The frame of students' email addresses was exhaustive and accurate.
4. Students' email addresses were working properly.
5. Students had regular and unfettered access to their OSU email accounts.

Limitations

The following limitations were identified for this study:

1. The findings of this study are limited to Oklahoma State University and should not be generalized to a larger population.
2. Agricultural literacy was confined to a 25-question test.
3. The test was limited to those who had access to a computer and high-speed Internet.
4. The test was developed in 2004 by Pense and Leising, thus, it was nine years old when used in this study. The test needs to be modernized to include current aspects of sustainable agriculture, alternative energy, climate change, and environmental literacy, to name a few potential updates.

CHAPTER II

LITERATURE REVIEW

The History of Educating People About Agriculture

In the early decades of American history, most of the population lived in rural areas and students were exposed more to agriculture during their schooling (Van Scotter, 1991). Moreover, curriculum was rich with agricultural references and examples because farming was a common piece of almost every student's life (True, 1929). In 1790, 93% of the U.S. population was rural and most of them farmers (Tauger, 2011).

The U.S. Department of Agriculture was created in 1862 (USDA, 2000). "The drive for agricultural education culminated in the passage" (USDA, 2000, para. 11) of the Morrill Act (1862), which provided federal land to each state to create a public institution that supported the Act's provisions (Carstensen, 1962). A growing need for agricultural and technical education in the U.S. existed (Duemer, 2007; Green, 1990; NASULGC, 2008). "The Morrill Act was intended to provided a broad segment of the population with practical education that had direct relevance to their daily lives" (NASULGC, 2008, p. 1). Although the long-term effects of this act were valuable to agricultural education, the short-term effects left most of the population believing that "no need for instruction in agriculture in the public schools existed because any student who wanted to learn agriculture would go to the land grant college" (Moore, 1987, para. 7).

The Second Morrill Act (1890) attempted to increase the access to higher education by offering additional grant funding to those state land-grant institutions that did not discriminate against race in their admission process (NASULGC, 2008). The Hatch Act of 1887 added another component to the land-grant system by creating the agricultural experiment stations (Carstensen, 1962). The Hatch Act appropriated federal grant funds for an agricultural experiment station in each state, which was to be connected to the land-grant institution (Committee on the Future of Land Grant Colleges of Agriculture [CFLGCA], & NRC, 1995; NASULGC, 2008). By creating experiment stations, LGUs were to conduct relevant research, which had the potential to benefit the public.

In 1914, the Smith-Lever Act became law. Its purpose was to establish a Cooperative Extension Service (CES) that was connected to each LGU. The purpose of the CES was to distribute information that was derived from the experiment stations' research effects (CFLGCA, & NRC, 1995; NASULGC, 2008; Phipps et al., 2008). Research was conducted at experiment stations to increase the existing agricultural knowledge of states' citizens. Each of these laws served a purpose in ensuring that the land-grant institutions played a key role in increasing the agricultural literacy of their states' citizens. Through these acts, land-grant institution were designed to teach the common man about agriculture and mechanics at the university; research, develop, and innovate at the experiment stations; and, then disseminate this knowledge to the public by way of the in Extension services (CFLGCA, & NRC, 1995).

In the 1920s through the 1940s, the American farmer encountered the Great Depression and its aftermath, which caused a cycle of debt from decreasing farm prices and the necessity to purchase high-priced equipment (Tauger, 2011). Because of the numerous years of plowing and planting, a considerable amount of soil in the Great Plains had become exhausted and weak, which created the Dust Bowl (Tauger, 2011). Thus, there was a decline in the number of people who were farming ensured, and the prominence of agriculture in education began to follow the

same trend (Van Scotter, 1991). A shift occurred in teachers viewing agriculture as a career choice rather than an essential part of every student's life; thus, agricultural education was presented only to those students who desired to study agriculture as an occupation (Phipps, Osborne, Dyer, & Ball, 2008; True, 1929).

Although agriculture was being phased out of some schools, a group of educators existed who continually made an effort to include agriculture into the classroom because they acknowledged the interconnecting functions of farming, food, and fiber production with environmental issues like protecting clean water, preserving ecosystems, and exploring alternative energy sources (Hillison, 1998). These teacher advocates preserved education about agriculture and the environment during a time when public interest in agriculture was diminishing (Hillison, 1987; Phipps et al., 2008; True, 1929).

In the 1960s and the 1970s, the need existed for more quality materials that teachers could use in their courses, so businesses, foundations, nonprofit groups, associations, and state and federal agencies met that challenge (Phipps et al., 2008). These entities began to develop and finance various resources and tools which assisted educators in integrating agriculture into their classes; nevertheless, minimal coordination or exchange of ideas occurred and no predominant point existed for nationwide coordination (Hillison, 1998).

In the 1980s, the farming community faced a multitude of problems, including increased surplus production, increased land prices, numerous farmers who were in excessive debt, interest rates were extraordinarily high because of complications in the economy, and a new federal administration attempted to reduce government support (Ganzel, 2009). In addition, high school agricultural education programs suffered a decrease in enrollment from a "new emphasis on academics . . . an overall declining school-aged population, and an economically depressed

agricultural industry" (Phipps et al., 2008, p. 38). Subsequently, in 1983, the National Council for Vocational and Technical Education in Agriculture, Inc. was formed (Phipps et al., 2008).

The National Research Council (NRC) Movement

In response to the decreasing profitability and global competiveness of American agriculture, along with weakening agricultural education programs, NRC formed the Committee on Agricultural Education in Secondary Schools (NRC, 1988). The committee's task was to "assess the contributions of instruction in agriculture to the maintenance and improvement of U.S. agricultural productivity and economic competiveness here and abroad" (NRC, 1988, p. v).

The NRC (1988) indicated the importance of the U.S. population being agriculturally literate by possessing knowledge *about* agriculture versus having knowledge *in* agriculture. "Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies," which was approximately five percent of the U.S. public school population (NRC, 1988, p. 1). They defined an agriculturally literate person as one who understands the food and fiber system including the "history and current economic, social and environmental significance" of the agriculture sector (NRC, 1988, p. 1). Their recommendation was to incorporate education *about* agriculture into existing courses from kindergarten through the twelfth grade in U.S. public schools (NRC, 1988).

The Mission of the Land-Grant Institution and its Role in Teaching Agricultural Literacy

The NASULGC (2008) identified three purposes that were reflected in the LGU legislation: (a) an objection to the reign of the classics in higher education; (b) a need to cultivate at the college level instruction involving the "practical realities of an agricultural and industrial society" (p. 4); and (c) an effort to offer training and education to those in the industrial classes. At Oklahoma State University, the three parts to the land-grant system are depicted by a triangle

(see Figure 1), which emphasizes the importance of all three (teaching, research, and extension) to the core mission of the university (Green, 1990).

> Redesigned in 2006, the Oklahoma State University System seal visually represents OSU's dedication to the land-grant university mission. The seal's focal point is the land-grant triangle, which represents the three primary components: research, instruction, and extension. Seventy-seven rays emanate from the triangle, representing the extension offices in every Oklahoma county. A rope-patterned circle at the outer edge of the rays commemorates the institution's western heritage. The "1890" marks the year OSU was established. The five pointed stars and five bands encircling the seal represent the five campuses that make up the OSU system. (Trapp, 2006, para. 5)

Figure 1. OSU land-grant system triangle. This figure illustrates the three parts of the land-grant institution.

Theoretically, the three components of the land-grant mission are given equal importance within the institution; however, the focus has shifted to a heavier emphasis on research, which has left teaching and extension shorthanded (Fribourg, 2005; Lindley; 1993; Sandmann, 1991). A call to restore balance among the functions to serve better the constituents of the LGU have been sounded by some stakeholders (Sandmann, 1991). Fribourg (2005) appealed to land-grant institutions to restructure their efforts to create a comprehensive "model of excellence" that assesses and praises all three dimensions of the program (p. 42). It is important that LGUs not lose sight of their purpose of employing the three functions (or *arms*) for the public good, including communicating with the general public (Fribourg, 2005; Sandmann, 1991).

Renne (1960) asserted it was the land-grant institution's responsibility to provide information and ensure that consumers understood agricultural problems, programs, and policies. LGUs possess the tools of education and extension programs, which lead to collaboration and unity among farm leaders who are charged with solving agricultural problems every day (Duemer, 2007; Renne, 1960).

To increase agricultural literacy among students at LGUs, Colbath and Morrish (2010) recommended that a general agriculture course be offered as a part of the core curriculum for all university students. Bellah et al., (2004) stated that it is the role of agricultural education departments in LGUs to not only focus on preparing future agriculture teachers, but also to boost the agricultural literacy efforts beyond those activities supported solely by grant-funded projects. This implication confronts directly the mission of faculty members at LGUs.

Agricultural Literacy

After the release of the NRC's report in 1988, more focus has been placed on agricultural literacy by various actors of the agricultural industry (AAAE Ad Hoc Agricultural Literacy Work Group**,** 1992; Phipps et al., 2008). Kovar and Ball (2013) conducted a synthesis of agricultural

literacy research from the past 20 years. They found that much of the agricultural literacy research has focused on elementary teachers and students. As such, they recommended more populations be tested and included in agricultural literacy programs (Kovar & Ball, 2013). Further, Kovar and Ball (2013) stated, "Knowledge and understanding of agriculture is necessary as the global population expands creating compounding issues of feeding the world, while establishing and maintaining a sustainable, viable agriculture system" (p. 175).

All sectors of the agricultural industry have suffered from a lack of consumers' understanding of agriculture and its importance in society (Powell, Agnew, & Trexler, 2008). "This, in turn, leads to the public's questioning of agricultural production methods, animal well-being in farm animal systems, the environmental impact of agriculture, the utilization efficiency of resources in agriculture, and the safety of the food supply" (Nordstrom et al., 2000, para.2). Thompson (1999) stated that "well-publicized incidents of food poisoning and muckraking journalism" fuel apprehension about the safety of the food and fiber system (p. 372). Thompson (1999) questioned the role that agricultural scientists play in "influencing public opinion" (p. 373). Specifically, four agricultural sectors dealing currently with sector-specific literacy issues: animal science, plant science, environment literacy, and food science (Hubert et al., 2000; Kvopperud, 2009; Marshall, 2012; Thompson, 1999; USFRA, 2011).

Animal science, animal production, and husbandry.

The animal agriculture sector has been facing numerous cases of negative public perceptions (Nordstrom et al., 2000; Thompson, 1999; USFRA, 2011). In a recent study, "86 percent of farmers/ranchers responded that the average consumer has little to no knowledge about modern farming/ranching" (USFRA, 2011). Indeed, negative publicity influences people and acts as a foundation for their consensus on a topic (Thompson, 1999). Further, numerous

documentaries and popular books have emerged, which depict animal production as "systematic animal cruelty" (Kvopperud, 2009, para. 2).

Because the public has little to no agricultural knowledge and experience, often their only exposure to animals is through owning and caring for a companion animal (Nordstrom et al., 2000). Frequently, they compare companion animals to farm animals, which skew their perceptions and attitudes concerning animal usage for food, fiber, and research (Nordstrom et al., 2000).

In addition, People for the Ethical Treatment of Animals (PETA) and the Humane Society of the United States (HSUS) are two large activists organizations supporting animal rights., the HSUS has advocated for humane treatment of animals, including banning swine farrowing crates and cages in poultry operations, and ending the use of common husbandry practices altogether, such as branding, dehorning, and castration (Huffstutter & Baertlein, 2012). In fact, HSUS is accumulating shares in agriculture and food companies "to press them to change corporate purchasing practices" (Huffstutter & Baertlein, 2012, para. 13).

Despite the multiple issues, agricultural advocates are meeting the challenge through multiple campaigns including the United States Department of Agriculture's (USDA) program, Know Your Farmer, Know Your Food. Moreover, advocates are reaching out to consumers through various platforms such as social media and YouTube to educate consumers about the production of their food.

Plant science and production.

Recently, the agronomy sector of agriculture has been in the spotlight for hot topics such as genetically modified organisms (GMOs) and organic and inorganic production. A push for Americans to eat more food that is "local, natural, holistic, and pure" (Kvopperud, 2009, para. 1) is evident.

Unfortunately, the public is misguided when it comes to new technologies in agriculture such as GMOs because anti-agricultural organizations "foster a distrust of technology" (Kvopperud, 2009, para. 6). Descriptions given to consumers by anti-GMO activists explain GMO products as "some kind of Frankenstein science" (Shapiro, 2013, para. 5). Subsequently, a surge of proposed state legislation across the U.S. have emerged requiring products with GMOs to be labeled as such (Kvopperud, 2009; Shapiro, 2013). "The public should know more about the pros and cons of genetic engineering, given how ubiquitous it is has become" (Shapiro, 2013, para. 11). The attractiveness of organic products has elevated amongst the public partly because of fears and misrepresentations of GMO products (Brandt, 2012).

"The popularity of organic products . . . is skyrocketing in the United States" (Brandt, 2012, para. 4). The public perception is that organic is superior to conventional products because organic is healthier, more expensive, and better for the environment (Brandt, 2012). Further, "accusations that farmers use too much fertilizer or too much pesticide" are promoted by anti-agriculture advocates (de la Rosa, 2011, para. 3). Yirridoe, Bonti-Ankomah, and Martin (2005) stated that "the future of organic agriculture will depend on . . . consumer demand," (p. 194) so it is vital that the agricultural community provide the consumer with information about conventional and organic farming.

Environmental literacy and sustainability.

"The sustainability paradigm is based on the fear that our present course [of using energy] is unsustainable" (Cohen, 2010, para. 11). Subsequently, the American public is concerned about global warming and supporting renewable energy sources now more than ever before (Curry, Ansolabehere, & Herzog, 2007). Media coverage has played a role in the public's perception of environmental controversies, and has "magnified the natural resource connections between the environment and agriculture" (Hubert et al., 2000, p. 527). "Americans are

prioritizing the economy above all else, there are growing signs that they are becoming more aware of environmental issues and are starting to question the validity of the trade-off between environmental quality and economic growth" (Cohen, 2010, para. 6)

Supporters of the local food movement have continued to fuel American distrust because they "don't provide facts and data; [rather] they trash the conventional system using allegation and innuendo" (Kvopperud, 2009, para. 6). Further, "American farmers have gotten a bad rap from a stereotype that pillories them for not being 'green' – not caring about their environmental footprint" (de la Rosa, 2011, para. 3). These perceptions, however, are not accurate. Agriculturists recognize the importance of providing and employing sustainable systems while optimizing production (Wolfenbarger, Owen, & Carrière, 2010).

An important part of the "sustainable development paradox" revolves around having "enough time to move up the learning curve" (Wellmer & Kosinowski, 2003, para. 23). The reality is that environmental quality is mainly a function of the choices and behaviors of the entire population (Science Advisory Board, 1995). Further, the possibility to use more resourceful methods of generating energy is immense, but the public commonly underestimates it (Afgan, Al Gobaisi, Carvalho, & Cumo, 1998, p. 249). Nevertheless, a recent poll found that "people are willing to pay to move to cleaner energy" (Gillis, 2012, para. 1). If alterations are not made to how Americans obtain and use their energy resources, "agriculture has the potential to have massive, irreversible environmental impact" (Tilman et al., 2001, p. 292), which would be negative. Thus, environmental literacy is an important component in educating the public about the balance amongst agriculture, climate change, sustainability, and natural resources (Hubert et al., 2000).

Food science, food production, and food safety.

The food sector is the most accessible sector for the public to interact with and be directly

affected by in terms of day-to-day activities. Yeung and Morris (2001) stated that,

> Perception of food safety risk is one such psychological interpretation which influences the attitudes and behaviour of consumers with respect to the purchase of food products. Thus, perception of food safety risk has consequences for both consumer and producer welfare, and the overall effectiveness and efficiency of the food supply chain. (p. 170)

A recent controversy in the food sector was the discovery of lean finely textured beef (LFTB) in beef production. Consumers and anti-agriculture activists picked up the news quickly and used social media to spread both true and false propaganda and information about the so-called *pink slime* (Huffstutter & Baertlein, 2012; Marshall, 2012). Marshall (2012) stated that "its [LFTB] food safety and healthfulness profiles were severely damaged, essentially on the basis of a really effective characterization being applied to it – pink slime" (para. 1).

Another issue that recently affected the dairy industry was the negative reaction to the recombinant bovine somatotrophin (rBST) hormone, which helps to increase milk production in dairy cattle. "Bad-faith efforts by biotechnology opponents to portray rBST as untested or harmful, and to discourage its use, keep society from taking advantage of a safe and useful product" (Miller, 2007, para. 5).

Not only are consumers concerned with how food is produced, they are concerned about food safety. Around 48 million Americans become ill every year from eating contaminated foods (CDC, 2013). Specifically, "a large outbreak of *Salmonella* infections in 2010 caused nearly 2,000 illnesses" (CDC, 2013, para. 14). Salmonella and other disease outbreaks cause consumers to distrust their food sources and can even trigger consumers to avoid not only the contaminated brand, but avoid the product all together.

In all sectors, a push for inform the public about their food and fiber system must exist not only prevent some of the aforementioned issues, but also to create more transparency by and

trust for the agricultural industry. "We [agriculturists] need to be actively engaged as an industry, and as individuals, in shaping consumer perception through education" (Marshall, 2012, para. 5).

Agricultural educators have focused more on reaching out to various populations to prevent unanticipated consequences and detrimental effects to agriculture as a result of the population's illiteracy about the food and agricultural industry (AAAE Ad Hoc Agricultural Literacy Work Group**,** 1992). In 1981, the U.S. Department of Agriculture (USDA) requested representatives of agricultural groups and educators to meet in Washington, D. C. to discuss agricultural literacy (Foster et al., 1990). The committee of representatives recommended that the USDA coordinate the national agricultural classroom literacy initiative and assist states in organizing their own programs (AAAE Ad Hoc Agricultural Literacy Work Group**,** 1992). Each state was responsible for coordinating their AITC programs in a way that met its needs (Malecki, Israel, & Toro, 2004; Pense, Leising, Portillo, & Igo, 2005). Beginning in 1981, an increased effort to integrate agriculture by complementing and enriching existing curriculum in the elementary and secondary school settings through AITC has existed (Foster et al., 1990; Pense et al., 2005). Although numerous state AITC programs have created instructional resources and led teacher-training workshops, "few conducted on-going assessments to determine what agricultural knowledge students were learning" (Pense et al., 2005).

After conducting survey research with 11,626 fourth grade teachers in Texas, Terry, Herring, and Larke (1992) found that numerous teachers were educating students about agricultural concepts, but they had "inaccurate perceptions and limited knowledge of agriculture" (p. 58). In addition, they found that those educators who had previous involvement in an agriculture course or program had greater knowledge of agriculture and possessed more accurate perceptions (Terry et al., 1992). Their findings imply that more should be done to help elementary teachers integrate agriculture into their existing curricula, including more exposure to agricultural concepts during their pre-service preparation to be teachers.

In the early 1990s, another push for the development of goals, objectives, programs, and implementation strategies unfolded to increase agricultural literacy. In 1992, the AAAE Ad Hoc Agricultural Literacy Work Group (1992) met to "describe the purposes of agricultural literacy, to identify activities appropriate for the purpose, recommend how activities should be organized, and design strategies to evaluate the effectiveness of activities" (p. 3). The group recommended the dissemination of agricultural concepts through a program model that targeted three audiences: elementary, middle, and secondary students, and adults (AAAE Ad Hoc Agricultural Literacy Work Group**,** 1992). In addition, Reed (1990) created a proposal for a state program to incorporate agricultural literacy into the elementary and secondary education system. Reed's (1990) approach had three phrases, which included objective goals and major strategy goals for each phase.

Overall, agricultural literacy efforts over the past 20 years have focused on elementary students and educators (Balschweid, Thompson, & Cole, 1998; Kovar & Ball, 2013; Meischen & Trexler, 2003). Further, many of the agricultural literacy programs operate on a small scale reaching a reduced population (Kovar & Ball, 2013). Finally, it is important for researchers, educators, and extensions agents to determine areas of knowledge scarcity and continue to concentrate on those efforts in future programs (Frick, 1993; Kovar & Ball, 2013).

The guide to food and fiber systems literacy.

The Guide to Food and Fiber Systems Literacy (FFSL) was developed at Oklahoma State University and released in 1998 (Hubert, Frank, & Igo, 2000). The Guide to FFSL was composed of standards, benchmarks, explanatory narrative, and sample instructional materials for kindergarten through twelfth grade (Phipps et al., 2008). Moreover, the Guide to FFSL "summarizes what America's youth should know about the Food and Fiber Systems to be agriculturally literate by the time they graduate from high school" (Leising, 1998, para. 5).

Teachers, school administrators, curriculum specialists, and agricultural industry specialists were involved in the development of the FFSL guide. Testing of standards and benchmarks was completed in elementary and middle schools during 1997-1998 in California, Montana, Oklahoma, and Pennsylvania (Leising & Pense, 2001). The guide includes instructional methods and tools to infuse agricultural concepts into the core academic subjects across grade levels (Phipps et al., 2008). Five thematic areas are addressed in the guide, including understanding agriculture; history, geography, and culture; science, technology, and environment; business and economics; and food, nutrition, and health (Leising & Pense, 2001). Each theme addresses multiple topics, with agricultural literacy being the foundational subject.

Understanding Food and Fiber Systems is the first theme and is all encompassing with respect to forming the groundwork on which the other themes are built. Five sub-themes are included in the guide:

> [U]nderstand the meaning of food and fiber systems, understand the essential components of food and fiber systems, understand food and fiber systems' relationship to society, understand the local, national, and international importance of food and fiber systems, and understand food and fiber systems careers. (Leising et al., 1998, p. 16-19)

The second theme, History, Geography, and Culture, focuses on exploring the national and international impact of agriculture, as well as the history of agriculture, including five sub-themes:

> [U]nderstand food and fiber systems' role in the evolution of civilizations, understand food and fiber systems' role in societies throughout world history, understand food and fiber systems' role in U.S. history, understand the relationship between food and fiber

systems and world cultures, and understand how different viewpoints impact food and fiber systems. (Leising et al., 1998, p. 19-23)

Science, Technology, and Environment is the third theme. This theme emphasizes the environmental and natural resource aspect of agriculture, and incorporates the role of science and technology innovation and advancement in the food and fiber system. Four sub-themes make up the larger theme:

> [U]nderstand how ecosystems are related to food and fiber systems, understand food and fiber systems' dependence on natural resources, understand management and conservation practices used in food and fiber systems, and understand science and technology's role in food and fiber systems. (Leising et al., 1998, p. 23-27)

The fourth theme, Business and Economics, concentrates on the agribusinesses within the food and fiber system. This theme illuminates the financial importance of agriculture both locally and internationally; moreover, it stresses the various roles that trade and the government play in agricultural economics and business. The theme includes four sub-themes:

> [U]nderstand food and fiber systems and economics are related, understand food and fiber systems have an impact on local, national, and international economics, understand government's role in food and fiber systems, and understand the factors influencing international trade of food and fiber products. (Leising et al., 1998, p. 27-31)

Food, Nutrition, and Health is the fifth and final theme in the Guide to FFSL. This theme contains some of the more obvious pieces of agriculture that would be relevant to students. It

includes four sub-themes: "understand food and fiber systems provide nourishment for people and animals, understand food and fiber systems provide healthy-diet components, understand food and fiber systems provide food choices, understand food and fiber promotes a safe food supply" (Leising et al., 1998, p. 31-33).

The five themes are designed purposefully to integrate concepts into existing subject areas easily. Along with the guide, resources and lesson plans for kindergarten through twelfth grade are included, which follow Food and Fiber Systems' standards and benchmarks. "The examples lead teachers to discover how existing instruction connects to agriculture" (Leising, 1998, para. 3).

Previous Research

Other research studies (Colbath & Morrish, 2010; Frick, Birkenholz, & Machtmes, 1995; Pense & Leising, 2004; Wright, Stewart, & Birkenholz, 1994) have investigated the effectiveness of agricultural literacy efforts, including AITC and the FFSL benchmarks, as well as examining the levels of agricultural literacy in various populations. Frick, Birkenholz, and Machtmes (1995) measured the knowledge and perceptions of 4-H members about agriculture, food, and natural resources. They found that the mean level of agricultural knowledge was 65.7% among 4-H members. Moreover, it was found that "4-H members living on farms with experience raising plants, gardens, or crops, and enrolled in high school agriculture produced lower knowledge of agriculture scores than those who did not possess those characteristics" (Frick, Birkenholz, & Machtmes, 1995, p. 48).

Frick, Birkenholz, Gardener, and Machtmes (1995) assessed the agricultural knowledge and perception of agriculture of rural and urban inner-city high school students. In contrast to Frick, Birkenholz, and Machtmes (1995), they determined that rural high school students answered correctly 65 percent of the questions in the knowledge section versus the urban inner-

city students who answered correctly only 47.9 percent of the questions (Frick, Birkenholz, Gardner, & Machtmes, 1995).

Wright et al., (1994) compared agricultural knowledge levels and perceptions of eleventh grade students with and without course-taking experiences in secondary agriculture programs. Their findings revealed that students in secondary agriculture programs had greater agricultural literacy than those who did not participate in agriculture programs at the secondary level (Wright et al., 1994).

Pense and Leising (2004) assessed the agricultural literacy levels of high school seniors in six different Oklahoma schools. The researchers used a criterion group *ex-post facto* design. Comparisons were made between general education and agricultural education students in urban, suburban, and rural settings. It was found that agricultural education and general education students did not significantly differ in their levels of overall agriculture knowledge; however, the mean score on the agricultural literacy test (49.15%) demonstrated that the students were not agriculturally literate (Pense & Leising, 2004).

Pense et al. (2005) conducted an experimental study to examine the effects of integrating AITC into existing curriculum on the agricultural literacy levels of students from kindergarten through the sixth grade. The sixth grade control group had gained the most knowledge in the posttest regarding Theme 2 - History, Geography, & Culture; they were least knowledgeable regarding Theme 1 - Understanding Agriculture (Pense et al., 2005). Overall, it was found that AITC integration impacted students knowledge about agriculture positively and that students gained knowledge in all five thematic areas (Pense et al., 2005).

Colbath and Morrish (2010) used a FFSL criterion-referenced test (Pense & Leising, 2004) to assess the agricultural literacy levels of collegiate freshmen students. They compared agricultural literacy scores and the spatial density (i.e., urban, suburban, and rural) of where

students were raised. Overall, agricultural literacy scores were 50.4%, indicating that students were not proficient in the FFSL benchmarks. Moreover, when test scores were compared using spatial density, it was found that statistically significant differences in agricultural knowledge existed amongst the three groups, with suburban students scoring the highest, followed by rural students, and then urban students. Recommendations were made to replicate the study at other institutions nationwide (Colbath & Morrish, 2010).

Conceptual Framework

Agricultural graduates must receive technical and specialized training so that they are prepared for the "dynamic, systematic, and difficult problems they will encounter as future leaders" (Grant, Field, Green, & Rollin, 2000, p. 1687). However, LGUs do not serve agricultural students solely. Parman (2012) reviewed twentieth-century farmers' human capital gains from formal schooling at land-grant colleges. He stated, "beyond the private returns to education, there was a very public aspect to education at the time" (p. 316). When an individual farmer invests in further education, he or she "tend[s] to increase the stock of useful public agricultural knowledge" (Parman, 2012, p. 318). This idea of increasing personal and public human capital still holds true in our modern society, but, instead of educating only the farmer about agriculture, a land-grant institution should be also interested in providing basic agricultural literacy to students in all disciplines (Renne, 1960).

Human capital is defined as the investment in a person's knowledge, skills, and experiences, which are necessary for employment or improving a person's overall well-being (Becker, 1964; Little, 2003; Shultz, 1971; Smith, 2010). Human capital can be specific to a particular sector of an industry or more general to a person's life (Scoones, 2000; Smith, 2010). Human capital is accumulated in various ways, such as attending school; participating in a variety of activities; training on-the-job, such as interning; or studying about global phenomena (Becker,

1962). Human capital affects how people think about various aspects of their lives (Reed & Wolniak, 2005). Therefore, the more a person has invested in his or her human capital, the more informed that person will be.

Human capital theory is derived from the sociological functionalist paradigm, which states that economic and technological innovation generally raises the skill levels required to perform jobs (Rubinson & Browne, 2005). The technical function theory also indicates that "education responds to industrial and economic growth" (Walters, 2004, p. 99). The human capital theory, with respect to education, is an economic variation of the technical functional theory (Walters, 2004). Human capital was first given attention when economists realized that physical capital growth does not explain much of the income growth in most countries (Becker, 1964). Shultz (1961) identified five categories of human capital, including health; on-the-job training; formal education; non-formal learning; and migration of individuals in response to job opportunities. Specifically, this study focuses on human capital in terms of students' knowledge, skills, and experiences (Becker, 1964; Little, 2003; Serneels, 2008; Smith, 2010) *in* and *about* agriculture (NRC, 1988).

There are two types of skills that are emphasized in the human capital theory: specific and general (Scoones, 2000). Specific skills are relative within a certain firm or sector, and general skills are those that can be utilized in a variety of firms or sectors (Scoones, 2000). As incoming freshmen, it was expected that the students had a plethora of prior education and experiences at the secondary level which drive their future ambitions, including their choice of academic major. If a freshman chose an agricultural major, it might be assumed he or she had participated in high school agricultural courses, youth agricultural organizations, or non-formal agricultural experiences. In turn, it could be assumed reasonably that those freshmen would have a higher level of agricultural literacy because they had additional opportunities to acquire more specific skills (Scoones, 2000) associated to agriculture. In contrast, those individuals without

prior education or experience may possess only general skills (or knowledge) about agriculture and display a lower level of agricultural literacy.

Previous studies have examined the impact education has on a person's career satisfaction and success (Little & Singh, 1992; Nitzan & Paroush, 1980; Sandy & Duncan, 1996; Walters, 2004). Sandy and Duncan (1996) compared students in private and public schools and found that those students who "attended private schools have better labor market experiences than those who attended public schools, even when reasonable measures of school quality, family background, educational achievement, occupation and motivation are included" (p. 311).

Walters (2004) investigated if higher education provides graduates with the knowledge and skills to be hired successfully in the workforce. He assessed data from 43,040 graduates collected two years following the respondents' graduation. He compared both level and subject of post-secondary schooling to the respondents' perception of whether or not their current job was related to their schooling. Walters (2004) stated, "[p]ostsecondary graduates with credentials that match those requested by their employers report a closer fit between their education and work than do graduats whose credentials do not directly match those recommended for their job[s]" (p. 116).

Further, Little and Singh (1992) explored the connection between motivation at school and motivation at work through a cross-sectional analysis of students and workers from England and Malaysia. They found a "positive relation between learning for interest in school and working for fulfillment and change in work" (p. 197). One of their possible explanations of this transfer between school experiences to the workplace was human capital theory (Little & Singh, 1992). The implications of these studies point to the importance of investing in education and related learning experiences in regard to future success and satisfaction.

Nitzan and Paroush (1980) indicated when people invest in their human capital, they have a smaller probability of making an error in an uncertain environment. Further, investment in human capital is similar to "self-protection" (Ehrlich & Becker, 1972, p. 624) by hedging against future risks (Nitzan & Paroush, 1980). Socially, the element of self-protection signifies the public's interest in investing in a society's members (Nitzan & Paroush, 1980). "The social rate of return to such an investment is the increase in the likelihood of society's making the correct decisions using a given collective decision-making process" (Nitzan & Paroush, 1980, p. 547). This indicates the significance of a society with knowledge about agriculture when it comes to voting and making informed decisions about the food and fiber system. Lanzi (2007) stated that the importance of increasing the skills, abilities, and competencies of individuals' human capital increases freedom through making self-empowerment, civic engagement, and social participation easier to accomplish.

Summary

It is evident that U.S. citizens' lack sufficient knowledge *about* agriculture (Doerfort, 2011; Kovar & Ball, 2013; NRC, 1988). However, citizens are called on frequently to make decisions that affect agriculture (Braverman & Rilla, 1991; Foster et al., 1990; Pense & Leising, 2004; Turnbull; 2002). One venue in which citizens can learn more *about* agriculture is through LGUs. Three purposes guide the mission of the land-grant institution: (a) education; (b) research; and (c) extension (Green, 1990; Trapp, 2006). Thus, LGUs can serve students who are attending courses, as well as communicating with the general public through extension (Fribourg, 2005; Sandmann, 1991).

All collegiate graduates must obtain practical and specialized training so they are equipped for the active, methodical, and challenging issues they will face as future leaders (Grant et al., 2000). Human capital is the investment in a person's knowledge, skills, and experiences,

which are required for employment or improving a person's general welfare (Becker, 1964; Little, 2003; Shultz, 1971). These skills can be sector specific for an industry or more general to a person's life (Scoones, 2000; Smith, 2010). Human capital is accrued in several ways, such as attending school; participating in a variety of activities; training on-the-job, such as interning; or studying about global phenomena (Becker, 1962). Human capital affects how individuals think about various facets of their lives (Reed & Wolniak, 2005). Hence, the more an individual has invested in his or her human capital, the more informed that person will be.

There is an imminent need to educate the population about agriculture. Therefore, the purpose of this census study was to examine the various levels of agricultural knowledge across disciplines of incoming freshmen at Oklahoma State University in the Fall semester of 2012.

CHAPTER III

METHODOLOGY

Introduction

The study was devised to describe the agricultural literacy levels of incoming freshmen at OSU in the Fall semester of 2012. The American public is more removed from agriculture than ever before, and they know little to nothing about the food and fiber system (Blackburn, 1999; NRC, 1988; USFRA, 2011). It is essential that they receive information and education to make socially responsible decisions, which will, in turn, affect the agricultural industry (Foster et al., 1990; NRC, 1988; Pense & Leising, 2004). One of the avenues to distribute such information is through the land-grant institution, which is made up of three *arms*: research, education, and extension (Fribourg, 2005; NASULGC, 2008; Renne, 1960).

The study was framed using the human capital theory. Human capital is defined as the investment in a person's knowledge, skills, and experiences necessary for employment or overall well-being (Becker, 1964; Little, 2003; Shultz, 1971; Smith, 2010). Specifically, this study focused on human capital in terms of students' knowledge, skills, and experiences (Becker, 1964; Little, 2003; Serneels, 2008; Smith, 2010) *in* and *about* agriculture (NRC, 1988).

Institutional Review Board

Before investigators can begin research on human subjects, they must request and receive approval from the University Research Services and the Institutional Review Board of Oklahoma State University. The application outlined the researcher's procedures and intentions to protect the rights and well being of human subjects involved in the study. As an incentive, participants were offered the opportunity to provide their email address to qualify for a gift card drawing. The drawing was conducted one week after the data collection period ended on October 30, 2012. Fifty student email addresses were selected randomly to receive gift cards to Quench-Bud's, which is a local business that sells drinks and snow cones. The study was approved on August 7, 2012 (see Appendix A). The institutional review board assigned the code, AG1236 to this study.

Instrumentation

The instrument utilized in the study was a criterion-referenced test titled Food and Fiber Systems Literacy (FFSL) (Appendix E). The FFSL test was developed by Pense and Leising (2004) and included 50 questions that measured equally (i.e., 10 items per theme) each of the five thematic areas: (a) understanding food and fiber systems, (b) history, geography, and culture, (c) science, technology, and environment, (d) business and economics, and (e) food, nutrition, and health.

Criterion-referenced tests are used in schools, industries, and the armed services because they offer valuable information in terms of the actual skills, tasks, or knowledge an individual possesses, which is somewhat different than what a norm-referenced test examines (Hambleton, 1986; Wiersma & Jurs, 1990). Criterion-referenced test scores have three collective uses: (a) to describe a participant's performance compared to the competencies being measured, (b) to designate a participant's mastery level for each competency measured, and (c) to depict the

performance of identified groups of participants in program evaluation studies (Hambleton, 1986).

Validity and reliability of the study's instrument.

A panel of three credentialed agricultural education teachers and three agricultural education graduate students wrote the test items based on the standards and benchmarks of the FFSL framework (Pense & Leising, 2004). After the test was completed, the questions were "validated by a panel of secondary school teachers of various disciplines to ensure that each item addressed its corresponding FFSL benchmark content, the content was grade-level appropriate, and each item was language appropriate" (Pense & Leising, 2004, p. 89). The original FFSL test addressed Wiersma's and Jurs' (1990) eight general factors to improve the reliability of an instrument. The eight factors included "homogeneous items, discriminating items, enough items, high-quality items, high-quality copying and format, clear directions to the student, a controlled setting, motivating introduction, and clear directions to the scorer" (Wiersma & Jurs, 1990, p. 200-201).

Two pilot tests were conducted; the first was with 17 senior students in an intact English IV class in a small, rural, Oklahoma high school, and the test demonstrated a reliability coefficient of 0.846, using the *Kuder/Richardson-20 (KR-20)* method (Pense & Leising, 2004). Following the first pilot test, the instrument was reviewed three more times and questions were revised or deleted based on feedback from students (Pense & Leising, 2004). The final pilot test was conducted with 20 students in a U.S. government class in another small, rural, Oklahoma high school, and it yielded a reliability coefficient of 0.933, using the *KR-20* method (Pense & Leising, 2004).

The researcher modified the original instrument to update it and reduce it in size. Edits were made and reviewed by a panel of two professors in the Department of Agricultural

Education, Communications, and Leadership and one professor in the Plant and Soil Sciences Department at OSU. Revisions were minor and dealt with modifying the language for clarity; the modifications did not affect the integrity of the test. The test was condensed to 25 questions, which assessed each of the five thematic areas evenly.

Popham and Husek (1969) debated that since internal reliability estimates compare individuals to specific criteria and not to other individuals, such reliability estimates are not suitable for criterion-referenced tests. Conversely, Kane (1986) indicated internal consistency on criterion-referenced tests as a critical matter and stated that internal reliability coefficients above .50 suggested the instrument reflected students' accumulated mean scores accurately. Therefore, the *Kuder-Richardson (KR-20)* formula was used to determine *post hoc* reliability coefficient of .65 for the 25-item criterion referenced test used in the study. Therefore, it was determined that all of the 25 questions were contributing appropriately to the internal consistency of the test.

Population

The target population consisted of all incoming freshmen students ($N = 4,289$) at Oklahoma State University (OSU) during the Fall semester of 2012. The selected population was students registered as incoming freshmen who were at least 18 years old ($N = 4,081$).

Oklahoma State University is made up of six colleges, which for the purpose of this census study were considered the students' *discipline*. The six colleges were the College of Agricultural Sciences and Natural Resources (CASNR); College of Arts and Sciences (A&S); Spears School of Business (SSB); College of Education (COE); College of Engineering, Architecture, and Technology (CEAT); and College of Human Sciences (CHS) (IRIM, 2012). A total of 185 different majors and options are offered across the six colleges at OSU (Oklahoma State University, 2013).

CASNR provides 16 majors (see APPENDIX G for a complete list of these majors). Some of the majors include Agribusiness, Biosystems Engineering, Food Science, and Natural Resource Ecology and Management (Majors, 2013). A&S instructs 27 majors (see APPENDIX H for a complete list of these majors). A portion of the majors include Biology, Geology, Music, and Political Science to name a few (Departments & Programs, 2013). SSB makes available nine majors (see APPENDIX I for a complete list of these majors), some of which include Accounting, Entrepreneurship, General Business, and Marketing amongst others (Undergraduate Programs, 2013). COE provides seven majors (see APPENDIX J for a complete list of these majors). A few of those include Aerospace Administration and Operations, Athletic Training, Leisure Studies, and Secondary Education (COE Undergraduate Degrees, 2013). CEAT instructs 14 majors (see APPENDIX K for a complete list of these majors). Some of them include Aerospace Engineering, Construction Management Technology, Fire Protection and Safety Technology, and Mechanical Engineering (Student Services, 2013). Finally, CHS makes available 14 majors (see APPENDIX L for a complete list of these majors), some of which include Apparel Design and Production, Child and Family Services, Dietetics, and Hotel and Restaurant Administration, (Undergraduate Degree Programs & Majors, 2013). In the 2012-2013 academic year, a total of 20,130 undergraduate students were enrolled at OSU (IRIM, 2012).

Regarding the entire population of the incoming freshmen class (N = 4,289), 2,110 were males (IRIM, 2012). The average high school core GPA was a 3.58 with 92% of incoming freshmen holding a 3.00 to 4.00 GPA (IRIM, 2012). Sixty-three percent of the new freshmen were Oklahoma residents (IRIM, 2012). The number of new freshmen enrolled by college in the Fall semester of 2012 was 425 in CASNR; 972 in A&S; 586 in SSB; 290 in COE; 857 in CEAT; and 291 in CHS. In addition, 868 students were enrolled in the Learning and Student Success Opportunity Center (LASSO) (IRIM, 2012) (see Table 1). Data from the LASSO Center were not included in Table 1 below because it is not an academic college within the university; rather,

it is where incoming students can receive additional academic advising without declaring a specific major (LASSO Center, 2013).

The number of degrees offered in the 2012-2013 academic year in each college were as follows: 59 in CASNR; 62 in A&S; 16 in SSB; 25 in COE; 25 in CEAT; and 14 in CHS (Oklahoma State University, 2013). The number of undergraduate degrees granted by each college between the years of 2007 and 2012 were 2,168 from CASNR; 4,806 from A&S; 5,047 from SSB; 1,995 from COE; 2,349 from CEAT; and 2,018 from CHS (IRIM, 2012) (see Table 1).

Table 1

Descriptions of Specific Variables Describing Freshmen Enrolled in the Six Colleges of Oklahoma State University

	CASNR	A&S	SSB	COE	CEAT	CHS
New Freshmen Enrolled in Fall semester of 2012	425	972	586	290	857	291
Degrees Offered in the 2012-2013 Academic Year	59	62	16	25	25	14
Undergraduate Degrees Granted 2007 to 2012	2,168	4,806	5,047	1,995	2,349	2,018

Data Collection

Because of the large population, the link to the instrument was submitted to the participants electronically using students' OSU email addresses. A frame of the students and their email addresses was collected from the OSU Communications Department. The web-based survey program, Qualtrics, was used to present the FFSL test for electronic data collection (See Appendix D). The researcher followed a modified approach according to Dillman's (2007) four-contact data collection method. The first email message was sent to the entire population (N = 4,081) on August 30, 2012 (See Appendix B). A follow-up reminder email message was sent to those respondents who did not provide their email address for the incentive drawing (n = 3,731) on September 10, 2012 (See Appendix C). The third and final reminder email message was sent to the same population that was used for the follow-up reminder email (n = 3,731) on October 2, 2012 (See Appendix D). The data collection period ended on October 23, 2012. Seven-hundred and eleven students completed the questionnaire, which was a response rate of 17.4%.

Control of Non-Response Error

To control for non-response error, the researcher compared early and late respondents, according to the recommendations by Miller and Smith (1983). Miller and Smith (1983) stated a way to approximate the types of replies from respondents was by comparing early respondents to late respondents statistically. Therefore, the first 25% of the respondents were considered *early* respondents, and the last 25% were considered *late* respondents. These two groups were compared statistically, using a *t*-test, based on their test scores and demographic information (see Tables 2, 3, & 4). Because no statistically significant differences were found, the data presented by the respondents can be generalized to the population at Oklahoma State University (N = 4,081) (Miller & Smith, 1983), which included all incoming freshmen over the age of 18 during the Fall semester of 2012.

Table 2

T-Tests Summary and Frequencies Comparing Early and Late Respondents' Personal Characteristics

	Early Respondents		Late Respondents		
	f	%	*f*	%	*p*
Gender					.238
Male	64	36.6	55	43.3	
Female	111	63.4	72	56.7	
Ethnicity					.143
American Indian	9	5.2	11	8.7	
African American	3	1.7	6	4.8	
Pacific Islander	3	1.7	1	0.8	
Hispanic	10	5.8	5	4.0	
White	148	85.5	103	81.7	
Home State					.682
Oklahoma	94	66.2	66	68.8	
Other	48	33.8	30	31.2	

Table 3

T-Tests Summary and Frequencies Comparing Early and Late Respondents' Personal Characteristics

	Early Respondents		Late Respondents		
	f	%	*f*	%	*p*
					.662
High School GPA					
4.00 – 3.50	129	74.1	92	73.6	
3.49 – 3.00	35	20.1	30	24.0	
2.99 – 2.50	10	5.7	3	2.4	
Home Community Size					.861
Rural	42	24.0	31	25.0	
Suburb	47	26.9	25	20.2	
Town	47	26.9	37	29.8	
City	39	22.3	31	25.0	
College					.424
CASNR	39	22.7	27	21.4	
A&S	40	23.3	40	31.7	
COE	20	11.6	12	9.5	
CEAT	40	23.3	28	22.2	
CHS	17	9.9	7	5.6	
SSB	16	9.3	12	9.5	

Table 4

T-Tests Summary and Frequencies Comparing Early and Late Respondents Test Scores

	Early Respondents				Late Respondents				
	f	%	*M*	*SD*	*f*	%	*M*	*SD*	*p*
College									.126
CASNR	39	22.7	15.24	2.93	27	21.4	14.23	3.06	
A&S	40	23.3	13.71	3.50	40	31.7	12.63	4.21	
COE	20	11.6	12.78	3.19	12	9.5	12.82	4.77	
CEAT	40	23.3	15.92	3.30	28	22.2	13.85	3.94	
CHS	17	9.9	11.88	4.22	7	5.6	14.00	2.71	
SSB	16	9.3	13.46	3.95	12	9.5	14.72	3.00	

Data Analysis

After the data collection period was closed, the responses were imported into Statistical Package for Social Sciences (SPSS). To interpret the data in SPSS, the variables were coded numerically based on the study's objectives (Creswell, 2012). For example, males were assigned the number one and females were assigned the number two. The researcher used an SPSS 19.0 data file to analyze the data using descriptive statistics of central tendency, variability, and relative standing (Ary, Jacobs, & Razavieh, 1996; Creswell, 2012). Measures of central tendency were expressed by means, median, and mode; measures of variability were expressed by frequencies, standard deviations, and ranges; and relative standing was demonstrated by calculating percentile ranks (Creswell, 2012).

The first objective was to describe the personal characteristics of incoming freshmen at Oklahoma State University. These characteristics included sex, age, ethnicity, college, major,

future career aspiration, home state, size of home community, high school organizational involvement, number of high school agricultural education courses taken, and student perceptions of agriculture. Frequencies and percentages were reported, as appropriate (Creswell, 2012; Field, 2009).

The second objective was to determine the agricultural literacy levels of incoming freshmen across all disciplines at Oklahoma State University. Discipline was defined to indicate the various colleges in which students were enrolled as incoming freshmen. Means, standard deviations, frequencies, and percentages were reported for the overall test scores. In addition, each of the five thematic constructs of the FFSL test were reported individually using means and standard deviations (Creswell, 2012).

Objective three was to determine the relationships between students' personal characteristics and their various levels of agricultural literacy. One-way Analyses of Variances (ANOVAs) were conducted to assess differences between more than two variables, but were only interpreted to reflect this population and not to infer to other populations outside the one examined (M. Payton, personal communication, December 4, 2012). *T*-tests were used on those variables of interest with only two levels to describe the interactions (Field, 2009; M. Payton, personal communication, December 4, 2012).

CHAPTER IV

FINDINGS

Introduction

The census study was devised to describe the agricultural literacy levels of incoming freshmen at OSU in the Fall semester of 2012. The American public is more removed from agriculture than ever before, and they know little to nothing about the food and fiber system (Blackburn, 1999; NRC, 1988; USFRA, 2011). It is essential that they receive information and education to make socially responsible decisions, which will, in turn, affect the agricultural industry (Foster et al., 1990; NRC, 1988; Pense & Leising, 2004). One of the avenues to distribute such information is through the land-grant institution, which is made up of three arms: research, education, and extension (Fribourg, 2005; NASULGC, 2008; Renne, 1960).

The study was framed using the human capital theory. Human capital is defined as the investment in a person's knowledge, skills, and experiences necessary for employment or overall well-being (Becker, 1964; Little, 2003; Shultz, 1971; Smith, 2010). Specifically, this study focused on human capital in terms of students' knowledge, skills, and experiences (Becker, 1964; Little, 2003; Serneels, 2008; Smith, 2010) *in* and *about* agriculture (NRC, 1988).

Purpose

The purpose of this census study was twofold: 1) assess the agricultural literacy of all incoming freshmen (N = 4,081) at Oklahoma State University in the Fall semester of 2012, and 2) compare students' scores on an agricultural literacy test against their selected personal characteristics. Three objectives guided the study.

Objectives

1. Describe the personal characteristics, such as gender, age, ethnicity, home state, home community size, participation in high school youth organization, number of agricultural education courses taken, and perceptions of agriculture, of incoming freshmen at Oklahoma State University.
2. Determine the agricultural literacy levels of incoming freshmen across all disciplines at Oklahoma State University in the Fall semester of 2012.
3. Determine the relationships between students' personal characteristics and their various levels of agricultural literacy.

Objective one sought to describe the personal characteristics of incoming freshmen at Oklahoma State University during the Fall semester of 2012. Three-hundred and thirty four (62.8%) female students and 198 (37.2%) male completed the questionnaire (see Table 5). Of those students, 38 (7.2%) were American Indian, 17 (3.2%) were African American, 5 (0.9%) were Pacific Islander, 28 (5.3%) were Hispanic, and 442 (83.4%) were White.

Table 5

Personal Characteristics of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012

	f	%
Gender (*n* = 532)		
Female	334	62.8
Male	198	37.2
Ethnicity (*n* = 530)		
American Indian	38	7.2
African American	17	3.2
Pacific Islander	5	0.9
Hispanic	28	5.3
White	442	83.4

The total number of students who resided in Oklahoma was 286 (66.5%) (see Table 6). Regarding the size of students' home communities, 124 (23.4%) self-reported that they resided in a city, 135 (25.5%) in a suburb, 152 (28.7%) in a town, and 118 (22.3%) in a rural area.

Table 6

Personal Characteristics of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012

	f	%
Home State (*n* = 430)		
Oklahoma	286	66.5
Out-of-state	144	33.5
Home Community Size (*n* = 529)		
City	124	23.4
Suburb	135	25.5
Town	152	28.7
Rural	118	22.3

When considering the organizations in which students participated during high school, 128 (31.1%) reported being in FFA, and 67 (16.3%) reported being in 4-H. In addition, 25 (6.1%) were in an environmental club, 49 (11.9%) were in science club, 115 (28.0%) were on an academic team, and 27 (6.6%) were on the debate team (see Table 7).

Table 7

High School Participation in Youth Organizations of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012 (n = 411)

	f	%
FFA	128	31.1
4-H	67	16.3
Environmental Club	25	6.1
Science Club	49	11.9
Academic Team	115	28.0
Debate Team	27	6.6

Regarding the number of agricultural education courses taken by students, 371 (69.9%) reported they had not taken a course, 49 (9.2%) took one course, 24 (4.5%) took two courses, 19 (3.6%) took three courses, and 68 (12.8%) indicated they had taken four courses (see Table 8).

Table 8

Number of Agricultural Education Courses Taken by Incoming Freshmen at Oklahoma State University, Fall Semester of 2012 (n = 463)

	f	%
0 courses	371	69.9
1 course	49	9.2
2 courses	24	4.5
3 courses	19	3.6
4 courses	68	12.8

As for the cumulative high school grade point averages (GPAs) of the students, 400 (75.6%) self-reported a GPA ranging from 4.00 to 3.50, 108 (20.4%) self-reported a GPA ranging from 3.49 to 3.00, 19 (3.6%) self-reported a GPA ranging from 2.99 to 2.50, and 2 (0.4%) self-reported a GPA ranging from 2.49 to 2.00 (see Table 9).

Table 9

Cumulative High School GPAs of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012 (*n* = 529)

	f	%
4.00 to 3.50	400	75.6
3.49 to 3.00	108	20.4
2.99 to 2.50	19	3.6
2.49 to 2.00	2	0.4

Regarding students' perceptions of their knowledge about agriculture, 65 (8.9%) considered themselves as *above average*, 364 (49.9%) regarded themselves as *average*, and 300 (41.2%) perceived themselves as *below average* (see Table 10). When considering the statement, "Agriculture plays an important role in U.S. society," 396 (74.9%) *strongly agreed*, 117 (22.1%) *agreed*, 13 (2.5%) *neither agreed or disagreed*, and 3 (0.6%) *disagreed*.

Table 10

Agricultural Perceptions of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012

	f	%
How knowledgeable do you consider yourself to be about agriculture?		
Above average	65	8.9
Average	364	49.9
Below average	300	41.2
Agriculture plays an important role in U.S. society.		
Strongly agree	396	74.9
Agree	117	22.1
Neither agree or disagree	13	2.5
Disagree	3	0.6

As for the question, "How important is agriculture as a fundamental aspect of our national security?," 203 (38.4%) perceived it to be *extremely important*, 241 (45.6%) found it to be *very important*, 76 (14.4%) noted it to be *neither important nor unimportant*, 6 (1.1%) thought it to be *very unimportant*, and 3 (0.6%) perceived it to be *not important at all* (see Table 11). In response to the question, "How important is it for students to take a general education course over agriculture, food, and fiber?," 111 (21.0%) considered it to be extremely important, 213 (40.3%) thought it was very important, 189 (35.7%) found it to be neither important nor unimportant, 12 (2.3%) perceived it to be very unimportant, and 4 (0.8%) viewed it as not being at all important (see Table 11).

Table 11

Agricultural Perceptions of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012

	f	%
How important is agriculture as a fundamental aspect of our national security?		
Extremely important	203	38.4
Very important	241	45.6
Neither important nor unimportant	76	14.4
Very unimportant	6	1.1
Not at all important	3	0.6
How important is it for students to take a general education course over agriculture, food, and fiber?		
Extremely important	111	21.0
Very important	213	40.3
Neither important nor unimportant	189	35.7
Very unimportant	12	2.3
Not at all important	4	0.8

Finally, regarding the question, "Would you like to learn more about agriculture as a student at OSU?," 211 (40.0%) responded yes, 235 (44.5%) responded maybe/not sure, and 82 (15.5%) responded no (see Table 12).

Table 12

Agricultural Perceptions of Incoming Freshmen at Oklahoma State University, Fall Semester of 2012

	f	%
Would you like to learn more about agriculture as a student at OSU?		
Yes	211	40.0
Maybe/Not sure	235	44.5
No	82	15.5

Objective two sought to determine the levels of agricultural literacy of incoming freshmen across all disciplines at Oklahoma State University in the Fall semester of 2012. On the 25-item FFSL test, students in CASNR (n = 119, 23.8%) had a mean score of 15.3 (SD = 8.2) (see Table 13). Students in A&S (n = 129, 25.8%) had a mean score of 12.4 (SD = 3.8). Students in COE (n = 49, 9.8%) had a mean score of 12.7 (SD = 3.8). Students in CEAT (n = 110, 22.0%) had a mean score of 15.1 (SD = 3.5). Students in the CHS (n = 44, 8.8%) had a mean score of 12.6 (SD = 4.6). Students in the SSB (n = 49, 9.8%) had a mean score of 13.8 (SD = 3.8) (see Table 13).

Table 13

Agricultural Literacy Test Scores of Incoming Freshmen at Oklahoma State University by College, Fall Semester of 2012 (*n* = 500)

Rank		*f*	%	*M*	*SD*
1	College of Agricultural Sciences and Natural Resources (CASNR)	119	23.8	15.33	8.2
6	College of Arts and Sciences (A&S)	129	25.8	12.46	3.8
4	College of Education (COE)	49	9.8	12.80	3.8
2	College of Engineering, Architecture, and Technology (CEAT)	110	22.0	15.15	3.5
5	College of Human Sciences (CHS)	44	8.8	12.66	4.6
3	Spears School of Business (SSB)	49	9.8	13.82	3.8

Note. For the purpose of interpretation, students' *disciplines* were defined as the *Colleges* in which students' academic majors resided.

Objective 3 sought to determine the relationships between students' personal characteristics and their various levels of agricultural literacy. A statistically significant difference was found between students' test scores and their college $F(5, 494) = 3.8$, $p = .00$ (see Table 14). Specifically, statistically significant differences were found between CASNR and A&S ($p = .01$), CASNR and COE ($p = .01$), and CASNR and CHS ($p = .00$). To determine practical significance, *mean differences* were calculated by subtracting the mean scores of Colleges as listed in Table 13. The practical significance can be observed by the *mean differences* found between CASNR and A&S ($MD = 1.87$), CASNR and COE ($MD = 2.53$), and CASNR and CHS ($MD = 2.67$).

Table 14

Analysis of Variance Summary Comparing Test Scores Between Students' Colleges, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
College	528.8	5	105.8	3.8	.00*
Error	13661.10	494	27.65		
Total	14189.86	499			

*$p < .05$.

An independent-samples *t*-test was conducted to compare the test scores of male and female students (see Table 15). A statistically significant difference in scores was found ($p = .00$) between male ($M = 15.27$, $SD = 3.32$) and female ($M = 13.45$, $SD = 6.15$) students, i.e., the male students were more knowledgeable of agriculture.

Table 15

Comparison of Freshmen Students' Gender and Test Scores Using a t-Test, Fall Semester of 2012

	n	*M*	*SD*	*t*	*p*
Male	189	15.27	3.32	4.33	.00*
Female	317	13.45	6.15		

*$p < .05$.

A statistically significant difference was found between students' test scores and size of their home community $F(3, 500) = 2.91$, $p = .03$ (see Table 16). Specifically, statistically significant differences were noted between town ($M = 14.52$) and city ($M = 13.23$) ($p = .01$) and

rural (*M* = 14.25) and city (*M* = 13.23) (*p* = .04). The practical significance can be observed by the *mean differences* found between city and town (*MD* = -1.29) and city and rural (*MD* = -1.02) (see Table 17).

Table 16

Analysis of Variance Summary Comparing Students' Test Scores by Size of Home Communities, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
Home Community Size	123.01	3	41.00	2.91	.03*
Error	7039.85	500	14.08		
Total	7162.86	503			

*$p < .05$.

Table 17

A Description of Student Test Scores by Size of Home Communities during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
4	City	121	24.0	13.23	3.8
3	Suburb	128	25.3	13.75	3.8
1	Town	141	28.0	14.52	3.5
2	Rural	114	22.7	14.25	3.8

An independent-samples *t*-test was conducted to compare test scores of students who did not take agriculture courses in high school and those who did take agriculture courses in high

school (see Table 18). A statistically significant difference in scores was found ($p = .01$) for students who took agriculture courses in high school ($M = 14.63$, $SD = 3.45$) and students who did not take agriculture courses in high school ($M = 13.72$, $SD = 3.85$).

Table 18

Comparison of Agricultural Courses Taken by Students and Their Test Scores Using a t-Test, Fall Semester of 2012

	n	*M*	*SD*	*t*	*p*
No agriculture courses taken	355	13.72	3.85	-2.49	.01*
Agriculture courses taken[a]	148	14.63	3.45		

Note. [a]The range of courses students could have selected was zero to four.; *$p < .05$.

A statistically significant difference was found between students' test scores and their perceived previous knowledge of agriculture $F(2, 504) = 15.58$, $p = .00$ (see Table 19). Specifically, statistically significant differences were revealed between students who rated their knowledge *above average* ($M = 17.48$) and *average* ($M = 14.23$) ($p = .00$), *above average* ($M = 17.48$) and *below average* ($M = 13.04$) ($p = .00$), and *average* ($M = 14.23$) and *below average* ($M = 13.04$) ($p = .02$). The practical significance can be observed by the *mean differences* found between *above average* and *average* ($MD = 3.25$), *above average* and *below average* ($MD = 4.44$), and *average* and *below average* ($MD = 1.19$) (see Table 20).

Table 19

Analysis of Variance Summary Comparing Students' Test Scores and Students' Perceptions of Their Previous Knowledge of Agriculture, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
Perception	840.24	2	420.12	15.58	.00*
Error	135492.67	504	26.97		
Total	14432.90	506			

*$p < .05$.

Table 20

A Description of Student Test Scores by Their Previous Knowledge of Agriculture during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
1	Above average	54	10.9	17.48	11.6
2	Average	258	50.4	14.23	3.7
3	Below average	195	38.7	13.04	3.9

An independent-samples *t*-test was conducted to compare test scores in non-membership in FFA and membership in FFA (see Table 21). A statistically significant difference in test scores ($p = .00$) for membership in FFA ($M = 14.79$, $SD = 3.29$) and non-membership in FFA ($M = 13.70$, $SD = 3.88$) was found.

Table 21

Comparison of Membership in FFA and Students' Test Scores Using a t-Test, Fall Semester of 2012

	n	*M*	*SD*	*t*	*p*
Not member in FFA	384	13.70	3.88	-3.03	.00*
Member in FFA	121	14.79	3.29		

*$p < .05$.

An independent-samples *t*-test was conducted to compare test scores in non-membership in 4-H and membership in 4-H (see Table 22). A statistically significant difference in scores ($p = .02$) for membership in 4-H ($M = 14.99$, $SD = 3.13$) and non-membership in 4-H ($M = 13.83$, $SD = 3.82$) was found.

Table 22

Comparison of Membership in 4-H and Students' Test Scores Using a t-Test, Fall Semester of 2012

	n	*M*	*SD*	*t*	*p*
Not member in 4-H	440	13.83	3.82	-2.33	.02*
Member in 4-H	65	14.99	3.13		

*$p < .05$.

No statistically significant difference was found between students' future career aspirations and their test scores (see Table 23).

Table 23

Comparison of Future Career Aspirations and Students' Test Scores Using a t-Test, Fall Semester of 2012

	n	*M*	*SD*	*t*	*p*
Not agriculturally related	388	13.82	3.93	-1.62	.11
Agriculturally related	98	14.51	3.00		

A statistically significant difference was found between students' theme 1 test scores in Understanding Food and Fiber Systems and their college $F(5, 515) = 2.47$, $p = .03$ (see Table 24). Specifically, statistically significant differences were noted between CEAT ($M = 2.95$) and CASNR ($M = 2.61$) ($p = .05$). The practical significance can be observed by the *mean differences* found between CASNR and CEAT ($MD = -0.34$) (see Table 25).

Table 24

Analysis of Variance Summary Comparing Theme 1 Test Scores Between Students' Colleges, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
College	22.117	5	4.423	2.47	.03*
Error	922.10	515	1.79		
Total	4642.00	521			

*$p < .05$.

Table 25

A Description of Student Test Scores for Theme 1 by College during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
3	CASNR	124	23.7	2.61	1.3
2	A&S	133	25.3	2.75	1.4
5	COE	51	9.7	2.45	1.3
1	CEAT	115	22.5	2.95	1.3
6	CHS	45	8.7	2.24	1.3
4	SSB	53	10.1	2.51	1.2

A statistically significant difference was found between students' theme 2 test scores in History, Geography, and Culture and their college $F(5, 516) = 4.62$, $p = .00$ (see Table 26). Specifically, statistically significant differences were revealed between CASNR ($M = 3.12$) and A&S ($M = 2.74$) ($p = .01$), CASNR ($M = 3.12$) and COE ($M = 2.52$) ($p = .00$), and CASNR ($M = 3.12$) and CHS ($M = 2.62$) ($p = .01$). The practical significance can be observed by the *mean differences* found between CASNR and A&S ($MD = 0.38$), CASNR and COE ($MD = 0.60$), and CASNR and CHS ($MD = 0.50$) (see Table 27).

Table 26

Analysis of Variance Summary Comparing Theme 2 Test Scores Between Students' Colleges, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
College	26.899	5	5.380	4.62	.00*
Error	601.502	516	1.166		
Total	5037.000	522			

*$p < .05$.

Table 27

A Description of Student Test Scores for Theme 2 by College during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
2	CASNR	124	23.8	3.12	0.9
4	A&S	133	25.5	2.74	1.2
6	COE	52	10.0	2.52	1.0
1	CEAT	115	22.0	3.13	1.0
5	CHS	45	8.6	2.62	1.1
3	SSB	53	10.1	2.91	1.1

A statistically significant difference was found between students' theme 3 test scores in Science, Technology, and Environment and their College $F(5, 514) = 3.09$, $p = .01$ (see Table 28). Specifically, statistically significant differences were demonstrated between CASNR ($M = 3.53$) and A&S ($M = 3.12$) ($p = .01$), CASNR ($M = 3.53$) and COE ($M = 3.04$) ($p = .02$), and

CASNR (M = 3.53) and CHS (M = 2.96) (p = .01). The practical significance can be observed by the *mean differences* found between CASNR and A&S (MD = 0.41), CASNR and COE (MD = 0.49), and CASNR and CHS (MD = 0.57) (see Table 29).

Table 28

Analysis of Variance Summary Comparing Theme 3 Test Scores Between Students' Colleges, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
College	25.587	5	5.117	3.09	.01*
Error	851.182	514	1.656		
Total	6566.000	520			

*p < .05.

Table 29

A Description of Student Test Scores for Theme 3 by College during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
1	CASNR	123	23.6	3.53	1.1
3	A&S	134	25.8	3.12	1.3
4	COE	51	9.8	3.04	1.3
1	CEAT	114	21.9	3.53	1.2
5	CHS	45	8.7	2.96	1.6
2	SSB	53	10.2	3.36	1.5

No statistically significant difference was found between students' college (see Table 30) and theme 4 test scores in Business and Economics (see Table 31).

Table 30

Analysis of Variance Summary Comparing Theme 4 Test Scores Between Students' Colleges, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
College	14.936	5	2.987	1.11	.35
Error	1355.499	505	2.684		
Total	1370.434	510			

Table 31

A Description of Student Test Scores for Theme 4 by College during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
2	CASNR	121	23.6	2.83	1.1
5	A&S	131	25.7	2.67	1.3
4	COE	51	10.1	2.71	1.2
1	CEAT	110	21.6	3.04	1.1
6	CHS	44	8.7	2.52	1.2
3	SSB	52	10.3	2.75	1.2

A statistically significant difference was found between students' theme 5 test scores in Food, Health, and Nutrition and their college $F(5, 519) = 3.94$, $p = .00$ (see Table 32). Specifically, statistically significant differences were noted between CASNR ($M = 2.49$) and A&S ($M = 2.10$) ($p = .00$) and CASNR ($M = 2.49$) and COE ($M = 1.91$) ($p = .00$). The practical significance can be observed by the *mean differences* found between CASNR and A&S ($MD = 0.39$) and CASNR and COE ($MD = 0.58$) (see Table 33).

Table 32

Analysis of Variance Summary Comparing Theme 5 Test Scores Between Students' Colleges, Fall Semester of 2012

	SS	*df*	*MS*	*F*	*p*
College	18.440	5	3.688	3.94	.00*
Error	486.371	519	0.937		
Total	3166.000	525			

*$p < .05$.

Table 33

A Description of Student Test Scores for Theme 5 by College during the Fall Semester of 2012

Rank		*f*	%	*M*	*SD*
1	CASNR	125	23.8	2.49	0.9
4	A&S	134	25.5	2.10	1.0
5	COE	52	9.9	1.91	1.0
2	CEAT	115	21.9	2.37	0.9
3	CHS	45	8.6	2.20	0.9
3	SSB	54	10.3	2.20	1.2

CHAPTER V

CONCLUSIONS

Introduction

The census study was devised to describe the agricultural literacy levels of incoming freshmen at OSU in the Fall semester of 2012. The American public is more removed from agriculture than ever before, and they know little to nothing about the food and fiber system (Blackburn, 1999; NRC, 1988; USFRA, 2011). It is essential that they receive information and education to make socially responsible decisions, which will, in turn, affect the agricultural industry (Foster et al., 1990; NRC, 1988; Pense & Leising, 2004). One of the avenues to distribute such information is through the land-grant institution, which is made up of three arms: research, education, and extension (Fribourg, 2005; NASULGC, 2008; Renne, 1960).

The study was framed using the human capital theory. Human capital is defined as the investment in a person's knowledge, skills, and experiences necessary for employment or overall well-being (Becker, 1964; Little, 2003; Shultz, 1971; Smith, 2010). Specifically, this study focused on human capital in terms of students' knowledge, skills, and experiences (Becker, 1964; Little, 2003; Serneels, 2008; Smith, 2010) *in* and *about* agriculture (NRC, 1988).

Purpose

The purpose of this census study was twofold: 1) assess the agricultural literacy of all incoming freshmen (N = 4,081) at Oklahoma State University in the Fall semester of 2012, and 2) compare students' scores on an agricultural literacy test against their selected personal characteristics. Three objectives guided the study.

Objectives

1. Describe the personal characteristics, such as gender, age, ethnicity, home state, home community size, participation in high school youth organization, number of agricultural education courses taken, and perceptions of agriculture, of incoming freshmen at Oklahoma State University.
2. Determine the agricultural literacy levels of incoming freshmen across all disciplines at Oklahoma State University in the Fall semester of 2012.
3. Determine the relationships between students' personal characteristics and their various levels of agricultural literacy.

Methods

To measure students' knowledge of agriculture, a 25-question criterion-referenced test was used. Specifically, the FFSL test, designed by Pense and Leising (2004) was employed to evaluate the agricultural literacy level of incoming freshmen at OSU during the Fall semester of 2012. Information was also recorded to determine relationships between students' personal characteristics and their level of agricultural literacy. Data were analyzed using means, standard deviations, frequencies, and percentages for descriptive statistics (Creswell, 2012). In addition, one-way ANOVAs and *t*-tests were used to assess interactions; however, these inferential statistics were used only to reflect the population and not to infer to other populations outside the one examined (M. Payton, personal communication, December 4, 2012).

Conclusions

The typical freshman student at Oklahoma State University during the Fall semester of 2012 was a white female from Oklahoma who held a 3.50-4.00 high school GPA and had not taken a high school agricultural education courses. In terms of the size of their home communities, the students were evenly distributed amongst the city, suburb, town, and rural. The freshmen were involved in various high school activities, although no specific club or organization dominated among all students.

The range of mean scores for all colleges was from 12.4 to 15.3 of the 25 questions. CASNR's mean score percentage was 61.2%, and was the highest mean score. Overall, the freshmen mean score on the agricultural literacy test was 56%, a finding that indicated these students do not even possess a *passing* knowledge of agriculture. This finding supports research conducted by Pense and Leising (2004) and Colbath and Morrish (2010) who found that students were not agriculturally literate, according to the FFSL benchmarks. Further, COE mean score percentage on the test was 50.8%. This finding of lower agricultural literacy scores among the students in COE supports the research done by Terry et al. (1992) who found that the mean score percentage on an agriculture test of teacher educators was 48.4%.

Statistically significant differences were found between CASNR and A&S, COE, and CHS, which refute the findings of Pense and Leising (2004) who found that agricultural education and general education students did not differ in their levels of overall agricultural knowledge. Males outscored females on the agricultural literacy test, which supports Colbath's and Morrish's (2010) findings who also found that male students expressed greater agricultural knowledge than did female students.

A statistically significant difference was noted between city and town and city and rural with students from a city scoring lower than those from a home community size equivalent to a

town or rural. This finding supports Frick, Birkenholz, Gardner, & et al. (1995) who found that rural high school students outscored the urban inner-city students on a test of agricultural knowledge.

Students who did not take agriculture courses in high school scored significantly lower than students who were enrolled in agriculture courses in high school. Similarly, a statistically significant difference existed in scores for those students who participated in FFA or 4-H during high school and those who did not. These findings support Colbath and Morrish (2010), Terry et al. (1992), and Wright et al. (1994) who found that students who took classes in a secondary agriculture or had agricultural experiences through an agricultural organization had greater agricultural literacy than those who did not.

Those students who perceived their previous agricultural knowledge as above average outscored students who perceived their previous agricultural knowledge as average or below average. Moreover, the students who perceived their previous agricultural knowledge as average outscored those students who perceived their previous agricultural knowledge as below average. In all, the participants' perceptions were accurate in regard to their knowledge of agriculture based on their test scores. This contradicts previous research that indicates "people regularly overestimate or underestimate their actual abilities" (Hoy & Spero, 2005).

Because investing in human capital leads to higher levels of employability, especially when that knowledge is sector specific (Scoones, 2000), it was important to determine if students who aspired to employment in the agricultural industry outscored those who did not. Somewhat surprisingly, no statistically significant difference was found between those students who had agriculturally related career aspiration paths and those who did not.

CEAT students outscored CASNR in theme 1 test scores in Understanding Food and Fiber Systems. CASNR students outscored A&S, COE, and CHS students in theme 2 test scores in History, Geography, and Culture and theme 3 test scores in Science, Technology, and

Environment. No statistically significant differences were found between the disciplines in theme 4 in Business and Economics. CASNR students outscored A&S and COE students in theme 5 test scores in Food, Health, and Nutrition.

Recommendations for Future Research

Although this study focused on the incoming freshmen class at OSU during the Fall semester of 2012, additional research should be conducted to examine the literacy levels of other classes, including all graduating seniors. Further, these students should be followed and assessed periodically to determine the impact that their education at a LGU had on their knowledge and understanding of agriculture. Further research should also test students at the end of their freshmen year with a parallel assessment to compare their knowledge gain with a final test for the same students as seniors to determine growth in agricultural literacy when matriculating from a land-grant institution.

This study should be replicated at other institutions with different freshmen populations. Specifically, students at LGUs should be compared to students at non-LGUs to determine the amount of agricultural literacy they bring to and exit with from a four-year college. Because much of the existing research focuses on students, additional research should be conducted on the agricultural literacy of adult citizens with an updated test, which would assess agricultural literacy in a more current context. The mission of the NRC (1988) Committee on Agricultural Education in Secondary Schools was to improve the agricultural literacy of all U.S. citizens. This study should be replicated with adults who are consumers of agricultural products, as well as those who help make important decisions on behalf of the American public such as congressional representatives and state legislators.

Because human capital served at the conceptual framework for this study, it is important to note that only knowledge (education) was tested; however, human capital is also measured by a

person's skills and experiences (Becker, 1964; Little, 2003; Shultz, 1971; Smith, 2010). Research should be done to explain better the role that each component plays in building a person's human capital. Due to the fact that emotions play a big part in determining the type of knowledge people acquire about a specific subject, the agricultural industry should attempt to measure the effect that certain experiences in agriculture have on peoples' knowledge of agriculture (Nordstrom et al., 2000).

Because knowledge can be measured in ways other than a criterion-referenced test, it is recommended that different instruments be used in conjunction with a cognitive test to measure students' and consumers' perceptions together with their emotional intelligence (Smith, Higgs, & Ellis, 2008). Various decisions made by people "are informed by emotional responses because that is what emotions are designed to do: to appraise and summarize an experience and inform [a person's] actions" (Lamia, 2010, para. 1). Therefore, a revised instrument should include questions that pertain to the emotional side of agricultural literacy, as well as investigate the sources from which people gather information about agriculture (Holloway, 2004; Verbeke, 2005). In addition, research should be conducted to measure not only where agricultural information is being acquired, but also where and how consumers use it (Verbeke, 2005).

Recommendations for Future Practice

It is evident from the study's findings that the dissemination of agricultural literacy is still a *work in progress.* Although an increase in providing more agriculturally-infused curriculum for K-12 has occurred during the last three decades, this study found that students were either not learning the concepts, or not retaining this information.

Because criterion-referenced tests are used often for credentialing, an introduction to agricultural literacy course should be offered at Oklahoma State University for all incoming freshmen. Students should be given a pre-test and a post-test, and if deemed proficient at end of

the course, a certificate of agricultural literacy should be awarded. Potential educational content areas should include history of agriculture, globalization of agriculture, animal agriculture practices, environmental literacy, sustainable agriculture practices, food production, and the economics of agriculture. Further, experiences and skill development opportunities should be offered throughout the course including utilizing agricultural research stations, farms, and related facilities in and around Stillwater, Oklahoma.

Specific disciplines in CASNR should collaborate and identify industry needs that could be offered to students seeking future careers in those sectors. Because people need to invest in human capital that will affect their careers directly (Scoones, 2000), CASNR should consider offering a course in agricultural literacy, focused on specific disciplinary issues and needs. In fact, this course could be added to the existing freshmen orientation course offered to CASNR freshmen by extending it into a semester-long course. Moreover, there should be one or more topics on general agricultural knowledge in the course to assist in educating students about the industry as a whole. In addition to the course, educators should consider using instructional technology to increase knowledge and emphasize good practices with agricultural workers and those interested in learning *about* agriculture (Mathiasen, Morley, Chapman, & Powell, 2012). One tool that should be considered when developing courses is the use of training videos (Mathiasen et al., 2012) and other forms of educational technology that would be appropriate for the digital natives of today (Bunch, 2012; Prensky, 2001).

Increasing education in sector specific skills (Scoones, 2000) would increase agricultural knowledge and build students' human capital. This supposition supports Walters' (2004) findings that graduates who possess qualifications that match employers' needs experience a stronger connection between their collegiate instruction and their employment.

It is important to focus on increasing agricultural literacy of those students in the COE. Nordstrom et al. (2000) found that "placing an emphasis on educating students in their early stages of education (elementary and middle school) could reduce the efforts necessary to educate adult members of the public" (para. 18). The findings supported Terry et al. (1992) who recommended that further efforts should be made to guide and motivate teachers who are attempting to integrate agriculture into their curricula. This facilitation could begin at the pre-service teacher preparation level with a community of practice (Wenger, 1998; Yamagata-Lynch, 2001) among agricultural education students, elementary education, and other secondary education students. Specifically, the agricultural education department at OSU should consider pairing CASNR students with COE students to develop lesson plans that support learning about the food and fiber system. This partnership would allow for cooperative learning to occur in building curriculum for K-12 that is infused with and enriched by agriculture (Hess & Trexler, 2011). The exchange of ideas would be beneficial to both students and add triangulation in the efforts to raise agricultural literacy and COE students' self-efficacy in terms of teaching agriculturally infused lessons (Harris & Birkenholz, 1996).

Although the overall mean scores for students were below average (see Table 13), it is important to focus in on the areas and themes where more emphasis should be placed (Kovar & Ball, 2013). The highest mean score of the five themes was theme 3, Science, Technology, and Environment (M = 3.29). The lowest mean score was theme 5, Food, Health and Nutrition (M = 2.25). New and existing agricultural literacy curriculum should increase its focus on improving students' knowledge in the area of food, health, and nutrition to boost knowledge in that area, as well as look into more ways to incorporate aspects of themes 1, 2, and 4.

Because agriculture is ever changing and evolving, the FFSL test should be enhanced to capture updated fields and issues in the industry, which also could be used with older demographic populations in addition to college students. The green energy initiative has swept

through the United States in the past few years. Therefore, some topics that might be added include climate change, biotechnology, Farm Bill topics and sustainable agricultural practices (Kovar & Ball, 2013).

Nordstrom et al. (2000) stated that "educational materials should be developed for all sectors of society" (para. 20). Mechling (1997) indicated the need to "increase agricultural awareness and knowledge among diverse community audiences" (para. 1). Therefore, to educate adult citizens outside the K-12 or post-secondary classroom, it is recommended that agricultural communicators and extension educators work together with agricultural educators to develop and provide adult literacy programs. Because many adults do not have the required education, it is essential to utilize various distribution methods to provide them with agricultural information, such as television, radio, and newspapers (Nordstrom et al., 2000; Van Scotter, 1991), and the Internet.

In addition to educating citizens, it is important for all sectors of the agricultural industry to work together to promote positive images of agriculture through liaisons and volunteers who are agriculturally literate. "Agriculture must become articulate in its relations with the public" (Thompson, 1999, p. 374). Consumers need access to information and education about the agricultural industry to make informed decisions (Foster et al., 1990; Johnson & Jorgenson, 2006; NRC, 1988; Pense & Leising, 2004; Turnbull, 2002). The agricultural industry must become more proactive in the agricultural literacy movement and stop allowing misrepresentations of the industry to be the primary source of information and education for many citizens.

Implications and Discussion

The general demographic profile of the participants in this study in regard to gender, ethnicity, and home college is fairly consistent with the 2012-2013 student body information for Oklahoma State University (IRIM, 2012). However, the proportion of CASNR students is much

higher at 23.8% compared to the general student body, which is 9.9% (IRIM, 2012). This could be because the subject line of the researcher's email message was, "Do You Know Agriculture? A Study of Incoming Freshmen," which may have attracted more interest from CASNR students. Conclusions and results can only be generalized to the population of incoming freshmen students at Oklahoma State University in the Fall semester of 2012.

Although CASNR students outperformed every other college statistically, the standard deviations were high. In fact, the standard deviation score for CASNR students almost doubled those of other colleges. Therefore, it could be implied that the range of scores was skewed because of drastic differences in students' knowledge about agriculture, which could be attributed to students' previous knowledge, skills, and experiences in agriculture being high or low prior to declaring an agricultural major in CASNR.

A statically significance between male and female scores was found (see Table 15), with males having higher mean scores. This could be explained by the findings that males frequently outscore females on science-based tests (Louis & Mistele, 2011). Ricketts, Duncan, and Peake (2006) indicated agriculture is the "world's oldest science" (p. 48). Further, Wilson and Curry (2011) stated, "[t]he integration of science and agricultural education has been a point of discussion and practice since the genesis of secondary agricultural education" (p. 136). Therefore, perhaps this is the reason male students scored higher on the FFSL test.

With the overall mean scores on the agricultural literacy test being below average, it could be surmised that efforts to infuse agriculture into K-12 curriculum are either non-existent or not being carried out successfully. If agricultural concepts should be taught in primary and secondary school settings, more of a push should ensue to ensure that future educators in the COE are attaining the information and tools they need to create and teach lessons that are infused properly with agricultural facts, principles, and concepts.

Research shows that it is important for a person to invest in education and experiences, which will relate to future success and satisfaction in their career (Little & Singh, 1992; Walters, 2004). However, no statically significant differences were found between those who were pursuing an agriculturally-related career and those who were not. Could the type of students who desire an agriculturally related-career be doing so without prior knowledge, skills, or experience in the field? If so, what caused them to choose agriculture as a career? Is 61.2% an acceptable agricultural literacy score for students who are seeking a bachelor degree in agriculture? If not, what can be done to educate students better during their secondary schooling who may be interested in seeking an agriculturally-related job thereafter?

Students from a home community size of town or rural outperformed those from a city. This could be attributed to the fact that students from a town or rural area were exposed to more agricultural practices and had a chance to develop skills through working on a family farm or had hands-on experiences in agricultural education, FFA, and 4-H programs. It also may be traced back to a stronger presence of an agricultural education program in students' school systems. Smaller schools possibly allowed for more collaboration between core education class instructors and the agricultural education instructors around formal or informal learning experiences.

The majority of participants (96%) self-reported a 3.00 to 4.00 high school GPA; however, the average score on the FFSL test across all the colleges at OSU was a 56% (M = 14.12). With such an elevated or potentially inflated high school GPA among the participants, it is peculiar that the overall mean score on the agricultural literacy test was below average. Further, it begs the question of what was or was not taught throughout the primary and secondary schooling of these students in regard to agriculture, food, and fiber? It could be assumed that the highest achieving students would produce a passing grade, but the findings of this study did not support that. Were programs like AITC being utilized in the K-12 setting? If so, why did

students not retain the information they would have potentially learned more from those experiences?

As a land-grant institution that was established to teach agriculture and industrial concepts (Foster et al., 1990; NASULGC, 2008; Renne, 1960), should OSU put more effort into ensuring that those students who do not have experience and skills in agriculture are given the opportunity to take a general or specific course on food and fiber? This study found that students perceived agriculture to be an important part of society and national security. Moreover, they reported a willingness or desire to learn more about it during their collegiate career. Forty-two percent (see Table 10) of the freshmen self-reported that they had *below average* knowledge about agriculture. Nevertheless, 97% of the freshmen respondents *strongly agreed* or *agreed* that agriculture plays an important role in U.S. society (see Table 10). Further, 61.3% of the freshmen thought it was *extremely important* or *very important* for students to take a general education course on agriculture, food, and fiber (see Table 11), and 84.5% of students reported that they would like to learn more about agriculture as a student at Oklahoma State University (see Table 12). This indicates the strong need that exists for this land-grant institution, and perhaps others, to offer a general education course focusing on agricultural literacy.

With the world population reaching 9 billion by 2050, the need exists for increased agriculture production (Blackburn, 1999; Hodges, 2005; Johnson & Jorgenson, 2006; Sayers, 2011). Therefore, an imminent need also exists for all citizens to be educated about the food and fiber system that supports our *collective food web*. It is not the responsibility of one entity within the agricultural industry to bear this burden, rather the industry, as a whole, should be taking small and large steps to promote and educate consumers about the source of their food and fiber—agriculture.

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APPENDICES

Appendix A

IRB Approval Letter

PARTICIPANT INFORMATION
OKLAHOMA STATE UNIVERSITY

Title: An Assessment of the Agricultural Literacy of the Incoming Freshmen Class at a Land Grant University in the 21st Century

Investigator(s): Cameron K. Jones, Bachelors of Science in Agricultural Education

Purpose: The purpose of the research study is to investigate freshmen students' awareness of and appreciation for agriculture according to their college major.

What to Expect: This research study is administered online. Participation in this research will involve completion of two questionnaires. The first questionnaire will ask for your knowledge on concepts related to and about agriculture and natural resources. The second questionnaire will ask for demographical information that pertains to your background. You must complete each question before moving on to the next. You will be expected to complete the questionnaire once. It should take you about 15 minutes to complete.

Risks: There are no risks associated with this project which are expected to be greater than those ordinarily encountered in daily life.

Benefits: Participating in this study will produce information, which will be helpful to faculty at this institution in terms of whether or not to consider offering a course to all incoming freshmen pertaining to general agricultural context. Students will also develop an understanding about the amount of technical knowledge they possess, which might lead them to take up a minor in an area of agriculture.

Compensation: You will have the opportunity to enter into a drawing for one of 50 gift cards to one of the following: Eskimo Joe's, Quench-Bud's, or iTunes. This drawing will take place September 13, 2012. Winners will be contacted September 13, 2012 through the email they provided at the end of the second questionnaire.

Your Rights and Confidentiality: Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time, without penalty.

Confidentiality: All information about you will be kept confidential and will not be released. Questionnaires and record forms will have identification numbers, rather than names, on them. The email you enter for the drawing is kept separate from all responses related to either questionnaire. You will not be identified individually; we will be looking at the group as a whole.

Contacts: You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Cameron Jones, B.S., 405-919-7842 or cameron.jones@okstate.edu; or Shane Robinson, Ph.D., Dept. of Agricultural Education, Communications & Leadership, 457 Agricultural Hall, Stillwater, OK 74078, 405-744-3094 or

shane.robinson@okstate.edu. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

If you choose to participate: Please, click NEXT if you choose to participate. By clicking NEXT, you are indicating that you freely and voluntarily and agree to participate in this study and you also acknowledge that you are at least 18 years of age.

It is recommended that you print a copy of this consent page for your records before you begin the study by clicking below.

Appendix B

First Email Correspondence

Congratulations!

You have been selected as an incoming freshman at Oklahoma State University to participate in a brief online survey that will enter you into a drawing for your chance at one of 50 gift cards.

This online survey is a part of a research study looking at the agricultural literacy of OSU freshmen in the fall 2012 class. Your input will provide valuable information that will be used to inform university administration and faculty on ways to enhance future general courses and curriculum.

The online questionnaire will consist of two parts taking a total of 15-20 minutes. The first part will consist of questions about agriculture and natural resources. The second part will be about your background information. Your participation is strictly voluntary, but would be greatly appreciated.

In no way will your answers influence your future time at OSU, nor will any personal identifiers be linked with the information and answers you provide.

If you choose to participate in the survey, you will be entered into a drawing for one of the 50 gift cards to Eskimo Joe's, Quench-Bud's, and Apple iTunes and will be contacted through the email address you will be asked to enter at the end of the questionnaire.

If you have any questions or concerns, please contact Cameron Jones at 405-919-7842 or cameron.jones@okstate.edu.

If you are willing to participate, please follow the link below.

https://okstatecasnr.qualtrics.com/SE/?SID=SV_77H9zkYByIEzaAZ

Appendix C

Second Email Correspondence

Don't miss your opportunity to take part in this study and be entered into a drawing for one of 50 gift cards!

As an incoming freshman at Oklahoma State University, you have been selected to participate in a brief online survey. This online survey is a part of a research study looking at the agricultural literacy of OSU freshmen in the fall 2012 class. Your input will provide valuable information that will be used to inform university administration and faculty on ways to enhance future general courses and curriculum.

The online questionnaire will consist of two parts taking a total of 15-20 minutes. The first part will consist of questions about agriculture and natural resources. The second part will be about your background information. Your participation is strictly voluntary, but would be greatly appreciated.

In no way will your answers influence your future time at OSU, nor will any personal identifiers be linked with the information and answers you provide.

If you choose to participate in the survey, you will be entered into a drawing for one of the 50 gift cards to Eskimo Joe's, Quench-Bud's, and Apple iTunes and will be contacted through the email address you will be asked to enter at the end of the questionnaire.

If you have any questions or concerns, please contact Cameron Jones at 405-919-7842 or cameron.jones@okstate.edu.

If you have not taken the survey and are willing to participate, please follow the link below.

https://okstatecasnr.qualtrics.com/SE/?SID=SV_77H9zkYByIEzaAZ

Thank you for your time and attention.

Appendix D

Final Email Correspondence

Don't miss your last opportunity to take part in this study and be entered into a drawing for one of 50 gift cards!

As an incoming freshman at Oklahoma State University, you have been selected to participate in a brief online survey. This online survey is a part of a research study looking at the agricultural literacy of OSU freshmen in the fall 2012 class. Your input will provide valuable information that will be used to inform university administration and faculty on ways to enhance future general courses and curriculum.

The online questionnaire will consist of two parts taking a total of 15-20 minutes. The first part will consist of questions about agriculture and natural resources. The second part will be about your background information. Your participation is strictly voluntary, but would be greatly appreciated.

In no way will your answers influence your future time at OSU, nor will any personal identifiers be linked with the information and answers you provide.

If you choose to participate in the survey, you will be entered into a drawing for one of the 50 gift cards to Eskimo Joe's, Quench-Bud's, and Apple iTunes and will be contacted through the email address you will be asked to enter at the end of the questionnaire.

If you have any questions or concerns, please contact Cameron Jones at 405-919-7842 or cameron.jones@okstate.edu.

If you have not taken the survey and are willing to participate, please follow the link below.

https://okstatecasnr.qualtrics.com/SE/?SID=SV_77H9zkYByIEzaAZ

Thank you for your time and attention.

Appendix E

Updated FFSL Test

1. How knowledgeable do you consider yourself to be about agriculture?

   (i.e. the production, processing, marketing, and distributing of animal and plant products; the economic impact of agriculture; its societal significance; agriculture's important relationship with natural resources and the environment; public agricultural policies; and the global significance of agriculture)

   a. Above average
   b. Average
   c. Below Average

2. What nutrient develops and repairs the human body organs and tissues?
   a. Carbohydrates
   b. Minerals
   c. Proteins
   d. Vitamins

3. What renewable natural resources are necessary for agricultural production?
   a. Air, water, fertilizer, and sunlight
   b. Soil, air, sunlight, and water
   c. Soil, air, water, and fertilizer
   d. Water, sunlight, organic matter, and air

4. What would be impacted by energy shortages/surpluses in the United States?
   a. Banana production
   b. Cross cultural relations
   c. Food prices
   d. Food safety

5. In Columbus' first voyage to America, his intent was to obtain what commodities?
   a. Sugar and spices
   b. Iron ore
   c. Silver and gold
   d. Corn and potatoes

6. What is the primary cause of food safety problems in the United States?
    a. Confusing regulations
    b. Improper food handling and preparation
    c. Improper food processing
    d. Improper use of antibiotics in animals

7. Which of the following actions or procedures *will likely inhibit* international trade if placed on an agricultural commodity?
    a. Letter of Credit
    b. North America Free Trade Agreement
    c. Product labeling
    d. Tariff

8. What technological innovation has the potential to increase plant resistance to disease and insects, and decrease food and fiber production costs?
    a. Cloning
    b. Genetic engineering
    c. Hydroponics
    d. Integrated pest management

9. In what way are wheat farmers most likely to increase their profits?
    a. Organize a marketing cooperative to export more of their wheat to developing countries
    b. Plant more acres of soybeans on the best land available
    c. Use vertical integration to process their raw wheat into flour, frozen dough, and other food products
    d. Use genetic engineering to develop new and improved wheat varieties

10. How has new technology in agriculture impacted the United States?
    a. Increased food prices and increased number of available food products
    b. Increased the number of people employed in farming and ranching, and decreased labor required
    c. Reduced access to new equipment for most farmers, and decreased cost of production
    d. Reduced required physical labor and increased production

11. What are the benefits of eating a balanced diet?
    a. Prevents nutritional diseases
    b. Increases the number of hour of sleep required
    c. Increases physical fitness
    d. Lowers food cost

12. How does the percentage of the population working directly in farming and production agriculture in the United States to other countries?
    a. Declining compared to less developed countries of the world
    b. Greater than in less developed countries of the world
    c. Greater than other developed countries of the world
    d. Increasing due to population growth and the increasing demand for food

13. The outbreak of a contagious animal disease in Taiwan would likely bring what type of response from the United States Government?
    a. Increase the tariff on meat imports from Taiwan
    b. Stop imports of meat and meat by-products from Taiwan
    c. Quarantine sick animals in Taiwan
    d. Require vaccination of animals in the United States against disease

14. Which of the following food combinations best describes a balanced meal using the four basic food groups?
    a. Milk, granola, grapefruit, and bread
    b. Broccoli, biscuits, peaches, and lamb
    c. Eggs, milk, pancakes, and orange juice
    d. Steak, toast, butter, and eggs

15. How have the U.S. agricultural technologies and conservation practices impacted other countries?
    a. Improved seed varieties and introduced efficient farm machinery
    b. Improved seed varieties and introduced organic fertilizers
    c. Improved seed varieties an encouraged manual harvesting
    d. Improved seed varieties and encouraged synthetic rubber

16. What governmental agency regulates fertilizers, pesticides, and herbicides?
    a. National Institute of Food and Agriculture (NIFA)
    b. Health and Human Services (HHS)
    c. Food and Drug Administration (FDA)
    d. Environmental Protection Agency (FDA)

17. What factors made is possible for the early Americans to establish settlements rather than pursue the wandering lifestyle of hunter/gatherers?
    a. Ability to produce food
    b. Abundance of wildlife
    c. Fur trading
    d. Trade with Native Americans

18. What supports plant growth and represents the living reservoir that buffers the flow of water, nutrients, and energy through an ecosystem?'
    a. Worms
    b. Air
    c. Sunlight
    d. Soil

19. What factor contributed most to the western expansion of the United States?
    a. Available capital
    b. Available labor
    c. Available land
    d. Available water

20. A genetically modified corn plant has been developed with natural resistance to pest. What type of agricultural business will be affected most directly by this new technological advancement?
    a. Agricultural chemical company
    b. Feed and milling company
    c. Tractor and equipment dealership
    d. Veterinary supply store

21. Which of the following government agencies regulates food handling, preparation, and storage?
    a. Environmental Protection Agency (EPA)
    b. Food and Drug Administration (FDA)
    c. Natural Resource Conservation Service (NRCS)
    d. National Institute of Food and Agriculture (NIFA)

22. What is an essential part of the Food and Fiber System?
    a. Consumer demand
    b. Consumer supply
    c. Natural resources
    d. Value-added products

23. When other countries adopted new technologies for growing wheat, what was the effect on wheat growers in the United States?
    a. United States wheat growers lost the production advantage in the world wheat market
    b. United States wheat growers lost the processing advantage in the world wheat market
    c. United States wheat growers gained a production advantage in the world wheat market
    d. United States wheat growers gained a processing advantage in the world wheat market

24. Why were past predictions that agriculture would not be able to meet the world's demand for food inaccurate?
    a. Average farm size increased
    b. Cost of food significantly increased
    c. New technology was introduced
    d. World population growth slowed

25. How did the North American Free Trade Agreement (NAFTA) impact United States' trade with other countries?
    a. Decreased trade with Mexico and Canada
    b. Increased trade with Mexico and Canada
    c. Slowed trade with Canada but accelerated trade with Mexico
    d. Slowed trade with Mexico but accelerated trade with Canada

26. What components does Agriculture include?
    a. Farming, distribution, and research of food, clothing, and shelter
    b. Production and regulation of food, clothing and shelter
    c. Production, processing, and selling of food, clothing, and shelter
    d. Production, processing, marketing, and distribution of food and fiber

Appendix F

Departments within each Discipline

College of Agricultural Sciences and Natural Resources

- Agricultural Economics; Agricultural Education, Communications, and Leadership; Animal Science, Biochemistry and Molecular Biology; Biosystems and Agricultural Engineering; Entomology and Plant Pathology; Horticulture and Landscape Architecture; Natural Resource Ecology and Management; Plant and Soil Sciences

College of Arts and Sciences

- Aerospace Studies; Art, Graphic Design, and Art History; Botany; Communication Sciences and Disorders; Chemistry; Computer Sciences; English; Foreign Languages; Geography; Geology; History; Mathematics; Media and Strategic Communications; Microbiology and Molecular Genetics; Military Science; Music; Philosophy; Physics; Political Science; Psychology; Sociology; Statistics; Theatre; Zoology

College of Education

- Health Education and Promotion; Leisure Studies; Physical Education; Aerospace Administration and Operations; Career and Technical Education; Elementary Education; Secondary Education

College of Engineering, Architecture, and Technology

- Architecture; Chemical Engineering; Civil and Environmental Engineering; Construction Management Technology; Electrical and Computer Engineering; Electrical Engineering Technology; Engineering Technology; Fire Protection and Safety Technology; Industrial and Safety Technology; Industrial Engineering and Management; Materials Science and Engineering; Mechanical and Aerospace Engineering; Mechanical Engineering and Technology

College of Human Sciences

- Design, Housing, and Merchandising; Human Development and Family Science, Hotel and Restaurant Administration, Nutritional Sciences

Spears School of Business

- Accounting; Economics and Legal Studies; Entrepreneurship; Finance; General Business; International Business; Management; Management Science and Information Systems; Marketing

Appendix G

Majors in College of Agricultural Sciences and Natural Resources

- Agribusiness
- Agricultural Communications
- Agricultural Economics
- Agricultural Leadership
- Animal Science
- Biochemistry and Molecular Biology
- Biosystems Engineering
- Entomology
- Environmental Sciences
- Food Science
- Horticulture
- Landscape Architecture
- Landscape Management
- Natural Resource Ecology and Management
- Plant and Soil Science

Appendix H

Majors in College of Arts & Science

- American Studies
- Art
- Biochemistry and Molecular Biology
- Biology
- Botany
- Communication Sciences and Disorders
- Chemistry
- Computer Sciences
- Economics
- English
- Foreign Languages and Literature
- Geography
- Geology
- History
- Liberal Studies
- Mathematics
- Media and Strategic Communications
- Microbiology and Molecular Genetics
- Music
- Philosophy
- Physics
- Political Science
- Psychology
- Sociology
- Statistics
- Theatre
- Zoology

Appendix I

Majors in Spears School of Business

- Accounting
- Economics and Legal Studies
- Entrepreneurship
- Finance
- General Business
- International Business
- Management
- Management Science and Information Systems
- Marketing

Appendix J

Majors in College of Education

- Health Education and Promotion
- Leisure Studies
- Physical Education
- Aerospace Administration and Operations
- Career and Technical Education
- Elementary Education
- Secondary Education

Appendix K

Majors in College of Engineering, Architecture, and Technology

- Aerospace Engineering
- Architectural Engineering
- Architecture Design
- Biosystems and Agricultural Engineering
- Chemical Engineering
- Civil and Environmental Engineering
- Computer Engineering
- Construction Management Technology
- Electrical Engineering
- Electrical Engineering Technology
- Fire Protection and Safety Technology
- Industrial Engineering and Management
- Mechanical Engineering
- Mechanical Engineering Technology

Appendix L

Majors in College of Human Sciences

- Allied Health
- Apparel Design and Production
- Child and Family Services
- Community Nutrition
- Dietetics
- Dietetics and Exercise
- Early Childhood Education
- Family and Consumer Sciences Education
- Hotel and Restaurant Administration
- Human Nutrition/Premedical Science
- Interior Design
- Merchandising
- Nutrition and Exercise
- Pre-Law

VITA

Cameron Jones

Candidate for the Degree of

Master of Science

Thesis: AN ASSESSMENT OF AGRICULTURAL LITERACY: WHAT INCOMING FRESHMEN KNOW AT OKLAHOMA STATE UNIVERSITY ABOUT THE FOOD AND FIBER SYSTEM?

Major Field: Agricultural Education

Biographical:

Education:

Completed the requirements for the Master of Science in Agricultural Education at Oklahoma State University, Stillwater, Oklahoma in May, 2013.

Completed the requirements for the Bachelor of Science in Agricultural Education at Oklahoma State University, Stillwater, Oklahoma in 2011.

Experience:

January 2012-Present
Graduate Assistant
OSU Department of Agricultural Education, Communications and Leadership
Oklahoma State University

- Constructed and demonstrated various lesson plans for agriculture teachers and extension agents on wind energy and agricultural communications
- Researched agricultural literacy levels of incoming freshmen at OSU
- Coordinated the departmental transfer recruiting event, "I Want to Teach Ag Day" for 40 transfer students in 2012 and 15 students in 2013
- Served as a teaching assistant for the AGED 4113_Labratory Instruction in Agricultural Education

Professional Memberships:

- Agricultural Education, Communications, & Leadership Graduate Student Association, 2010 – Present
- Alpha Tau Alpha, 2008 – 2011
- Phi Kappa Phi Honor Society, 2009 – Present
- Mortar Board Honor Society, 2010 – Present