AN ASSESSMENT OF AGRICULTURAL KNOWLEDGE OF KINDERGARTEN THROUGH SIXTH GRADE

TEACHERS

Ву

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Bachelor of Science University of California Davis Davis, California 1993

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Submitted to the faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
May, 2002

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ACKNOWLEDGMENTS

In education as in national and world affairs, history teaches us that in times of desperation we have a tendency to look for global, charismatic, single solutions to very serious problems. Only after these fail - often at great cost - are we prepared to look for solutions that are more firmly based in reality (Chall, 1989, p. 532).

I would like to acknowledge the many persons whose cooperation and assistance helped make this study possible.

Sincere appreciation is expressed to Dr. James G. Leising for your advice, professionalism, teaching and research opportunities, and support throughout my time at OSU. More importantly, thank you for all the lunches with Seb and I.

Special thanks to Dr. James White who taught me how to wordsmith and who has demonstrated the strength to persevere.

Special thanks to Dr. P. Larry Claypool. You always made time in your day to go over data, demonstrated extreme patience, and built a strong foundation for my statistical endeavors.

Special thanks to Dr. Charles Cox, Jamie Allen, and Pat Thompson for allowing me to pilot test my instrument during your summer AITC workshops.

Special thanks to Dr. James P. Key for being so flexible with your schedule at the last minute. In addition, thank you for asking all the right questions.

I also wish to express my deep and sincere appreciation to Oklahoma State

University and the people of this great state and the nation for helping me finance this degree.

Sincere appreciation is expressed to the program directors and teachers of Agriculture in the Classroom in Arizona, Montana, New York, and Oklahoma that participated in this study. In addition, appreciation is expressed to Elizabeth, Bonnie, and Kellie for all their hard work and organization.

A special expression of love and gratitude is expressed to my parents, Ernest and Linda Portillo, to my brother, Trek Portillo, and to my in-laws, Mike and Nancy MacKinnon.

Lastly, I wish to express my unconditional love to my beautiful wife, Dr. Erin M. Portillo, DVM. To you, this work is dedicated.

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CHAPTER I

INTRODUCTION

In the 1971 book, *Future Shock*, futurist, Alvin Tofler diagnosed society's inability to adapt to an exponential bombardment of change. "There are discoverable limits to the amount of change that the human organism can absorb, and that by endlessly accelerating change without first determining these limits, we cannot tolerate" (p. 326). For Tofler, the cause of this colossal change was technology, whereby societies, like individuals, cannot adapt to physical and psychological stresses placed upon it suddenly and continuously.

As a follow up, Tofler (1980) wrote *The Third Wave*. Tofler illustrated the 'first wave' as the dawning of a new civilization by the invention of agriculture. Nomadic tribes became sedentary and soon were able to feed large amounts of people, in which, agrarian societies developed, grew, and prospered. Adoption to new forms of technology was slow.

"Enter the machines with all their blessings and curses" (Mautz, 2000, p.1). The 'second wave' manufactured itself from agrarian societies and built the foundation for the trusses of the industrial age. Agricultural commodities became less expensive and were made more available by the inventions of Edward Cartwright (power loom), Eli Whitney (cotton gin), Luther Burbank (improved varieties), John Deere (steel cast plow), Cyrus McCormick (mechanical reaper), Thomas Jefferson (moldboard plow), and Jethro Tull

(improved agronomic practices), etc. (Mautz, 2000). As a result, less of the population was required to maintain strong ties to agriculture and to retain agricultural skills.

In the early sixties, Tofler saw the struggle beginning between the second wave with a new wave. This 'third wave' had programmed itself into the fabric of everyday life.

As a result, this wave had copied and continues to paste change at alarming rates.

One way to measure the advance of technology is to measure the time it takes society to adopt a given technology. It took 38 years for the telephone to achieve 10 million users in the United States. The fax machine required only 22 years, the personal computer seven years, and the World Wide Web only three years ...

Many say the amount of knowledge in the world is doubling approximately every 12 months and will continue to do so. (National Council for Agricultural Education, 1998a, p. 1).

For Tofler, society had entered into a techno-revolution, a digital age, the age of information. With the introduction of computer technology into the national economy and the end of the cold war, the United States in the 1980's was clearly undergoing the effects of Tofler's 'third wave.'

In the agricultural sector, the 'third wave' had exacerbated declining profitability and international competitiveness of American agriculture, which resulted in demographic changes of the American farm. Recognizing these changes occurring in agriculture, the National Research Council (NRC) commissioned a Committee on Agricultural Education in Secondary Schools in 1985 "...to assess the contributions of instruction in agriculture to the maintenance and improvement of U.S. agricultural productivity and economic competitiveness here and abroad" (p. v). In 1988, findings by

the Committee on Agricultural Education in Secondary Schools reported agricultural education's curriculum as primarily emphasizing occupational skill development. Primary recommendations were to broaden the agricultural education curriculum and to develop more competent teachers.

Ten years later, the National Council for Agricultural Education (NCAE) published *Reinventing Agricultural Education for the Year 2020* in which NCAE envisioned a reinvented agricultural education for the year 2020. This reinvented agricultural education broadened the definition of agriculture and acknowledged that a new agricultural education included "the fundamental needs of society...which begins in early childhood and continues throughout life" (NCAE, 1998b, p. 1).

Are the fundamental needs of society being met today? Research findings from Frick, Birkenholz, Gardner, and Machtmes (1994) supported the need for elementary and secondary education about agriculture (see also Horn & Vining, 1986; Williams & White, 1991). Also, research findings from Elliot (1999) supported the need for adult education about agriculture (see also Flood & Elliot, 1994; Frick, Birkenholz, & Machtmes, 1995a; McBlair & Shelhamer, 1996; Ryan & Lockaby, 1996; Vestal & Briers, 1999).

Since research findings indicated the need for elementary, secondary, and adult education about agriculture in order to meet the fundamental needs of society, what were the levels of agricultural knowledge of classroom teachers? Cox (1994) found that the majority of Oklahoma fourth grade teachers failed to select the correct response in an agricultural knowledge assessment. Therefore, how will future generations make wise choices about food, agriculture and the environment?

Of the 51 members in the United States House of Representatives who made up the House Committee on Agriculture in 2002, 33 representatives (65%) stated no experience or background in agriculture on their official web sites (United States House of Representatives, 2002). Of the 21 senators who made up the United States Senate Committee on Agriculture, Nutrition, and Forestry in 2002, 15 senators (71%) stated no experience or background in agriculture on their official web sites (United States Senate, 2002). This was astonishing because their jurisdiction covers subjects related to almost 15 percent of the United States gross domestic product (Commission on 21st Century Production Agriculture, 2001). Given the importance of agriculture to the general economy and our personal lives, how much agricultural knowledge should each person possess?

Statement of the Problem

"America's food and fiber systems determine the nations' general welfare and standard of living. Today, nearly ninety percent of the population is two or three generations removed from direct contact with food and fiber production" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, p. 4). Since future decision-makers will learn primarily from their formal education teachers, society needs kindergarten through sixth grade teachers who are agriculturally literate. Therefore, a need exists to educate teachers about agriculture so future generations can make wise choices about food, agriculture and the environment.

Purpose of the Study

The purpose of this study was to assess the agricultural knowledge of selected kindergarten through sixth grade teachers. This study also sought to describe selected personal characteristics of those teachers and to explore the nature and strength of relationships among those teacher characteristics and their agricultural knowledge.

Objectives of the Study

To accomplish the purpose of this study, the following objectives were established:

- 1) To describe teacher characteristics of Agriculture in the Classroom (AITC) trained teachers and non-AITC trained teachers.
- 2) To develop an appropriate instrument to compare agricultural knowledge differences between AITC trained teachers and non-AITC trained teachers across the five thematic areas of the Food and Fiber Systems Literacy (FFSL) Framework.
- 3) To describe the relationship between agricultural knowledge and teacher characteristics.
- 4) To describe resources and materials used by AITC trained teachers to teach about agriculture.

Scope of the Study

The scope of this study included selected kindergarten through sixth grade teachers in the states of: Arizona, Montana, Oklahoma, and Utah during the 2001-2002 school year.

Limitations of the Study

The following limitations were made in conducting this study:

- 1) States differed by type of AITC training teachers received.
- 2) Not all AITC programs could be tested.
- 3) This study was limited to 90 teachers within four states.
- 4) Some teachers who had been trained through AITC did not consider it as being agricultural literacy.

Definition of Terms

The following terms were used as defined in this study:

Agricultural Literacy – "Possessing knowledge and understanding of Food and Fiber Systems. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, p. 9).

<u>Content Literacy</u> – Having or showing knowledge in a particular domain.

<u>Cultural Literacy</u> - "Grasping the significance of what is known and using it well" (Schuster, 1989, p. 540).

<u>Functional Literacy</u> – The ability level to read and/or write.

Knowledge – "Range of information, awareness, or understanding" (Webster, 1996, p. 748).

<u>Food and Fiber Systems</u> – "Term used synonymously with the term agriculture" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, p. 9).

<u>Food and Fiber Systems Literacy</u> – "Term used synonymously with the term agricultural literacy" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, 9).

Food and Fiber Systems Literacy Framework – "A curriculum model with five thematic areas delineating what a person should know to be agriculturally literate.

Included are descriptions of each theme's standards, and accompanying grade-grouped benchmarks" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, p. 9).

Benchmark – "Statement identifying expected or anticipated skill or understanding relation to Food and Fiber Systems at various developmental levels. May be declarative, procedural, or contextual in the type of understanding it describes" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, p.9).

Standard – "Describes what a student should understand relative to Food and Fiber Systems" (Leising, Igo, Heald, Hubert, Yamamoto, 1998, p.9).

<u>Agriculture in the Classroom</u> – USDA program "aimed at providing training and teaching materials for elementary teachers to incorporate agricultural concepts into their instruction" (Herren & Oakley, 1995).

<u>Agriculture</u> – "A field that encompasses the production of agricultural commodities, including food, fiber, wood products, horticultural crops, and other plant and animal products. The terms also includes the financing, processing, marketing and distribution of agricultural products; farm production supply and service industries;

health, nutrition and food consumption; the use and conservation of land and water resources; development and maintenance of recreational resources; and related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system" (NRC, 1998, p. 2).

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter was to provide theoretical support for this study.

Professional journals and magazines, books, proceedings from research meetings, private and public organizations and United States government documents were used to provide a detailed representation of the relevant literature. This review of literature was divided into the following sections: a) Assessment; b) Literacy as Functional, Content,

Informational, and Cultural; c) Adult Literacy; d) Rationale for Education about Agriculture; e) Creating a National Framework; and f) Integrating Agriculture into the Curriculum.

Assessment

Madaus and O'Dwyer (1999) reported the historical process of testing or assessment as being the same. "One obtains a small sample of an examinee's behavior from what is technically called a domain or universe -- that is, a large body of knowledge and the skills associated with it" (p. 689). Furthermore, "One uses the performance on the sample of situations that represents the domain to make inferences about the person's probable performance relative to the entire domain" (p. 689). Then, "...on the basis of the inference, one can classify, describe, or make decisions about" (p. 689) that individual.

· Madaus and O'Dwyer (1999) also reported that there has only been four ways in

which these samples were obtained from an individual. First, the individual supplied oral and/or written answers to a series of questions (e.g., essay questions, short-answer questions, oral defense). Second, the individual produced a product (e.g., portfolio, a research paper, a forged craft). Third, the individual demonstrated a skill according to specific criteria (e.g., conducted a scientific experiment, restored an antique tractor). Lastly, the individual selected the appropriate solution to a proposed problem from many possible solutions (e.g., select-item response questions). Interestingly, Madaus and O'Dwyer (1999) defined performance assessment as only involving the first three methods which "requires examinees to construct/supply answers, perform, or produce something for evaluation" (p. 689).

History of Assessment

Webster (1996) defined 'paradigm' as "an overall concept accepted by most people in an intellectual community, ... because of its effectiveness in explaining a complex process, idea, or set of data" (p. 979). If historic events of assessment were seen as an indication for the future of assessment, then assessment will be trapped in an endless cycle as evident by Madaus and O'Dwyer's (1999) historical review of assessment. According to Madaus and O'Dwyer (1999) there have been three paradigms for assessment: premodern; modern; and postmodern.

Premodern Period

Beginning with China in 210 B. C., the Han Dynasty used assessment for civil service and the selection of military officers. During the Sung Dynasty (960-1279 A. D.),

"The skills assessed included completing passages from memory; summarizing the meanings of the classics; composing a discussion, a poetic description, and a piece of poetry; and, finally, demonstrating reasoning ability by discussing five (seeming) conflicts within the classics" (Madaus & O'Dwyer, 1999, p. 690, parenthesis in original). However, the Sung Dynasty recognized the subjective nature of higher-ordered thinking skills and returned to rote responses, thus causing a shadow on performance assessment.

During the Middles Ages, performance assessment in Europe was used to certify guild members (craftsmen) and gentlemen (noblemen). Moving out of the Dark Ages towards the Enlightenment Period, Europe shifted away from a qualitative perspective (e.g., Scholasticism & Humanism) to a quantitative worldview (e.g., Copernicus, Kepler, & Galileo). Exacerbated by a population explosion, increased wealth, and Science in Western Europe, quantitative performance assessment filled the need to quantify achievement, efficiency, and standardization (Madaus & O'Dwyer, 1999).

Moving towards the 19th century, religious reformations shaped liberal arts examinations in Western Europe. As a result, Madaus and O'Dwyer (1999) reported performance assessment delimitated knowledge into small segments to be sampled, producing "a transmissionist view of learning and instruction" (p. 691) and linking instruction to assessment. As previously noted with China, Western Europe also noticed subjective differences in qualitative performance assessments when rank was used to evaluate individuals. Therefore, to avoid any partiality by evaluators, quantitative scores were adopted and implemented (Madaus & O'Dwyer, 1999).

In 1885, Horace Mann replaced oral examinations with a written examination in Boston public schools. Mann recognized the need for a factory model for schools to

examine all students under similar conditions in the most efficient manor possible due to an increasing student population. Mann was also politically savvy. He recognized a factory model for schools allowed for the standardization, precision, clarity, and quantification of students and schools to be used for administrative endeavors (Madaus & O'Dwyer, 1999).

Modern Period

The modern period of performance assessment began at the close of the 19th century. "This was a movement brought to fruition in 1905 by Alfred Binet's introduction of the first successful "intelligence" test. Until then, examinations concentrated on a domain defined by a rhetorical style, canon, syllabus, curriculum, or craft" (Madaus & O'Dwyer, 1999, p. 693, quotes in original). As a result, performance assessment developed into the academic area of psychological testing (psychometrics) which relied on statistical criteria in the selection of questions to be used (Madaus & O'Dwyer, 1999).

As the population continually increased in all areas of society, a need existed to test large amounts of individuals. E. A Kirkpatrick echoed this by stating, "in the interest of economy of time ... so far as possible shall be so planned that they can be given to a whole class or school at once, instead of to each individual separately" (as cited in Madaus & O'Dwyer, 1999, p. 693). Arthor Otis responded in 1917 with his development of the Army Alpha I.Q. Test. The implications of this test to the army and its two million recruits satisfied the need for "a more efficient, manageable, easily scored, and easily recorded technology" (p. 693).

Another hallmark of the modern period was the concept of norm-referenced scoring as a result of Frederick Kelly's suggestion to create "norms in terms of which a child can readily be scientifically classed for pedagogical purposes" (Madaus & O'Dwyer, 1999, p. 693). Thus, a movement away from written essay (subjective) tests to multiple-choice (standardized) tests was prompted by educational research that reported essay tests were unreliable (see Starch & Elliot, 1912, as cited in Madaus & O'Dwyer, 1999, 694).

Frederick Taylor's (1967) book, *The Principle of Scientific Management*, had a profound effect on education, which ultimately led to the scientific movement of education. In essence, administrators were able to measure students which directly measured a school's efficiency to be compared to other schools or school districts. This was achieved by Kelly's introduction of the previously mentioned concept of norm-referenced scoring. After World War I, short-answer tests were replaced by Kelly's multiple-choice questions. In 1955, Everet Lindquist's invented the high-speed optical scanner which "greatly facilitated the development of the ubiquitous national, norm-referenced standardized, commercial tests that Americans have come to know and either love or hate" (Madaus & O'Dwyer, 1999, 693). Lastly, the introduction of computers in the 1970's "made it possible to gradually replace paper-and-pencil administrations of test; to overcome the problem of having to have a limited number of large-scale, fixed-date administrations; to reduce testing time; and to reduce the time it took to score the test" (p. 693).

Postmodern Period

Reacting to the behaviorists of the modern period like Thorndike, Watson,
Pavlov, and Skinner, educational measurement came under intense scrutiny by humanists
in the postmodern period like Eisner, Freire, Piaget, and Rogers (see also Eisner, 1999;
Haertel, 1999). As a result, a new educational movement called for 'new' and 'authentic'
forms of assessment. Thus, assessment came full circle when the humanists called for and
adopted these new types of assessment characterized by 'performance', 'portfolios', and
'products'.

Madaus and O'Dwyer (1999) summarized the criticism of performance assessment in the postmodern period as six technical and efficiency reasons to continue with multiple-choice response questions. First, when large numbers of subjects were involved, performance assessment was inefficient and more difficult to administer, disruptive to the daily schedule and function of the school, and more timing consuming to take than multiple-choice testing. Second, performance assessment was not easily standardized leading to a lack of comparability of results. Third, performance assessment was vulnerable to manipulation. Fourth, performance assessment was not reliable. Fifth, performance assessment lacked an adequate sample size of student performance raising doubts about the generalizability of the results to the larger domain of interest. Lastly, performance assessment was more costly to administer (see also Koretz, Madaus, Haertel, & Beaton, 1992; Koretz et al., 1991, 1994; Madaus & Greaney, 1985; Madaus & Kellaghan, 1992; Nuttall, 1992; Shavelson, Gao, & Baxter, 1993, as cited in Madaus & O'Dwyer, 1999). In other words, "authentic assessments are currently in the middle of a serious ideological controversy over what to measure and how to measure it" (p. 694).

Changes in technology used in assessment have sparked the debate about which type of assessment is better, performance or multiple-choice. Madaus and O'Dwyer's (1999) prognosis for the future use of performance assessment with large numbers of subjects to be tested must hurdle over criticism of "manageability, standardization, difficulty of administration, subjectivity, unreliability, comparability, and expense" (p. 694). In the end, Madaus and O'Dwyer's (1999) limitations of performance assessment will force future researchers to address the aforementioned pitfalls in which future assessment is conceived and designed.

National Reports

On October 4, 1957, the Soviet Union successfully launched the world's first artificial satellite, Sputnik I. As a result, a new era in United States political, military, technological, and scientific developments was simultaneously launched (National Aeronautics and Space Administration, 2002). No other single event had caused a more profound effect on education in the United States. More importantly, the United States became seriously focused on math and science content literacy. As a result, there have been five international studies on math and science achievement between 1960 and 1999 (National Center Educational Statistics, 2002a).

Science and Math

Mathematics and science were the first academic areas in which the United States began testing the content literacy of its youth. In 1960, the First International Mathematics Study (FIMS) included 12 industrialized Western European countries. Data were collected on 13-year-olds and students in their final year of high school. In 1970,

the First International Science Study (FISS) included 19 countries. Data were collected on 10-year-olds, 14-year-olds, and students in their final year of high school, and a population of students between ages 14 and 18 (NCES, 2002a).

The Second International Mathematics Study (SIMS) was conducted during the 1981-1982 school year. Twenty countries were included in the study. Data were collected on students in grades with the most 13-year-olds and students taking mathematics in their final year of high school. The Second International Science Study (SISS) was administered between 1983 and 1986 with 24 countries participating. Data were collected on 10 and 14 year-olds and students in their final year of high school (NCES, 2002a).

Evidence from FIMS, FISS, SIMS, and SISS indicated that U. S. students lagged behind other students from developed countries. In an attempt to explain the data, there were no reliable patterns related to type of curriculum, age, or grade. More importantly, these previous assessments provided valuable information about the collection and analysis of the data in order to improve the quality and standards of future surveys.

In 1995, the Third International Mathematics and Science Study (TIMSS) examined the mathematics and science achievement of students in 42 countries. Data indicated U.S. students scored above the international average in both mathematics and science at the fourth-grade level. Data also indicated U.S. students scored above the international average in science and below the international average in mathematics at the eighth-grade level. Students in their final year of high school scored among the lowest in both science and mathematics, including the most advanced students of the U.S (NCES, 2002b).

A follow-up study to TIMMS, the Third International Mathematics and Science Study-Repeat (TIMSS-R) was conducted in 1999. The purpose of the TIMMS-R was "to gauge how close the U.S. was to its goal of being first in the world in mathematics and science achievement (NCES, 2002c). In addition, the purpose was also to establish benchmarks for international comparison by U.S. states. Data indicated U.S. eighth graders performed above the international average in mathematics and science, but in the middle of the participating 38 countries. Results about other grades are not currently available (NCES, 2002d).

A Nation at Risk

In 1983, the National Commission on Excellence in Education (NCEE) declared the United States 'A Nation at Risk' (NCEE, 1983a). The commission found education in the U.S. at risk regarding the following areas: curriculum content; level of knowledge, abilities, and skills high school and college graduates should possess; amount of time students study inside and outside of the school day; and poor and inadequate teacher preparation (NCEE, 1983b). As a result, the 1980s started another education reformation in curriculum and instruction, assessment, and teacher education.

One outcome of *A Nation at Risk* was that the NCEE proposed improving literacy in a large sense with literacy being a priority as a national goal of education. The implications to vocational education were troublesome. In effect, students were tracked into a common core curriculum with few vocational education electives. Ascher (1984) stated,

The reformers tend to assert that a sound general/liberal education is "truly vocational" (Alder, 1982), that all secondary school students need career orientation but not specific job training, that career education is best undertaken in experiential-based internship programs, and that equity is best achieved through avoiding the second-class status of vocational training (p. 1, see also Alder, 1982). Sixteen years later, NCEE (1999) published, *A Nation Still at Risk*. Even though

the nation was not at immediate risk, findings were inadequate.

Internationally, U.S. youngsters hold their own at the elementary level but falter

Internationally, U.S. youngsters hold their own at the elementary level but falter in the middle years and drop far behind in high school. We seem to be the only country in the world whose children fall farther behind the longer they stay in school. That is true of our advanced students and our so-called good schools, as well as those in the middle. Remediation is rampant in college, with some 30% of entering freshmen in need of remedial courses in reading, writing, and mathematics. Employers report difficulty finding people to hire who have the skills, knowledge, habits, and attitudes they require for technologically sophisticated positions. Though the pay they offer is excellent, the supply of competent U.S.-educated workers is too meager to fill the available jobs (ERIC Digest, 1999, p. 1).

Standards-Based Assessment

Many criticisms of standardized multiple-choice testing and performance assessment involved 'what constituted achievement?' Mabry (1999) stated, "The strategy is *predictive* in that the performance of test-takers is anticipated, and it is *preordinate* in

that what will count as satisfactory performance is determined before the test is administered" (p. 674, italics in original). Searching for something different in the 1980's, the idea of standards-based assessment presented an answer. Interestingly, Moss and Schutz (1999) stated, "much of the public rhetoric about tests appears to assume a degree of accuracy, objectivity, and "truth" that exceeds the capabilities of measurement technology" (p. 680).

At the conceptual level, a distinction between types of standards was required for use across disciplines. Linn (1994) described this distinction by separating standards into three types: content, performance, and delivery.

Content standards articulate the concepts and skills students should be taught and should learn; they tell what to assess. Performance standards describe more explicitly and more concretely what students should demonstrate in order to show proficiency. Delivery standards, arguably the most problematic to implement; they define the quality of educational opportunities and resources that must be provided to students (as cited in Mabry, 1999, p. 674).

Standards-based assessment involved four main stages, which are similar across academic areas. First, the development of standards required a process of dialogue among representative members of a community (e.g., panel of experts). This community required specialists in measurement and evaluation and specialists in the academic areas. Second, the proposed standards were submitted for review and comment by internal and external exerts in the particular field. Third, the proposed standards were revised according to reviewers' comments. Fourth, the finalized standards were used to develop a

standardized assessment. This standardized assessment was intended to reflect the status of the panel of experts with respect to the final standards.

In the case of standards-based assessment in the field of education, the responsibility is typically shared by teachers, teacher educators, measurement specialists, and experts from relevant supporting disciplines. The quality of any assessment rests, in part, on the nature, substance, and quality of the collaboration among the responsible parties (Moss & Schutz, 1999, p.681).

What Has Been Done Before?

The Carnegie Forum on Education and the Economy's Task Force on Teaching as a Profession published the 1986 report, *A Nation Prepared: Teachers for the 21st Century*. As a response to this report and the 1983 report, *A Nation at Risk*, the National Board for Professional Teaching Standards (NBPTS) developed a standards-based assessment for the purpose of certifying accomplished teachers (NBPTS, 2002). In 1989, the National Council of Teachers of Mathematics (NCTM) established content and performance standards about what and how mathematics should be taught, understood, and skills developed in educational settings. Because of impact by NCTM's stance, other academic areas were motivated to develop their own content standards (see also Leising, Igo, Heald, Hubert, Yamamoto, 1998). As a result of the standards movement, the federal government required all states to report student achievement by performance standards in 1997 to receive Title 1 funding of the Elementary and Secondary Education Act (Mabry, 1999).

Literacy as Functional, Content, Informational and Cultural

The idea of literacy is a complex phenomenon because it is difficult to exactly define the elastic parameters of literacy in any broad sense. For example, individuals that had difficulty reading or writing were described as 'functionally illiterate' (Baron, 2002). However, these same individuals were able to navigate from one city to another or prepare food at restaurants. These individuals have adapted to pictures, objects, and sounds. Other individuals that have limited knowledge of basic subject areas like mathematics, science, or history were described as 'content illiterate' by educational assessments. However, these same individuals repair our automobiles, build our houses, or pour our cement foundations. Baron (2002) stated these individuals may have limited proficiency in English or a physical impairment. Still, other individuals that have difficulty operating computers and various multimedia were described as 'information illiterate' (Plotnick, 1999).

In 1987, E.D. Hirsch wrote *Cultural Literacy: What every American Needs to Know.* Hirsch defined cultural literacy as the possession of information, "only a few hundred pages of information stand between the literate and the illiterate, between dependence and autonomy" (as cited in Schuster, 1989, p. 540). Responding to Hirsch's characteristic of cultural literacy, Schuster (1989) argued that if this were true, computers would be more literate than people. Cultural literacy was a human characteristic because it was what a person does with the information that mattered most.

According to Schuster (1989), the two barriers to cultural literacy were a lack of desire and the social climate of our time. For Schuster, an individual must want to become culturally literate and continually practice. Schuster suggested four methods for

change to occur in students. First, teachers should find out what interests their students and build on those interests. Second, teachers should provide more out-of-school experiences. Third, teachers should share their experiences with their students. Teaching is an art, not a process. Lastly, emphasis should be put into skills that build functional, content, and informational literacy.

Adults Literacy

The federal government has been involved with adult education for over 200 years (National Adult Education Professional Development Consortium, Inc., 1998).

Passage of the Economic Opportunity Act was signed into law by President Johnson on August 20, 1964, which began the first adult basic education program for states. On November 3, 1966, President Johnson signed into law Congressman Carl D. Perkins' amendment to the Elementary and Secondary Education Act (P.L. 89-750) which created the National Advisory Council on Adult Education. On June 5, 1991, President Bush signed into law the National Literacy Act (P.L. 102-73) which increased authorization for literacy programs, established a National Institute for Literacy, and authorized state literacy resource centers (NAEPDC, 1998). In 1998, the Adult Education Act was repealed and replaced by the Workforce Investment Act (P.L. 105-220).

The National Literacy Act of 1991 defined literacy as "an individual's ability to read, write, and speak in English and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and to develop one's knowledge and potential" (National Assessments of Adult Literacy, 2002, p.1).

Similarly, NAAL incorporated into their assessments a broad range of information processing skills to accomplish the range of tasks associated with work, home, and community contexts proposed by Schuster (1989). The 1992 and 2002 NAAL used the following definition of literacy: "using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential" (p. 1).

Rationale for Education about Agriculture

In 1794, President Washington stated, "I know of no pursuit in which more real and important services can be rendered to any country than by improving its agriculture. its breed of useful animals, and other branches of a husbandman's cares" (The Columbia World of Quotations, 1996). The 1790 total population of colonial America was approximately 17 million people, whereby farmers made up 90 percent of the labor force. One hundred years later, the total population of the United States in 1890 was approximately 62.9 million people. The estimated farm population was 29.4 million people, whereby farmers made up 43 percent of the labor force. Another hundred years later, the total population of the United States in 1990 was about 246 million people. The estimated farm population was 4.5 million people, whereby farmers made up 2.6 percent of the labor force (USDA, 2002a; see also Frick, 1988; Lichte & Birkenholz, 1993; Tisdale, 1991). The latest data for the year, 2000, indicated farming, fishing, and forestry, accounted for just one percent of the total employment by occupational group in the United States. Estimated projections for 2010 indicated farming, fishing, and forestry would decrease to 0.9 percent of the total employment by occupational group in the United States (United States Department of Labor, 2002).

With more and more families and workers removed from the farm and the agricultural sector, there existed a need for an informed and agriculturally knowledgeable citizenry (AATEA, 1989; Frick, Kahler, & Miller, 1991; Leising, Zilbert, Hogan, Hubert, & Johnson, 1992; Mawby, 1984; Russell, McCracken, & Miller, 1990). In 1984, the W. K. Kellogg Foundation reported that adequate food supplies, proper food use, and knowledge of the agricultural sector were important issues that effect the entire world community (as cited in Brown & Stewart, 1993; see also Cox, McCormick, & Miller, 1989; Leising, 1990; Wright, Stewart, & Birkenholz, 1994). As a follow-up, the Committee on Agricultural Education in Secondary Schools reported "most Americans know very little about agriculture, its social and economic significance in the United States, and particularly, its links to human health and environmental quality" (NRC, 1988, p. 9).

Therefore, who will address future trends in agriculture? Agricultural projections reflect trends toward fewer but larger farms, greater risk of income volatility for farmers, consumer food (retail) prices rising less than the general inflation rate, and expenditures for meals eaten away from home reaching almost half of total food spending by 2005 (USDA, 2002b). Hamlin (1962) stated that if voters were to elect representatives whose function was to create farm policy, while possessing no agricultural knowledge, the future for the agricultural sector looked dim (as cited in Wright, Stewart, & Birkenholz, 1994; see also Deavers, 1987; Fuller, 1992; Frick, Birkenholz, Gardner, & Machtmes, 1994; Firck, Birkenholz, & Machtmes, 1995a,b; Harris & Birkenholz, 1996; Mayer & Mayer, 1974; Nipp, 1988). As previously stated, members on the agricultural committees of the U.S. House and Senate have limited experiences or backgrounds in agriculture

(35% and 29% respectively). Moreover, Wright, Stewart, & Birkenholz, (1994) stated "public policy affecting agriculture and society is directly affected by societal goals.

These goals have been decided by people who have little knowledge about agriculture, how it relates to society, and its economic and global significance to our nation" (p. 55).

Early Agricultural Literacy Movements

To the chagrin of many contemporary agricultural education researchers, the concept of agricultural literacy was not new. Snowden & Shoemake (1973) stated Socrates, Comenius, and Pestalozzi believed young people should learn about plants, animals and the way people use them (as cited in Terry, Herring, & Larke, 1992). In fact, during the American colonial period, many of the immigrants "were at least minimally proficient in the production of food and fiber" (Parmley, May, & Hutchinson, 1996, p. 4). According to Cochran (1979), American colonial agriculture developed out of a failure to understand agricultural practices by those individuals who did not originally intend to become farmers (as cited in Parmley, May, & Hutchinson, 1996).

On March 1, 1785, the Philadelphia Society for the Promotion of Agriculture and other rural concerns was organized by men who had no connection with agriculture but understood the importance of agriculture (Parmley, May, & Hutchinson, 1996; USDA, 1895, 2002c; Woodward, 1939). In contrast, societies and publications like the Berkshire Agricultural Society in 1811, the *American Farmer* and the *Plough Boy* in 1819, the *New England Farmer* in 1822, the *New York Farmer* and *Southern Agriculturist* in 1828 organized and were created to improve farming practices. By the 1860s, there were 941

agricultural societies in the United States promoting farming practices and agricultural awareness (USDA, 2002c,d).

By the beginning of the 1900s, the National Grange, Farmers' Union, and Farm Bureau were formed. Many states set up land-grant colleges with help of the Morrill Acts of 1862 and 1890. States started experiment stations with the passage of the Hatch Act of 1887, Cooperative Extension with the passage of Smith-Lever in 1914, and secondary agricultural education programs with the passage of Smith-Hughes in 1917 (Portillo, 2000).

Examining the theoretical foundation for agricultural education, David Snedden's social efficiency theory and Charles Prosser's sixteen theorems for vocational education have gone largely unnoticed as they related to literacy. In Snedden's Doctrine of Social Efficiency he argued, "The proper education for the working classes is based upon the reform school model. It provides for physical training, moral indoctrination, job specific skill training, and the rudiments of literacy education" (as cited in Portillo, 2000, p. 126). According to Prosser, "Vocational education will render efficient social service in proportion as it meets the specific training needs of any group at the time that they need it and in such a way that they can most effectively profit by the instruction" (as cited in Portillo, 2000, p. 129). Prosser and Snedden collectively envisioned vocational education as the accumulation and application of all academic areas in the pursuit occupational skill training. This was evident by the nature of jobs during the early 1900s and the changing nature of skills required for employment. In any type of job today, the employee will need to be informational literate and have excellent communication skills (NRC, 1988). In 1982, the National Association of State Universities and Land-Grant Colleges Resident Instruction Committee on Organization and Policy reported that 13 percent of the jobs in the agricultural sector were filled by underqualified employees (as cited in Mallory & Sommer, 1986).

In the *Handbook for Agricultural Education in Public Schools*, Phipps (1972) stated three reasons why agricultural education should be considered as part of the general education for all middle school and high school students. First, Phipps stated, "Agricultural education is also needed and should be supplied for those interested in agriculture as an avocation" (p. 4). For Phipps, 'avocation' meant that agricultural education was a 'practical art' by which "the content of practical arts includes those things which a person needs to know to perform successfully the practical activities in which nearly everyone engages in the process of living" (p. 4).

Second, Phipps related agricultural education to citizenship. "Everyone needs to know the role and functions of agriculture if he is to behave as an effective citizen" (p. 4). Citizenship was important to Phipps for agricultural and social policy dictated the continued growth and development of this nation's agricultural sector (see also Deavers, 1987; Fuller, 1992; Frick, Birkenholz, Gardner, & Machtmes, 1994; Firck, Birkenholz, & Machtmes, 1995a,b; Harris & Birkenholz, 1996; Mayer & Mayer, 1974; Nipp, 1988; Wright, Stewart, & Birkenholz, 1994).

Lastly, Phipps realized that every individual required a certain level of agricultural knowledge. He envisioned agricultural education as part of a comprehensive program, where by "a comprehensive program of agricultural education for a community necessitates a comprehensive school system dedicated to serving the best interests of all the people" (p. 5). Inherently then, the best interests of all the people required a "type of

education in agriculture is that designed to teach people what they need to know about agriculture to be intelligent consumers of agricultural products" (p. 4).

Assessment of Agricultural Knowledge Prior to 1989

Drake (1990) stated the success of any program with the goal of teaching children about agriculture depends ultimately upon the ability of that teacher. This was important especially considering Swan and Donaldson (1970) and Bowers and Kohl (1986) found low levels of agricultural knowledge possessed by elementary school teachers (cited in Terry, Herring, & Larke, 1992).

Using a multiple-choice test to measure agricultural knowledge in production agriculture, Morton and McCracken (1979) investigated the relationship between the quality of Supervised Occupation Experience (SOE) programs and level of academic achievement. They reported higher levels of achievement associated with high quality SOE programs (as cited in Kotrlik, Parton, & Lelle, 1986). Cheek and McGhee (1985) reported FFA students with SOE projects score significantly higher on a test measuring applied principles of agribusiness and national resource education (as cited in Kotrlik, Parton, & Lelle, 1986).

Horn and Vining (1986) collected data about agricultural knowledge from 2000 Kansas students in the fifth, eighth and eleventh grades. They found fewer than 30 percent of the students tested could correctly respond to basic question about agriculture (as cited in Williams, 1990; Wright, Stewart, & Birkenholz, 1994). Similarly, Perey (1989) found low levels of agricultural knowledge among Arizona students (cited in Williams, 1990).

In another Arizona study, adults were found possessing limited knowledge and poor perceptions of agriculture (Behavior Research Center of Phoenix, 1898, as cited in Terry, Herring, & Larke, 1992). Oliver (1986) found Virginia students in 244 fourthgrade classrooms had only a nominal concept of food and fiber origins. Startling, Oliver stated students were not even curious to find out (as cited in NRC, 1988). In testimony for the NRC (1988) study, Heath (1986) reported one parent stated the following:

Agriculture is not stressed in the school systems whatsoever. This is easily seen in all three of my children, who get precious little in the way of discussion of agriculture or what it means to modern society from kindergarten to high school (as cited in NRC, 1988, p. 10).

A Definition for Agriculture and Agricultural Literacy

In 1985, the National Research Council established the Committee on Agricultural Education in Secondary Schools to "assess the contributions of instruction in agriculture to the maintenance and improvement of U.S. agricultural productivity and economic competitiveness here and abroad" (NRC, 1988, p. v). In their report, Understanding Agriculture: New Directions for Education, the committee's findings illustrated "agricultural education must become more than vocational agriculture" (p. 1) and "major revisions are needed within vocational agriculture" (p. 1).

More importantly, the NRC (1988) report developed the idea of 'agriculture' to mean more than just production agriculture. The misunderstanding of the idea of agriculture was evident by Mallory and Sommer's (1986) findings that high school students equated agriculture with farming typified by hard, boring, and financially

unstable work. The NRC report accomplished this objective in two ways. First, NRC defined the idea of agriculture where all citizens use agricultural systems directly or indirectly.

The terms are used broadly and encompass the production of agricultural commodities, including food, fiber, wood products, horticultural corps, and other plant and animal products. The terms also include the financing, processing, marketing, and distribution of agricultural products; farm production supply and service industries; health, nutrition, and food consumption; the use and conservation of land and water resources; development and maintenance of recreational resources; and related economic, sociological, political, environment, and cultural characteristics of the food and fiber system (p. vi).

Second, NRC developed the idea of 'agricultural literacy' similarly to Schuster's (1989) idea of 'cultural literacy.' Schuster believed that literacy was more than the possessing knowledge, but also included how the knowledge was used. Likewise, NRC believed that it was important to understand the basic concepts and to make informed decisions.

"Achieving the goal of agricultural literacy will produce informed citizens *able to participate* in establishing the policies that will support a competitive agricultural industry in this country and abroad" (p. 2, emphasis added).

Assessment of Agricultural Knowledge After 1989

In 1989, Blum investigated the relationship between education level and agricultural knowledge. When the education level of Israeli individuals rose, then agricultural knowledge was more useful and effective. Williams (1990) reported findings

showed Oklahoma students had more knowledge of the concept, "agriculture is the business that provides food, clothing and shelter" (p. 33), but had little or no level of understanding "of the historical significance of agriculture to the development of our nation" (p. 33-34). In addition, findings showed that students who participated in 4-H and/or FFA at the fourth and eighth grade levels had higher scores than non-participants. However, 4-H/FFA participants scored slightly lower than non-participants at the eleventh grade.

In a national study of kindergarten through eighth grades, Hall (1991) reported 64 percent of states had educational programs about agriculture in at least one grade level. Harbstreit and Welton (1992) found Kansas high school students possessed limited international agricultural knowledge concerning agricultural products, policy, geography, and cultures. Humphrey, Stewart, and Linhardt (1994) found elementary education majors in Missouri had high knowledge levels about agriculture and high perceptions about agriculture.

Cox (1994) investigated the level of agricultural knowledge and perceptions of fourth grade teachers in Oklahoma. Demographic data revealed Oklahoma fourth grade teachers had personal ties to agriculture, either by living on a farm or were former 4-H or FFA members. Curriculum data revealed Oklahoma teachers did not associate agricultural with science even though they taught topics directly related to agriculture. In addition, teachers relied primarily on textbooks and periodicals as sources of information for lessons. Lastly, teachers listed plants and development, ecology and environment, nutrition, and entomology as regular lesson topics presented to their students. However,

the majority of teachers failed to select the correct response in a knowledge assessment of regarding these same topics.

Frick, Birkenholz, Gardner, and Machtmes (1995) found rural high school students from Indiana were most knowledgeable about natural resource concepts and least knowledgeable about plants in agriculture concepts. They also found urban high school students from Michigan were more knowledgeable about natural resource concepts and least knowledgeable about policy concepts and plants in agriculture concepts. More specifically, rural Indiana high school students had significantly higher knowledge scores across seven agricultural concepts than did urban Michigan high school students.

Frick, Birkenholz, and Machtmes (1995a) found urban and rural adults were most knowledgeable about animal concepts and least knowledge about plants in agriculture concepts. Respondents living on farms were more knowledgeable about agriculture than non-farm rural respondents and urban respondents. Furthermore, respondents with higher levels of education were more knowledgeable about agriculture then respondents with less education.

In a similar study, Frick, Birkenholz, and Machtmes (1995b) found the overall level of agricultural knowledge possessed by 4-H members was high. 4-H members were most knowledgeable about natural resource and marketing of agricultural product concepts and least knowledgeable about plants in agriculture concepts. Differing from their adult study, respondents who lived on farms with experiences in raising gardens and crops and and enrolled in high school agriculture had lower knowledge scores than those with the opposite characteristics.

Mabie and Baker (1996) reported urban California fifth and sixth graders new very little about the food and fiber system before completing an activity program.

Students increased their agricultural knowledge during the program and after its completion. Harris and Birkenholz (1996) investigated the agricultural literacy of 616 Missouri secondary educators. Data analysis revealed these educators were knowledgeable of and had positive attitudes towards agriculture. Balschweid, Thompson, and Cole (1998) investigated agricultural literacy effects of a summer agriculture workshop on non-agriculture Oregon teachers. Data analysis showed 40.2 percent of program participants used information gained from the summer workshop in more than 20 lesson plans each year. Participants agreed the information was useful for implementation into their curriculum, but time was a barrier. Participant perceptions about animals, crops, and food processing were more favorable than soils, agricultural mechanics and agricultural economics.

Igo (1998) investigated agricultural knowledge differences between elementary and middle school students of Oklahoma and Montana. Igo reported the greatest agricultural knowledge increases occurred in the Food and Fiber Systems Literacy Framework themes for history, culture and geography and science and environment.

Defining Agricultural Literacy

After redefining 'agriculture,' the NRC (1988) report stated, "An understanding of basic concepts and knowledge spanning and uniting all of these subjects define the term "agricultural literacy" (p. vi, quotes in original). This presented the opportunity for agricultural education researchers to develop an accepted definition for 'agricultural

literacy.' As graduate students at Iowa State University, Frick and Spotanski (1990) suggested agricultural literacy initiatives should incorporate the following three dimensions: "1) an understanding of the applied processes or methods of agriculture, 2) the basic vocabulary of agricultural terms, and 3) the impact of agriculture on society" (p. 6). These three dimensions were to be integrated into each subject area "to ensure the development of agricultural literacy" (p.6).

Addressing how agricultural literacy was an objective of Illinois agricultural education at the elementary, middle, and secondary levels, Law (1990) suggested,

Agricultural literacy may be defined as the development of the individual in the principles and concepts underlying modern agricultural technology ... It also includes an awareness of the impact agriculture has on the environment, on society, and on everyday living of the individual" (p. 5).

In a position statement on agricultural literacy, Russell, McCracken, and Miller (1990) argued, "Agricultural literacy should include historical understanding, social significance, economic contributions, scientific understanding, and awareness and understanding of agricultural careers" (p. 13).

Frick, Kahler, and Miller (1991) used a Delphi study consisting of a panel of experts from agricultural industry, elementary and secondary education, and higher education to refine a group definition of agricultural literacy. As a result of consensus, the panel of experts settled on the following:

Agricultural literacy can be defined as possessing knowledge and understanding of our food and fiber system. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture.

Basic agricultural information includes: the production of plant and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing of agricultural products, the processing of agricultural products, public agricultural policies, the global significance of agriculture, and the distribution of agricultural products (p. 52).

In 1998, the National Council for Agricultural Education (NCAE) published Reinventing Agricultural Education for the Year 2020 (RAE 2020). The purpose of this initiative was to strengthen and reposition agricultural education for the future. To accomplish this task, NCAE developed a vision statement, "All people value and understand the vital role of agriculture and natural resources in advancing personal and global well-being" (p. 2). Adopting NRC's (1988) definition of agriculture, NCAE mentioned "agriculture and natural resources" in their vision statement. By making a distinction between production agriculture and the environment, NCAE's stance reverted the idea of agriculture back to its stereotypical definition.

In addition, NCAE developed the following four goals to "prepare students for successful careers and a lifetime of informed choices in the global agriculture and natural resources system" (p. 2):

- 1. Highly motivated, well-educated teachers provide quality education for students at all levels, pre-kindergarten through adult;
- All students have access to seamless, lifelong instruction in agriculture and natural resources through a wide variety of delivery methods and education settings;

- 3. All students achieve conversational literacy of agriculture and natural resources; and
- 4. Partnerships and strategic alliances ensure a continuous presence of education in and about agriculture and natural resources (p. 3-4).

Particularly interesting was NCAE's reference to 'conversational literacy' of agriculture and natural resources in its third goal. By using 'conversational,' NCAE included Schuster's (1989) idea of cultural literacy, "grasping the significance of what is known and using it well" (p. 540). In addition, it simplified NRC's (1988) goal of agricultural literacy to "produce informed citizens able to participate in establishing the polices that will support a competitive agricultural industry in the country and abroad" (p. 2).

Creating a National Framework

In their position statement on agricultural literacy, Russell, McCracken, and Miller (1990) put forth for discussion guiding principles for agricultural literacy development and implementation, objectives to achieve agricultural literacy, and the clientele of agricultural literacy programs. More importantly, Russell, McCracken, and Miller reinforced the content areas for agricultural literacy programs as formally suggested by the NRC (1988) report, *Understanding Agriculture: New Directions for Education*. They also suggested that all U.S. citizens should understand the areas of nutrition, economics, society, and the environment in a historical and contemporary context.

Investigating subject areas required for agricultural literacy, Frick, Kahler, and Miller (1991) identified subject areas falling within a framework of agricultural literacy

and identified agricultural concepts that every U.S. citizen should know. The following 11 areas were identified: 1) agriculture's important relationship with the environment; 2) the processing of agricultural products; 3) public agricultural policies; 4) agriculture's important relationship with natural resources; 5) production of animal products; 6) societal significance of agriculture; 7) production of plant products; 8) economic impact of agriculture; 9) the marketing of agricultural products; 10) the distribution of agricultural products; and 11) the global significance of agriculture.

In a follow-up to, Frick, Kahler, and Miller (1991), Frick (1993) identified four agricultural literacy subject areas and 15 topics for the establishment for a framework of a middle school agricultural education core curriculum. Frick (1993) also identified five exploratory subject areas and 14 topics for the establishment of a framework for a middle school agricultural education core curriculum.

In 1992, Leising, Zilbert, Hogan, Hubert, and Johnson drafted the first California Agricultural Literacy Framework (CALF) to establish what K-12 grade students should learn 'about agriculture' in the public schools. It was not their purpose to establish a separate curriculum, but rather to "facilitate the systematic and comprehensive incorporation of agricultural concepts into existing courses and subject matter" (p. 2).

The components integral to CALF consisted of agricultural literacy, career exploration, and career preparation corresponding to elementary, middle, and high school students. Furthermore, six thematic areas were identified by a national review as the foundation for the framework. The thematic areas were: "1) food and fiber systems (understanding agriculture); 2) historical, cultural, and geographical significance; 3)

science (agricultural-environmental interdependence); 4) business and economics; 5) food, nutrition, and health; and 6) career pathways in agriculture" (p. 3).

Improving upon CALF, Leising, Igo, Heald, Hubert, and Yamamoto (1998) developed *A Guide to Food and Fiber Systems Literacy*. In effect, this answered many questions about the 'what, who, why, and how' of agricultural literacy (see also Frick & Wilson, 1996; Leising & Zilbert, 1994; Martin, 1996). This guide contained a Food and Fiber Systems Literacy (FFSL) Framework with standards and benchmarks and sample instructional materials for grades K-8. Five themes comprised the FFSL Framework which included: 1) understanding food and fiber systems; 2) history, geography, and culture; 3) science, technology, and environment, 4) business and economics; and 5) food, nutrition, and health.

In an assessment of student agricultural literacy based on FFSL, Leising, Pense, and Igo (2001) reported Nebraska students (control group) possessed more knowledge than did Oklahoma and Montana students prior to the study (treatment group). Oklahoma and Montana students increased student knowledge about agriculture after teachers infused agriculture into their existing curriculum based on FFSL. Student knowledge increased in the following FFSL themes: 1 (understanding agriculture); 2 (history, geography, and culture); and 3 (science, technology, and environment).

Integrating Agriculture into the Curriculum

"I'm tired of hearing all that agriculture/farm crisis stuff, it doesn't have anything to do with me; my family lives in town, and I buy all our food from the grocery store" (Tisdale, 1991, p. 11). In an attempt to alter the general public's perception about

agriculture, many commodity groups and general farm organizations at the local level were organized. Some of these groups have subsequently developed into state and national organizations. However, the public's perception about agriculture still remained unchanged. Not until Willie Nelson, in the early 1980s, make the plight of the American farmer nationally known by his 'farm-aid' concert promotions, did the sentiment of the American public change. As a result, many of these state and national organizations teamed up with state and federal agencies to integrate agriculture into existing public school curriculum in grades kindergarten through twelve.

Agriculture in the Classroom

Agriculture in the Classroom (AITC) began as a national grassroots program in the early 1970s to integrate agriculture into public schools in order to create a greater awareness about agriculture's role in the economy and society. Former Secretary of Agriculture, John Block and former Secretary of Education Terrel H. Bell were able to secure signatures from 30 governors in 1983 endorsing the AITC Declaration of Principle (Moore, 1993).

Today, AITC is carried out in every state according to state needs and interests. The USDA supports state AITC programs by providing assistance, materials and information, encourages cooperation between USDA and state agencies, and coordinates with national commodity organizations and businesses to promote an increased student awareness about agriculture (AITC, 2002a,b). "Each and every summer, ... I stressed that they had the power to influence generations of informed consumers... and to develop an appreciation of agriculture's relevance to the nation's social, economic, and physical well-

being" (Ann Veneman, USDA Secretary, in a statement about California's Summer Agricultural Institutes, California Foundation for AITC, 2001, 1,5).

Assessment of Agriculture in the Classroom

Evaluating Georgia's AITC program, Herren and Oakley (1995) assessed the agricultural knowledge of second grade students. Using a pretest/posttest assessment, data indicated student agricultural knowledge increased for rural and urban students. Data also indicated no difference between scores of students whose teachers were raised on a farm from those teachers who were not raise on a farm. Significant differences were found between scores of students whose teachers had little or no agricultural experience.

Wilhelm (1998) investigated whether Oklahoma AITC summer institutes influenced teachers' use of topics related to agriculture in their teaching. Data indicated teachers who have attended Oklahoma AITC summer institutes taught more topics related to agriculture than did teachers who did not attend an AITC summer institute. Data also indicated institute participants used a greater variety of resources in their curriculum.

Balschweid, Thompson, and Cole (1998) investigated the effectiveness of Oregon AITC summer institutes. Findings indicated teachers' curriculum included agriculture as the vehicle for teaching subject matter. Results of the study also indicated time was the major impediment to implementing agricultural topics into existing curriculum. Teachers who completed the institute indicated insufficient access to necessary supplies and materials were barriers.

Food, Land and People

Because of recommendations from NRC (1988), Project Food, Land, and People (FLP) was created in 1988 to assist teachers and students to better understand the importance and relationship between food, land, and people. Similar to USDA's Agriculture in the Classroom, the FFA's Food for America, and California's Life Lab Science Program, FLP sought to infuse agriculture into existing K-12 curriculum by activity-based materials (Pope, 1990). "This program would also provide opportunities for teaching critical thinking and problem-solving skills and provide education opportunities that would lead to the enhancement of mature and responsible behavior" (p. 8).

Established in the Presidio National Park of San Francisco as a nonprofit organization, FLP consists of an USA division, a world learning center, and an international division. FLP publishes *Resources for Learning*, a science and social sciences-based curriculum (FLP, 2002). To achieve FLP's mission, "To provide educational resources and promote approaches to learning which help educatiors and students in PreK-12 to better understand the interrelationships between agriculture, the environment and people of the world" (p.1), FLP addresses the following seven basic areas: 1) basic food production; 2) historical development of agriculture; 3) agriculture and the environment; 4) economics, 5) images and attitudes; 6) decision-making; and 7) future considerations.

Summary of the Literature

Historically, man's and government's prosperity have rested on the ability of man and government to feed themselves. Ancient Greeks, like Marcus 'The Elder' Cato (234-249 B.C.), noted the importance of knowledge about agriculture,

The climate should be good, with few storms, and the soil should be good as well. Ideally, the farm should be situated in a healthy place, such as at the foot of a mountain, and face south. There should be plenty of laborers and a good water supply (as cited in Nystrom & Spyridakis, 1990, p.23).

As man and government moved away from agriculture through their expendable income on food and gross domestic product respectively, the ability to make correct decisions about the future of agriculture was paramount to our health and national economy. As evidence, newspapers continually headline childhood and adult obesity, poor dietary school lunch programs, and environmental implications concerning drilling oil in the Arctic National Wildlife Refuge (ANWR).

Therefore, what should the average person know about agriculture in order to make informed decisions for themselves and others? The research of Frick, Kahler, and Miller (1991) and Leising, Zilbert, Hogan, Hubert, and Johnson (1992) started the debate on what individuals should know about agriculture and how they use (synthesize, analyze, & communicate) that knowledge.

As a follow-up, Harbstreit and Welton (1992), Frick, Birkenholz, Garnder, and Machtmes (1995), Mabie and Baker (1996), and Elliot (1999) indicated a need existed to educate elementary, secondary, and adult students about agriculture. However, Cox

(1994) reported the need to educate teachers about agriculture in order to improve the agricultural knowledge of students.

CHAPTER III

METHODOLOGY

This chapter described the methods and procedures used in conducting this study. To secure data, which would supply information relative to the purpose and objectives of the study, a population was specified and instruments were developed for data collection. Procedures were identified to facilitate collection and analysis of the data. Data were collected during the fall of 2001.

Purpose of the Study

The purpose of this study was to assess the agricultural knowledge of selected kindergarten through sixth grade teachers. This study also sought to describe selected characteristics of those teachers and to explore the nature and strength of relationships among those teacher characteristics and their agricultural knowledge.

Objectives of the Study

In order to accomplish the purpose of the study, the following objectives were established:

1) To describe teacher characteristics of Agriculture in the Classroom (AITC) trained teachers and non-AITC trained teachers.

- 2) To develop an appropriate instrument to compare agricultural knowledge differences between AITC trained teachers and non-AITC trained teachers across the five thematic areas of the Food and Fiber Systems Literacy (FFSL) Framework.
- 3) To describe the relationship between agricultural knowledge and teacher characteristics.
- 4) To describe resources and materials used by AITC trained teachers to teach about agriculture.

The Study Design

This research study was based in a descriptive-correlation research design (Ary, Jacobs, and Razavieh, 1985) that described the agricultural knowledge of kindergarten through sixth grade teachers and selected teacher characteristics. In addition, this study explored the nature and strength of associations among those teacher characteristics and their agricultural knowledge. According to Ary, Jacobs, and Razavieh (1985), "Descriptive research studies are designed to obtain information concerning the current status of phenomena. They are directed toward determining the nature of a situation as it exists at the time of the study" (p. 322). Since prediction was not the intent of this study, care should be used not to extend the results of the associations among variables beyond this study population from whom data were collected.

Institutional Review Board

Federal regulations and Oklahoma State University (OSU) policy required review and approval of all research studies that involved human subjects before investigators could begin their research. The OSU Office of University Research Services, through the Institutional Review Board (IRB), conducted this review to protect the rights and welfare of human subjects involved in biomedical and behavioral research. In compliance with the aforementioned policy, this study was granted permission to be conducted and was assigned the following IRB number: <u>AG0125</u> (see Appendix A).

The Study Population

The populations for this study consisted of 90 kindergarten through sixth grade teachers from Arizona, Montana, Oklahoma, and Utah. Agriculture in the Classroom training (AITC) differentiated these 90 teachers into two groups. The first group consisted of 44 teachers who underwent AITC training in the respective state. The second group consisted of 46 teachers who have never received AITC training in their respective state. A detailed description of the population follows.

An external-advisory committee was formed to include state AITC coordinators, United States Department of Agriculture AITC staff, and Agricultural Education faculty (see Appendix B). This committee recommended states for participation in the study. Subsequently, the states, Arizona, California, Illinois, Missouri, Montana, New York, Oklahoma, and Utah were selected due to strong state AITC programs and the willingness to participate in the study. California, Illinois and Missouri eventually

declined to participate prior to the initiation of the study and New York was not included in the findings due to the failure in receiving data.

State AITC coordinators from the selected states identified strong AITC public elementary school programs. Specific schools were selected because teachers were identified as having demonstrated strong AITC classroom programs. In each state, two AITC trained teachers at each grade level (K-6) were identified in this study. The selected population included 44 teachers (see Table 1). In addition, state AITC

Distribution of AITC Trained Teachers by State and Grade

Table 1

State					
Grade	AZ	OK	MT	UT	Total
K-1	2	4	3	2	11
2-3	2	4	4	3	13
4-5	3	4	4	3	14
6	1	2	2	1	6
Total	8	14	13	9	44

AITC program. These schools were selected due to similarities in geographical location, family income levels, school lunch program, average daily attendance and size of school. In each state, two non-AITC trained teachers at each grade level (K-6) were identified in this study. This portion of the total population included 46 teachers (see Table 2). Subsequently, a total of 90 (80%) teachers from a total population of 112 teachers participated in this study.

Table 2

Distribution of Non-AITC Trained Teachers by State and Grade

State					
Grade	AZ	OK	MT	UT	Total
K-1	3	3	4	1	11 .
2-3	4	4	4	2	14
4-5	4	4	4	2	14
6	2	2	2	1	7
Total	13	13	14	6	46

Development of the Instrument

Part I (Agricultural Knowledge Instrument)

Since no instrument was readily available, a criterion-referenced test instrument (see Appendix C) was developed to assess the agricultural knowledge of teachers across five thematic areas of the Food and Fiber Systems Literacy (FFSL) Framework (see Appendix D). "In contrast to norm-referenced tests, criterion-referenced tests are developed specifically to measure performance against some absolute criterion ... Such tests have more content validity for purposes of evaluating a curriculum than would norm-referenced tests" (Worthen, Sanders, & Fitzpatrick, 1997, p. 352).

The development of this instrument began with a review and evaluation of the kindergarten through eighth grade test instruments used by Igo (1998). This instrument was based on the FFSL Framework's benchmarks and standards within the five FFSL theme areas. Specifically, this instrument was based on the standards and benchmarks of the 9-12 grade grouping in the FFSL Framework. The purpose of this instrument was to ascertain the domain of agricultural knowledge which kindergarten through sixth grade teachers possessed.

The final instrument contained 50 multiple-choice test items. There were 11 test items associated with the first FFSL theme, 'Understanding Food and Fiber Systems'. There were 10 test items associated with the second FFSL theme, 'History, Geography, and Culture'. There were 11 test items associated with the third FFSL theme, 'Science, Technology, & Environment'. There were seven test items associated with the fourth FFSL theme, 'Business and Economics'. Lastly, there were 11 test items associated with the fifth FFSL theme, 'Food, Nutrition, and Health'.

Test validity of this criterion-referenced test instrument was addressed by examining content validity, criterion validity, and construct validity according to Wiersma and Jurs (1990) and pilot testing.

Content Validity

Content validity of criterion-referenced tests referred to the degree to which test items reflected the intended domain.

Content validation is sometimes done by having a panel of experts review the items on the test and rate them in terms of how closely they match the objective or domain specifications. The panel need not be large but the members should be knowledgeable about both the content area and the target audience. Such experts might consist of teachers of the same subject at the same grade level. Experienced teachers can serve in this role very well (Wiersma & Jurs, 1990, p. 272).

A panel of six trained Agricultural Education teachers agreed to serve on a developmental panel for this test instrument. Each teacher was sent an initial letter (see Appendix E) that explained the task and FFSL standards and benchmarks. In October

2000, the panel met, received instructions, and worked in pairs to construct appropriate test items. The panel was charged to construct at least 100 relevant test items. The type of test items initially included were the following: true/false; matching; and multiple-choice.

Ultimately, multiple-choice test items were selected because they "are the most widely used and highly regarded of the selection-type items" (Gronlund, 1998, p. 53). Since multiple-choice items consist of a stem (the question) and alternatives (the choices), the construction of test items followed rules suggested by Gronlund (1998) for writing multiple-choice items.

During November 2000, this panel of experts evaluated preliminary content validity of the test instrument. Content validation of the test instrument was determined by inputting test items and the FFSL benchmarks into a spreadsheet according to the five FFSL themes and their specific standards, thereby, creating a grid that reflected the criteria for analyzing the questions (see Appendix F).

During the first week of December 2000, a revised test instrument was emailed to 144 Oklahoma Agricultural Education instructors and hand-delivered to eight agricultural education faculty and graduate students with teaching experience in the Department of Agricultural Education, Communication, and 4H Youth Development at OSU. Cover letters were sent to each group (see Appendix G & H). The purpose of this review was to ensure that each test item addressed its corresponding FFSL benchmark. The content of each test item was grade-level analyzed with respect to curriculum and reading ability. The test instrument was then reviewed and inappropriate questions were deleted and problematic questions were revised a third time by the OSU research team.

Criterion Validity

A check for criterion validity of the test instrument addressed the degree to which the test scores were accurate and useful predictors of performance on some other criterion measure (Wiersma & Jurs, 1990). Therefore, the criterion validity of the test instrument was shown by the degree to which performance on the second FFSL theme was predictable if we knew the level of performance on the first FFSL theme. Accordingly, each FFSL theme was measured for criterion validity using the Pearson product-moment coefficient to describe the strength and direction of the relationship between FFSL themes. The following conventions were used to describe these relationships: .20 or lower, 'very low'; .20 to .40, 'low'; .40 to .60, 'moderate'; .60 to .80, 'strong'; and .80 or higher, 'very large' Bartz (1994). According to Bartz (1994), "Most published validity coefficients are usually in the range of .50 or lower" (p. 275).

The strength of the association of relationships between FFSL themes ranged from 'very low' to 'strong'. Themes one and four had the lowest coefficient (.302), followed by themes five and four (.322) and themes four and three (.358). In the 'moderate' range were themes four and two (.450), themes five and one (.503), themes two and one (.522), themes five and three (.583), and themes three and one (.596). Two had 'strong' relationships, themes three and two (.623) and themes five and two (.645). Furthermore, all relationships consisted of positive coefficients. Lastly, data suggested that some FFSL themes with moderate to strong relationships might be a predictor for other FFSL themes (see Appendix I).

Construct Validity

The construct validity of this test instrument was a determination that helped this researcher understand what the test instrument really measured and how the test instrument worked across the variety of settings and conditions. Construct validity was determined by logical and statistical analyses. "Tests do not measure constructs directly; rather, they measure performance or behaviors that reflect constructs. We infer from theory expected patterns of scores from measures of these constructs (i.e., how they should relate to scores from other measures" (Wiersma & Jurs, 1990, p. 279).

A panel of experts consisting of trained Agricultural Education instructors determined whether the test instrument represented the themes of the FFSL Framework. This logical analysis required the panel of experts to rate the extent to which the test questions matched their corresponding FFSL theme. "If this sounds like content validity procedures, it should because it is the same" (Wiersma & Jurs, 1990p. 280).

Further construct validity was conducted by statistical analysis of group differences between teachers with AITC training and teachers with no AITC training. It was expected that teachers with AITC training would have higher average scores than teachers with no AITC training. This was reasonable to expect since AITC training educates the teacher about agriculture and how to infuse agriculture into their existing curriculum. When comparing group differences, Wiersma and Jurs (1990) suggested,

"We would administer our test to these groups, compare the average scores, and see whether our expectations are confirmed by the data. If we find that the test scores follow our theoretical expectations, then we have additional evidence that the test is measuring what it was intended to measure. We have an even better

idea about what the test scores mean and the purposes for which the test might be used (p. 280).

Therefore, data supported the expectation that the average score for AITC trained teachers would be higher than for teachers with no AITC training. Further examination of average theme scores supported the expectation of higher scores across all themes for teachers with AITC training (see Table 3).

Table 3

Distribution of Average Scores of Teacher Agricultural Knowledge by Training and Theme

	AITC	Training
Theme	Trained	<u>Untrained</u>
	M	M
0 41 4 9	=0 (0	
Overall Average Score	73.68	65.43
Theme 1	72.73	64.82
Theme 2	84.77	76.52
Theme 3	79.55	66.80
Theme 4	64.29	59.63
Theme 5	64.70	58.30

Note. Means were reported as percent scores.

Further statistical analysis of construct validity included item analysis for discrimination and difficulty. Wiersma and Jurs (1990) suggested, "Further insights into the characteristics of the test can be gained by looking at the patterns of responses to the questions" (p. 281). Item discrimination was based on calculating the proportion of teachers who answered each item correctly, the proportion of teachers who answered each item incorrectly, and the standard deviation. Wiersma and Jurs (1990) stated,

The discrimination index can range from -1 to +1. Items with positive values of the discrimination index are desired because those are the items that are contributing to the usefulness of the total score. When the discrimination index is

near zero, it indicates that the item is contributing nothing to the discriminating power of the overall test (p. 245).

Item discrimination was calculated to determine the discrimination index of each test item (see Appendix J). The mean item discrimination was 0.348.

Item difficulty was calculated to determine the percentage of teachers who answered each test item correctly. Wiersma and Jurs (1990) stated, "Item difficulty indexes can be very revealing. Sometimes items can be much more difficult than the teacher expected" (p. 244). Item difficulty was determined by the percentage of teachers who answered a test question correctly over the number of teachers responding. The higher the percentage, the easier the test questions (see Appendix K). The mean item difficulty was 69.444.

Pilot Tests

In the summer of 2001, two pilot tests were administered to further test and statistically analyze the test items. These pilot tests were administered to teachers participating in Oklahoma Agriculture in the Classroom Summer Institute. The first training program occurred in June and the second in August. Elementary teachers were identified among the participants of the training program for analysis. Means, medians, standard deviations, reliability (Kuder-Richardson 20), mean difficulties and mean discriminations were determined (see Table 4). Test items were reviewed and restated according to previously described validity controls.

Table 4

Distribution of Statistical Analyses by Pilot Tests and Study Group

1446			· · · · · · · · · · · · · · · · · · ·			M	\overline{M}
Pilot Tests	N	M	Mdn	SD	K-R 20	Difficulty	Discrimination
First	16	31.75	33.00	3.40	0.70	63.50	0.17
Second	27	33.59	33.00	4.54	0.74	67.19	0.23
Study Group	90	34.72	36.00	7.32	0.69	69.44	0.35

Note. Means and medians were reported as percent scores.

Internal Consistency

Norm-referenced tests were designed to measure differences between individuals, not performance on a domain (Ary, Jacobs, & Razavieh, 1996). In contrast, criterionreferenced tests were designed to determine a subject's status with respect to a welldefined domain, criterion, or objective. "Reliability of this type of test is concerned with the consistency with which this status is estimated" (p. 289). Correlations or reliability coefficients on these tests are not considered appropriate. "... An individual's performance is not compared to others but rather to the range of possible scores. Thus, the two kinds of tests serve different purposes and therefore what it means to be reliable will also differ" (Wiersma & Jurs, 1990, p. 262). Furthermore, Mabry (1999) stated, "In traditional measurement thinking, reliability is suppose to support validity. Measurement textbooks uniformly proclaim that reliability is necessary but not sufficient for validity" (p. 675, see also Cole, 1988; Cronbach, 1988; Messick, 1989). Therefore, to increase test reliability, this researcher made every effort to control the sources of unreliability addressed by Wiersma and Jurs (1990): homogeneous items; discriminating items; enough items; clear directions to the individual; a controlled setting; motivating introduction; and clear directions to the scorer.

In addition, the standard error of measurement was calculated to quantify variation among the scores from the study group (see Table 5). This provided the Table 5

Distribution of Teacher Agricultural Knowledge by Standard Error of Measurement

	Proportion Number of Answered			
Score	Questions	Correctly	SEM	
Overall Average Score	50	.69	0.07	

Note. SEM is the standard error of measurement

researcher with an estimate of the error which may be involved in each teachers' agricultural knowledge score by taking into consideration the unreliability of the test.

"The standard error of measurement is different from most of the other numerical values that indicate how reliable a test is ... A value near 0 for the standard error of measurement would mean that the measure is very reliable; there is little error" (Wiersma & Jurs, 1990, p. 262).

Part II (Demographic Instrument)

A demographic instrument was developed to collect background information and selected characteristics of teachers (see Appendix L). All questions were referenced to previous agricultural knowledge research (see Appendix M). Specific variables identified as important in research studies included: gender; ethnicity; experience in agriculture; academic preparation; teacher preparation; experience in teaching; place of residency; agricultural literacy training; type of school; resources used to teach about agriculture; and benefits from integrating agriculture into core academic subjects.

Interpreting Agriculture Knowledge

Since the purpose of this study was to assess the agricultural knowledge of selected K-6 grade teachers, the results expressed the level of specific agricultural knowledge each teacher could demonstrate without reference to the performance of others. Generally accepted in academic settings, scalar labels of performance were the following: 90%-100%, 'superior knowledge'; 80%-89%, 'acceptable knowledge'; 70%-79%, 'moderate knowledge'; 60%-69%, 'minimal knowledge'; and less than 60%, 'unacceptably low knowledge' (Terry, Herring, & Larke, 1992). However, Gronlund (1998) stated, "criterion-referenced test are typically, but not exclusively, used for mastery testing" (p. 27). Also addressing item selection procedures for criterion-referenced tests, Gronlund (1998) stated, "all items needed to adequately describe performance. No attempt is made to alter item difficulty or to eliminate easy items to increase the spread of scores" (p.28). Therefore, no mastery level of performance was established by this study since item selection procedures were performed.

Collection of Data

Data were collected from 44 K-6 grade teachers with AITC training and from 46 K-6 grade teachers with no AITC training in the fall of 2001. Collaboration with each state AITC coordinator in the four participating states led to the selection of teachers for inclusion in the study. Directions and procedures for collecting the data from each site were developed and mailed to each state AITC coordinator and teacher (see Appendices N & O). The AITC coordinator for each state visited the school and administered the

instruments to the teachers. Completed instruments were collected by each state AITC coordinator and returned via the United States Postal Service.

Analysis of Data

The data from the test and demographic instruments were quantitative and entered into Statistical Package for Social Science (SPSS) for Windows, version 8.0 for analysis. Data were analyzed using descriptive statistics to describe and summarize observations. In addition, the researcher summarized solicited comments to three open-ended questions concerning benefits of AITC training and types of outdoor activities used to teach agriculture.

The following presents a description of the data analysis for each objective:

Objective 1: Teacher characteristics of AITC trained teachers and non-AITC trained teachers were described using frequency distributions and percentages.

Objective 2: The development of an appropriate instrument was described by content, criterion, and construct validity. In addition, pilot tests were item analyzed by descriptive statistics. Agricultural knowledge differences between AITC trained teachers and non-AITC trained teachers were described using frequency distributions, percentages, and measures of central tendency and variability. Glass' delta was also calculated as an effect sizes to determine agricultural knowledge improvement. Conventions for Glass' delta were based on Cohen's d (1988): small, less than 0.49; medium, 0.50-0.79; large, greater than 0.80.

Objective 3: Associations between agricultural knowledge and teacher characteristics were described using correlation coefficients. Point biserial coefficients were used due to

instrument items containing interval level data and genuine dichotomous level data. Conventions used to interpret Point biserial coefficients were the same as Pearson product moment coefficients since the Point biserial coefficient is a mathematical simplification of the Pearson product moment coefficient (Ary, Jacobs, & Razavieh, 1985).

Objective 4: Resources and materials used to teach about agriculture were described using frequency distributions and percentages.

CHAPTER IV

FINDINGS

The purpose of this chapter was to present the data collected from the instruments used to conduct the study. The data were organized according to the objectives of the study.

Purpose of the Study

The purpose of this study was to assess the agricultural knowledge of selected kindergarten through sixth grade teachers. This study also sought to describe selected characteristics of those teachers and to explore the nature and strength of relationships among those teacher characteristics and their agricultural knowledge.

Objectives of the Study

In order to accomplish the purpose of the study, the following objectives were established:

- To describe teacher characteristics of Agriculture in the Classroom (AITC) trained teachers and non-AITC trained teachers.
- To develop an appropriate instrument to compare agricultural knowledge differences between AITC trained teachers and non-AITC

- trained teachers across the five thematic areas of the Food and Fiber Systems Literacy (FFSL) Framework.
- To describe the relationship between agricultural knowledge and teacher characteristics.
- 4) To describe resources and materials used by AITC trained teachers to teach about agriculture.

The Study Population

The scope of this study included selected AITC trained and untrained teachers from Arizona, Montana, Oklahoma, and Utah during the 2001-2002 school year.

Objective 1: To describe teacher characteristics of Agriculture in the Classroom (AITC) trained teachers and non-AITC trained teachers.

Data in Table 6 described the frequency and proportion of teachers by AITC training. Data indicated 44 (48.9%) teachers had AITC training and 46 (51.1%) had no AITC training. Ninety (80%) teachers responded to this demographic instrument resulting in a non-response of 22 (20%) teachers.

Distribution of Teachers by AITC Training

Table 6

AITC Training	Frequency (f)	Percent (P)	Number (N)
Trained	44	48.90	44
Untrained	46	51.10	46
Total	90	100.00	90

Data in Table 7 described the frequency and proportion of teachers by AITC training and gender. Data indicated five (11.6%) male and 38 (88.4%) female AITC

trained teachers. Data also indicated 5 (11.4%) male and 39 (88.6) female untrained teachers. In addition, data indicated a total of 10 (11.5%) male and 77 (88.5%) female teachers, which comprised the responding population of teachers.

Table 7

Distribution of Teachers by AITC Training and Gender

	<u>Male</u>	<u>Female</u>	
AITC Training	f(P)	f(P)	N
Trained	5 (11.6)	38 (88.4)	43
Untrained	5 (11.4)	39 (88.6)	44
Total	10 (11.5)	77 (88.5)	87
			

Note. Item non-response was three teachers.

Data in Table 8 described the frequency and proportion of teachers by AITC training and ethnicity. Data indicated 38 (97.4%) Caucasian and one (2.6%) Native American AITC trained teachers. Data also indicated 43 (100%) Caucasian untrained teachers. In addition, data indicated a total of 81 (98.8%) Caucasian and one (1.2%) Native American teachers, which comprised the responding population of teachers.

Distribution of Teachers by AITC Training and Ethnicity

Ethnicity				
	Caucasian	Native American		
AITC Training	f(P)	f(P)	N	
Trained	38 (97.4)	1 (2.6)	39	
Untrained	43 (100.0)		43	
Total	81 (98.8)	1 (1.2)	82	

Note. Item non-response was eight teachers.

Table 8

Data in Table 9 described the frequency and proportion of teachers by training of the variable, 'grew up on a farm.' Data indicated 6 (14%) AITC trained teachers who grew up on a farm and 37 (86%) AITC trained teachers who did not grow up on a farm.

Data also indicated 9 (20%) untrained teachers who grew up on a farm and 35 (79.5%) untrained teachers who did not grow up on a farm. In addition, data indicated a total of 15 (17.2%) teachers who grew up on a farm and 72 (82.8%) teachers who did not grow up on a farm, which comprised the responding population of teachers.

Distribution of Teachers by AITC Training and Growing Up on a Farm

Grew Up on a Farm					
	<u>Yes</u>	<u>No</u>			
AITC Training	f(P)	f(P)	N		
Trained	6 (14.0)	37 (86.0)	43		
Untrained	9 (20.5)	35 (79.5)	44		
Total	15 (17.2)	72 (82.8)	87		

Note. Item non-response was three teachers.

Table 9

Data in Table 10 described the frequency and proportion of teachers by AITC training and past 4-H membership. Data indicated 16 (37.2%) AITC trained teachers with past 4-H membership and 27 (62.8%) AITC trained teachers with no past 4-H membership. Data also indicated 10 (22.7%) untrained teachers with past 4-H membership and 34 (77.3%) untrained teachers with no past 4-H membership. In addition, data indicated a total of 26 (29.9%) teachers with past 4-H membership and 61 (70.1%) teachers with no past 4-H membership, which comprised the responding population of teachers.

Table 10

Distribution of Teachers by AITC Training and 4-H Membership

4-H Membership					
	$\underline{\text{Yes}}$	<u>No</u>			
AITC Training	f(P)	f(P)	N		
Trained	16 (37.2)	27 (62.8)	43		
Untrained	10 (37.2)	34 (77.3)	44		
Total	26 (29.9)	61 (70.1)	87		

Note. Item non-response was three teachers.

Data in Table 11 described the frequency and proportion of teachers with AITC training and past FFA membership. Data indicated no AITC trained teachers with past FFA membership and 43 (100%) AITC trained teachers with no past FFA membership. Data also indicated no untrained teachers with past FFA membership and 44 (100%) untrained teachers with no past FFA membership.

Distribution of Teachers by AITC Training and FFA Membership

FFA Membership					
	Yes	<u>No</u>			
AITC Training	f(P)	f(P)	N		
Trained		43 (100.0)	43		
Untrained	···	44 (100.0)	44		
Total		87 (100.0)	87		

Note. Item non-response was three teachers.

Table 11

Data in Table 12 described the frequency and proportion of AITC trained teachers who have taken an agriculture course in high school. Data indicated no AITC trained teachers that had take an agriculture course in high school and 42 (100%) AITC trained teachers that had taken no agriculture courses in high school. Data also indicated one untrained teacher who had taken an agriculture course in high school and 43 untrained teachers who had not taken an agriculture course in high school.

Table 12

Distribution of Teachers by AITC Training and Agricultural Courses Taken in High School

	Agriculture Courses	Taken in High School	
•	<u>Yes</u>	<u>No</u>	
AITC Training	f(P)	f(P)	N
Trained		42 (100.0)	42
Untrained	1 (2.3)	43 (97.7)	44
Total	1 (1.2)	85(98.8)	86

Note. Item non-response was four teachers.

Data in Table 13 described the frequency and proportion of teachers with AITC training and the number of semesters of agriculture courses taken in high school. Data indicated no AITC trained teachers had completed any agriculture course in high school. Data also indicated one (33.3%) untrained teacher had taken one semester of agriculture coursework in high school, one (33.3%) untrained teacher had taken two semesters of agriculture courses in high school and one (33.3%) untrained teacher had taken three semesters of agriculture coursework in high school.

Table 13

Distribution of Teachers by AITC Training and Semester(s) of Agriculture Courses
Taken in High School

	Agriculture C	ourses Taken in	High School	
	1 Semester	2 Semesters	3 Semesters	
AITC Training	f(P)	f(P)	f(P)	N
			•	
Trained				
Untrained	1 (33.3)	1 (33.3)	1 (33.3)	3
Total	1 (33.3)	1 (33.3)	1 (33.3)	3

Note. Item non-response was due to a lack of an affirmative answer to question six on the demographic instrument.

Data in Table 14 described the frequency and proportion of teachers with AITC training and their highest level of education obtained. Data indicated one (2.3%) AITC trained teacher with an AA/AS degree, 30 (69.8%) with BA/BS degrees, and 12 (27.9%)

with MA/MS degrees. Data also indicated 31 (70.5%) untrained teachers with BA/BS degrees and 13 (29.5%) untrained teachers with MA/MS degrees. In addition, data indicated a total of one (1.1%) teacher with an AA/AS, 61 (70.1) teachers with BA/BS degrees and 25 (28.7%) teachers with MA/MS degrees of the responding population of teachers.

Table 14

Distribution of Teachers by AITC Training and Highest Level of Education

	Highe	est Level of Edu	cation	
	AA/AS	BA/BS	MA/MS	
AITC Training	f(P)	f(P)	f(P)	N
m 1	1 (2.2)	20 (60 0)	10 (27.0)	10
Trained	1 (2.3)	30 (69.8)	12 (27.9)	43
Untrained		31 (70.5)	13 (29.5)	44
Total	1 (1.1)	61 (70.1)	25 (28.7)	87

Note. Item non-response was three teachers.

Data in Table 15 described the frequency and proportion of teachers with AITC training and agriculture major. Data indicated 3 (7.5%) AITC trained teachers with agriculture majors and 37 (92.5%) AITC trained teachers with non-agriculture majors. Data also indicated no untrained teachers with agriculture majors and 42 (100%) untrained teachers with non-agriculture majors. In addition, data indicated a total of 3 (3.7%) teachers with agriculture majors and 79 (96.3%) teachers with non-agriculture majors of the responding population of teachers.

Table 15

Distribution of Teachers by AITC Training and Type of Undergraduate Major

	Agricult	ure Major	
	<u>Yes</u>	<u>No</u>	
AITC Training	f(P)	f(P)	N
Trained	3 (7.5%)	37 (92.5%)	40
Untrained	·	42 (100.0%)	42
Total	3 (3.7)	79 (96.3%)	82
Total	3 (3.7)	79 (90.3%)	

Note. Item non-response was eight teachers.

Data in Table 16 described the frequency and proportion of teachers with AITC training and undergraduate major. Data indicated AITC trained teachers had the following types of undergraduate majors: 20 (50%) Elementary Education; 9 (22.5%) Education; 3 (7.5%) Early Childhood; and 1 (2.5%) General Studies, Mathematics, Elementary Education/History; Child Development, Business Administration/Elementary Education, Science/Social Studies, Forestry, and History. Data also indicated untrained teachers had the following types of undergraduate majors: 22 (52.4%) Elementary Education; 7 (16.7%) Education; 4 (9.5%) Early Childhood; 2 (4.8%) Social Studies; and 1 (2.4%) Child Development, Elementary Education/History, General Studies, Sociology, Art History, Criminology, Elementary Education/Psychology, Special Education, and English.

Table 16

Distribution of Teachers by AITC Training and Undergraduate Major

	AITC Training					
	Trained	<u>Untrained</u>	Total			
Undergraduate Major	f(P)	f(P)	f(P)			
Education	9 (22.5)	7 (16.7)	16 (19.5)			
Child Development	1 (2.5)		1 (1.2)			
Elementary Education	20 (50.0)	22 (52.4)	42 (51.2)			
Elementary Education &	1 (2.5)		1 (1.2)			
History						
Early Childhood	3 (7.5)	4 (9.5)	7 (8.5)			
Social Studies		2 (4.8)	2 (2.4)			
General Studies	1 (2.5)	1 (2.4)	2 (2.4)			
Mathematics	1 (2.5)	4.4	1 (1.2)			
Business Administration &	1 (2.5)		1 (1.2)			
Elementary Education						
Science & Social Studies	1 (2.5)		1 (1.2)			
Sociology		1 (2.4)	1 (1.2)			
Art History		1 (2.4)	1 (1.2)			
Criminology		1 (2.4)	1 (1.2)			
Elementary Education &		1 (2.4)	1 (1.2)			
Psychology						
Forestry	1 (2.5)		1 (1.2)			
History	1 (2.5)		1 (1.2)			
Special Education		1 (2.4)	1 (1.2)			
English		1 (2.4)	1 (1.2)			

Data in Table 17 described the frequency and proportion of teachers with AITC training and type of teaching certification. Data indicated teachers with AITC training had the following types of teaching certifications: 42 (68.9%) Elementary; 4 (6.6%) Reading; 3 (4.9%) Language Arts, Social Studies, and Other; 2 (3.3%) Special Education; and 1 (1.6%) Multiple Subject, Science, Physical Education, and Music. Data also indicated untrained teachers had the following types of teaching certifications: 41 (69.5%) Elementary; 4 (6.8%) Reading and Social Studies; 3 (5.1%) Other; and 1 (1.7%) Multiple Subject, Science, Physical Education, Music, and Special Education.

Table 17

Distribution of Teachers by AITC Training and Type of Teaching Certification

	AITC 7	Training	
Type of Teaching	<u>Trained</u>	<u>Untrained</u>	Total
Certification	f(P)	f(P)	f(P)
Elementary	42 (68.9)	41 (69.5)	83 (69.2)
Multiple Subject	1 (1.6)	1 (1.7)	2 (1.7)
Language Arts	3 (4.9)	2 (3.4)	5 (4.2)
Reading	4 (6.6)	4 (6.8)	8 (6.7)
Science	1 (1.6)	1 (1.7)	2 (1.7)
Social Studies	3 (4.9)	4 (6.8)	7 (5.8)
Physical Education	1 (1.6)	1 (1.7)	2 (1.7)
Music	1 (1.6)	1 (1.7)	2 (1.7)
Special Education	2 (3.3)	1 (1.7)	3 (2.5)
Other	3 (4.9)	3 (5.1)	6 (5.0)
Health	1 (33.3)		
Early Childhood	2 (66.7)	2 (66.7)	4 (66.7)
English as a Second		1 (33.3)	1 (33.3)
Language			

Note. Some teachers reported holding multiple credentials.

Data in Table 18 described the frequency and proportion of teachers with AITC training and the number of semester hours of agriculture taken in college. Data indicated teachers with AITC training took the following numbers of semester hours of agriculture during college: 27 (87.1%) 1-3 hours; 2 (6.5%) 4-6 hours; 1 (3.2%) 7-9 hours; and 1 (3.2%) 10-12 hours. Data also indicated untrained teachers took the following numbers of semester hours of agriculture during college: 26 (92.9%) 1-3 hours and 2 (7.1%) 7-9 hours. In addition, data indicated a total of 53 (89.8%) teachers took 1-3 semester hours of agriculture during college of the responding population of teachers.

Table 18

Distribution of Teachers by AITC Training and Number of Semester Hours of Agriculture Taken in College

		Number of Sen	nester Hours of		
Agriculture Taken in College					
AITC	<u>1-3 Hours</u>	<u>4-6 Hours</u>	<u>7-9 Hours</u>	<u>10-12 Hours</u>	
Training	f(P)	f(P)	f(P)	f(P)	N
Trained	27 (87.1)	2 (6.5)	1 (3.2)	1 (3.2)	31
Untrained	26 (92.9)		2 (7.1)		28
Total	53 (89.8)	2 (3.4)	3 (5.1)	1 (1.7)	59

Note. Item non-response was 37 teachers.

Data in Table 19 described the frequency and proportion of teachers with AITC training and the type of city in which they reside. Data indicated teachers with AITC training resided in the following types of cities: 3 (21.4%) rural; 9 (64.3%) suburban; and 2 (14.3%) urban. Data also indicated untrained teachers resided in the following types of cities: 7 (31.8%) rural; 7 (31.8%) suburban; and 8 (36.4%) urban. In addition, data indicated a total of 10 (27.8%) teachers resided in a rural city, 16 (44.4%) teachers resided in a suburban city, and 10 (27.8%) teachers resided in an urban city of the responding population of teachers.

Table 19

Distribution of Teachers by AITC Training and Type of City They Reside In

	Туре	of City They Resi	de In	
	Rural	Suburban	<u>Urban</u>	•
AITC Training	f(P)	f(P)	f(P)	N
Trained	3 (21.4)	9 (64.3)	2 (14.3)	14
Untrained	7 (31.8)	7 (31.8)	8 (36.4)	22
Total	10 (27.8)	16 (44.4)	10 (27.8)	36

Note. Item non-response was 54 teachers.

Data in Table 20 described the frequency and proportion of teachers with AITC training and work experience in agriculture. Data indicated 13 (30.2%) AITC trained

teachers had work experience in agriculture while 30 (69.8%) AITC trained teachers had no work experience in agriculture. Data also indicated 14 (31.8%) untrained teachers had work experience in agriculture while 30 (68.2%) untrained teachers had no work experience in agriculture. In addition, data indicated a total of 27 (31%) teachers with work experience in agriculture, while 60 (69%) teachers had no work experience in agriculture of the responding population of teachers.

Table 20

Distribution of Teachers by AITC Training and Work Experience in Agriculture

	Work Experience in Agriculture		
	<u>Yes</u>	<u>No</u>	
AITC Training	f(P)	f(P)	
Trained	13 (30.2)	30 (69.8)	
Untrained	14 (31.8)	30 (68.2)	
Total	27 (31.0)	60 (69.0)	

Note. Item non-response was three teachers.

Data in Table 21 described the frequency and proportion of teachers with AITC training and the number of years worked in agriculture. Data indicated 13 AITC trained teachers had worked in agriculture the following number of years: four (30.8%) teachers one year of less; three (23.1%) teachers two years; two (15.4%) teachers three years and 10 years or more; and one (7.7%) teacher four and six years. Data also indicated 15 untrained teachers had worked in agriculture the following number of years: five (33.3%) teachers one year of less; four (26.7%) teachers 10 years or more; two (13.3) teachers two years; and one (6.7%) teacher three, five, six and eight years.

Distribution of Teachers by AITC Training and Number of Year Worked in Agriculture

Table 21

Number of Years	AITC '	Γraining	
Worked in	<u>Trained</u>	<u>Untrained</u>	Total
Agriculture	f(P)	f(P)	f(P)
1 Year or Less	4 (30.8)	5 (33.3)	9 (32.1)
2 Years	3 (23.1)	2 (13.3)	5 (17.9)
3 Years	2 (15.4)	1 (6.7)	3 (10.7)
4 Years	1 (7.7)		1 (3.6)
5 Years		1 (6.7)	1 (3.6)
6 Years	1 (7.7)	1 (6.7)	2 (7.1)
8 Years		1 (6.7)	1 (3.6)
10 Years or More	2 (15.4)	4 (26.7)	6 (21.4)

Note. Item response rate was due to an affirmative response on question 13 on the demographic instrument.

Data in Table 22 described the frequency and proportion of teachers with AITC training and farm engagement. Data indicated 5 (11.6%) AITC trained teachers were engaged in farming while 38 (88.4%) were not engaged in farming. Data also indicated 5 (11.4%) untrained teachers were engaged in farming while 39 (88.6%) were not engaged in farming. In addition, data indicated a total of 10 (11.5%) teachers were engaged in farming of the responding population of teachers.

Table 22

Distribution of Teachers by AITC Training and Farm Engagement

	Farm Eng	gagement
	Yes	<u>No</u>
AITC Training	$\overline{f(P)}$	f(P)
Trained	5 (11.6)	38 (88.4)
Untrained	5 (11.4)	39 (88.6)
Total	10 (11.5)	77 (88.5)

Note. Item non-response was three teachers.

Data in Table 23 described the frequency and proportion of teachers with AITC training and the number of acres they were farming. Data indicated AITC training

teachers farmed the following number of acres: 1 (20.0) teacher one to nine acres, 10-49 acres, and 500-999 acres; and 2 (40.0) teachers 1,000 acres or more. Data also indicated untrained teachers farmed the following number of acres: 1 (10.0) teacher one to nine acres, 10-49 acres, 50-179 acres, 180-499 acres, 500-999 acres, and 1,000 acres or more.

Distribution of Teachers by AITC Training and Number of Acres Farming

	AITC Training			
	<u>Trained</u>	Untrained	Total	
Number of Acres Farmed	f(P)	f(P)	f(P)	
1-9 Acres	1 (20.0)		1 (10.0)	
10-49 Acres	1 (20.0)	1 (20.0)	2 (20.0)	
50-179 Acres		1 (20.0)	1 (10.0)	
180-499 Acres		1 (20.0)	1 (10.0)	
500-999 Acres	1 (20.0)	1 (20.0)	2 (20.0)	
1,000 Acres of More	2 (40.0)	1 (20.0)	3 (30.0)	
Total Farming	5 (100.0)	5 (100.0)	10 (100.0)	
Not Farming	39 (49.0)	41 (51.0)	80 (100.0)	

Note. Item non-response was 10 teachers.

Table 23

Data in Table 24 described the frequency and proportion of teachers with AITC training and received some type of agricultural literacy training. Data indicated 26 (61.9%) AITC trained teachers replied they had received some type of agricultural literacy training while 16 (38.1%) AITC trained teachers replied they had not received any type of agricultural literacy training. Data also indicated 3 (6.8%) untrained teachers replied they had received some type of agricultural literacy training while 41 (93.2%) untrained teachers replied they had never received any type of agricultural literacy training.

Table 24

Distribution of Teachers by AITC Training and Agricultural Literacy Training

	Received Some Type of Agri	cultural Literacy Training
	<u>Yes</u>	<u>No</u>
AITC Training	f(P)	f(P)
Trained	26 (61.9)	16 (38.1)
Untrained	3 (6.8)	41 (93.2)
Total	29 (33.7)	57 (66.3)

Note. Item non-response was four teachers.

Data in Table 25 described the frequency and proportion of teachers with AITC training and the type of agricultural literacy training they received. Data indicated AITC trained teachers received the following types of agricultural literacy training: 3 (9.1%) school district; 19 (57.6%) AITC; 10 (30.3%) Food, Land and People; and 1 (3.0) other. Data also indicated untrained AITC teachers received the following type of agricultural literacy training: 2 (50%) school district; 1 (25%) AITC; and 1 (25%) commodity group. In addition, data indicated one AITC trained teacher replied no AITC training and one AITC trained teacher replied attending a summer agriculture institute (Other).

Table 25

Distribution of Teachers by AITC Training and Type of Agricultural Literacy Training Received

	AITC Training		
Type of Agricultural	Trained	<u>Untrained</u>	
Literacy Training Received	f(P)	f(P)	N
School District	3 (9.1)	2 (50.0)	5
AITC	19 (57.6)	1 (25.0)	20
Food, Land & People	10 (30.3)		10
Commodity Group		1 (25.0)	1
Other	1 (3.0)		1

Data in Table 26 described the frequency and proportion of teachers with AITC training and the number of received hours by type of agricultural literacy training. Data

indicated two AITC trained teachers received one to one and one-half hours of agricultural literacy training by their school district. Data also indicated two untrained teachers received between four and six hours of agricultural literacy training by their school district.

Table 26

Distribution of Teachers by AITC Training and Number of Agricultural Literacy Training Hours Received by School District

	AITC '	Training
Number of Training Hours	<u>Trained</u>	<u>Untrained</u>
by School District	f(P)	f(P)
1	1 (50.0)	
1.5	1 (50.0)	
4		1 (50.0)
6		1 (50.0)

Data in Table 27 described the frequency and proportion of teachers with AITC training and the number of hours received by type of agricultural literacy training. Data indicated nine AITC trained teachers received two to 48 hours of agricultural literacy training by Agriculture in the Classroom.

Table 27

Distribution of Teachers by AITC Training and Number of Agricultural Literacy Training Hours Received by AITC

	AITC	Training
Number of Training Hours by AITC	$\frac{\text{Trained}}{f(P)}$	$\frac{\text{Untrained}}{f(P)}$
10 or Less	4(44.4)	
20	1 (11.1)	
30	1 (11.1)	
40	1 (11.1)	
48	2 (22.2)	

Data in Table 28 described the frequency and proportion of teachers with AITC training and the number of received hours by type of agricultural literacy training. Data indicated four AITC trained teachers received six to sixteen hours of agricultural literacy training by Project Food, Land and People.

Table 28

Distribution of Teachers by Number of Agricultural Literacy Training Hours Received by Food, Land and People and AITC Training

	AITC Training	
Number of Training Hours	Trained	<u>Untrained</u>
by FLP	f(P)	f(P)
6	2 (50.0)	
8	1 (25.0)	
16	1 (25.0)	

Data in Table 29 described the frequency and proportion of teachers with AITC training and the number of received hours by type of agricultural literacy training. Data indicated one untrained teacher received eight hours of agricultural literacy training by an agricultural commodity group.

Table 29

Distribution of Teachers by Number of Agricultural Literacy Training Hours Received by an Agricultural Commodity Group and AITC Training

	AITC '	Training
Number of Training Hours	<u>Trained</u>	<u>Untrained</u>
by Ag Comm. Group	f(P)	f(P)
8	1 (100.0)	

Data in Table 30 described the frequency and proportion of teachers with AITC training and the number of received hours by type of agricultural literacy training. Data

indicated one untrained teacher received 48 hours of agricultural literacy training by some other type of agricultural literacy training.

Table 30

Distribution of Teachers by Number of Agricultural Literacy Training Hours Received by Summer Agriculture Institute and AITC Training

	AITC T	Training
Number of Training Hours	<u>Trained</u>	<u>Untrained</u>
by Summer Ag Institute	f(P)	f(P)
48	1 (100.0)	

Data in Table 31 indicated the frequency and proportion of teachers with AITC training and the number of years of teaching experience. Data indicated a wide range of teaching experience for both groups of teachers. Data indicated total years of teaching experience for all teachers were the following: 17 teachers with one to six years of teaching experience; 15 teachers with seven to 12 years of teaching experience; 18 teachers with 13-18 years of teaching experience; 19 teachers with 19-24 years of teaching experience; 12 teachers with 25-30 years of teaching experience; and five teachers with 30 years or more teaching experience.

Table 31

Distribution of Teachers by Number of Years Teaching and AITC Training

			
	AITC 7		
	<u>Trained</u>	<u>Untrained</u>	
Number of Years Teaching	f(P)	f(P)	N
1-6 Years	9 (21.4)	8 (18.2)	17
7-12 Years	9 (21.40	6 (13.6)	15
13-18 Years	6 (14.3)	12 (27.3)	18
19-24 Years	11 (26.2)	8 (18.2)	19
25-30 Years	5 (11.9)	7 (15.9)	. 12
31 More Years	2 (4.8)	3 (6.8)	5
3.7 / Ti	, ,		

Note. Item non-response was four teachers.

Data in Table 32 indicated the frequency and proportion of teachers with AITC training and the type of school. Data indicated a total of 29 teachers work in rural schools, 14 teachers work in urban schools, and 32 teachers work in suburban schools. In addition, one teacher reported they worked in a rural/suburban school.

Table 32

Distribution of Teachers by Type of School and AITC Training

	AITC	Fraining Training	
Type of School	$\frac{\text{Trained}}{f(P)}$	$\frac{\text{Untrained}}{f(P)}$	Total $f(P)$
Rural	14 (40.0)	15 (36.6)	29 (38.20
Urban	3 (8.6)	11 (26.8)	14 (18.4)
Suburban	17 (48.6)	15 (36.6)	32 (42.1)
Rural/Suburban	1 (2.9)	´	1 (1.3)

Note. Item non-response was 14 teachers.

Table 33

Data in Table 33 indicated the frequency and proportion of teachers with AITC training and the size of the school by student population. Data indicated totals for the following size of schools: four schools had 100 students or less; 3 schools had 101-200 students; 34 schools had 201-501 students; 17 schools had 501-900 students; and 6 schools had more than 901 students enrolled.

Distribution of Teachers by Size of School and AITC Training

		<u> </u>	
	AITC 7		
	Trained	<u>Untrained</u>	Total
Size of School	f(P)	f(P)	f(P)
100 Students or Less	2 (5.7)	2 (6.9)	4 (6.3)
101-200 Students	2 (5.7)	1 (3.4)	3 (4.7)
201-500 Students	17 (48.6)	17 (58.6)	34 (53.1)
501-900 Students	12 (34.3)	5 (17.2)	17 (26.6)
901 Students or More	2 (5.7)	4 (13.8)	6 (9.4)

Note. Item non-response was 26 teachers.

Objective 2: To develop an appropriate instrument to compare agricultural knowledge differences between AITC trained teachers and non-AITC trained teachers across the five thematic areas of the Food and Fiber Systems Literacy (FFSL) Framework.

Data in Table 34 described agricultural knowledge scores of AITC trained teachers according to the FFSL Framework themes. For theme one (Understanding Food & Fiber Systems), the average score of AITC trained teachers was 72.73 percent followed by larger median (77.27) and mode (81.82) scores and a negatively skewed (-0.63) distribution. The standard deviation (16.75) and the range of scores (72.73) indicated a slight platykurtic (-0.13) distribution. For theme two (History, Geography, & Culture), the average score of AITC trained teachers was 84.77 percent followed by larger median (90.00) and mode (100.00) scores and a negatively skewed (-0.91) distribution. The standard deviation (15.32) and the range of scores (60.00) indicated a slight leptokurtic (0.38) distribution. For theme three (Science, Technology, & Environment), the average score of AITC trained teachers was 79.55 percent followed by larger median (81.82) and mode (81.82) scores and a negatively skewed (-0.96) distribution. The standard deviation (15.08) and the range of scores (63.64) indicated a leptokurtic (1.04) distribution. For theme four (Business & Economics), the average score of AITC trained teachers was 64.29 percent followed by larger median (71.43%) and mode (71.43) scores and a negatively skewed (-0.83) distribution. The standard deviation (18.10) and the range of scores (71.43) indicated a slight leptokurtic (0.31) distribution. For theme five (Food, Nutrition, & Health), the average score of AITC trained teachers was 64.70 percent followed by smaller median (63.66) and mode (63.64) scores and a negatively skewed (-0.15) distribution. The standard deviation (16.07) and the range of scores (63.64) indicated a slight platykurtic (-0.44) distribution.

Table 34

Distribution of AITC Trained Teachers' Agricultural Knowledge Scores by Theme (N = 44)

Theme	M	Mdn	Mode	SD	Range	Skewness	Kurtosis
Theme 1	72.73	77.27	81.82	16.75	72.73	-0.63	-0.13
Theme 2	84.77	90.00	100.00	15.32	60.00	-0.91	0.38
Theme 3	79.55	81.82	81.82	15.08	63.64	-0.96	1.04
Theme 4	64.29	71.43	71.43	18.10	71.43	-0.83	0.31
Theme 5	64.70	63.66	63.64	16.07	63.64	-0.15	-0.44

Note. Means, medians, and modes were reported as percent scores.

Data in Table 35 described agricultural knowledge scores of non-AITC trained teachers according to the FFSL Framework themes. For theme one (Understanding Food & Fiber Systems), the average score of non-AITC teachers was 64.82 percent followed by larger median (72.73) and mode (72.73) scores and a negatively skewed (-0.87) distribution. The standard deviation (17.73) and the range of scores (72.73) indicated a slight leptokurtic (0.37) distribution. For theme two (History, Geography, & Culture), the average score of non-AITC teachers was 76.52 percent followed by a larger median (80.00) score and a smaller mode (70.00) scores The relation between the mean, median and mode did not indicate a normal distribution. The standard deviation was 19.00 and the range of scores was 80.00. For theme three (Science, Technology, & Environment), the average score of non-AITC teachers was 66.80 percent followed by larger median (72.73) and mode (81.82) scores and a negatively skewed (-0.70) distribution. The standard deviation (22.86) and the range of scores (81.82) indicated a slight platykurtic (-0.27) distribution. For theme four (Business & Economics), the average score of non-AITC teachers was 59.63 percent followed by a smaller median (57.14) score and a larger mode (71.43) score. The relation between the mean, median and mode did not indicate a normal distribution. The standard deviation was 18.64 and the range of scores was 71.43.

For theme five (Food, Nutrition, & Health), the average score of non-AITC teachers was 58.30 percent followed by a larger median (63.64) score and a smaller mode (54.55) score. The relation between the mean, median and mode did not indicate a normal distribution. The standard deviation was 22.07 and the range of scores was 90.91.

Table 35

Distribution of Non-AITC Trained Teachers' Agricultural Knowledge Scores by Theme (N = 46)

Theme	M	Mdn	Mode	SD	Range	Skewness	Kurtosis
Theme 1	64.82	72.73	72.73	17.73	72.73	-0.87	0.37
Theme 2	76.52	80.00	70.00	19.00	80.00	-0.98	1.06
Theme 3	66.80	72.73	81.82	22.86	81.82	-0.70	-0.27
Theme 4	59.63	57.14	71.43	18.64	71.43	-0.02	-0.85
Theme 5	58.30	63.64	54.55	22.07	90.91	-0.39	-0.57

Note. Means, medians, and modes were reported as percent scores.

Data in Table 36 described agricultural knowledge scores of teachers by AITC training. The average score of AITC trained teachers was 73.68 percent followed by larger median (76.00) and mode (76.00) scores and a negatively skewed (-0.89) distribution. The standard deviation (11.89) and the range of scores (50.00) indicated a leptokurtic (0.60) distribution. The average score of non-AITC trained teachers was 65.43 percent followed by larger median (70.00) and mode (72.00) scores and a negatively skewed (-0.81) distribution. The standard deviation (16.07) and the range of scores (62.00) indicated a slight leptokurtic (0.60) distribution.

Table 36

Distribution of Teacher Agricultural Knowledge Scores by Training (N = 90)

Training	<u> </u>	Mdn	Mode	SD	Range	Skewness	Kurtosis
Trained	73.68	76.00	76.00	11.89	50.00	-0.89	0.60
Untrained	65.43	70.00	72.00	16.07	62.00	-0.81	0.22

Note. Means, medians, and modes were reported as percent scores.

Data in Table 37 described the magnitude of AITC training on teachers by agricultural knowledge scores. For theme 1 (Understanding Food & Fiber Systems), a small effect size of 0.45 indicated that the mean of the AITC trained teachers was at the 67.5th percentile of the non-AITC trained teachers. For theme 2 (History, Geography, & Culture), a small effect size of 0.43 indicated that the mean of the AITC AITC trained teachers was at the 66.5th percentile of the non-AITC trained teachers. For theme 3 (Science, Technology, & Environment), a medium effect size of 0.56 indicated that the mean of the AITC trained teachers was at the 71.5th percentile of the non-AITC trained teachers. For theme 4 (Business & Economics), a small effect size of 0.25 indicated that the mean of the AITC trained teachers was at the 60th percentile of the non-AITC trained teachers. For theme 5 (Food, Nutrition, & Health), a small effect size of 0.29 indicated that the mean of the AITC trained teachers was at the 61.5th percentile of the non-AITC trained teachers. For the aggregate agricultural knowledge score, a medium effect size of 0.51 indicated that the mean of the AITC trained teachers was at the 69.5th percentile of the non-AITC trained teachers.

Table 37

Distribution of the Magnitude of AITC Training on Teachers by Agricultural Knowledge Scores

	AITC :		Percentile		
Theme	$M_{ m Trained}$	$M_{ m Untrained}$	SD Untrained	Effect Size	Standing
Theme 1	72.73	64.82	17.73	0.45	67.5
Theme 2	84.77	76.52	19.00	0.43	66.5
Theme 3	79.55	66.80	22.86	0.56	71.5
Theme 4	64.29	59.63	18.64	0.25	60.0
Theme 5	64.70	58.30	22.07	0.29	61.5
Overall	73.68	65.43	16.07	0.51	69.5
Average					

Note. Means were reported as percent scores.

Data in Table 38 described agricultural knowledge scores of all teachers by the FFSL Framework themes. For theme 1 (Understanding Food & Fiber Systems), the average score for all teachers was 68.69 percent followed by larger median (72.73) and mode (81.82) scores and a negatively skewed (-0.74) distribution. The standard deviation (17.62) and the range of scores (81.82) indicated a leptokurtic (0.25) distribution. For theme 2 (History, Geography, & Culture), the average score for all teachers was 80.56 percent followed by a small median (80.00) score and a larger mode (100.00) scores and a negatively skewed (-1.02) distribution. The standard deviation (17.00) and the range of scores (80.00) indicated a leptokurtic (1.25) distribution. For theme 3 (Science, Technology, & Environment), the average score for all teachers was 73.03 percent followed by larger median (81.82) and mode (81.82) scores and a negatively skewed (-1.01) distribution. The standard deviation (20.37) and the range of scores (81.82) indicated a leptokurtic (0.55) distribution. For theme 4 (Business & Economics the average score for all teachers was 61.90 percent followed by larger median (71.43) and mode (71.43) scores and a negatively skewed (-0.39) distribution. The standard deviation (18.42) and the range of scores (85.71) indicated a platykurtic (-0.55) distribution. For theme 5 (Food, Nutrition, & Health), the average score for all teachers was 61.41 percent followed by larger median (63.64) and mode (63.64) scores and a negatively skewed (-0.47) distribution. The standard deviation (19.53) and the range of scores (90.91) indicated a platykurtic (-0.17) distribution. The average score for all teachers was 69.47 followed by larger median (72.00) and mode (76.00) score and a negatively skewed (-0.98) distribution. The standard deviation (14.70) and the range of scores (62.00) indicated a leptokurtic (0.75) distribution.

Table 38

Distribution of Teacher Agricultural Knowledge Scores by Theme (N = 90)

				_	-	,	
Theme	M	Mdn	Mode	SD	Range	Skewness	Kurtosis
	60.60	50.50	04.00	15.60	01.00	0.74	0.05
Theme 1	68.69	72.73	81.82	17.62	81.82	-0.74	0.25
Theme 2	80.56	80.00	100.00	17.00	80.00	-1.02	1.12
Theme 3	73.03	81.82	81.82	20.37	81.82	-1.01	0.50
Theme 4	61.90	71.43	71.43	18.42	85.71	-0.39	-0.55
Theme 5	61.41	63.64	63.64	19.53	90.91	-0.47	-0.17
Overall	69.47	72.00	76.00	14.70	62.00	-0.98	0.75
Average							

Note. Means, medians, and modes were reported as percent scores.

Data in Table 39 described the standard error of measurement of teacher agricultural knowledge and the resulting interval estimate. For theme one (understanding food and fiber systems), the proportion of 11 questions answered correctly was 68.69 percent. An estimate of the error that may be involved with this theme was 0.15. Therefore, it was estimated that teachers could correctly answer between 53.69 to 83.69 percent of the items in theme one correctly. For theme two (history, geography, & culture), the proportion of 10 questions answered correctly was 80.56 percent. An estimate of the error that may be involved with this theme was 0.13. Therefore, it was estimated that teachers could correctly answer between 67.56 to 93.56 percent of the items in theme two correctly. For theme three (science, technology, & environment), the proportion of 11 questions answered correctly was 73.03 percent. An estimate of the error that may be involved with this theme was 0.14. Therefore, it was estimated that teachers could correctly answer between 59.03 to 87.03 percent of the items in theme three correctly. For theme four (business & economics), the proportion of seven questions answered correctly was 61.9 percent. An estimate of the error that may be involved with this theme was 0.2. Therefore, it was estimated that teachers could correctly answer

between 41.9 to 81.9 percent of the items in theme four correctly. For theme five (food, nutrition, & health), the proportion of 11 questions answered correctly was 61.41 percent. An estimate of the error that may be involved with this theme was 0.15. Therefore, it was estimated that teachers could correctly answer between 46.41 to 76.41 percent of the items in theme five correctly. The overall proportion of 50 questions answered correctly was 69.47 percent. An estimate of the error that may be involved with this score was 0.07. Therefore, it was estimated that teachers could correctly answer between 62.47 to 76.47 percent of the all items correctly.

Table 39

Distribution of Teacher Agricultural Knowledge Scores by Standard Error of Measurement and Interval Estimate

Theme	Percent Correctly	Number of		Interval
	Answered	Test Items	SEM	Estimate
Theme 1	68.69	11	0.15	53.69-83.69
Theme 2	80.56	10	0.13	67.56-93.56
Theme 3	73.03	11	0.14	59.03-87.03
Theme 4	61.90	7	0.20	41.90-81.90
Theme 5	61.41	10	0.15	46.41-76.41
Overall Average Score	69.47	50	0.07	62.47-76.47

Objective 3: To describe the relationship between agricultural knowledge and teacher characteristics.

Data in Table 40 described the strength and direction of the relationship between agricultural knowledge scores of teachers and teachers who grew up on a farm. Data indicated teachers who grew up on a farm had a higher mean percent score (75.87) than those who did not grow up on a farm (68.41). The calculated point biserial correlation

(0.1991) indicated a positive, yet low relationship between agricultural knowledge and whether a teacher grew up on a farm.

Table 40

Distribution of Teachers by Correlation of Agricultural Knowledge Score to Growing Up on a Farm

Teacher Characteristic	N	М	SD	t	df	$r_{ m pb}$	Strength of Relationship
Grew Up on a							
Farm Yes	15	75.87	10.07	1.873	85	0.1991	Low
No	72	68.41	14.67	2.2.0			2011

Note. Means were reported as percent scores.

Data in Table 41 described the strength and direction of the relationship between agricultural knowledge percent score of teachers and 4-H membership. Data indicated teachers who were 4-H members had a higher mean percent score (74.15) than those who were not 4-H members (67.80). The calculated point biserial correlation (0.2056) indicated a positive, yet low relationship between agricultural knowledge and prior 4-H membership.

Table 41

Distribution of Teachers by Correlation of Agricultural Knowledge Score to 4-H

Membership

Teacher Characteristic	N	М	SD	t	df	$r_{ m pb}$	Strength of Relationship
4-H Members							
Yes	26	74.15	10.78	1.937	85	0.2056	Low
No	61	67.80	15.14				

Note. Means were reported as percent scores.

Data in Table 42 described the strength and direction of the relationship between agricultural knowledge percent score of teachers and type of degree. Data indicated teachers with a bachelor's degree had a higher mean percent score (70.30) than those with

a master's degree (68.32). The calculated point biserial correlation (0.0630) indicated a positive, yet very low relationship between agricultural knowledge and type of degree.

Distribution of Teachers by Correlation of Agricultural Knowledge Score to Type of

Teacher Characteristic	N	M	SD	t	df	$r_{ m pb}$	Strength of Relationship
Type of Degree			•				
BS/BA	61	70.30	14.00	0.579	84	0.0630	Low
MS/MA	25	68.32	15.21	•			

Note. Means were reported as percent scores.

Table 42

Table 43

Data in Table 43 described the strength and direction of the relationship between agricultural knowledge percent score of teachers and agriculture courses taken in college. Data indicated teachers that have taken an agriculture course during college had a higher mean score (70.03) than teachers who did not take an agriculture courses during college (68.33). The calculated point biserial correlation (0.0548) indicated a positive, yet very low relationship between agricultural knowledge and agriculture courses taken in college.

Distribution of Teachers by Correlation of Agricultural Knowledge Score to Agriculture Courses Taken in College

Teacher Characteristic	N	М	SD	t	df	$r_{ m pb}$	Strength of Relationship
Taken College							
Ag Courses Yes	60	70.03	13.06	0.515	88	0.0548	Low
No	30	68.33	17.72				

Note. Means were reported as percent scores.

Data in Table 44 described the strength and direction of the relationship between agricultural knowledge percent score of teachers and work experience in agriculture. Data indicated teachers with work experience in agriculture had a higher mean percent score

(72.52) than teachers with no work experience in agriculture (68.43). The calculated point biserial correlation (0.1337) indicated a positive, yet low relationship between agricultural knowledge and work experience in agriculture.

Table 44

Distribution of Teachers by Correlation of Agricultural Knowledge Score to Work Experience in Agriculture

Teacher Characteristic	N	М	SD	t	df	$r_{ m pb}$	Strength of Relationship
Worked in Ag.			•				
Yes	27	72.52	10.58	1.244	85	0.1337	Low
No	60	68.43	15.50				

Note. Means were reported as percent scores.

Data in Table 45 described the strength and direction of the relationship between agricultural knowledge percent score of teachers and AITC training. Data indicated teachers with AITC training had a higher mean percent score (73.68) than those with no AITC training (65.43). The calculated point biserial correlation (0.2821) indicated a positive, yet very low relationship between agricultural knowledge and AITC training.

Distribution of Teachers by Correlation of Agricultural Knowledge Score to Agriculture in the Classroom Training

Teacher Characteristic	N	М	SD	t	df	$r_{ m pb}$	Strength of Relationship
AITC Training							•
Yes	44	73.68	11.89	2.758	88	0.2821	Low
No	46	65.43	16.07				

Note. Means were reported as percent scores.

Table 45

Data in Table 46 described the strength and direction of the relationship between agricultural knowledge percent score of teachers and area of residence. Data indicated teachers living in rural areas had a higher mean percent score (72.97) than those living in

urban areas (65.57). The calculated point biserial correlation (0.2391) indicated a positive, yet low relationship between agricultural knowledge and area of residence.

Distribution of Teachers by Correlation of Agricultural Knowledge Score to Living in a Rural or Urban Area

Teacher Characteristic	N	М	SD	t	df	$r_{ m pb}$	Strength of Relationship
Live in Rural or Urban Area							
Rural	29	72.97	12.99	1.577	41	0.2391	Low
Urban	14	65.57	17.06				

Note. Means were reported as percent scores.

Table 46

Objective 4: To describe resources and materials used by AITC trained teachers to teach about agriculture.

Data in Table 47 described the frequency and proportion of teachers with AITC training and types of resources used to teach about agriculture. Data indicated 33 (22.8%) teachers used books, four (2.8%) teachers used CD ROM, 31 (21.4%) teachers used activities, 16 (11%) teachers used agricultural professionals, 27 (18.6%) teachers used videos, two (1.4%) teachers used newsletters, one (0.6%) teacher used a commodity group information sheet, five (3.4%) teachers used state agricultural facts sheets, 20 (13.8%) teachers used lesson plans, and six (4.1%) teachers described other resources as FLP, AITC, agricultural field trips, projects and FFA.

Distribution of Teachers by AITC Training and Types of Resources Used To Teach Agriculture

Type of Resource Used to Teach	AITC Trained	
about Agriculture	f(P)	
Books	33 (22.8)	
CD ROM	4 (2.8)	
Activities	31 (21.4)	
Ag Professionals	16 (11.0)	
Video	27 (18.6)	
Newsletter	2 (1.4)	
Commodity Group Info Sheets	1 (0.6)	
State Ag Fact Sheets	5 (3.4)	
Lesson Plans	20 (13.8)	
Other	6 (4.1)	

Note. Teachers listed all that applied.

Table 47

Data in Table 48 described the frequency and proportion of teachers with AITC training and web resources used to teach about agriculture. Data indicated two (28.6%) teachers used the national AITC web site, three (42.9%) teachers used a state AITC web site, one (14.3%) teacher used an agricultural commodity web site, and one (14.3%) teacher used other and indicated a plant science web site about seeds.

Table 48

Distribution of Teachers by AITC Training and Web Resources Used to Teach Agriculture

Web Resources Used to Teach	AITC Trained	
about Agriculture	f(P)	
National AITC	2 (28.6)	
State AITC	3 (42.9)	
Ag Comm Sites	1 (14.3)	
On-line Library		
Other	1 (14.3)	

Note. Teachers listed all that applied.

Items 22, 23, and 24 were open-ended questions on the demographic instrument.

Item 22 asked AITC trained teachers how they benefited from integrating agriculture into

core academic subjects (e.g., math, history, & language arts). Teachers indicated an increased awareness of agriculture and an ease of teaching. Teachers also indicated they were able to teach science related activities, increase their knowledge of history, and use real-life examples which allowed students to make better-informed decisions (see Table 49).

Table 49

Distribution of Teacher Responses to How They Benefited from Integrating Agriculture into Core Academic Subjects

	AITC Trained Teachers
Responses	(f)
Knowledge of history	3
Teach science related activities	3
Students will make better future decisions	1
Real-life examples to use	. 2
Teaching becomes easier	4
Increased awareness	4
Allows more material to be covered	1

Item 23 asked AITC trained teachers how did their students benefit from the integration of agriculture into their core academic subjects. Teachers indicated students became more aware of the origins of agricultural products. Teachers also reported students learn about history by real-life examples and hands-on activities (see Table 50).

Distribution of Teacher Responses to How Students Benefited from Integrating Agriculture into Core Academic Subjects

Table 50

	AITC Trained Teachers
Responses	(f)
Awareness of product origins	13
Learn more about history	3
More subject area emphasis	1
Real-life examples	5
Hands-on activities	1

Item 24 asked AITC trained teachers what outdoor student learning activities did they use to teach about food, agriculture, and the environment. Teachers overwhelmingly reported that they used school gardens and recycling project (e.g., newspaper & aluminum). Teachers also reported they planted trees, went on field trips, used environmental and weather, plant and animal activities, and participated in Ag Week and Earth Day activities (see Table 51).

Table 51

Distribution of Teacher Responses to Types of Outdoor Student Learning Activities They Used to Teach About Food, Agriculture, and the Environment

	AITC Trained Teachers
Responses	(f)
	10
Gardens	12
Recycling (newspaper & aluminum)	15
Field trips	5
Planting trees	5
Planting seeds	7
Weather Activities	1
Environmental Activities	2
Participated in Ag Week	1
Participated in Earth Day	1
Animal Activities	1
Hands-on Activities	1

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this chapter was to present a review and summary of this study. Summary, conclusions, recommendations, and implications were based on an analysis and interpretation of the data presented.

Purpose of the Study

The purpose of this study was to assess the agricultural knowledge of selected kindergarten through sixth grade teachers. This study also sought to describe selected personal characteristics of those teachers and to explore the nature and strength of relationships among those teacher characteristics and their agricultural knowledge.

Objectives of the Study

To accomplish the purpose of this study, the following objectives were established:

- To describe teacher characteristics of Agriculture in the Classroom
 (AITC) trained teachers and non-AITC trained teachers.
- To develop an appropriate instrument to compare agricultural
 knowledge differences between AITC trained teachers and non-AITC

- trained teachers across the five thematic areas of the Food and Fiber Systems Literacy (FFSL) Framework.
- 3) To describe the relationship between agricultural knowledge and teacher characteristics.
- 4) To describe resources and materials used by AITC trained teachers to teach about agriculture.

Scope of the Study

The scope of this study included selected kindergarten through sixth grade teachers in the states of: Arizona, Montana, Oklahoma, and Utah during the 2001-2002 school year.

Summary of Methods and Procedures

The data from the test and demographic instruments were quantitative. Data were analyzed using descriptive statistics to describe and summarize observations. In addition, the researcher summarized solicited comments to three open-ended questions concerning benefits of AITC training and types of outdoor activities used to teach agriculture.

Major Findings of the Study

Objective one was to describe teacher characteristics of AITC trained and non-AITC trained teachers. The selected variables used in the development of the demographic instrument were derived from the review of literature. These demographics

used to profile AITC trained teachers and non-AITC trained teachers were summarized in Table 52.

Table 52

Profile of Teachers by AITC Training

		Chara	acteristic	
Demographic	Trained	P	Untrained	P
Gender	Female	88.4	Female	88.6
Ethnicity	Caucasian	97.4	Caucasian	100.0
Grew Up on a Farm	No	86.0	No	79.5
4-H Member	No	62.8	No	77.3
FFA Member	No	100.0	No	100.0
Ag Courses Taken in H.S.	No	100.0	No	97.7
Level of Education	Bachelor's	69.8	Bachelor's	70.5
Undergraduate Major	Elem. Ed.	50.0	Elem. Ed.	52.4
Teaching Certification	Elementary	68.9	Elementary	69.5
Ag Course Taken in College	1-3 Hours	87.1	1-3 Hours	92.9
Residence	Suburban	64.3	Urban	36.4
Work Experience in Ag	No	69.8	No	68.2
Teaching Experience	19-24	26.2	13-18	27.3
Type of School	Rural	40.0	Urban	26.8
Size of School	201-500	48.6	201-500	58.6

Objective two was to compare agricultural knowledge differences between AITC trained and non-AITC trained teachers across the five thematic area of the FFSL Framework. Agricultural knowledge percent scores were summarized in Table 53.

Table 53

Distribution of Teachers by AITC Training and Agricultural Knowledge Scores

		AITC 7	Training		
	<u>AITC </u>	<u>Frained</u>	Non-AITC Trained		
Theme	M	SD	M	SD	
Theme 1	72.73	16.75	64.82	17.73	
Theme 2	84.77	15.32	76.52	19.00	
Theme 3	79.55	15.08	66.80	22.86	
Theme 4	64.29	18.10	59.63	18.64	
Theme 5	64.70	16.07	58.30	22.07	
Overall	73.68	11.89	65.43	16.07	
Average					
X 7				· · · · · · · · · · · · · · · · · · ·	

Note. Means were reported as percent scores.

Objective three was to describe the relationship between agricultural knowledge score and selected teacher characteristics. The following selected teacher characteristics were used: 1) growing up on a farm; 2) 4-H membership; 3) level of education; 4) Agriculture courses taken in college; 5) work experience in agriculture; 6) agricultural literacy training; and 7) area of residence. Correlations for these selected teacher characteristics indicated a positive direction, but low strengths of relationships.

Objective four was to describe the resources and materials used by AITC trained teachers to teach about agriculture. The types of resource used to teach about agriculture were primarily from books (22.8%), activities (21.4%), videos (18.6%), lesson plans (13.8%), and agricultural professionals (11%). In addition, these teachers primarily used state AITC web sites (42.9%) and the national AITC web site (28.6%) as web resources to teach about agriculture. In addition, by integrating agriculture into existing curriculum, teachers and students became more aware of agriculture provided by outdoor activities and real-life examples.

Conclusions

Examination, analysis, and interpretation of the findings provided the opportunity for the author to draw the following conclusions:

- These teachers were overwhelmingly Caucasian females who did not grow up on a farm or participate in a 4-H youth program, FFA, or high school agricultural education. These teachers typically had a bachelor's degree in elementary education with an elementary teaching credential, took at least one type of agriculture course in college and had no work experience in agriculture. Furthermore, it was concluded that these teachers were experienced classroom teachers in small schools. These conclusions concurred and supported findings from Herren and Oakley (1995) and Wilhelm (1998).
- It was concluded that AITC trained teachers scored higher than non-AITC trained teachers overall and across the five thematic areas of the FFSL Framework. Furthermore, AITC trained and non-AITC trained teachers scored the highest on theme two (History, Geography, and Culture), theme three (Science, Technology, and Environment), and theme one (Understanding Food & Fiber Systems). AITC trained teachers scored the lowest on theme four (Business and Economics) and non-AITC trained teachers scored the lowest on theme five (Food, Nutrition, and Health). It was also concluded non-AITC trained teachers had a greater spread of scores across all the themes than did AITC trained teachers.

- 3) It was concluded that AITC training improved teachers' agricultural knowledge scores.
- 4) It was concluded that selected demographic characteristics of agricultural background (Growing up on a farm, 4-H membership, Type of degree, Agriculture courses taken in college, Work experience in agriculture, Agriculture in the Classroom training, Living in a rural or urban area) provided low relationships associated with agricultural knowledge scores.
- Teachers who integrated agriculture into their curriculum mainly used books, activities, and videos as resources for teaching about agriculture and participated in school gardens and recycling as outdoor activities to teach about agriculture. These conclusions supported Wilhelm (1998).

Recommendations

The following recommendations for agricultural education were made from the conclusions drawn from the data analysis:

- 1) Based on the major findings and conclusions, agricultural knowledge scores of teachers were relatively low except for theme two (History, Geography, and Culture). It was recommended to compare a larger and more diverse population of teachers to a population of agricultural specialists.
- 2) Based on the major finding and conclusions concerning themes one (understanding food and fiber systems), two (history, geography, and culture), and three (science, technology, and environment) of the FFSL Framework and findings by Igo (1998) and Leising, Pense, and Igo (2001), it was

recommended that curriculum be developed and newsletters be created that addressed themes four (business and economics) and five (food, nutrition, and health). In addition, it was recommended that summer agriculture institutes place more training emphasis in themes four (business and economics) and five (food, nutrition, and health).

It is imperative that we make the connection between the ways in which the individual learns about agriculture and the ways in which the individual uses agriculture. It was recommended that AITC learning activities be developed that can be applied to real-life scenarios. This would support Schuster's (1989) recommendations that learners apply their knowledge and that teachers provide more out-of-school experiences for learners. This would also support Frick, Kahler, and Miller's (1991) recommendation that individuals to able to synthesize, analyze, and communicate basic information about agriculture.

Recommendations for Further Study

The following were recommendations for further research based on my experience and knowledge gained from conducting this study:

- 1) It was recommended to conduct an experimental or quasi-experimental study to determine whether the theme areas differ on average with GPA and/or achievement scores.
- 2) It was recommended to systematically combine quantitative data from a number of studies, focusing on benchmarks of the FFSL Framework. A meta-

- analysis would allow common benchmarks to be established to determine whether an individual was agriculturally literate or agriculturally illiterate.
- If data from this study had occurred as a randomly designed, future indications for research may suggest no interaction effect for type of training and FFSL theme. However, data may suggest statistical significance for the main effects, theme and type of training. Further investigation of the main effect, theme, might reveal theme two is statistically different from themes three, one, four, and five. Themes one and three may be statistically significant from themes four and five (see Appendix P). In addition, the research should pay close attention to the normality assumption.

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APPENDICES

APPENDIX A

IRB APPROVAL

Oklahoma State University Institutional Review Board

Protocol Expires: 8/31/02

Date: Thursday, July 19, 2001

IRB Application No AG0125

Proposal Title:

THE IMPACT OF SELECTED AGRICULTURE IN THE CLASSROOM TEACHERS ON

STUDENT AGRICULTURAL LITERACY

Principal Investigator(s):

Seburn Levoy Pense

Matthew T. Portillo

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448 Ag Hali

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Stillwater, OK 74078

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Reviewed and

Processed as:

Expedited (Spec Pop)

Approval Status Recommended by Reviewer(s): Approved

Dear PI:

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

- Conduct this study exactly as it has been approved. Any modifications to the research protocol.
 must be submitted with the appropriate signatures for IRB approval.
- 2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
- Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
- 4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson, Chair Institutional Review Board

APPENDIX B EXTERNAL ADVISORY COMMITTEE

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APPENDIX C

AGRICULTURAL KNOWLEDGE INSTRUMENT

Co-developed with Seburn L. Pense, see Pense, S. L. (2002). Agricultural Literacy Assessment Among Secondary School Students: A Comparison of Agricultural Education Students and General Education Students. Unpublished Doctoral Dissertation. Oklahoma State University, Stillwater.

Teacher Agricultural Assessment

Instructions: Select the best answer for each question and mark the corresponding letter on your answer sheet. Please note that the words "food and fiber systems/production" are used interchangeably with the word "agriculture;" in other words, each expression has the same meaning.

- 1. Which of the following *does not* influence farmer/producer decisions about what type of product to grow and how it is processed?
 - A. Consumer preferences
 - B. Government regulations
 - C. Historical events
 - D. Specific commodity prices overseas
- 2. A genetically modified corn plant has been developed with natural resistance to pests. What type of agricultural business will be most directly affected by this new technological advancement?
 - A. Agricultural chemical company
 - B. Feed and milling company
 - C. Tractor and equipment dealership
 - D. Veterinary supply store
- 3. What nutrient develops and repairs body organs and tissues?
 - A. Carbohydrates
 - B. Minerals
 - C. Proteins
 - D. Vitamins
- 4. Which of the following occupations is *least related* to the industry of agriculture?
 - A. Fashion designer
 - B. Park ranger
 - C. Landscape designer
 - D. Meat inspector
- 5. Which one 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. United States Department of Agriculture (USDA)

- 6. What does consumer product testing not determine?
 - A. Customer health related to products
 - B. Customer preferences
 - C. Durability of products
 - D. Shopping patterns within a retail outlet
- 7. Planting trees around a farm field will help protect the environment in what way?
 - A. Increase the amount of top soil
 - B. Reduce the need for fertilizers
 - C. Reduce water use
 - D. Reduce wind erosion
- 8. What role did agriculture *not play* in the growth and development of America?
 - A. Communications
 - B. Food & textile industry
 - C. Immigration policy
 - D. Trade
- 9. What will energy shortages/surpluses experienced in the United States impact?
 - A. Banana production
 - B. Cross cultural relations
 - C. Food prices
 - D. Food safety
- 10. What is an essential part of the Food and Fiber System?
 - A. Consumer Demand
 - B. Consumer Supply
 - C. Natural resources
 - D. Value-added products
- 11. Why is America able to sustain a high standard of living?
 - A. Agricultural Industry
 - B. International Trade
 - C. Micro-computer industry
 - D. Stock Market
- 12. What technology was recently introduced in the Meat Industry to increase shelf life?
 - A. Curing
 - B. Dehydration
 - C. Freezing
 - D. Irradiation

- 13. What supports plant growth and represents the living reservoir that buffers the flow of water, nutrients, and energy through an ecosystem?
 - A. Air
 - B. Soil
 - C. Sunlight
 - D. Worms
- 14. 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
- 15. What was the effect on United States' beef exports to the United Kingdom when England detected Mad Cow Disease in their beef herds?
 - A. No change in United Kingdom's demand for United States' beef
 - B. United Kingdom's demand decreased for United States' beef
 - C. United Kingdom's demand for United States' beef increased
 - D. United States' demand for beef decreased
- 16. 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
- 17. 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
- 18. 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

- 19. How has new technology in agriculture impacted America?
 - 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
- 20. In what way are wheat farmers most likely to increase their profits?
 - A. Export more of their wheat to developing countries
 - B. Plant more acres of soybeans on the best land available
 - C. Process their raw wheat into flour, frozen dough and other food products
 - D. Use genetic engineering to develop new improved wheat varieties
- 21. What has the *least influence* on production practices of farmers in the United States?
 - A. Machinery costs to producers
 - B. New York Stock Exchange
 - C. Price of the commodity to the processor
 - D. Religious beliefs of consumers
- 22. Which of the following action or procedures placed on an agricultural commodity *will* inhibit international trade.
 - A. Letter of Credit
 - B. North America Free Trade Agreement
 - C. Product labeling
 - D. Tariff
- 23. If hoof and mouth disease were discovered in the United States, what populations would be at risk of infection?
 - A. Humans and cattle
 - B. Poultry and cattle
 - C. Sheep and horses
 - D. Swine and goats
- 24. What was significant about the cotton gin, plow, and mechanical reaper?
 - A. Increased crop yields per acre
 - B. Increased the status of farmers
 - C. Increased the work load of farmers
 - D. Freed up laborers to do other jobs
- 25. Why is planting grass an important practice in sustaining the ecological system?
 - A. Contributes to rapid water run-off
 - B. Increases microorganisms in the soil
 - C. Increases nutrients in the soil
 - D. Prevents wind and water erosion

- 26. Until recently, what components were commonly added in the feed rations of cattle and sheep?
 - A. Animal by-products
 - B. Human waste
 - C. Vegetable by-products
 - D. Wood by-products
- 27. The major world producer of dates in 1992 was Iraq, while the state of California was the second largest producer. What was the impact of the gulf war on the date industry?
 - A. Demand decreased and price increased
 - B. Demand increased and price increased
 - C. Supply decreased and price increased
 - D. Supply increased and price increased
- 28. How does the percentage of the population working directly in farming and production agriculture in the United States compare to other countries in the world?
 - A. Population is declining compared to less developed countries of the world.
 - B. Population is greater than in less developed countries of the world.
 - C. Population is greater than other developed countries of the world.
 - D. Population is increasing due to population growth & the increasing demand for food.
- 29. What are the benefits of eating a balanced diet?
 - A. Increases physical fitness
 - B. Increases the number of hours of sleep required
 - C. Lowers food costs
 - D. Prevents nutritional diseases
- 30. Which agricultural sector has the least number of workers?
 - A. Distribution
 - B. Processing
 - C. Production
 - D. Transportation
- 31. What is the most important energy source in the production, processing and distribution of food products?
 - A. Ethanol
 - B. Fossil fuels
 - C. Hydroelectric energy
 - D. Solar energy

- 32. What impact did the American Revolutionary War have on the price of cotton in England?
 - A. The cost of men's cotton pants decreased.
 - B. The cost of men and women's cotton clothing stayed the same.
 - C. The cost of men's cotton shirts increased.
 - D. The cost of women's cotton blouses decreased.
- 33. The outbreak of a contagious animal disease in Taiwan would likely bring what type of response from the United States Government?
 - A. United States would increase the tariff on meat imports from Taiwan.
 - B. United States would stop imports of meat and meat by-products from Taiwan.
 - C. United States would quarantine sick animals in Taiwan.
 - D. United States would require vaccination of animals in the United States against the disease.
- 34. How do plants and animals meet society's needs in ways other than food, clothing, and shelter?
 - A. Fuels and Electronics
 - B. Medicines and Plastics
 - C. Medicines and Recreation
 - D. Plastics and Recreation
- 35. How have the United States' agricultural technology and conservation impacted other countries?
 - A. Improved seed varieties and introduced efficient farm machinery
 - B. Improved seed varieties and introduced organic fertilizers
 - C. Improved seed varieties and encouraged manual harvesting
 - D. Improved seed varieties and encouraged synthetic rubber
- 36. Predict the price of coffee in the United States if the supply of coffee in Brazil decreased.
 - A. The drought in Brazil would not affect coffee prices in the United States.
 - B. The price of coffee in the United States would decrease.
 - C. The price of coffee in the United States would increase.
 - D. The price of coffee in the United States would stay the same.
- 37. 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 introduced
 - D. World population growth slowed

- 38. 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 gained a production advantage in the world wheat market.
 - B. United States wheat growers gained a processing advantage in the world wheat market.
 - C. United States wheat growers lost the production advantage in the world wheat market.
 - D. United States wheat growers lost the processing advantage in the world wheat market.
- 39. How did the North American Food and Trade Agreement (NAFTA) impact United States' trade with other countries?
 - A. Decreased trade with Mexico and Canada
 - B. Increased trade with Canada and Mexico
 - C. Slowed trade with Canada but accelerated trade with Mexico
 - D. Slowed trade with Mexico but accelerated trade with Canada
- 40. In Columbus' first voyage to America, his intent was to obtain what commodities?
 - A. Corn and potatoes
 - B. Iron ore
 - C. Silver and gold
 - D. Sugar and spices
- 41. Of the following answers, which one is not a purpose of a food additive?
 - A. Improve appearance
 - B. Improve flavor
 - C. Improve nutrition
 - D. Reduce production costs
- 42. What governmental agency regulates fertilizers, pesticides, and herbicides?
 - A. United States Department of Agriculture (USDA)
 - B. Environmental Protection Agency (EPA)
 - C. Food and Drug Administration (FDA)
 - D. Health and Human Services (HHS)
- 43. How has the conversion of wetland to farmland affected waterfowl populations?
 - A. Waterfowl populations have decreased
 - B. Waterfowl populations have increased
 - C. Waterfowl populations have not been studied
 - D. Waterfowl populations have stayed the same

- 44. What factors made it possible for early Americans to establish settlements rather than assume the wandering lifestyle of hunters/gathers?
 - A. Ability to produce food
 - B. Abundance of wildlife
 - C. Fur trading
 - D. Trade with Native Americans
- 45. What term describes the control and management of resources for present and future use?
 - A. Conservation
 - B. Preservation
 - C. Reclamation
 - D. Restoration
- 46. What factor contributed to the western expansion of the United States?
 - A. Available capital
 - B. Available labor
 - C. Available land
 - D. Available water
- 47. Why is homogenization used in milk processing?
 - A. To extend shelf life
 - B. To reduce milk fat content
 - C. To reduce milk fat to smaller particles
 - D. To separate milk solids and liquids
- 48. What is the oldest and most essential industry in the world?
 - A. Construction
 - B. Food/Fiber production
 - C. Manufacturing
 - D. Mining
- 49. What is a major source of protein for humans?
 - A. Corn and spinach
 - B. Beans and spinach
 - C. Rice and beans
 - D. Rice and corn
- 50. Which of the following food combinations best describes a balanced meal using the four basic food groups?
 - A. Broccoli, biscuits, peaches, & lamb
 - B. Eggs, milk, pancakes, & orange juice
 - C. Milk, granola, grapefruit, & bread
 - D. Steak, toast, butter, & eggs

APPENDIX D

FOOD AND FIBER SYSTEMS LITERACY FRAMEWORK STANDARDS AND BENCHMARKS

Sta	ındards	1
C. Understand Food and Fiber Systems provide (nod choices)	D. Understand Food and Fiber Systems promote a safe food supply.	Bench- marks
Students will recognize how individual preferences affect food selection. They will show where their food preferences fit into the Food Guide Pyramid.	Students will recognize safe food practices. They will illustrate ways to practice food safety.	K-1
Students will identify food advertisements. They will explain the relationship between food choice and advertising.	Students will describe safe food handling, preparation, and storage. They will show proper handling, preparation and storage of foods.	2-3
Students will explain how factors, such as culture and convenience, affect food choices. They will analyze how food preferences have changed over time.	Students will recognize the govern- ment makes food safety policies. They will explain how these policies promote a safe food supply.	4-5
Students will explain how food choices are influenced by economics. They will compare food choices based on cost.	Students will recognize food contaminants. They will classify the contaminants that make food unsafe.	6-8
Students will describe how research and development influences food choices. They will research new food choices.	Students will recognize factors affecting a safe food supply. They will evaluate how food safety issues impact Food and Fiber Systems.	9-12

V. Food, Nutrition, and Health

A. Understand Rood and	国民产生,从2018年的大学的产品的工程主义的1970年的大学中国1980年1980年1980年1980年1980年1980年1980年1980年
Mber Systems provide nourishment for people and antimals.	IB, Undersend Food and Piber Systems provide thealthy-lifer components
Students will explain people and animals obtain sustenance from Food and Fiber Systems products. They will illustrate products people and animals eat.	Students will identify the parts of the Food Guide Pyramid. They will illustrate a well-balanced meal.
Students will distinguish between processed and unproc- essed foodstuffs people and animals eat. They will compare how common foodstuffs eaten by humans and animals are differently processed.	Students will match food groups with their recommended daily servings. They will plan healthy meals for one day.
Students will identify ways of processing foodstuffs for people and animals. They will explain reasons for processing foodstuffs.	Students will identify the six basic food nutrients: carbohydrates, protein, water, vitamins, minerals, and fats. They will categorize foods based on nutritional content.
Students will identify agricul- tural products in food and feed. They will compare food and feed ingredient labels.	Students will interpret food nutritional labels. They will compare personal food intake to the USDA Food Guide Pyramid recommendations.
Students will recognize that food and feed products contain additives. They will categorize additives from ingredient labels.	Students will recognize life stages and activity levels change human nutrition requirements. They will construct healthy diet and exercise plans for different life stages and activity levels.
	Students will explain people and animals obtain sustenance from Food and Fiber Systems products. They will illustrate products people and animals eat. Students will distinguish between processed and unprocessed foodstuffs people and animals eat. They will compare how common foodstuffs eaten by humans and animals are differently processed. Students will identify ways of processing foodstuffs for people and animals. They will explain reasons for processing foodstuffs. Students will identify agricultural products in food and feed. They will compare food and feed ingredient labels. Students will recognize that food and feed products contain additives. They will categorize

Sta	ndards	1 .
C. Undersend government's role in Food-and Fiber Systems	D. Understand feeters influending international trade of food and filter products	Bench-
		marks
Not applicable at this level.	Students will recognize food and clothing comes from other countries. They will give examples of food and fiber products from other countries.	K-1
Students will recognize the government regulates Food and Fiber Systems. They will classify government functions, including safety, inspection, and grading.	Students will define import and export. They will identify U.S. food and fiber products exported to other countries.	2-3
Students will explain the need for government regulation in agriculture. They will give examples of regulations and laws impacting Food and Fiber Systems.	Students will explain why nations trade products and services. They will make a list of agricultural services the U.S. trades with other nations.	4-5
Students will recognize the government responds to people's needs related to Food and Fiber Systems. They will evaluate how these responses impact agriculture.	Students will explain "free trade" and "balance of trade." They will compare U.S. food and fiber trade policies to other nations' policies.	6-8
Students will identify interna- tional Food and Fiber Systems issues. They will analyze governments' roles in interna- tional agricultural issues.	Students will identify factors influencing international trade. They will explain how these factors impact U.S. food and fiber products and services.	9-12

IV. Business and Economics

	Standards					
Bench- marks	A Understand Food and Fiber Systems and economics are related.	B. Understand Pool and Fiber Systems have an impact on local, mational, and international econo- mics.				
K-1	Students will recognize agricultural products have monetary value. They will explain how food and clothing are worth money.	Students will identify people in the community who rely on Food and Fiber Systems to make a living. They will connect Food and Fiber Systems to local businesses.				
2-3	Students will describe how a shortage or surplus of a product provides an opportunity for trade. They will predict what happens when shortages or surpluses occur.	Students will recognize people responsible for delivering agricultural products to consumers. They will compare jobs performed from production to consumption.				
4-5	Students will define agribusiness. They will give examples of agribusinesses in the community.	Students will identify how value is added to raw agricultural products after production. They will compare the value of raw and processed products.				
6-8	Students will identify Food and Fiber Systems-related careers. They will compare business and economic skills and educational qualifications for agricultural careers.	Students will identify industries whose inputs are from Food and Fiber Systems. They will evaluate industries to determine the agricultural inputs.				
9-12	Students will identify events affecting food and fiber trade. They will analyze the economic impact of these events on Food and Fiber Systems.	Students will identify economic activities generated by Food and Fiber Systems. They will compare how agricultural and non-agricultural businesses influence the economy.				

Sta	indards	l
C. Understand management and conserva- tion practices used in Food and Fiber Systems.	D. Understand science and technology's role in Food and Eiber Systems.	Bench- marks
Students will define natural resource conservation. They will describe ways to conserve natural resources.	Students will identify tools and machines used in Food and Fiber Systems. They will give examples of tools and machines used to produce food and fiber products.	K-1
Students will identify natural resource-management practices that limit pollution. They will cite agricultural practices used to manage and conserve soil, water, and air.	Students will recognize inventors and their inventions related to Food and Fiber Systems. They will describe the agricultural importance of the inventions.	2-3
Students will identify pest- management practices in Food and Fiber Systems. They will compare traditional and alternative pest-management practices.	Students will explain how technological advancements enhance Food and Fiber Systems' efficiency. They will list technologies that reduce manual labor needs in agriculture.	4-5
Students will identify agencies and policies that regulate natural resources-management and conservation of Food and Fiber Systems. They will determine the impact these policies and regulations on food and fiber systems.	Students will identify Food and Fiber Systems careers dependent on science and technology skills. They will contrast these skills needed for agricultural and non-agricultural careers.	6-8
Students will recognize U.S. management and conservation practices impact other countries. They will evaluate the impact of these practices on Food and Fiber Systems in other countries.	Students will recognize how science and technology impact Food and Fiber Systems. They will analyze the effects of science and technology on food, clothing, shelter, and career choices.	9-12

III. Science, Technology, and Environment

	<u>Standards</u>					
Bench- marks	A Understand how ecosystems are related to Pood and Piber Systems.	B: Understand Food and Fiber Systems dependence on natural resources.				
K-1	Students will identify the natural life cycles of plants and animals. They will illustrate life-cycle stages.	Students will identify natural resources. They will illustrate natural resources used by Food and Fiber Systems.				
2-3	Students will describe compo- nents of an ecosystem. They will illustrate specific compo- nents of an ecosystem in the community.	Students will describe renewable and non-renewable natural resources. They will classify natural resources used in the production of food, clothing, and shelter into renewable or non-renewable categories.				
4-5	Students will discover ecosys- tems regenerate. They will analyze the interac- tion of Food and Fiber Systems with natural cycles.	Students will examine how living organisms transform natural resources into consumer products. They will analyze food, clothing, and shelter to determine the natural resources used.				
6-8	Students will discover similarities of ecosystems in the world. They will categorize ecosystems by common characteristics (e.g. topography, climate, soil type and other factors).	Students will identify classes of organisms involved in Food and Fiber Systems. They will explain the roles of these organisms in agriculture.				
9-12	Students will identify how Food and Fiber Systems affect ecosystems. They will evaluate the positive and negative impacts of agriculture on ecosystems.	Students will explain why all countries' agricultural systems depend on natural resources. They will evaluate why Food and Fiber Systems compete for natural resources.				

Sta	indards	
D. Understand the relationship botycen (Food and Elber Systems and world entimess	B. Understand how different viewpoints impact Pood- and Piber Systems	Bench-
		marks
Students will discover foods they consume originated from different countries. They will trace foods back to the original country.	Students will realize people live in cities, towns, and rural areas. They will illustrate characteristics of cities, towns, and rural areas.	K-1
Students will explain why agriculture influences food and clothing in cultures. They will compare food and clothing among cultures.	Students will determine whether they live in a city, suburb, town, or rural area. They will give examples of contrasting views of Food and Fiber Systems in the community.	2-3
Students will identify geo- graphic origins of plants and animals. They will locate current world-production areas of Food and Fiber Systems products.	Students will identify Food and Fiber Systems issues in the community or state. They will contrast different viewpoints of each issue.	4-5
Students will explain how geography influences food and fiber production. They will analyze regional geographic characteristics influencing food, clothing, and shelter choices.	Students will summarize national Food and Fiber Systems issues. They will analyze the viewpoints of major stakeholders.	6-8
Students will recognize world cultures affect agriculture. They will explain how consumer trends impact Food and Fiber Systems.	Students will compare global issues impacting Food and Fiber Systems. They will justify personal viewpoints based on research.	9-12

II. History, Geography, and Culture

	Standards Lk = 1 cm					
Bench-	A. Undersend Food and Fiber Systems' role in the evolution of civilizations.	B. Understand Footbard Piber Pystems ² role in societies throughout world history	C. Understand Food and Fiber Systems/ role in U-S. history.			
Κħ	Students will illustrate how agriculture provides food, clothing and shelter. They will classify agricultural products as food, clothing, or shelter.	Students will illustrate how events, such as seasonal festivals, focus on Food and Fiber Systems. They will identify agriculture-based celebrations or festivals in the community.	Students will realize most early Americans were agriculturalists. They will identify prominent early Americans involved in Food and Fiber Systems.			
2:3	Students will explain how agriculture is the foundation of civilizations. They will identify family experiences or involve- ment with Food and Fiber Systems.	Students will identify an early society. They will illustrate agriculture's role in sustaining that society.	Students will describe how native and settler populations interacted with the environment. They will identify the origins of food, clothing, and shelter of American Indians and early settlers.			
4 =5	Students will analyze how early inhabitants mostly relied on hunting and gathering. They will describe agricultural changes from nomadic societies to permanent settlements.	Students will discuss how the desire to obtain exotic foods and spices, and precious gems and minerals motivated European exploration. They will trace the origins of food, fiber, and natural resources early European explorers traded.	Students will illustrate how people seeking to meet their basic needs moved from region to region as resources became scarce. Students will describe examples of immigration and migration in U.S. history.			
6-8	Students will determine agriculture's role in the development of civilizations. They will evaluate innovations that increased the availability of food, clothing, and shelter.	Students will explain how expanded trade led to development of industrialized societies. They will evaluate the importance of agricultural commodities in the growth of international trade during the Age of Exploration.	Students will identify historical events that influenced agricultural development. They will describe positive and negative impacts on Food and Fiber Systems, resulting from historical events.			
9-12	Students will compare nomadic life to settlements and towns. They will analyze how the barter system evolved and encouraged economic growth, communication, and multiculturalism.	Students will identify nations where international food and fiber involvement exists. They will investigate the impact of global societies on food and fiber systems.	Students will identify the role agriculture played in U.S. development. They will analyze agriculture's role in events that shape the nation.			
		8				

Sta	ndards	
D. Understand the local, nettonal, and laterna- tional importance of Food and Fiber Systems,	E. Understand Foodland Filter Systems careers.	Bench (marks
Students will identify local Food and Fiber Systems businesses. They will match these businesses to agricultural products.	Students will identify Food and Fiber Systems jobs in the community. They will collect pictures of people doing agricultural work.	K-1
Students will determine resources, such as water and land, are shared by households, businesses, and agriculture. They will describe examples of multiple uses for land and water resources.	Students will generate a list of Food and Fiber Systems careers. They will research characteristics of agricultural careers.	2÷3
Students will explain how traders, explorers, and colonists brought plants and animals to this country. They will locate the origins of regional agricultural products available.	Students will examine the changes in Food and Fiber Systems due to technological advances, and subsequent changes in occupational opportunities. They will identify agricultural careers and how they have changed.	4-5
Students will examine why agriculture is the oldest, largest, and most-essential industry. They will discuss the national and international importance of Food and Fiber Systems.	Students will recognize that agricul- tural inventions and discoveries produce new career opportunities. They will compare knowledge, skills, and attitudes required for entry-level, technical, and professional careers in Food and Fiber Systems.	6-8
Students will explain how globalization has impacted commodities traded on world markets. They will cite examples of how global markets affect personal and professional choices.	Students will discuss non-traditional agricultural careers and their effects on other industries. They will create a career path and determine its relationship to Food and Fiber Systems.	9-12

I. Understanding Food and Fiber Systems

Bench:	TO SERVICE AND ADDRESS OF THE PROPERTY OF THE	B. Understand the essential components of Foodend Riber Systems (espiporodue tion, processing marketing thirdbutton, reservaband development, natural resource materials and regulation).	C, Understand Roodengl Piber Systems' relac Houship to society.
K=1	Students will discover food, clothing, and shelter originate from plants and animals. They will match and/or illustrate a product and its origin.	Students will identify types of farms. They will match different kinds of farms to their products.	Students will identify Food and Fiber Systems products. They will give examples of agricultural products they use.
2:3	Students will tell how agriculture provides people's basic food, clothing, and shelter needs. They will identify regional agricultural products and the basic needs they fulfill.	Students will describe the journey of an agricultural product from the farm to the consumer. They will label the sequence of steps a food or fiber product takes from production, processing, marketing and distribution to the consumer.	Students will identify people who work in Food and Fiber Systems. They will categorize people in the community who provide food, clothing, and shelter.
4-5	Students will identify the natural resources Food and Fiber Systems use to provide people's basic needs. They will describe how resources (rivers, forests, oceans, range land, etc.) contribute to world agricultural production.	Students will determine the role of natural resource management in Food and Fiber Systems. They will explain the importance of managing soil, air, water and energy to agricultural production.	Students will identify major agricultural commodities produced in their state. They will compare commodity output at state and national levels.
6≑8	Students will define agriculture in terms of the Food and Fiber System components. They will show agriculture is a complex system of production, processing, marketing and distribution.	Students will describe the function of Food and Fiber System components, including production, processing, marketing, distribution, research and development, natural resource management, and regulation. They will discuss the function of each component.	Students will recognize Americans spend the smallest proportion of personal income on food. They will compare how much Americans spend on food to the amount others spend.
9-12	Students will explain why agriculture is the foundation of a nation's standard of living. They will demonstrate that Food and Fiber Systems must be sustainable, and resources used must be renewed and replenished.	Students will explain the importance of the essential components of Food and Fiber Systems and describe their interdependence. They will discuss how the components have changed.	Students will identify plant and animal products that serve as ingredients for producing products that meet societal needs other than food, clothing and shelter. They will explain plant and animal products and byproducts are used to manufacture medical, cosmetic, cleaning and other products.

APPENDIX E COVER LETTER FOR DEVELOPMENT PANEL

Dear <Name>:

Dr. Leising, Professor and Head of the Department of Agricultural Education at OSU, gave me your name as someone that contributed to a study in agricultural literacy three of four years ago. That project, Food and Fiber Systems Literacy (FFSL), was completed in 1999 and greatly advanced agricultural education. Thank you once again for your help in making that program a success.

At this time, we would like to further that study by addressing agricultural literacy among those students that are about to complete their high school education. We are attempting to develop an instrument that will measure agricultural literacy among seniors based upon the standards and benchmarks you helped develop for grades 9-12 in the FFSL Framework.

In order to construct a valid instrument for this study I formed a panel of experienced agriculture teachers to help me frame appropriate questions that will accurately assess agricultural literacy at the high school level. They produced approximately 100 questions that addressed each standard and benchmark in the five thematic areas of the FFSL Framework. Many of the questions address more than one standard in the five thematic areas; thus, the number of questions under each category vary. Through a process of validation and pilot testing, we expect to eliminate about help of the questions and reword some of those retained.

Would you consider helping us, once again, by reading through the test questions and evaluating them for grade-appropriate language, content, and adherence to the FFSL standards and benchmarks? By doing this, you will be helping us with the validation step on this process of test development.

Enclosed is a copy of the questions printed in a format that should help facilitate your evaluation. Please read the benchmark first, then evaluate those questions applied to that benchmark. This test will be given to teachers in the fall and seniors in the spring. This instrument will assess that body of agricultural knowledge that **every** adult and graduating high school student should know in order to be considered agricultural literate and capable of understanding agricultural issues that relate to their lives and society at large.

Thank you in advance for your much needed help and vital role in this project.

Sincerely,

Matthew T. Portillo Graduate Teaching Associate Oklahoma State University Dept. of Agricultural Education 448 AGH Stillwater, OK. 74078 (405) 744-2972

$\label{eq:appendix} \mbox{APPENDIX F}$ CONTENT VALIDATION SPREADSHEET

Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.

448 Agricultural Hall
Oklahoma State University
Stillwater, OK. 74078
(405) 744-8084
pense@okstate.edu

448 Agricultural Hall
Oklahoma State University
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mportil@okstate.edu

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	To what extent does this question measure the benchmark? Is the content of ti question appropriation		ppropriate language level appropriate for an Agriculturally literate		ge level ate for an ally literate	If your answer is no to any of the questions, please explain why.		
		Not at all	Somewhat	Very much	Yes	Yes No		No	Comments
V. C.	Benchmark: Students will describe how research and development influences food choices. They will research new food choices.								
74	What are two factors of Research and Development that influence food choice? A. Economics and personal safety B. Popular opinion and taste C. Knowledge of product and taste D. Consumer opinion and economics								
75	"Reduced Fat" foods have more fat than: A. Fat Free Foods B. Fatty Foods C. Fat Reduced Foods D. Fat Controlled Foods								
76	What controversial technology is used in the Meat Industry to increase shelf life? A. Freezing B. Irradiation C. Dehydration D. Curing								
777	Match the technology method in Column B to the food product in Column A. B 60. Tomato A. Modified Growth Hormone 61. Milk B. Genetic Modified Organism 62. Green Beans 63. Ice Cream 64. Cheese							8	
V. D.	Benchmark: Students will recognize factors affecting a safe food supply. They will evaluate how food safety issues impact Food and Fiber Systems.								
78	What are the primary food safety problems today? A. Improper storage B. Improper preparation C. Improper handling D. All the above						1		
79	Which one of the following government agencies regulates food handling, preparation and storage? A. USDA B. NRCS C. FDA D. EPA								
80	A. Homogenized B. Purified C. Pasteurtzed D. Sterilized								

For all inquiries concerning this survey, please contact the following:

Seburn Pense, Research Associate Research Associate Department of Agricultural Education Matthew Portillo Research Associate Department of Agricultural Education

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	ques	at extent do stion measur benchmark?	re the	question a for an Ag	appropriate riculturally adult?	langua appropri Agricultui	uestion's age level ate for an rally literate lult?	If your answer is no to any of the questions, please explain why.
		Not at all	Somewhat	Very much	Yes	No	Yes	No	Comments
61	What does a foreign country place on an agricultural commodity to stop trade? A. Tariffs B. Embargo C. Taxes D. Regulations								
62	What types of taces do foreigtn countries utilize to prevent the consumption of U.S. com by their people? A. Tariffs B. Supply C. Demand D. Embargo								
	Benchmark: Students will recognize that food and feed products contain additives. They will categorize additives from ingredient labels.								
	Choose the ingredient that is an additive in milk. A. Lactose B. Vitamin D C. Sugar D. Water								
94719	Bread is fortified with Vitamin to make it more nutritious. A. Vitamin C B. Vitamin D C. Vitamin A D. Vitamin B 12								
	What additives are used to preserve foods? A. Salt, flavorings, and oils B. Flavor enhancers and sugar C. Food coloring, sugar and flavorings D. Salt, spices, and sugars								
66	What is the additive in cookies that allows the dough to rise? A. Baking Soda B. Salt C. Sugar D. Spices								
V. B.	Benchmark: Students will recognize life stages and activity levels change human nutrition requirements. They will construct healthy diet and exercise plans for different life stages and activity levels.								
67	In order, what are the life stages? A. Maintenance, growth, lactation, gestation B. Growth, maintenance, lactation, gestation C. Growth, maintenance, gestation, lactation D. Growth, gestation, maintenance, lactation								
68	A major source of protein is: A. Oranges B. Corn C. Salad D. Meat								
69	What nutrient develops and repairs body organs and tissues? A. Protein B. Carbohydrates C. Vitamins D. Minerals								
	What beverage should a nursing mother consume if she needed more calcium? A. Pop B. Orange Julce C. Grape Julce D. Water								
	Osteoporosis occurs in older women who lack what mineral? A. Selenium B. Magnesium C. Iron D. Calcium								
	What condition is a result of deficiency in iron? A. Anemia B. Cancer C. Rickets D. Blindness	100000000000000000000000000000000000000							
73	An average person should exercise times per week for minutes. A. 1; 10 B. 2; 20 C. 3; 30 D. 7; 30								

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	ques	at extent do ation measur benchmark	e the	for an Agr	ppropriate	langua appropri Agricultur	uestion's age level late for an rally literate	If your answer is no to any of the questions, please explain why.
	comments. Benchmark: Students will identify events affecting food and fiber		Somewhat	Very much	Yes	No	Yes	No	Comments
IV. A.	Benchmark: Students will identify events affecting food and fiber trade. They will analyze the economic impact of these events on Food and Fiber Systems.								
53	If a freeze destroys Brazil's coffee crop, then what will be the effect on the cost of coffee in the U.S? A. No change in prices B. Prices increase C. Prices decrease D. Consumption increases								
54	What was the effect on U.S. beef exports to Europe when England detected Mad Cow Disease in U.S. beef? A. No change in consumption B. Demand increased C. Demand decreased D. Prices								
IV. B.	Berichmark: Students will identify economic activities generated by Food and Fiber Systems. They will compare how agricultural and non-agricultural businesses influence the economy.								
55	True—False Global market forces affect supply and demand for agricultural products.								
IV. C.	Benchmark: Students will identify international Food and Fiber Systems issues. They will analyze governments' roles in International agricultural issues.								
	True—False At the Year 2000 World Trade Conference in Seattle leaders from all over the world met to discuss future trade, including the exchange of agricultural commodities.								
57	In 1995, an outbreak of Swine Hoof and Mouth Disease in the country of Talwan had a significant impact on swine farms in America. It led to A. A large new market for U.S. pork in the country of Viet Nam B. A large new market for U.S. pork in the country of Japan C. A rejection of pork products by Asian countries; even rejecting U.S. pork D. Fear of hoof and mouth disease, causing U.S. pork prices to suffer worldwide.								
58	An outbreak of what disease in England caused Europe to shun U.S. beef? A. Brucellosis B. Hoof & Mouth Disease C. Anthrax D. Mad Cow Disease E. Hydraphobia								
59	A few years ago an Alar scare caused many people in America to stop eating apples. What is Alar? A. Disease B. Mutation C. Pesticide D. Insect E. Bacteria								
	Benchmark: Students will identify factors influencing international trade. They will explain how these factors impact U.S. food and fiber products and services.								
60	NAFTA, the North American Food & Trade Agreement, involved which countries? A. U.S. & Hawali B. Mexico & Canada C. U.S., Mexico, & Canada D. U.S. & Canada								

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	ques	at extent do tion measur benchmark?	e the	is the content of the question appropriate for an Agriculturally literate adult?		is the quantities is the quantities appropriate Agricultura additional additi	ge level ite for an	if your answer is no to any of the questions, please explain why.
		Not at all	Somewhat	Very much	Yes	No	Yes	No :	Comments
46	True—False Great strides have been made to increase the efficiency of agricultural production, thus fewer numbers of people are needed to support new agricultural technologies.						w 192	:	
47	is the world's largest and most essential industry. A. Automotive B. Mining C. Biotechnology D. Agriculture						:		
48	has the potential to increase plant resistance to disease and insects, and decrease food and fiber production costs. A. Genetic engineering B. Integrated Pest Management C. Cloning D. Bio-degradable plastics E. Bio-rhythms							:	
	What was significant about the cotton gin, plow, and mechanical reaper? A. They caused stock prices to go up B. Increased the work load of agriculturalists C. They freed up laborers to do other lobs D. Increased the status of farmers E. They improved the taste of many modern foods							:	
	What effect would the production of crops like genetically modified com have on the economy? A. Lower food prices, higher food quality, and reduced environmental impacts B. Lower food prices, lower food quality, and increased environmental impacts C. Higher food prices, higher food quality, and reduced environmental impacts D. Higher food prices, higher food quality, and increased environmental impacts								
	The prediction by past economists that agriculture would not be able to meet the world's demand for food was inaccurate due to: A. Improved technology B. Greater number of workers C. Increased work ethic D. Higher cost of food								
52	Match the job description in Column B to the appropriate career in Column A. A Milk production, storage, & processing. Soil fertility. Role of insects in disease transmission. Effects of chemical breakdown on the environment. B A Pathologist B Toxicologist C C C Chemist D Microbiologist								

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.		at extent do tion measur benchmark	re the	Is the content of the question appropriate for an Agriculturally literate adult?		langua appropri Agricultur	uestion's ge level ate for an rally literate lult?	If your answer is no to any of the questions, please explain why.
			Somewhat	Very much	Yes	No	Yes	No	Comments
37	are: A. coal, natural gas, and sunlight B. coal, natural gas, and diesel C. soil, air, and herbicides D. soil, air, and sunlight E. soil, air, and natural gas								
38	Grass is a renewable resource and is an important part of the ecological system in that it A. Prevents wildfires B. Slows down flood waters C. Provides wind resistance D. Prevents wind and water erosion E. Contributes to rapid water run-off						-		
III. C.	Benchmark: Students will recognize U.S. management and conservation practices impact other countries. They will evaluate the impact of these practices on Food and Fiber Systems in other countries:								
39	True—False Agricultural management practices used in the United States have been adopted and used by other countries.		7					1	
40	True—False Hedgegrass, cover crops, and windbreaks provide soil conservation benefits as well as habitat for wildlife.								
41	True—False Loss of agricultural chemicals from farm fields can be reduced substantially by using farm management practices tailored to specific pest problems as well as soil, crop, and climatic conditions.								
42	True-False Cover crops add organic matter back to the soil.								
	United States agricultural management practices that have impacted other countries include A. Improved seed varieties, tractors and combines, and synthetic fertilizers B. Improved seed varieties, tractors and combines and synthetic rubber C. Improved seed varieties, tractors and combines, and organic fertilizers D. Improved seed varieties, tractors and combines, and organic food		14						
44	The control and management of resources for present and future use is called A. Preservation B. Mechanization C. Conservation D. Desertification E. Manipulation								
45	What effect would less restrictive forest management practices in other parts of the world have on America's timber industry? A. Our wood products would be less expensive than those produced in other countries. B. Our wood products would be more expensive than those produced in other countries. C. Trade restrictions would be stronger against America selling her wood products on the world market. D. American wood products would increase their marketability.								
III. D.	Benchmark: Students will recognize how science and technology impact Food and Fiber Systems. They will analyze the effects of science and technology on food, clothing, shelter, and career choices.								

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	ques	eat extent do stion measur benchmark	re the	question a for an Ag	tent of the appropriate riculturally adult?	langua appropri Agricultur	uestion's ge level ate for an ally literate ult?	If your answer is no to any of the questions, please explain why.
	comments.	Not at all	Somewhat	Very much	Yes	No	Yes	No	Comments
	Benchmark: Students will identify how Food and Fiber Systems affect ecosystems. They will evaluate the positive and negative impacts of agriculture on ecosystems.								
	True-False Livestock confinement production units such as feedlots contribute to air and water pollution.								
27	True—False Geography and topography can limit agriculture production, and generally determine ecosystem diversity.							- 1	
28	True-False Removal of trees and burning them on site adds nutrients to the soll, but after three to four years the nutrients are								
29	Tribe False Soil erosion occurs naturally on all land.								
30	True—False As a result of the conversion of wetlands to agricultural land, the water fowl population increased.								
	True-False Accumulation of organic matter contributes to soil erosion.								
32	supports plant growth and represents the living reservoir that buffers the flow of water, nutrients, and energy through an ecosystem. A Soll B Sunlight C Air D Fertilizer E Fences						1	i i	
33	Planting a hedgerow around a farm field will help protect the environment in what way? A. Reduce water use B. Reduce wind erosion C. Reduce the need for pesticides D. Reduce the need for fertilizers E. Reduce fuel consumption				27				
34	Match the preventive measure in Column A to their counterparts in Column B. A B Cover crops A. Protection from wind Rotation of crops B. Natural predators to insects Hedge rows C. Lower soil erosion Drip Irrigation D. Soil-building value Integrated pest management E. Resistance to diseases and insects							-	
III. B.	Benchmark: Students will explain why all countries' agricultural systems depend on natural resources. They will evaluate why Food and Fiber Systems compete for natural resources.								
	True—False Fossil fuels are important in the production, processing, and distribution of agricultural products.								
36	True—False Natural resource concerns today are different from what they were in the Dust Bowl era.								

- 4

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	ques	at extent do stion measur benchmark	e the	10 in 11 in 11	ppropriate foulturally	langua appropri Agricultur	uestion's ge level ate for an ally literate ult?	
	Comments.	Not at all	Somewhat	Very much	Yes	No	Yes	No	Comments
17	What happened to the price of cotton in England during the revolutionary war? A. Stayed the same B. Increased C. Decreased								
2.55	Benchmark: Students will identify the role agriculture played in U.S. development. They will analyze agriculture's role in events that shape the nation.								
18	True-False Food availability did not play a key role in America's history.								
19	What will be the economic impact of genetically modified transgenic crops to the average consumer? A. Increased food prices B. Decreased food prices C. Health problems D. No change								
20	*Match the technological advance in Column A to its result in Column B. A B_ Genetic Engineering A. Soil fertility Microbiology B. Less labor and more production Chemistry C. Breeding and selection Internal Combustion Engines storage, processing								
II. D.	Benchmark: Students will recognize world cultures affect agriculture. They will explain how consumer trends impact Food and Fiber Systems.								
	Which of the following agricultural products are imported to the US? A. Automobiles & machinery B. Electronics & computers C. Clothing & coffee D. Brass & stone								
	True—False Agriculture is the oldest and most essential industry in the world.								
23	When Columbus was traveling the world, he was in search of A. Spices and sugar B. Farmers C. Meats D. Grains								
II. E.	Benchmark: Students will compare global issues impacting Food and Fiber Systems. They will justify personal viewpoints based on research.								
	The major producer of dates in 1992 was Iraq. What was the impact to Celifornia date production (the 2nd largest producer) during the guif war? A. Supply decreased and price increased B. Supply increased and price increased and price increased and price increased D. Demand decreased and price increased.								
25	True—False Improved transportation and distribution bring us many different foods from around the country as well as the world.								

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	ques	at extent do ton measur benchmark?	e the	Is the content of the question appropriate for an Agriculturally literate adult?		langua appropri Agricultur	uestion's ge level ate for an ally literate lult?	
	confinents.	Not at all	Somewhat	Very much	Yes	No	Yes	No	Comments
8	Plants meet society's needs by providing A. Profits B. Jobs C. Shelter D. Investment								
l. D.	Benchmark: Students will explain how globalization has impacted commodities traded on world markets. They will cite examples of how global markets affect personal and professional choices.								建
9	When other countries adopted new technologies for growing wheat, what was the effect upon wheat growers in the United States? A. There was no effect B. U.S. growers gained an advantage in the world's wheat market C. U.S. growers lost the advantage in the world's wheat market D. U.S. growers got rich								
I. E.	Benchmark: Students will discuss non-traditional agricultural careers, and their effects on other industries. They will create a career path and determine its relationship to Food and Fiber Systems.								
10	True-False Few Issues affecting society today are related to								
11	A genetically modified com plant has been developed with natural resistence to pests. What type of agri-business will be most directly affected by this new technological advancement? A. A tractor and equipment dealership B. A feed and milling company C. A veterinary supply store D. A chemical fertilizer and insecticide dealership						T .		
12	True—False Building construction, welding, and metal fabrication are not related to the industry of agriculture.								200
13	Which of the following careers is most related to agriculture? A. Lawyer B. Banker C. Astronomer D. Bio-technician								
II, A,	Benchmark: Students will compare nomadic life to settlements and towns. They will analyze how the barter system evolved and encouraged economic growth, communication, and multiculturalism.		27 (43						
14	Which trade in ther early development of the United States contributed to the western expansion of the U.S.? A. Cheap land B. Newspaper C. Telegraph D. Crop Production E. Fur Trapping		1 -						
15	True-False Agriculture has constantly changed with the changing needs of society.								
	Impact of global societies on Food and Fiber Systems.								2000
16	Predict the cost of U.S. coffee when Brazil has an environmental drought. A. Stay the same B. Increase C. Decrease						100000000000000000000000000000000000000		

Teacher Validation of an Agricultural Literacy Instrument

	Directions: Please provide feedback to the following questions for assessing Agricultural Literacy among adults. Please check the appropriate boxes and provide any comments.	0.000	nat extent do stion measur benchmark	re the	question a	tent of the appropriate dculturally adult?	langua appropri Agricultur	uestion's ge level ate for an ally literate ult?	If your answer is no to any of the questions, please explain why.
	Benchmark: Students will explain why agriculture is the		Somewhat	Very much	Yes	No	Yes	No	Comments
I. A.	Benchmark: Students will explain why agriculture is the foundation of a nation's standard of flying. They will demonstrate that Food and Fiber Systems must be sustainable, and resources used must be renewed and replenished.								
1	Which of the following has the Federal Forest Service not enacted to sustain a renewable resource? A. Clearcutting B. Controlled Burns C. Land Improvement D. Harvest guotas E. Irrigation						1		
, 2	True-False Agriculture is the production of food and organic fiber that people require in their dally lives.								
I. B.	Benchmark: Students will explain the importance of the essential components of Food and Fiber Systems and describe their interdependence. They will discuss how the components have changed.								
3	True-False Supply influences producer decisions about what type of product to grow, process and market.								
4	An essential component of the Food and Fiber System is: A. Natural resource management B. Consumption C. Value-added products D. Sustainability								
5	Place the following essential components of the Food and Fiber System in the order in which they occur. A. production, processing, marketing, distribution B. production, marketing, processing, distribution C. distribution, marketing, processing, production D. distribution, processing, production, marketing								
I. C.	Benchmark: Students will identify plant and animal products that serve as ingredients for producing products that meet societal needs other than food, clothing and shelter. They will explain plant and animal products and hyproducts are used to manufacture medical, cosmetic, cleaning and other products.								
	How do plants and animals meet society's needs in ways other than food, clothing, and shelter? A. Medicine & Recreation B. Medicine & Plastic C. Plastic & Fuel D. Fuel & Electronics								
7	Even though the majority of people in the world still work directly in agriculture production, what is the percentage of those working in agriculture production in the United States? A. 15% B. 30% C. 2% D. 50%								

APPENDIX G

EMAIL FOR OKLAHOMA AGRICULTURAL EDUCATION TEACHERS

Dear Agriculture Instructor:

The Food & Fiber Systems Literacy (FFSL) project was completed in 1999 and greatly advanced agricultural education. At this time, we would like to further that study by addressing agricultural literacy among those students that are about to complete their high school education. We are attempting to develop an instrument that will measure agricultural literacy among seniors based upon the standards and benchmarks develop for grades 9-12 in the Food & Fiber Systems Literacy Program.

In order to construct a valid instrument for this study, we are formulating a panel of experienced agriculture teachers and core academic teachers to help frame appropriate questions that will accurately assess agricultural literacy at the high school level. We have produced 80 questions that address each standard and benchmark in the five thematic areas of agriculture. Many of the questions address more than one standard in the five agriculturally related themes; thus, the number of questions under each category varies. Through this process of validation and pilot testing, we expect to shorten this questionnaire and reword some of those questions that are retained.

Would you please consider helping us by reading through the test questions and evaluating them for grade-appropriate language, content, and adherence to the FFSL standards and benchmarks? By doing this, you will be helping us with the validation step in this process of test development.

Enclosed is a copy of the questions printed in a format that should help facilitate your evaluation. Please read the benchmark first, and then evaluate those questions applied to that benchmark. Bear in mind that this test will be given to seniors in their spring semester and should reflect that body of agricultural knowledge that **every** graduating high school student should know in order to be considered agriculturally literate and capable of understanding agricultural issues that relate to their lives and society at large.

Thank you in advance for your much needed help and vital role in this project.

Instructions: To make comments on the test questions, open up the attachment. Make your comments and save the file. Please reply to this email and attach the saved file.

Sincerely,

Seb Pense Research Associate Oklahoma State University Dept. of Agricultural Education 448 AGH Stillwater, OK. 74078 (405) 744-8084

Matthew T. Portillo Graduate Teaching Associate Oklahoma State University Dept. of Agricultural Education 448 AGH Stillwater, OK. 74078 (405) 744-2972 Dear Faculty and Graduate Students:

The Food & Fiber Systems Literacy project was completed in 1999 and greatly advanced agricultural education. At this time, we would like to further that study by addressing agricultural literacy among those students that are about to complete their high school education. We are attempting to develop an instrument that will measure agricultural literacy among seniors based upon the standards and benchmarks develop for grades 9-12 in the Food & Fiber Systems Literacy Program.

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Sincerely,

Seb Pense Research Associate Oklahoma State University Dept. of Agricultural Education 448 AGH Stillwater, OK. 74078 (405) 744-8084 Matthew T. Portillo Graduate Teaching Associate Oklahoma State University Dept. of Agricultural Education 448 AGH Stillwater, OK. 74078 (405) 744-2972

APPENDIX H COVER LETTER FOR OSU CURRICULUM SPECIALISTS

Memorandum

Dear OSU Curriculum Specialists:

Most of you already know that I will be addressing agricultural literacy in my dissertation. In order to construct a valid instrument for my study I need to from a panel of experienced teachers to help me frame appropriate questions that will accurately assess agricultural literacy for adults. Could I trouble you to help me in this initial phase of my project? Most of you have already indicated the Friday afternoon would be a good time to meet, so I would suggest a 2:00 p.m. meeting this Friday, October 6, in room 450 of Ag Hall. Afterwards, if everyone is in agreement, I would like to take the group out for dinner.

To help you prepare for our time together, you may want to put together some resource materials to bring to the meeting and possibly write a few questions in advance that might seem appropriate. I am attaching a copy of the standards and benchmarks from the Food and Fiber Systems Literacy Project and also a copy of the posttest for grades 7 and 8.

We want to produce approximately 100 questions that address each standard and benchmark in the five thematic areas of agriculture. The questions will be similar to these developed for grades 7 and 8, only scaled up for grade 12. The instrument will be given to teachers in their fall semester and should reflect that body of agriculture knowledge that every graduating high school student (adult) should know in order to be considered agriculturally literate, capable of understanding agricultural issues that relate to their lives and society at large.

As each question is written, please be sure to identify it with a Roman numeral and capital letter, corresponding to one of the five thematic areas (I, II, III, IV, V) and the appropriate standard (A, B, C, D, E).

Thank you in advance for your much needed help and vital role in this project. See you on Friday.

Sincerely,

Matthew T. Portillo Graduate Teaching Associate Oklahoma State University Dept. of Agricultural Education 448 AGH Stillwater, OK. 74078 (405) 744-2972

APPENDIX I CRITERION VALIDITY CORRELATIONS

CRITERION VALIDITY FOR THE AGRICULTURAL KNOWLEDGE TEST INSTRUMENT

***************************************	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
Theme 1	1.000				
Theme 2	.522	1.000			
Theme 3	.596	.623	1.000		
Theme 4	.307	.450	.358	1.000	
Theme 5	.503	.645	.583	.322	1.000

Note. N = 90.

APPENDIX J ITEM DISCRIMINATION INDICES

ITEM DISCRIMINATION FOR THE AGRICULTURAL KNOWLEDGE TEST INSTRUMENT

		R	Response	es	1111	
Question	A	В	С	D	E	Item Discrimination
1	1	1	72*	15	1	0.149
2	69*	18	3	0	0	0.304
3	4	7	66*	12	1	0.377
4	57*	19	12	2	0	0.205
5	1,	43	2	44*	0	0.276
6	16	9	11	54*	0	0.171
7	2	0	2	86*	0	0.384
8	65*	2	23	0	0	0.545
9	4	8	71*	7	0	0.141
10	23	4	50*	13	0	0.073
11	76*	13	0	1	0	0.207
12	8	14	9	59*	0	0.448
13	6	63*	7	13	0	0.558
14	2	56*	9	23	0	0.030
15	5	10	66*	8	0	0.112
16	4	67*	7	11	0	0.314
17	13	5	10	62*	0	0.429
18	5	77*	5	3	0	0.479

Note. * Denotes the correct answer. N = 90.

ITEM DISCRIMINATION FOR THE AGRICULTURAL KNOWLEDGE TEST
INSTRUMENT (Continued)

		F	Response	es		
Question	A	В	C	D	Е	Item Discrimination
19	12	7	3	68*	0	0.408
20	30	2	24*	31	0	-0.060
21	16	47*	13	14	Ö	0.312
22	6	19	7	57*	0	0.668
23	29	2	19	40*	0	0.289
24	32	1	6	51*	0	0.583
25	1	4	7	78*	0	0.573
26	52*	2	29	7	0	0.419
27	3	9	76*	2	0	0.371
28	61*	8	7	14	0	0.503
29	26	1	3	59*	0	0.377
. 30	2	9	63*	16	0	0.458
31	4	39*	18	29	0	0.249
32	3	18	69*	0	0	0.343
33	2	76*	5	7	0	0.194
34	1	34	55*	0	0	0.283
35	65*	17	3	5	0	0.542
36	1	3	82*	4	0	0.412

Note. * Denotes the correct answer. N = 90.

ITEM DISCRIMINATION FOR THE AGRICULTURAL KNOWLEDGE TEST
INSTRUMENT (Continued)

	Responses					
Question	A	В	C	D	Е	Item Discrimination
37	1	6	76*	6	0	0.502
38	8	8	66*	8	0	0.343
39	7	69*	7	7	0	0.358
40	5	1	24	60*	0	0.313
41	7	3	7	73*	0	0.625
42	25	57*	6	2	0	0.072
43	75*	5	3	7	0	0.544
44	80*	5	0	4	0	0.424
45	68*	19	2	0	1	0.408
46	2	4	77*	7	0	0.384
47	35	11	33*	11	0	0.495
48	2	79*	4	5	0	0.615
49	3	28	55*	3	0	0.176
50	45	35	7	2	0	0.034

Note. * Denotes the correct answer. N = 90.

APPENDIX K ITEM DIFFICULTY INDICES

ITEM DIFFICULTY FOR THE AGRICULTURAL KNOWLEDGE TEST INSTRUMENT

Question	Item Difficulty	Question	Item Difficulty	Question	Item Difficulty
	(%)		(%)		(%)
1	80.00	18	85.56	35	72.22
2	76.67	19	75.56	36	91.11
3	73.33	20	26.67	37	84.44
4	63.33	21	52.22	38	73.33
5	48.89	22	63.33	39	76.67
6	60.00	23	44.44	40	66.67
7	95.56	24	56.67	41	81.11
8	72.22	25	86.67	42	63.33
9	78.89	26	57.78	43	83.33
10	55.56	27	84.44	44	88.89
11	84.44	28	67.78	45	75.56
12	65.56	29	65.56	46	85.56
13	70.00	30	70.00	47	36.67
14	62.22	31	43.33	48	87.78
15	73.33	32	76.67	49	61.11
16	74.44	33	84.44	50	38.89
17	68.89	34	61.11		

Note. N =90.

APPENDIX L DEMOGRAPHIC INSTRUMENT

Teacher Assessment – Part II Background Information

Instructions: Select the best answer for each question and mark the corresponding box <u>on the instrument</u>. Respond to questions requiring a narrative response in the space provided. If additional space is needed, please use the backside of the page.

1. G	Gender:			
	□ Male	☐ Female		
2. E	thnicity: (Chec	•		
		n (other than		sian or Pacific Islander
	Hispanic)			exican-American
	\square Black or A	African-American	□ Pu	ierto Rican
	☐ American Native Aı	Indian or other nerican		her Hispanic her:
3. D	oid you grow uj	on a farm?		
	□ Yes			•
	\square No			
		•		
4. V	Vere you a men	nber of 4-H?		
	□ Yes			
	\square No			
5. W		nber of the Futur	e Farmers o	of America (FFA) in high school?
	□ Yes			
	□ No			
6. D	oid vou complet	te any agriculture	e course(s) i	n high school?
	□ Yes		()	
	□ No			·
7. If	f yes, how man	y semester agricu	ltural cours	ses did you complete during middle
SC	chool and high	school? (Check o	ne)	
	□ 1	□ 4	□ 7	□ more than 10
	□ 2	□ 5	□ 8	
	□ 3	□ 6	□ 9	
8. W	-	ghest level of edu	cation? (Ch	eck one)
	□ AA/AS			
	\square BS/BA			
	□ MS/MA			
	□ Ph.D/Ed.1)		

9. W	hat was your	undergraduat	e major?	
	· · · · · · · · · · · · · · · · · · ·	<u>.</u>		
10. V	-		r teacher certification? (
	☐ Elementa	•	☐ Reading	□ Music
	☐ Multi-Su	•	☐ Science	□ Math
				☐ Special Education
	☐ Language	e Arts	☐ Physical Education	☐ Other:
	How many colleompleted?	lege semester (credit hours of agricultu	ral courses have you
	Check one)			·
`	•	□ 10-12	□ 17-19	☐ more than 27
	□ 4-6	□ 13-15	□ 20-23	
	□ 7-9	□ 16-18	□ 24-26	
12. V	What is the po	pulation of the	e area in which you resid	le?
	Rural		.	
	Suburban		 _	
	Urban			
13. I	Have you ever □ Yes □ No	worked in agr	iculture or an agricultu	rally related job?
14. I	f yes, how ma	ny years did y	ou work in the job(s)? (0	Check one)
	☐ 1 year or			□ more than 10
	□ 2	□ 5	□ 8	
	□ 3	□ 6	□ 9	
15. A	Are you curren Yes No	ntly engaged ir	any farming or ranchi	ng activity?
16 I	fyes how ma	ny acres de ve	u farm or ranch? (Chec	k one)
10. 1	1 yes, now ma. □ 1-9	□ 500-999	u fai m of fanch: (Chec	K one)
	□ 1-9 □ 10-49		1 1 000	
	□ 180-499		11,000	
	□ 160 -4 99			
17. I	•	received agric	ultural literacy education	on training?
	□ Yes			
	\square No			

Type		# Hours:
	et In-Service	
☐ Ag in the Clas		
☐ Food, Land, &		***************************************
	Commodity Groups	
9. How many years harmonic 1-3	ave you taught school? (Che	
-		
	□ 16-18 □ 19-21 □	
□ 7-9 □ 10-12		31 of more
□ 10-12	□ <i>22-2</i> 4	
0. Do you teach in a r	ural, urban, or suburban scl	hool? (Check one)
Type	Total Number of Studen	its in the School
□ Rural		
🗆 Urban		
☐ Suburban 1. What type(s) of agragriculture? (Chec	ricultural literacy resources (
☐ Suburban 21. What type(s) of agi	ricultural literacy resources of the control of the	Web Sites: ☐ National Agriculture in the Classroom ☐ State Agriculture in the Classroom ☐ Agricultural Commodity sites
☐ Suburban 1. What type(s) of agragriculture? (Check ☐ Books ☐ CD ROM ☐ Activities ☐ Agricultural P ☐ Video/Film St	ricultural literacy resources of the control of the	Web Sites: □ National Agriculture in the Classroom □ State Agriculture in the Classroom □ Agricultural Commodity sites
☐ Suburban 1. What type(s) of agriculture? (Check ☐ Books ☐ CD ROM ☐ Activities ☐ Agricultural P ☐ Video/Film St	ricultural literacy resources of the control of the	Web Sites: ☐ National Agriculture in the Classroom ☐ State Agriculture in the Classroom ☐ Agricultural Commodity sites ☐ Other:
□ Suburban 1. What type(s) of agriculture? (Checonomic Books □ CD ROM □ Activities □ Agricultural P □ Video/Film State Commodity Green	ricultural literacy resources of the control of the	Web Sites: □ National Agriculture in the Classroom □ State Agriculture in the Classroom □ Agricultural Commodity sites □ Other:

3.	How do your students benefit from the integration of agriculture into their core academic subjects of math, history, and language arts, etc?					
	What outdoor student learning activities do you use to teach about feed					
4.	What outdoor student learning activities do you use to teach about food, agriculture, and the environment? (e.g. vegetable gardening, planting trees, and recycling newspaper, etc.)					

APPENDIX M

AGRICULTURAL KNOWLEDGE INSTRUMENT REFERENCED TO PREVIOUS RESEARCH

Demographic Instrument

Objective 2

Background Experience (Harris & Birkenholz, 1996 found statistical differences but no practical significance in agricultural knowledge scores among all secondary teachers and administrators) (Humphrey, J.K., Stewart, B.R., & Linhardt, R.E. (1994) found statistically significant and moderate correlations between confidence in teaching agricultural concepts and agricultural experience. p. 29).

What is your gender? (Frick, Birkenholz, & Machtmes 1995 found positive correlation and statistical significant difference in adult agricultural knowledge scores with male gender. p. 49).

Male Female

What is your ethnicity? (Frick, Birkenholz, & Machtmes 1995 found negative & positive correlations with statistical significant difference in adult agricultural knowledge scores ethnicity. p. 49).

Did you grow up on a farm? (No sig. dif. Found between agricultural knowledge scores of second graders whose teachers were raised on a farm and those whose teachers were not. Herren & Oakley, 1995)

Yes

No

Do you have any close relatives currently living on a farm or ranch? (Humphrey, J.K., Stewart, B.R., & Linhardt, R.E. (1994) found a moderate correlation between relatives on a farm and confidence in teaching agricultural concepts P. 29). (Frick, Birkenholz, & Machtmes 1995 found a negative correlation and statistical significant difference in adult agricultural knowledge scores with relatives that live on a farm. p. 48).

Yes No

Were you a member of 4-H? (Terry, Herring, & Larke, 1992 reported sig. dif. between teachers with 4-H exp and ag knowledge test scores than teachers with no 4H exp and ag knowledge test scores) (Frick, Birkenholz, & Machtmes, 1995 found 4-H members living on farms with experience in raising plants, gardens, or crops and enrolled in high school agricultural produced <u>lower</u> knowledge of agricultural scores. p. 48)

Yes No Did you take any type of agriculture course in high school? (Humphrey, Stewart, Linhardt, 1994 found statistical significance in agricultural knowledge scores of all 11th graders in schools that offer and do not offer agriculture, mean scores were higher in schools that offered agriculture and with students who took agriculture)

Yes No

If yes, how many agriculture courses did you take in high school? (Humphrey, Stewart, Linhardt, 1994 found statistical significance in agricultural knowledge scores of all 11th graders in schools that offer and do not offer agriculture, mean scores were higher in schools that offered agriculture and with students who took agriculture)

Were you a member of the Future Farmers of America (FFA) in high school? (Humphrey, Stewart, Linhardt, 1994 found statistical significance in agricultural knowledge scores of all 11th graders in schools that offer and do not offer agriculture, mean scores were higher in schools that offered agriculture and with students who took agriculture)

Yes No

What is your highest level of education? (Frick, Birkenholz, & Machtmes 1995 found positive correlation and statistical significant difference in adult agricultural knowledge scores with a BS degree or higher. p. 48).

BS/BA MS/MA Ph.D/Ed.D

How many college credit hours of agriculture courses have you completed? (Terry, Herring, & Larke, 1992 reported sig. dif. between teachers who had taken ag courses in college and ag knowledge scores than those who had not taken at least one ag course in college and ag knowledge scores).

Where is your personal residence located? (no direct evidence in the literature that shows this question important to ask.)

Rural Urban Suburban

What is the population size of your town/city? (Frick, Birkenholz, & Machtmes 1995 found a positive correlation and statistical significant difference in adult agricultural knowledge scores with those who live in town/city populations between 10-25K people. p. 49).

Have you ever worked in an agricultural related job? (Humphrey, J.K., Stewart, B.R., & Linhardt, R.E. (1994) found a moderate correlation between work experience in agriculture and confidence in teaching agricultural concepts. p. 29).

Yes No

Are you currently engaged in any farming or ranching activity? (Humphrey, J.K., Stewart, B.R., & Linhardt, R.E. (1994) found a moderate correlation between work experience in agriculture and confidence in teaching agricultural concepts. p. 29).

Large scale Medium scale Small scale Hobby None

How many acres do you own or rent for your farming or ranching activity? (Humphrey, J.K., Stewart, B.R., & Linhardt, R.E. (1994) found a moderate correlation between work experience in agriculture and confidence in teaching agricultural concepts. p. 29). (Frick, Birkenholz, & Machtmes 1995 found a positive correlation and statistical significant difference in adult agricultural knowledge scores with those with 10-50 acre farms. p. 49).

Objective 2

In-service Training_(Harris & Birkenholz, 1996, Terry, Herring, & Larke, 1992).

Have you ever received Food & Fiber Systems Literacy training? (Brown & Stewart found statistical significance in pretest and posttest agricultural knowledge scores in middle school students after being exposes to an agriculture curriculum. p.20).

Yes No

If yes to the above question, how many hours of training did you receive? (Brown & Stewart found no statistical significance in knowledge scores by length of instruction in middle school students. p.21).

Please describe the type of Food and Fiber Systems training you received. (Brown & Stewart found statistical significance in pretest and posttest agricultural knowledge scores in middle school students. p.20).

Have you ever received any Agriculture in the Classroom (AITC) training? (Brown & Stewart found statistical significance in pretest and posttest agricultural knowledge scores in middle school students after being exposes to an agriculture curriculum. P.20). (Herren & Oakley, 1995 found statistical significant differences in 2nd and 4th teachers' agriculture knowledge, class assignments, and urban and rural teachers who had AITC training. p. 29)

Yes

No

If yes to the above question, how many hours of training did you receive? (Brown & Stewart found no statistical significance in knowledge scores by length of instruction in middle school students after being exposes to an agriculture curriculum. p.21).

Please describe the type of Agriculture in the Classroom (AITC) training you received. (Brown & Stewart found statistical significance in pretest and posttest agricultural knowledge scores in middle school students after being exposes to an agriculture curriculum. p.20).

Objective 3

Resources/Materials Used:

What motivates you to use AITC resources? (no literature found that focused on motivation to use AITC resources.)

How do you benefit by using AITC resources? (no literature found that focused on how the teacher benefits by using AITC resources.)

What type(s) of AITC resources do you use? (no literature found that focused on the type of AITC resources used in the classroom.)

National or state web pages

AITC personnel

On-line discussion groups

Ag Science Project Ideas

Newsletter

Grants

Virtual Field Trips

Commodity group information sheets

Other:

Please describe any non-AITC resource(s) you use? (no literature found that focused on the other types of agricultural related resources used in the classroom.)

Do you use agriculture professionals as resources for instruction? (Terry, Herring, & Larke, 1992 reported sig. dif. between teachers who used ag professionals as resource people and ag knowledge scores than those teachers who did not use ag professionals as resource people and ag knowledge scores.)

Yes

No

If yes, what fields of agriculture professionals do you use as resources for instruction? (Mabie, R. & Baker M. (1996) recommended Extension professionals should assist teachers introducing experiential activities into their science curriculum. P. 3)

Objective 3

Activities: (Mabie, R. & Baker M. (1996). Reported students' knowledge increased through participation in experiential activities. Students went from knowing very little to becoming quit knowledgeable. p.3)

Do you use any gardening activities as a part of your curriculum? (Mabie, R. & Baker M. (1996) found urban 5^{th} & 6^{th} graders involved in gardening activities increased their agricultural knowledge. p.4).

Yes

No

Do you use any outdoor agricultural activities (other than gardening) as a part of your curriculum? (no specifice literature found) (Mabie, R. & Baker M. (1996) found urban 5th & 6th graders involved in gardening activities increased their agricultural knowledge. p.4).

Yes

No

If yes, what types of outdoor agricultural activities do you use? (no specific literature found) (Mabie, R. & Baker M. (1996) found urban 5th & 6th graders involved in gardening activities increased their agricultural knowledge. p.4).

Do you conduct any agricultural laboratory experiments as part of your curriculum? (no specific literature found) (Mabie, R. & Baker M. (1996) found urban 5th & 6th graders involved in gardening activities increased their agricultural knowledge. p.4).

Yes

No

If yes, describe the types of agricultural laboratory experiments you use as part of your curriculum? (no specific literature found) (Mabie, R. & Baker M. (1996) found urban 5^{th} & 6^{th} graders involved in gardening activities increased their agricultural knowledge. p.4).

Objective 2

Teaching:

How many years have you taught? (Terry, Herring, & Larke, 1992 reported significant differences between teachers with five or fewer years of teaching experience and those with more than five years in the classroom. p. 58).

Do you teach in a rural, urban, suburban school? (Frick, Birkenholz, Gardner, & Machtmes (1995) found statistical significant difference in high school students' agricultural knowledge scores of rural over urban inner-city high school students. P. 7).

Rural

Urban

Suburban

APPENDIX N

DIRECTIONS AND PROCEEDURES TO STATE AITC COORDINATORS

Instructions for AITC State Coordinators

USDA Study of Agriculture in the Classroom Oklahoma State University

As you prepare for data collection and give instructions to teachers as to how to conduct testing, please bear in mind that this is a research project designed to evaluate teacher and student knowledge in agriculture. Results of this study will assist in enhancing the Agriculture in the Classroom programs. As with every research project, we want to be consistent in the collection of data in every classroom that is involved. Therefore, please impress upon administrators and teachers that they should follow instructions exactly as they are written out. We want every teacher to give these tests in similar settings using the same instructions to students.

As coordinator of this research project for your state, you are asked to do the following:

- 1. Obtain signatures on the Administrator Consent Form for each participating school and set a date for administration of tests.
- 2. Provide the Parental Consent/Announcement Form to every school and teacher, asking them to send this announcement out one week prior to testing. This step is important in order for this research project to be in compliance with human subject regulations.
- 3. Provide a list of participating schools, and teachers by grade level, to the project coordinator at Oklahoma State University prior to his arrival for the first day of testing.
- 4. Arrange for a meeting to review testing procedures with the project coordinator prior to test administration, and accompany him to the first testing site.
- 5. Review instructions with participating teachers at the testing sites.
- 6. Distribute test packets to teachers. Note that the teacher survey and the student tests are numbered the same in order to compare student scores with their teacher's survey information. Be sure that the right packet gets to the right teacher, and don't allow mixing of tests from one class to another. If a teacher packet does not have a sufficient number of tests, use the surplus tests only to supplement the packet and be sure to write the packet number on the additional tests.
- 7. Remain at the school while testing is taking place; where appropriate, visit classrooms and be available to advise teachers on test administration.

- 8. Collect completed tests (student and teacher). Be sure to keep each classroom's tests in its own manila envelop.
- 9. Mail packets for both the treatment and control schools to AITC Project staff at Oklahoma State University.

APPENDIX O DIRECTIONS AND PROCEEDURES TO TEACHERS

Instructions for Teachers Administering Student Tests USDA Study of Agriculture in the Classroom Oklahoma State University

As you prepare to administer the agricultural knowledge tests for students, please bear in mind that this is a research project designed to evaluate teacher and student knowledge in agriculture. Results of this study will assist in enhancing the Agriculture in the Classroom programs. As with every research project, we want to be consistent in the collection of data in every classroom that is involved. Therefore, please follow instructions exactly as they are written out. We want every teacher to give these tests in similar settings using the same instructions to students.

As teachers administering these tests, we are asking you to do the following:

- 1. Read the instructions written at the top of the students' tests, and ask students to begin.
- 2. Distribute the tests and any writing utensils that students may need to take the test.

Note: K-1 and 2-3 grade levels will need a pencil, and red and blue crayons.

- 3. Allow each student a reasonable amount of time to complete the test. If students require help while taking the test, read the question for them but try not to give away the answer.
- 4. You are asked to complete the teacher survey some time during the day when you can be alone and give it your full concentration.
- 5. List the names of the students participating in the test and include it in the envelope. (This list will be kept on file and returned to you in the spring by the AITC coordinator for your reference when giving the posttest next April. At that time, we will ask you to test only those students who took this pre-test. Researchers will not see the names of the students, thereby protecting student anonymity.)
- 6. When the last student has finished taking the test, collect all tests. Place them with the completed teacher survey and the student name list, in the manila envelope provided. Return the completed student tests and teacher survey to the Ag in the Classroom coordinator.

Special Notes:

a) This is an anonymous test; scores for individuals and schools will be reported as group data. Therefore, there is no advantage to the school or class in helping students to perform better. Results from this study will help to improve the state Agriculture in the Classroom program.

b) Please do not copy or keep a copy of the tests for reference or use as a teaching tool. The test will be given again as a posttest at the end of the school year.

Thank you for your participation in this important study!

APPENDIX P SPLIT-PLOT DESIGN

Split-Plot Design

Assumptions

The linear model on which the split-plot design analysis is based can be written as $Y_{ijk} = \mu + \alpha_j + \pi_k + \beta_j + (\alpha\beta)_{ij} + \beta\pi_{jk} + \epsilon_{ijk}$. Whereas, the following terms mean: Y_{ijk} equals any subjects' score; μ equals the grand mean; α_j equals the effect of variable A (Training) at level j (Trained, Untrained); π_k equals between error; β_k equals the effect of variable B (Theme) at level j (Understanding Food & Fiber Systems, History, Geography, & Culture, Science, Technology, & Environment, Business & Economics, and Food, Nutrition, & Health); $(\alpha\beta)_{ij}$ equals the joint effect at levels i and j; and $\beta\pi_{jk} + \epsilon_{ijk}$ equals within error (Keppel, 1991).

The assumptions under which the F ratios obtained from this split-plot design were addressed. First, the independence assumption asks 'Are the observations independent?' This assumption was met by the design of the study. Each teacher took the exam by themselves with no influence on each other. Thus, the teachers' exams were unrelated.

The second assumption, normality, was meet by a visual examination of a stem-and-leaf plot (histogram) of each group for the variable, Training (see Figures 1 & 2). Addressing skewness and kurtosis of these histograms, Stevens (2002) said "...that skewness has only a slight effect (generally only a few hundredths) on level of significance or power. The effects of kurtosis on level of significance, although greater, also tend to be slight" (p.261). Furthermore, Bock (1975) stated "even for distributions which depart markedly from normality, sums of 50 or more observation approximate to

normality" (as cited in Stevens, 2002, p. 262). This is due to the central limit theorem which states, "...the sum of independent observations having any distribution whatsoever approaches a normal distribution as the number of observations increases" (p. 262). Therefore, the means of the independent observations approach normality and thus, the sampling distribution of F.

Stem Leaf	#
10 0000000000000000000000	22
9	
9 00000000011111111111111111111111	33
8 666666666	10
8 00000002222222222222222222222222222	37
7	
7 00000000111111111111111133333333333333	44
6	
6 0044444444444444444444	24
5 5555555555557777777777	25
5 0	1
4 55555555	9
4 03333	5
3 6666	4
3	
2 77999	5
2	
1	
14	1

Multiply Stem.Leaf by 10**+1

Figure 1. Stem-and-Leaf Plot (Histogram) for AITC trained teachers.

The third assumption, homogeneity of variance, was met by the Hartley F_{max} Test. The calculated value for F_{max} and the critical value for $F_{\text{max}.05; 10, 30}$ were 1.07 and 3.29 respectively. It should be noted that the Hartley F_{max} Test is affected by nonnormality as it is "overly sensitive to violations of the normality assumption" (Keppel, 1991, p. 101). With respect to unequal sample sizes affecting Type I error rate and power, Stevens

(2002) reported, "As long as the group sizes are approximately equal (largest/smallest 1.5), F is robust" (p. 268). For this study, the unequal sample size ratio was 1.05.

Histogram	#
102.5+*****	13
· *******	21
***	6
*******	29
· ************************************	57
· *******	24
****	9
******	22
***	5
*****	13
***	6
.*	1
*****	16
.*	1
***	6
7.5+*	1

^{*} may represent up to 2 counts

Figure 2. Histogram for AITC untrained teachers.

The fourth assumption, homogeneity of covariance, was met by evaluating the sphericity assumption for the observed covariance matrices using the Box test of equality of covariance matrices. From this test, the F ratio was 1.306 with a p-value of 0.188 (see Table 54). Therefore, we failed to reject the null hypothesis of equal covariance matrices.

Table 54

Box's Test of Equality of Covariance Matrices

Box's M	F	df1	df2	р
20.866	1.306	15	31042	.188

From Table 55, we were able to analysis data as per our hypotheses.

Table 55

Split-Plot Analysis of Variance

Source	df	SS	MS	\overline{F}	p
T	1	7171.489866	7171.489866	7.38	0.0080*
Error (T)	88	85556.66021	972.23478		
Th	4	23297.26208	5824.31552	32.53	<.0001*
Th x T	4	819.30991	204.82748	1.14	0.3355
Error (Th)	352	63020.2727	179.0349		
Total	449	179759.7964			

Note. *p < .05. $\omega_T^2 = .03$. $\omega_{Th}^2 = .13$

We can perform appropriate following hypothesis tests:

a)
$$H_0$$
: all $(\alpha\beta)_{ij} = 0$ vs. H_1 : not all $(\alpha\beta)_{ij}$ are zero $F = 1.14$ with a p -value = 0.3355

We fail to reject the null hypothesis. Therefore, we cannot conclude that there is a significant interaction between type of training and theme with respect to the mean agricultural literacy score.

b) H_0 : all $\alpha_j = 0$ vs. H_1 : not all α_j are zero

F = 7.38 with a p-value = 0.0080

We reject the null hypothesis. Therefore, we can conclude that the mean agricultural literacy score is different for at least one type of training. Calculation of omega squared suggested that about three percent of the variability in agricultural knowledge may be due to the type of training received. According to Kirk (1996), this is evidence of a small effect of type of training upon agricultural knowledge.

c) H_0 : all $\beta_j = 0$ vs. H_1 : not all β_j are zero F = 32.53 with a p-value < .0001

We reject the null hypothesis. Therefore, we can conclude that the mean agricultural literacy score is different for at least one theme. Calculation of omega squared suggested that about 13 percent of the variability in agricultural knowledge may be due to the theme. According to Kirk (1996), this is evidence of a large effect of theme upon agricultural knowledge.

Using Tukey's post hoc procedure, the following line diagram may be drawn:

Theme

5 4 1 3 2

Figure 3. Line diagram for post hoc analysis.

Omega-squared (ω^2)

The omega squared index provides a relative measure of the strength (practical significance) of an independent variable. Using omega-squared for this study's design, the variance components were associated with the appropriate main effects and interactions.

Therefore, the following equation for omega-squared was used:

$$(\omega^2) = [SS_{\text{Effect}} - (df_{\text{Effect}}) MS_{\text{error}}] / SS_{\text{Total}} + MS_{\text{error}}$$

Estimating the interaction effects (Training x Theme) and main effect (Training, Theme), the following omega-squared indices were calculated: $\omega^2_{\text{Training x Theme}} = [819.30991 - (4) \ 179.0349] \ / \ 179759.7964 + 179.0349 = 0.000573363$ $\omega^2_{\text{Training}} = [7171.489866 - (1) \ 972.23478] \ / \ 179759.7964 + 972.23478 = .03430081$ $\omega^2_{\text{Theme}} = [23297.26208 - (4) \ 179.0349] \ / \ 179759.7964 + 179.0349 = 0.125493326$ The convention used to interpret omega squared were the following according to Kirk (1996, p. 751): small, $\omega^2 = .010$; medium, $\omega^2 = .059$; and large, $\omega^2 = .138$.



Matthew Trent Portillo

Candidate for the Degree of

Doctor of Philosophy

Thesis: AN ASSESSMENT OF AGRICULTURAL KNOWLEDGE OF KINDERGARTEN THROUGH-SIXTH GRADE TEACHERS

Major Field: Agricultural Education

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Personal Date: Born at Mather Air Force Base in Rancho Cordova, California on June 22, 1968, son of Ernest and Linda Portillo, married July 8, 1995, husband of Erin Michelle Portillo.

Education: Graduated from Jesuit High School, Carmichael, California in June 1986; received Associate of Arts degree in General Education from American River College, Sacramento, California in June 1990; received Bachelor of Science degree in International Agricultural Development a Minor in Philosophy and Agricultural Education Teaching Credential from University of California at Davis, California in June 1993 and June 1995 respectively, received Master of Science degree in Agricultural Education from Oklahoma State University in July, 2000. Completed the requirements for the Doctor of Philosophy degree in Agricultural Education at Oklahoma State University in (May, 2002).

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