The Food and Fiber System Literacy of elementary teachers and their students
by Alexander Michael Malcolm

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Education
Montana State University

Abstract:
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This quasi-experimental study consisted of five different pretest instruments related to the Food and Fiber Literacy Framework. One instrument was for the teachers and consisted of 40 items. The other four instruments were for the students; Kindergarten through First grade, Second through Third grade, Fourth through Sixth grade, and Seventh through Eighth grade. These instruments varied in number of items.

The responses to the instruments were compiled into a Microsoft EXCEL spreadsheet (1997). The teacher data was then imported into SPSS-X (1997) to conduct a One-Way analysis of variance.

The data from this study revealed several factors, which could impact the Food and Fiber literacy in a positive manner. There was no significant difference among the teachers' Food and Fiber Literacy attitudes and perceptions at all three schools. The students had a greater understanding of the Food and Fiber systems in the lower grade levels, than those students in the higher grade levels. If the teaching profession utilized this data and research method more frequently, all participants would gain understanding of the Food and Fiber industry. This would improve the knowledge and perception society has toward the Food and Fiber system.

THE FOOD AND FIBER SYSTEM LITERACY OF ELEMENTARY TEACHERS AND THEIR STUDENTS

By

Alexander Michael Malcolm

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APPROVAL

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Alexander Michael Malcolm

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliography, style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

The purpose of this study was to determine the Food and Fiber literacy level of Elementary teachers and their students from three schools. The three schools represented different socio-economic and cultural backgrounds. The three schools were from Woodland, California, an urban school; Yale, Oklahoma, a suburban school; and Townsend, Montana, a rural school.

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CHAPTER ONE

INTRODUCTION

Agriculture, the Food and Fiber System, is the world's largest and most essential industry. The Food and Fiber system relates to any sector of the industry supplying farm inputs or engaging in the production, processing, and distribution of agricultural products (Food and Fiber Literacy Framework, 1996). Everyone all over the world consumes the products of agriculture, from the food they eat, the clothes they wear, to the homes in which they live. A growing world population will increase the demands for agricultural products as well as the amount of qualified personnel to work for the agriculture industry. The consuming public lacks the general understanding of the importance of agricultural policies including price supports, conservation programs, and export programs that affect the supply and cost of agricultural products. This may be due to not providing education about agriculture in public schools. According to the National Research Council (1988), agriculture was not being taught in the elementary schools and has been segregated into vocational agriculture courses at the secondary level.

The Food and Fiber system has contributed significantly to our history and culture. The future of mankind, depends upon the success of agriculture. A society which is literate about or Food and Fiber System, is needed to preserve the industry, which

produces food and raw materials needed to satisfy the most basic of human needs. (Birkenholz, 1993)

An initial task to be addressed when educating a society to be literate in the Food and Fiber system is to define what is agricultural literacy. There are several different meanings and concepts to examine when considering what it means to be agriculturally literate. In the past, literacy usually referred to some level of reading and writing skills.

According to Jacquelyn Deeds (1991), "Agricultural Literacy should have a meaning of having *knowledge and competencies about agriculture"*. A functional level of Agricultural Literacy does not imply a perfect level of understanding but rather a minimum level of understanding (Frick, 1990). The first step in improving the agricultural literacy level of a population is to determine the current level of knowledge and/or perceptions towards agriculture. Various projects that are working toward agricultural literacy include enrichment programs for junior high students, short term activities such as Food for America, and the Agriculture in the Classroom program.

There are many forces that challenge education of American agriculture in the classroom settings today. Demographics, urbanization, life styles, and global competition are just of few of these challenges.

Frick (1990) quoted:

> Gordon Douglass, editor of Cultivating Agriculture Literacy, stated that agricultural literacy should include "... a description of the place of agriculture in human history; a philosophical investigation of the purposes of agriculture, an examination of the links between nutrition and human development from the perspective of social science. It should also include a basic introduction of the biochemistry of agroecosystems."(p. 2)

Frick (1990) also stated the following:

> Agricultural Literacy is the understanding and possessing such knowledge of our food and fiber systems. An individual possessing such knowledge would be able to synthesize, analyze and communicate basic information about agriculture. Basic agricultural knowledge includes: production of plants and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing and processing of agriculture products, public agricultural policies, the global significance of agriculture, and the distribution of agriculture products." (p. 41)

According to Birkenholz (1993), the direct involvement in production agriculture is declining; therefore, increasing numbers of citizens are becoming more vocal about issues related to agriculture, food, and natural resources that surround them each and every day. For citizens to make a reasoned and intelligent decision about the policies and issues affecting the Food and Fiber system, there needs to be some education of all individuals about the Food and Fiber system. We have to explain away concerns that are not warranted and make those changes that are justified. Preparing better stewards of the land is not enough. We must prepare better communicators to promote the industry of agriculture.

For the first 150 years of American history, agriculture was an important part of education. By educating our youth, we are educating the next generation to become more aware of how agriculture affects each and every one of us. By educating teachers, society will become more knowledgeable about agriculture and better able to make wise decisions, while helping in writing the next 150 years of American history.

Problem Statement

The purpose of this study was to determine the Food and Fiber Literacy level of Elementary teachers and their students from three schools. The three schools represented different socio-economic and cultural backgrounds. The three schools were from Woodland California, an urban school; Yale, Oklahoma, a suburban school; and Townsend, Montana, a rural school.

Statement of Need

With the potential for future generations having less direct contact with our Food and Fiber System, the level of the Food and Fiber systems knowledge should be addressed through formal education about the Food and Fiber System. Food and Fiber literacy should become a national issue and priority. Failure to educate the populace about the Food and Fiber system will place the value our society has on this industry in jeopardy. Future lawmakers may be deciding the fate of this industry. If society does not have the basic knowledge of the Food and Fiber System, individuals will be making a decision based on biased or incomplete information. This in turn will put undo risk on this industry which is so vital to this nation's well being.

In the National Research Council book, Cultivating Agricultural Literacy (1984), Mawby stated:

> ... today most people, including those in key positions of public decision-making, do not understand the complexities of our food systems; nor do they fully comprehend its relationship to human nutrition or its impact on international trade and relations... People's inability to look at problems in their entirety, instead of seeing only isolated fragments, is especially severe in regard to agriculture

> issues. The production of food-agriculture is the basic human enterprise, yet each decade fewer people have a full appreciation of the reality.... (p. 7)

An individual who is literate about agriculture will have the practical knowledge that is needed to care for the environment and be aware of the agriculture services that are available to them. In conclusion, a person who is agriculturally literate is an informed citizen who will be able to make an informed decision in advocating for the policies that effect the agriculture industry.

The National Academy of Science stated, in Understanding Agriculture: New Directions for Education (1994), that:

1. Agricultural Education is far too important to just be taught to the relative few students enrolled in vocational education. (p. 8)
2. Beginning in kindergarten and continuing through the twelfth grade, all students should receive systematic instruction about agriculture. (p. 10)
3. The subject matter of agricultural instruction must be broadened. (p. 9)
4. Institutions should provide leadership in the initiation of agricultural literacy for all our nation's youth. (p. 17)
5. Teachers should be encouraged to incorporate materials about scientific, economic, and public health aspects of agriculture in their lessons. (p. 11)
6. Science teachers and specialists with knowledge of agriculture should design materials to give students an interest and an increased understanding of the Food and Fiber system. (p. 15)

The teachers are the professionals who stimulate learning in much of our society. If the teachers are literate toward the Food and Fiber system, then issues related to our Food and Fiber system will be better understood as a whole, because society will understand the facts. Hence, teachers will make a more educated decision for themselves and society at large.

Objectives

To fulfill the purpose of this study, the following objectives were identified.

1. Measure the Food and Fiber literacy level of elementary teachers;

2. Pre-assess students' Food and Fiber literacy level; and

3. Determine the influence of selected demographic variables that may influence the teacher's attitudes and perceptions of the Food and Fiber systems.

Definitions

The following definitions were formulated specifically for this research project.

1. Agricultural Literacy: "Knowledge and understanding of the Food and Fiber System" (Frick, p. 41, 1990).

2. Food and Fiber systems: Compromises all activities necessary to produce, harvest, process and transport food and fiber products (The Food and Fiber System Literacy Framework; p. 2, 1996)

3. Food and Fiber products: Things that we utilize every day, such as cardboard, chicken, chopsticks, cosmetics, dental floss, beef, dyes, inks, medicines, paper, ribbon, ore, rope, soap, tires, toothpicks, etc. (The Food and Fiber System Literacy Framework; p. 1, 1996).

4. Rural: Relating to the country, country life, and agriculture. (Webster Dictionary); A person who lives on a farm or ranch, divided into places of 2500 persons or less, such territory and its population and housing units for each extended cities whose closely settled area was locate in an urbanized area. (1990 U.S. Census)

5. Urban: Showing characteristics of, constituting a city (Webster Dictionary) A person or individual who lives in a city or town. Consists of territory, persons, and housing units in:

   A. Places of 2500 persons or more which are incorporated as cities, villages (except in Alaska and New York), and towns (except in the six New England states, New York, and Wisconsin), but excluding those rural portions of "extended cities". (1990 U.S. Census)

B. 2500 persons or more. (1990 U.S. Census)

6. Agrarian: Agriculturally related. Coming from a Farm/Ranch Background (Webster Dictionary).

7. Educational Institutions: A high school or college institution (Webster Dictionary).

8. Transient Student: A student that takes several different courses from different colleges (Terry 1996).

9. Colleges: Referring to the different areas within the university, such as the College of Agriculture, College of Education, or College of Business (Terry 1996).

10. Scientific Literacy: (A) An understanding of the process or methods of science of testing the models of reality, (B) A basic vocabulary of scientific and technical terms and concepts, (C) An understanding of the impact of science and agriculture has on society (Miller 1989).

11. Bedroom Community: Extended Cities

12. Rural Farms: All households and housing units on farms. Must sell $1,000 or more in agricultural products. (1990 U.S. Census)

13. Rural Non-Farm: The remaining rural portions. (1990 U.S. Census)

14. Urbanized Area: Comprises one or more places ("central place") and adjacent territory ("urban fringe") together must have 50,000 persons or more. (1990 U.S. Census)

Assumptions

The following assumptions for this study were:

1. There is a growing lack of interest or knowledge about our Food and Fiber Systems as our society has evolved from agrarian to urban.

2. Kindergarten through Eighth grade teachers have a minimal knowledge about the Food and Fiber System and will gain additional knowledge while teaching the Food and Fiber System's curriculum.

3. Students have a greater understanding about the Food and Fiber industry at a younger age.

4. Students at the lower grade levels should have greater knowledge base about the Food and Fiber industry due to the fact of the teachers assisting the students in answering items on the student collection instruments.

Limitations

This study was limited to:

1. The population will be one school in each of the following states:

    a. Oklahoma
    b. California
    c. Montana

2. The duration of the study will be for the school year of 1997 through 1998.

CHAPTER TWO

REVIEW OF LITERATURE

Three sections cover the review of literature: (1) Food and Fiber Systems, (2) Agricultural Literacy, (3) Completed and related research reports. The three sections laid the basis of the study, supporting the need.

Introduction

Agriculture, food, and food production are basic to human welfare and have contributed significantly to our history and culture (National Research Council, 1988). The future of mankind is directly dependent upon agriculture. Throughout the history of the United States, agriculture has contributed significantly to the country's economic development. Every citizen has a vested interest in agriculture (Adkisson, 1990). Mawby (1984) wrote, "Many bad decisions affecting food production can be traced to a lack of understanding about agriculture on the part of the 97 percent of our people who don't live on farms." (page 72).

According to Birkenholz (1990), an educated citizenry is needed to ensure the preservation of the industry that produces the food needed to satisfy the most basic of human needs. "Man, whether civilized or savage, is a child of nature—he is not the

master of nature." (Carter, 1981). When he tries to circumvent the laws of nature, he usually destroys the natural environment that sustains him. Civilization must conform its actions to certain natural laws if it is to maintain its dominance over the environment.

The education system in the United States reaches nearly all the youth and many adults at the same time. Means of transportation are rapid and the opportunities for public discussion are more numerous. Newspapers and radio broadcasting systems reach more homes, and televisions and motion-picture theatres serve those who prefer to get their information visually. There is no reason why almost 100 percent of our population should not be properly informed about the essential issues that affect our everyday existence. Misinformation can be imparted almost as effectively as correct information. We must evaluate our problems and devise solutions for them if we are to rescue this civilization from the pitfalls that lie ahead. Mawby (1984), in an editorial titled "Agricultural Colleges must take the lead in ending ignorance about farming" in The Chronicle of Higher Education, described the role of land grant colleges and universities in educating non-farm people about agriculture. He wrote:

> A variety of institutions can play a role in shaping the direction of American agriculture, but none is more qualified than the land grant colleges of agriculture, with their unique tradition of research, teaching, and extension. Taken collectively, these institutions can educate or influence both the people and the processes affecting the future of agriculture. (p. 72)

Land grant colleges of agriculture are uniquely situated to address the needs of an agriculturally illiterate society. Identifying shortfalls and misconceptions in the public's knowledge of agriculture is prerequisite to charting an appropriate course of action.

A person who is literate about agriculture understands the basic concepts of the Food and Fiber system, its history and current economic status. With this understanding, any individual will have a greater awareness of the social and environmental significance agriculture brings to society. Teachers in the elementary and secondary education programs should be encouraged to develop or enhance a greater understanding of the importance and significance of agriculture in this nation and the world.

According to the Mayer (1974) article, "Agriculture: The Island Empire"," a limited number of scientists believe agriculture is a science, even though agriculture was the mother of all scientific research" (p 83). The success or failure of science as a whole unit will depend tremendously on the success or failure of agriculture. American society sees mathematics, astronomy, and physics as the leading edge of scientific progress. However, throughout history, agriculture has been the most advanced science and in some respects the largest science of all. The cycle of plants and seeds, when and how to plant, what grows best in different soil types, and how much water is needed for each different cash crop, are several ideas that were learned through experimentation. No scientist will perform a greater act of faith on an experiment on predictability than a farmer who plows under a portion of the year's harvest for better yields for the next year.

A national project called "*Project 2061: Science for all Americans*", found that "most Americans are not scientifically literate" (p 13). This is a devastating statement since our economy is based on a global market, which relies heavily on science and

technology. Teachers must not only prepare students for employment, but they must also educate them about the broader aspects of agriculture.

Food and Fiber Systems

The continuing trend of urban sprawl and suburban creep is threatening farmlands and a way of life that contributes to this nation's well being and prosperity. As more people understand the contributions of the Food and Fiber system, they will understand its significance to the rural community, the suburbs, cities, and nations all over the world.

David Hall (1991) stated, "with a declining knowledge about agriculture, Agriculture in the Classroom (AITC) was developed at a national level, by the United States Department of Agriculture (USDA). Each state approaches AITC from the basis of its own needs and the resources it has available for teacher training." (p. 6)

A study conducted by David Hall, entitled Agricultural Literacy programs: Current Status, (1991), was sent to State supervisors, State FFA executive secretaries, or their counter parts in each of the 50 states. Sixty-four percent of those schools surveyed had at least one grade receiving instruction about agriculture. This survey focused on the following areas:

1. Instruction "About Agriculture" defined as consumer education about agriculture.
2. Instruction "About Agriculture" defined as career education in agriculture.
3. FFA involvement by Junior High Students.

Eighteen states did not have a current program of instruction about agriculture as of February 1991. Hall noted that a tremendous amount of work needed to be done before the majority of the students would receive instruction in at least one grade. (p. 7)

With farm residents being outnumbered 40 to 1 in the general population of the United States, a basic appreciation of our Food and Fiber system is extremely important. This is especially true, when agriculture is the major industry in the state. Even those students who have agriculture backgrounds are deficient in some areas of agriculture (National Research Council, 1988).

The National Research Council found that:

> Few systematic educational efforts are made to teach or otherwise develop agricultural literacy in students of any age. Although children are taught something about agriculture, the material tends to be fragmented, frequently outdated, usually farm oriented, and often negative or condescending in tone. (p. 9)

Therefore, it is easily understood why there is such a deficiency in agricultural literacy among students or even the general public. In order for America to feed itself and the rest of the world, we need to become better educated in agriculture as a whole to not only make well-informed decisions about the Food and Fiber System, but more importantly, to have public support for the industry.

According to John Pope (1990), there have been several programs initiated to advocate agricultural literacy, such as FFA's Food for America, USDA's Agriculture in the Classroom (AITC), and California's Life Lab Science program. The most recent

program, which has come from recommendations from these three programs, is titled Food, Land, and People.

Food, Land, and People addressed seven different areas of agricultural literacy: (1) Basic food production, (2) History of agriculture, (3) Agriculture and the environment, (4) Economics, (5) Views and perceptions of the interdependence of Food, Land, and People, (6) Decision-making or policy making for the future of agriculture, and (7) Future global management.

In a study titled Idaho Agriculture in the Classroom - Teaching Elementary Teachers and Students About Agriculture, (Pals, 1996) noted that one half (50%) of Idaho's work force is involved in the state's private industry, the Food and Fiber system. The image of agriculture as a high-technology industry was needed in the school's classroom to interest the leaders of tomorrow and future scientists. This is one reason why the Idaho Agriculture in the Classroom (IAITC) was created. IAITC was created as part of a nationwide effort to increase the limited knowledge possessed by school children and their educators. Idaho Agriculture in the Classroom created in-service workshops and curriculum that has aided in the education of elementary teachers (Pals, 1996). This program gives the teachers the opportunity to learn about the agricultural industry and develop hands-on techniques using the teacher's guide. In certain areas, even the students were becoming the teachers. These students teach younger elementary students about agriculture. This opportunity has helped them tremendously because students are learning about agriculture while practicing their public speaking skills.

One such program making its way into the elementary grades is the National FFA's Food for America. This program helps elementary students become more knowledgeable in the food and fiber system. It reaches students in grades 1-6. The curriculum is very adaptable to each student and to the school's program. The Food for America program can be integrated into regular classes since this program can be taught in traditional subjects (Hall, 1991). Charles Shiflet (1985) feels that this program is very beneficial for the recruitment of students and educating the public about agricultural practices.

In a study that evaluated Georgia's Agriculture in the Classroom Program, sixteen classes of second grade students and twelve classes of fourth grade students participated. In this study guided by Herren and Oakly (1996), a total of 598 students were included. The purpose of this study was to determine the effectiveness of the Agriculture in the Classroom program in Georgia. The program's main objective was teaching elementary students about agriculture. An experimental "posttest only" control group design was conducted for this study. The second and fourth grades were selected because the curriculum had been used longer. According to the data, the state's Agriculture in the Classroom program was effective in teaching agricultural concepts to these two grade levels.

According to Perritt and Morton (1990), Agriculture in the Classroom has made significant strides; however, it has barely scratched the surface. "The FFA's Food for America program is being utilized as a vehicle to inject agriculture into the social studies

and science classrooms at the elementary level" (p. 14). They feel that it is (1) important to create an awareness of the importance of agriculture in elementary school age students, and (2) to promote a positive image of careers in agriculture.

According to Dale Law (1990), in Illinois the agriculture instructor serves as the resource person who assists the elementary school teachers in identifying where and how to incorporate agriculture into the classroom activities. Agricultural extension agents also serve as a vital resource for the elementary school teachers where there is no agricultural education program in the school district. Law feels that it is very important to build a solid, constructive partnership between the schools and the resource person.

In Montana (Lombardi and Malone, 1990), agricultural literacy is primarily delivered through a grassroots voluntary organization called Agriculture in Montana Schools (AMS). Teachers and students gain a better understanding of the contribution agriculture has on their lives and to their state and national economies. In order to gain this understanding, AMS provides a number of programs and contests throughout the year. These different activities help the educators, as well as the students, gain knowledge and concepts about how the food and fiber system works and how it contributes to everyday life.

How can we educate the younger children, kindergarten through second grade, about the importance of agriculture? The earlier in life that information is presented to children, the more receptive they are to accepting and applying correct concepts for the rest of their life. According to McReynolds (1985), "Nothing in these grade levels dealt

with the dependence and needs of the American farmer." In conjunction with other professors, the authors created new material and curriculum which provided background information for the teachers, while implementing writing, math, and communication skills that the students have learned already in their early academic life.

A study conducted by Humphrey, Stewart, and Linhart (1993) noted that the teacher is the key to becoming an agriculturally literate society. Teachers observe and direct the mental life of all learners in one way or another. The purpose of this study, Preservice Elementary Education Majors Knowledge of Agriculture (1993), was to assess the level of knowledge and perceptions about agriculture in the U.S. of preservice elementary education majors at the University of Missouri-Columbia. In this study the researchers concluded that the overall mean of knowledge is relatively high, but with a great variance. The perception held by the education majors is positive but it also varies greatly. Those student teachers who have had previous agricultural experience are more confident and have a greater perception of agriculture than those student teachers who have not had previous agriculture experience.

Terry, Herring, and Larke (1990) addressed the idea of supplementing the elementary teachers with information about agriculture to implement into their classes. The purpose of this study was to assess fourth grade teachers' understanding and use of agricultural concepts in their teaching and to determine if assistance is needed to help teachers implement programs of agricultural literacy in the classes that they teach. The objectives of this study were to (1) identify selected personal and professional

characteristics of fourth grade teachers, (2) determine the teachers' knowledge and perceptions, and (3) determine the extent the teachers use agriculture in their classrooms. Researchers found that teachers spent an average of eight hours a year teaching agriculture in their class. Teachers felt that less structured programs with a list of reference materials would be of help to them.

The literature provided evidence that agricultural literacy of the general public is limited. Therefore, a need exists to educate all school-age children and adults about the agricultural system (National Research Council, 1988).

In some states there have been materials developed to teach agricultural literacy to students in kindergarten through sixth grade. Leising and Zilbert (1994) solicited reviews and comments on the framework from groups who have an interest in education about agriculture. Eight groups were randomly selected, all from California, with the exception of teacher educators and state supervisors who were selected from across the nation.

The researchers concluded that education about agriculture was very important and should be included in the school curriculum. Science and social studies were the two areas where agriculture would be easiest to integrate. The comments on the framework indicated a strong interest in general education about agriculture.

It was recommended by Leising and Zilbert (1994) that curricula and educational materials be developed for general education about agriculture for all grade levels. Curriculum development efforts should focus on the integration of agriculture with grade specific criteria in science, social studies, and history. They also recommended that

general education about agriculture be aggressively pursued through partnerships with education, government, and agricultural industries.

Cheek (1985) stated that if we are to continue to prepare enough people for agricultural careers, then we must educate students about the field of agriculture. Students should be introduced to agriculture at an early age. Educational psychologists tell us that attitudes, values and interests of children are formed at an early age, with most of it being completed by middle school. Elementary and pre-vocational school programs serve an important purpose, as they help the students explore their abilities, interests, and aptitudes. Cheek felt that this would be an exceptional time for students to participate with "hands on" experiences.

According to Kuempel and Spivey (1990), research has shown that applications or "hands on" experiences are a preferred academic instructional tool. They feel that all of the courses should heavily emphasize the use of applied laboratory experimentation. Teachers in other areas of curriculum can utilize agricultural labs. They feel that as society becomes more technologically advanced, agricultural educators need to modify their existing programs to meet the needs of today's society. Agriculture can continue to contribute, as it always has, to this country.

Agricultural Literacy

The integration of agriculture in the curricula of school districts reflects a broad base of community interest and support. Much of the material could be incorporated into existing courses and would not have to be taught separately.

Dr. James Leising (1990) stated:

> 'Education professionals' see the teaching of 'the Food and Fiber Systems' as diluting the traditional career/vocational program. Others see the need for agricultural literacy as a challenge and opportunity to integrate agricultural knowledge across the curriculum in an effort to create a truly agriculturally literate population and motivate more students to pursue agricultural careers (p. 4).

To understand the concept of agricultural literacy, one must investigate the concept of literacy itself. Literacy usually refers to some minimum level of reading and writing skills. Determining the threshold level for literacy is not an exact science. It is a judgement by experts as to the minimum level of knowledge required by someone to function in a certain role and setting.

Frick and Spotanski (1990) felt that the implementation of agricultural literacy initiatives demand the emphasis of three major issues, (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. These three themes must be incorporated to ensure the development of agricultural literacy.

Why is there a need for an agriculturally literate public? According to John Pope (1990), "the real need for an agriculturally literate society is knowledge of the impact the

industry has upon our daily lives. The American people rely on agriculture for basic survival needs, economic needs and to protect the land. The interrelationship of these areas is why agriculture literacy is a basic need in America today." (p. 8).

Russel, McCraken, and Miller (1990) stated that fewer than 5% of American high school students are enrolled in agriculture education courses. A very small percentage of junior high and elementary students are being touched by agricultural literacy programs. One reason for this low number is due to the absence of information about agriculture in public education programs.

Frick, Kahler, and Miller, and Wade (1990) developed a study that provided educators with concepts about agriculture that every citizen should know. This study was the basic guideline for many other studies or projects related to agricultural literacy. The objectives for this study was to (1) identify the subject areas falling within the framework of agricultural literacy and (2) identify the agricultural concepts that the majority of citizens should know.

A total of 147 people were asked to fill out a Delphi instrument where a consensus was formed on 11 broad categories. These 11 agricultural literacy concept areas are now the basis for many surveys, which are used in many agricultural literacy projects. These 11 concept areas are broad categories with several subgroups related to the area.

Birkenholz (1993) recommended steps should be taken to guarantee the literacy level of agriculture in adults as well as all students in this country. In this pilot study about agricultural literacy, he found that there needed to be further education towards

agriculture. Two-thirds of the responses he received on the knowledge section were correct. In an educational setting, data collected would have resulted in a score of 66%, a "D" in the classroom setting. The area of Natural Resources received the highest scores among all those tested, while all of those tested scored lowest in the areas of Plants in Agriculture, Agriculture Policy, and Agricultural Processing. Birkenholz concluded that there needs to be further education in these areas to enhance the general knowledge and understanding of the American citizens. For the perception area, Birkenholz felt that each responding group was relatively positive. Over 2,000 respondents replied to the questionnaire. There were four subgroups that were concentrated on; (1) Indiana High School Seniors, (2) Michigan High School Seniors, (3) Rural Missouri Adults, and (4) Urban Missouri Adults. Over half of the respondents were female The ethnic background for this survey resulted in 55% Caucasian, 35% African-American, and 10% other.

Failure to educate the American society about the Food and Fiber System could place this nation's leading industry in harm. American citizens are responsible for the protection of this industry, which is directly influenced by the policies that are developed by groups and individuals who have limited knowledge and experience about agriculture (W.K. Kellogg, Cultivating Agricultural Literacy, 1984, pg. 123,).

The National Research Council stated:

> "Agriculture is too important a topic to be taught to only a relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies." (Understanding Agriculture: New Directions for Education; 1988, p. 1)

In another study conducted by Frick, Birkenholz, and Machtmes (1995), the knowledge and perceptions of 4-H members in Indiana towards the several agriculture concept areas was relatively high, but varied widely. Data were collected from 550 respondents; however, this did not constitute a representative sample of the 4-H membership in Indiana. Of those who responded, 361 were female and 189 were male. The areas of Natural Resources and Marketing of Agricultural Products had the highest scores among those 4-H members surveyed. Plants in Agriculture were the areas that received the lowest scores. The perceptions towards Agricultural Literacy were very good; however, they vary among the different area concepts. This study provided evidence that there still needs to be further education towards youth in our society, regarding the industry which produces and markets our food needed to nurture human life.

Frick, Birkenholz, Gardner, and Machtmes (1995) looked at the rural and inner-city high school students' knowledge and perceptions towards agriculture. The population consisted of rural and inner-city high school students in midwestern states. The survey content was similar to other research completed by Frick et al. (1990). With 1,121 students responding, 668 of them were from a rural area (populations consisting of 25,000 or less), and there were 453 urban or inner-city students (populations of 100,000 or greater). Rural high school students responded with more knowledge about Natural Resources and were least knowledgeable about Plants in Agriculture. The inner-city respondents were most knowledgeable about Natural Resources, as well, but were least knowledgeable about Policies.

In a study of Rural and Urban Adult Knowledge and Perception of Agriculture, conducted by Frick, Birkenholz, and Machtmes (1995), both groups were found to be somewhat knowledgeable about agriculture and had a relatively positive attitude towards the agriculture industry. The data collected for this survey was in Missouri. Of the 884 individual respondents, 456 of them were from a rural setting and 428 were from an urban setting. The area that received the highest score was in the Natural Resources concept. Agriculture policy received the lowest scores on the survey. Both the Rural and Urban groups felt that by having a higher level of education, a person would have a greater understanding about agriculture than those who had less education.

A study conducted by Thomson (1996) looked at suburbanites' perceptions about agriculture. The purpose for this study was to understand how consumers in southeastern Pennsylvania viewed themselves in the context of their food system and the importance on sustaining regional agriculture. One thousand two hundred fourteen consumers were asked to fill out questionnaires in 8 different counties. Of those interviewed, 7 out of 10 respondents were female and had the responsibility of buying food for their household.

Thomson's study found that (1) consumers are not knowledgeable about the relationship between food and the land, (2) there was a lack of language to discuss the complex issues associated with a sustainable food system, (3) consumers do not hold strong opinions about locally grown produce and how it is grown, but (4) they believe that their buying practices influence farming in the region and what is available to purchase.

The study, "Agricultural Awareness in Arizona", conducted by Flood and Elliot (1994), looked at the current knowledge levels about agriculture possessed by urban community college students and to solicit and report on their current opinions about agriculture. A population of 230 students was used in this survey. Nearly 65% were Caucasian. Over 80% of the respondents felt that they needed facts about agriculture in order to make an informed decision. There were no significant differences in the scores between those who had FFA, 4-H or previous agricultural experience and those who had no agricultural experience at all.

The National Research Council (1988) stated:

> Most Americans know very little about agriculture, its social and economic significance in the United States, and particularly, its link to human health and environmental quality (pg. 9).

A study conducted by Bertelsen and Miller (1990) looked at the agricultural literacy in urban Arizona. The purpose of this study was to assess the literacy level of agriculture among elementary, junior high, and high school students in the Flowing Wells School District in Tucson, Arizona. The sample population of the study consisted of 63 students from the fifth grade, 128 from the eighth grade and 115 students from the eleventh grade. In this study it was concluded that the agricultural literacy level was at an intolerably low level for all grades.

A study by Terry and Lawyer (1996) determined university student's perception of issues relating to agriculture. Students were found to have a favorable perception about the safety of food and the impact agriculture had upon the economy and the environment.

The purpose of this study was to determine the perceptions of university students regarding controversial issues related to agriculture and how students' demographic characteristics are associated with those perceptions. A sample of 400 was drawn from the population of 24,600, which was the spring enrollment at Texas Tech University. A total of 390 students responded to the questionnaire. Overall, those students felt that their food was safe to eat and that agriculture had a positive impact on our economy and environment. According to the data, demographic characteristics, gender and hometown explained the largest amount of variation associated with the students' perceptions about the use of medications on animals, food safety, animal welfare, and farming and ranching practices.

Dyer, Lacey, and Osborne (1996) looked at the knowledge about and perceptions towards agriculture of College of Agriculture freshman at the University of Illinois. With enrollment in the College of Agriculture and high school agriculture programs closely paralleling, this study was used as an effort to better identify, recruit, and retain students within the College of Agriculture. High school agriculture was perceived as a good preparation for college. Of those surveyed, 60% indicated that they intended to get a degree within the college of agriculture. Those freshmen who completed a high school agriculture program indicated a more positive attitude towards the university's agriculture curriculum, and agriculture as a career, than those students who did not receive any educational instruction in high school agriculture.

A study conducted by Harris and Birkenholz (1996) was designed to assess the knowledge and attitudes of secondary educators in 245 secondary schools in Missouri. Agriculture teachers had the most knowledge and the most positive attitude toward agriculture. Those teachers who taught language arts and mathematics were the least knowledgeable. With such a diverse degree of knowledge and perceptions toward agriculture, each group of teachers surveyed still had a positive attitude toward the industry of agriculture. Since the teacher's knowledge and attitudes toward agriculture was not a major barrier, the teachers could incorporate agricultural concepts and illustrations to increase the levels of agricultural literacy among their students. The majority of the teachers surveyed were from predominately rural areas. Results indicated that with positive attitudes and perceptions by the educators, there is a potential for expanding the agricultural literacy initiative throughout other courses in the secondary school curricula.

A study completed by McBlair and Shelhamer (1996), focused on the relationship of agricultural literacy of superintendents, principals, and counselors in four western states to the adherence of state guidelines and student enrollment. This was a descriptive research study that looked at the previous agricultural experience, agricultural literacy level, relationship between the literacy test scores and the school's adherence to state guidelines for agricultural education, and the relationship between literacy test scores and enrollment in the agricultural education classes. The majority of administrators did not have the necessary background to make an informed decision about agricultural education.

Assessing the knowledge and understanding of city and government leaders is important and vital to the field of agriculture. These opinion leaders have a major impact upon society's perspective on agriculture. Ryan and Lockaby (1996) conducted a study that looked at the agricultural literacy level of city and government officials. The research design was a descriptive-correctional, in which the population consisted of 70 city and government officials from a mid-size town in the southwest. In the knowledge section, the mean score was 39.4 out of a possible 60. No significant relationships were found. This study recommended defining the level at which a person is agriculturally literate.

With agriculture being the central industry on the high plains and south plains of Texas, an assessment of agricultural literacy of civic leaders was needed. Bell-Ritz and Lockaby (1996) conducted their assessment of civic leaders in a selected city. The population in this study consisted of leaders of different civic organizations within the city of Lubbock, Texas. Twenty organizations were randomly selected. Overall, the members of the civic groups were not very knowledgeable about agriculture compared to other surveys done in similar fashion.

Fellers-Howell and White (1996) conducted their research survey by determining the agricultural literacy level of broadcast news representatives of radio stations in Oklahoma. Howell and White looked at selected demographics, identified the relative levels of agricultural literacy levels, determined if there is a relationship, and also determined if the reporters felt a need to report agriculture news and activities to the public. The population of this study consisted of 129 radio stations across Oklahoma.

Sixty-nine radio station reporters returned surveys for a return rate of 53.5 percent. It was found that the respondents were knowledgeable toward agriculture. However it was apparent that there was little understanding of the technical and policy issues of the industry.

Related Articles

In the article, The Race Toward Academics through Agriscience, Trexler and Barrett discussed the importance of science and agriculture. When trying to develop new curriculum for agricultural education courses, developers found inherent similarities between the science objectives and existing objectives in agriculture. This discovery made the point that agriscience education could be in the academic limelight.

As agriculture and science are combining in the school curriculum, *Project 2061* (1989) was a tremendous opportunity to develop those agricultural concepts into science There were four major concepts in this project. The first theme looked at the present curricula in science and math. Agriscience in many states is based upon science objectives. Thus, the agriscience courses are taking on the affect of being like an encyclopedia. The second theme of *Project 2061* looked at the methods of instruction. To improve agriscience instruction, educational principles that help students learn and master the understanding of competencies were used. In order for the students to achieve mastery learning, educators should incorporate three different learning practices; the first being Conceptual Learning, which suggests an instructor break down course information into

major concepts. These concepts are then arranged in order so that they build upon each other. The second learning practice is Connected Learning, where the students must connect different concepts to what they already know. By doing this, educators are increasing the student's retention and comprehension. The third set of learning practices relates to Discovery Learning. In this area, students learn conceptual ideas by participating in laboratory activities. These three learning practices helped the teachers and students gain an understanding about how science and agriculture combine in most areas.

Trexler and Miller (1992) contended that scientific literacy is vital to this nation's well being and economic competitiveness. In order for this success to proceed, a group of educators, community members, and industry leaders worked together to form a strategic plan. This plan recommended that the teachers (1) connect science concepts to their students' lives, (2) retool through the acquisition of new knowledge, and (3) adopt emerging teaching practices. From this need new curriculum was created, Agriculturally Based Curriculum in Science, ABC in Science. The curriculum design of this program was to teach science through agriculture, which would incorporate more agriculture into the classroom, while effectively teaching science.

Trexler (1994) explained that there is a need to change the route which educators take to introduce agriculture into the classroom. Some of the agricultural themes are reaching only a handful of teachers and are not reaching the majority of students, who are the focus of the projects. He found that three of the top six most important staff

development needs are: (1) assessing student learning, (2) interdisciplinary approaches, and (3) teaching content.

Trexler and Sudvedi (1996) conducted a project that looked at the perception of agriculture as a context for elementary science teaching. The purpose of this study had two parts. The first was to look at the perceptions of the teachers and principals relative to agriculture as a context for science. Second, the study attempted to determine how elementary agriscience curricula affects those perceptions about teaching by State-mandated science competencies through the Food and Fiber system. The study found that the teachers and principals in this county believed that agriculture and science were interrelated. Principals held a more positive outlook on teaching science through agricultural examples, while the teachers held a more negative attitude.

A study, conducted by Garton, Birkenholz, and Thompson (1996), assessed the students' attitudes toward and knowledge of environmental science concepts before and after being taught the Introduction to Environmental Science unit. In this study, there was little practical difference between the pretest and posttest attitude scores. However, those students who participated in the field test did gain a more positive attitude toward the environment and greater knowledge of the environmental sciences.

Another study conducted by Dyer and Osborne (1995), looked at the attitudes of Illinois guidance counselors toward agriculture programs. The primary purpose of this study was to determine the attitudes of guidance counselors toward agricultural and science education programs. Another purpose of this study was to investigate the

relationships of guidance counselors' attitudes and selected demographic variables. This study was also a descriptive study.

Dyer and Osborne found that the attitudes of guidance counselors have become more positive toward agriculture over the last decade and believed agriculture to be a scientific field of study. They believed that agricultural programs were superior in work value than that of science programs.

Another study conducted by Dyer and Osborne entitled, "The influence of science-based agriculture courses on attitudes of Illinois guidance counselors", (1994) is closely related to the previous study. It was concluded that the guidance counselors considered agriculture to be important; however, there needs to be an extended effort to publicize the scientific attributes of agriculture with a special emphasis on agricultural education. It was felt that the agriculture teachers should implement science applications in their agriculture instruction and familiarize guidance counselors with its content.

In a paper that was presented to the 1989 annual meeting of the American Association for the Advancement of Science, Jon Miller stated that to be scientifically literate, it is necessary to have at least a minimal understanding of the processes of science, a minimal understanding of scientific terms and concepts, and a minimal level of understanding of the impact of science on society. To be classified as having a minimum level of knowledge towards science, a respondent had to be able to provide a satisfactory open-ended explanation of what it means to study something scientific and to recognize

astrology as not at all scientific. It was found that only twelve percent of American adults met the requirements of being literate about science.

A study conducted by Osborne and Dyer (1995) looked at the attitudes of Illinois high school science teachers toward the agriculture industry and education programs in agriculture. It was found the majority of teachers were familiar with the agricultural industry and would like to learn more about it. Agricultural technologies recorded the most positive attitudes with the teachers. The teachers did have a positive attitude toward agriculture; however, they did not encourage their students to pursue agriculture as a career option.

Another study conducted by Osborne and Dyer, looked at the attitudes of Illinois Agriscience students and their parents toward agriculture and agricultural education programs (1996). This descriptive research survey had a target population of high school students enrolled in the Biological Science Applications in Agriculture (BSAA) course and the parents of those students. A total of 285 students out of 1170 were surveyed.

Over half of the students felt that the BSAA course was fun and interesting and it helped them learn more about agriculture. However, the students felt that there was a substantially greater amount of homework, reading and tests in this curriculum. In conclusion, students felt that agriculture is a scientific field with numerous career opportunities. More of the female students were considering the agriculture career option.

Johnson and Newman (1993) conducted a study of the perceptions of administrators, guidance counselors, and science teachers concerning the pilot agriscience

courses. The study found that the administrators, counselors, and teachers had positive perceptions toward the agriscience courses. They felt that this curriculum challenged the students' ability level. They also felt that the students should take agriscience courses whether entering college or the workforce after high school.

The study, "Arkansas Agriculture Teachers' Opinions concerning science credit for Agriculture", was conducted by Johnson (1995) to determine the opinions of Arkansas secondary agriculture teachers concerning science credit for agriculture. Johnson concluded that those agricultural courses being offered for science credit must be relevant, rigorous courses that are taught in an applied context. The teachers reported that they taught material that covered over half of the science objectives in their class. Finally, agriculture courses that are taken for science credit should focus on the life sciences, such as plant and animal related courses.

Enderlin, Petrea, and Osborne (1993) conducted a study entitled, "Student and Teacher Attitude Towards and Performance in an Integrated Science/Agriculture Course". It was concluded that the students enjoyed learning in this type of instructional setting. The teachers enjoyed teaching this class and felt that their students learned more through this type of instructional setting. However, they felt that many times they were unprepared as a result of the extra time required to prepare for each class session.

Connors and Elliot (1993) conducted a survey entitled, "The Influence of Agriscience and Natural Resources Curriculum on Students' Science Achievement Scores". The study concluded that those students who had agriscience and natural

resources for a class performed equally as well as those seniors who did not take any agriscience or natural resource classes. The seniors' grade point average had more of a direct result on their science achievement scores.

CHAPTER THREE

METHODOLOGY

This chapter describes the procedures that were used in completing this survey. This chapter is organized into six different sections; (1) Population Selection, (2) Instrument Design, (3) Instrument Validation, (4) Data Collection, (5) Data Analysis, and (6) Summary.

Population Selection

The Food and Fiber Project committee desired three public schools from different geographic regions of the nation. They selected the three different states based on geographic, culture, ethnic, and socio-economic diversity The committee wanted a school from a rural area, suburban area, and an urban area. Within each of the three states, several public schools were targeted for an interview. The schools were selected for this project based on an interview conducted by the selection committee.

The teacher population for this study consisted of 51 teachers from the three different schools ranging from elementary to eighth grade middle school teachers. Of the 51 teachers participating in this project, 38 were female and 13 were male. Ten of those teachers were from a town larger than 100,000 people. Eighteen teachers were from a town with a population of 10,000 to 100,000. Four teachers lived near a town with a population of 2501 to 10,000. Another thirteen teachers were from a town with a

population between 1000 and 2500. Four teachers were from a town with less than 1000 people.

The students were not randomly selected due to the fact that they attend the schools that were selected. Over 200 students participated in this project for the rural school in Townsend, Montana. There were over 300 students who participated in this project for the suburban school in Yale, Oklahoma. Over 500 students participated in this project for the urban school in Woodland, California.

Instrument Design

This quasi-experimental study employed a pretest treatment format. The instrument assessed the Food and Fiber Systems literacy level of the teachers before they started teaching the Food and Fiber Systems curriculum in their classroom.

The data collection instrument for the teachers was organized into two different sections. The first section contained a series of items that addressed both knowledge and perception of Food and Fiber Literacy. The second section contained items regarding demographic information. This instrument was developed with the assistance of a committee of agricultural educators and statisticians at two land grant institutions in the United States. The first section of the data collection instrument contained items which were written half as knowledge items and the other half as perception items. A series of 40 questions were chosen from the five different sections in the Food and Fiber Systems Literacy Framework. The five different concept areas were (A) Understanding Agriculture, (B) Historical, Cultural, and Geographical Significance, (C) Science: Agricultural - Environmental Interdependence, (D) Business and Economics, and (E) Food, Nutrition, and Health. Within each section a series of items were compiled. The final set of items used on the survey was refined by a group of experts whose field of

expertise and knowledge was the Food and Fiber industry. Eight items from each of the five sections were chosen to form a 40-item survey (Appendix B) A Likert-type scale, ranging from (1) Strongly Agree to (5) Strongly Disagree, allowed the teachers to respond to the 40 items related to the Food and Fiber System.

The second section of the data instrument consisted of questions directed to the respondents in an attempt to collect personal and situational demographic information. These questions were related to age, gender, size of town in which they live, history of agriculture background, teaching experience and education level (Appendix C).

The data collection instruments for the students were developed to test the knowledge of the students in kindergarten through eighth grade. Four different student instruments were developed from the Food and Fiber Literacy Framework and Curriculum. They were developed for grades K-1, 2-3, 4-6, and 7-8. Items from the instruments were derived from the learner outcomes and different questions were asked from within the five major areas of the Food and Fiber Literacy Framework. Age, reading and comprehension level were considered for the instrument at each grade level. These instruments were developed with the assistance of Dr. Marty Frick, Montana State University, Carl Igo, Oklahoma State University, Dr. Ann DeOnis, Montana State University, Dr. Eric Stroymeyer, Montana State University, Dr. James Leising, Oklahoma State University and several elementary teachers at Townsend and Yale elementary schools who were involved with the project.

The kindergarten through first grade data collection instrument had a total of sixteen questions. The teachers, due to the fact that most of the students were not able to read at this level, read the items and answers on this instrument. It was felt that the students at this level would have a better comprehension if the answers were in picture form. Each answer had a label for the teachers to read in case the teacher did not

understand the picture. This instrument was broken into two different sections; matching and multiple choice (Appendix D)

At the second and third grade level, teachers had the option of reading the questions and answers or giving their students the opportunity to read the questions and answers themselves. This instrument had a total of twenty questions. It was broken into three different categories: matching, ranking, and multiple choice (Appendix E).

The fourth through sixth grade data collection instrument had a total of thirty questions. These students were expected to read, so the teachers did not read the questions or answers to their students. This instrument was broken into three different sections: matching, multiple choice, and true/false (Appendix F).

The seventh and eighth grade instrument consisted of thirty questions. The instrument also measured the students' knowledge of the Food and Fiber Industry. The questions for this instrument consisted of true/false, matching, and multiple choice (Appendix G).

Instrument Validation

A teacher pilot test was conducted with 35 elementary level student teachers at Montana State University. The pilot test was validated after a review of clarity, readability, and relevance to the objectives of the research project. The respondents said it was well written and easily understood. The survey instrument was revised and deemed ready for the population group.

The Cronbach's alpha reliability coefficient computed for the pilot test was .78. According to the experts on the panel, this instrument was considered a valid tool for assessing the Food and Fiber literacy of this project.

The instruments for student population were pilot tested on elementary students within driving distance of MSU-Bozeman for economic and geographic reasons. These instruments were distributed among students at a local rural school. The students were given 30 minutes to work on the test, except for the K-1 students who received one hour. The teachers administered the test to their students. After the test was given, teachers were asked for their input to improve the different instruments. The student data collection instruments were then computed using the Split-half reliability in Statistical Package for Social Science (SPSS Base 7.5 for Windows), available through the SPSS statistical software package.

For kindergarten and first grade, the teachers recommended that this instrument be taken over a period of two to three days. They felt that the students were getting tired of the items on the instrument after the first couple of pages. The Guttman Split-Half reliability correlation for this instrument was .7377. Upon reviewing the results of this instrument and visiting with the committee panel, it was felt to be valid and reliable for the students in this project.

The survey instrument for second and third grades had the strongest reliability of all four instruments. The teachers felt that this instrument was very good. They felt that the time period was a little short and said that the time needed to be lengthened for those students who have trouble reading and comprehending what the item asks. The Guttman Split-half reliability coefficient was .9105.

The fourth through sixth grade instrument had the lowest split-half reliability of all four instruments. The teachers who administered the instruments said that the students understood the questions and had plenty of time. The Guttman Split-half reliability coefficient for this instrument was .3909. After consulting the committee about this instrument, the instrument was left intact with a few corrections. The instrument could

not be altered due to the fact that all of the questions were related to the framework and specific guidelines within the framework.

Regarding the seventh and eighth grades, the teacher who administered this instrument said the time and quality of the instrument was fine and that the students understood and comprehended what was being asked for each item. The Guttman Split-half reliability coefficient factor for this instrument was .6579. The committee agreed that the reliability coefficient on this instrument is still strong enough for a reliable and valid instrument.

Data Collection

Once the schools were selected, the instruments designed and conducted a census deemed viable for the project population, the testing instruments were distributed to the teachers before the inservice training started. The first inservice training was held on May 14, 1997 at the curriculum inservice training in the northwestern location; Townsend, Montana. A total of 9 teachers responded to the questions on the instrument survey. The second inservice training was held at the midwestern location; Yale, Oklahoma, on May 24, 1997. A total of 17 teachers responded to the questions at the second training. The third training was held in the western location, Woodland, California, during the month of June, where 26 teachers attended the inservice training. Those teachers who attended more than one training took the pretest instrument only once.

All of the questionnaires were returned since it was a captive audience. There were three different inservice training sites, one for each school. The instrument for the teachers were all hand scored by the researcher.

Upon confirmation of validity and reliability of the student instruments, they were sent to the three schools for measuring academic performance of the students. These instruments were sent to the schools by September 15, 1997. The committee felt this was

a good starting date, mainly allowing students time to settle into their classrooms. The collection of the instruments was completed by October 1, 1997. With a captive audience, there was a 100% return rate for the student instruments. The rural school and the suburban school had a 100% return rate for all grades, kindergarten through eighth grade. The urban school returned all of their instruments except for the fourth through sixth grade instrument. There was a return rate of 11 (92%) of 12 instruments. Any instruments returned after October 1 were considered to be late responders. The researcher corrected all of the student instruments by hand and compiled data into a Microsoft Excel Spreadsheet and statistically analyzed it using SPSS.

Data Analysis

The information was analyzed and gathered in a summary report for all the teachers and those involved in the project to view. The data was entered into Microsoft Excel spreadsheets as the instruments were mailed back to the researcher.

During the input process on the teacher instruments, the researcher keyed in the numbered response they indicated for each item, (1) Strongly Agree, (2) Agree, (3) Neutral, (4) Disagree, and (5) Strongly Disagree. After each item was entered into the spreadsheet, the items were then categorized into the five Food and Fiber literacy framework concepts. Averages and means were computed for each of the framework concepts. The data was then transferred into SPSS-7.5 for Windows for a One-way ANOVA analysis to determine significant differences among the three different schools and the five major Food and Fiber Literacy framework questions. The results were then compiled into comparative tables for more accurate reporting

The researcher entered student instrument data into each of the three different school Microsoft Excel spreadsheets for each school. Due to the fact that this part of the

project was descriptive, averages and means for each school were computed for later analysis of these data.

The selected demographic variables for the teacher instrument were selected into a Microsoft Excel Spreadsheet. The researcher sorted the data by assigning a number code to a common response. The data was compiled for analysis of significant differences among the schools and its teachers.

Summary

This was a quasi-experimental study of agricultural literacy of the Food and Fiber Literacy Framework. The population consisted of teachers and students from three selected schools throughout the United States. These three public schools represented geographic, culture, ethnic, and socio-economic diversity. One school represented urban, one school represented suburban, and one school represented a rural culture.

Responses to the items in both the teacher and student instruments were analyzed by a computer statistical package. Means, averages, and standard deviations were calculated for each question in the instruments. The data on these instruments were used to determine a difference among the schools and instruction. The selected demographic features were used to determine any significant differences in knowledge and perceptions of the teachers.

CHAPTER FOUR

RESULTS OF THE STUDY

The purpose of this section of the study was to assess the attitudes and perceptions about the Food and Fiber System of those elementary teachers in Montana, California, and Oklahoma, who are teaching Kindergarten through Eighth grade, in the Food and Fiber Literacy Project. Also, this study was to assess the knowledge level of those students who were attending the schools participating in this project.

This chapter is reported in several parts. Data are presented in the following sections, (1) Selected demographics of those teachers participating in this survey, (2), Teacher Literacy Level, (3) Stepwise regression of the five Food and Fiber concept areas by the selected demographics, and (4) Knowledge of the students.

The data collected represented three different kinds of schools throughout the United States. The three schools that are represented in this survey are (1) urban (California) school, (2) suburban (Oklahoma) school, and (3) rural (Montana) school. The results of this data are only generalizable to the teachers and students of the Food and Fiber Literacy project.

Selected Demographics

This section describes selected demographics among all of the schools and teachers involved.

Upon receiving the instruments, five surveys were found to be unusable due to a missing page for a response rate of 51 (93%) out of 55. These five instruments were still used in the data; however, with incomplete demographic information, they were not used for input on the demographic section. A total of 51 completed instruments were used for demographic data analysis.

The data presented in Table 1 provide an indication of the demographic characteristics of the respondent groups. The four subgroups reported in Table 1 consist of Rural-Montana, Suburban-Oklahoma, and Urban-California, and Total- all three schools combined. The rural contingent of teachers had nine respondents who represented the rural school. The suburban group of teachers had sixteen respondents who represented the suburban school. The urban group of teachers had twenty-six respondents who represented the urban school.

From the total of 51 respondents, 38 (75%) indicated they were female, while 13 (25%) teachers responded their gender was male. Refer to Table 1 for totals on school subgroups.

Out of 51 total teachers, 14 (28%) of the teachers reported having grown up on a farm and/or ranch. Thirteen (25%) teachers responded having lived in a rural area (a population less than 2500 people). Another thirteen (25%) teachers indicated they grew up in a town or city (a population greater than 50,000 people). Eleven (22%) teachers

said they grew up in a suburb (2500-50,000 people). Refer to Table 1 for totals on school subgroups.

Out of 49 total teachers, 18 (37%) stated the population of the nearest town to their home was between 10,001 and 100,000 people. Thirteen (27%) teachers indicated they lived near a town with a population of 1001 and 2500 people. Ten (20%) teachers responded by indicating they lived near a town with a population greater than 100,000 people. Four (8%) stated the town they lived closest to has a population between 2501 and 10,000 people. Another four (8%) teachers indicated they lived near a town with less than 1000 people. For the breakdown of the schools in their subgroups refer to Table 1. For this demographic variable there were two non-respondents.

Out of all fifty teachers, 33 (66%) said they had relatives who lived or worked on a farm and/or ranch. Seventeen (34%) reported they did not have any relatives who lived or worked on a farm and/or ranch. Refer to Table 1 for totals on school subgroups. For this variable there was one non-respondent.

The majority of all the teachers, 32 (63%) of 51 teachers indicated they did not have any relatives who worked in a non-production agricultural business. Nineteen (37%) teachers reported that they did have relatives who worked in a non-production agricultural business. Refer to Table 1 for totals on school subgroups.

Of 51 total teachers, 43 (84%) indicated they did not take any agricultural courses in either high school or college. Eight (16%) teachers said they did take at least one agricultural course in either high school or college. Refer to Table 1 for totals on school subgroups.

Table 1. Selected Demographics of the teachers in the Food and Fiber Literacy project.

Selected Demographics of the Teachers in the Food and Fiber Literacy Project.	**Rural-Montana[c]**	**Suburban-Oklahoma**	**Urban-California**	**Total-all three schools**
Total number of participants	n=9 No. (percentage)	n=16 No. (percentage)	n=26 No. (percentage)	N=51 No. (percentage)
Gender [a]				
Male	2 (22%)	3 (19%)	8 (31%)	13 (25%)
Female	7 (78%)	13 (81%)	18 (69%)	38 (75%)
Where did you grow up? [a]				
Town/City	2 (22%)	1 (6%)	10 (38%)	13 (25%)
Suburb	1 (11%)	1 (6%)	9 (35%)	11 (22%)
Rural Area	2 (22%)	9 (56%)	2 (8%)	13 (25%)
Farm/Ranch	4 (44%)	5 (32%)	5 (19%)	14 (28%)
Do you have relatives who live or work on a farm and/or ranch?[a]				
Yes	2 (22%)	15 (94%)	11 (44%)	33 (66%)
No	7 (78%)	1 (6%)	14 (56%)	17 (34%)
Do you have relatives who work in a non-production agricultural business? [a]				
	4 (44%)	6 (37%)	9 (35%)	19 (37%)
Yes	5 (56%)	10 (63%)	17 (65%)	32 (63%)
No				
Did you take agricultural courses in High School or College? [a]				
	3 (33%)			
Yes	6 (67%)	2 (13%)	4 (15%)	8 (16%)
No		14 (87%)	22 (85%)	43 (84%)
Were you a Member of FFA and/or 4-H? [a]				
Yes		10 (63%)	2 (8%)	15 (29%)
No		6 (37%)	24 (92%)	36 (71%)
	2.33			
	2.67			
	3.33			
	3.30			
	4.44			
	4.89			

[a] Data presented is rounded to nearest percentage point.
[b] Data presented in question 60 is rounded to nearest hundredth of a decimal point.
[c] Schools are coded: Northwest (Rural); Midwest (Suburban); West (Urban)

The majority of all the teachers combined, 36 (71%) of 51 teachers said they were not a member of FFA or 4-H. Fifteen (29%) teachers indicated they were members of FFA and/or 4-H. Refer to Table 1 for totals on school subgroups.

With a rating of (1) being most important through (6) being least important, the teachers rated the six most important issues related to the Food and Fiber industry. The teachers involved with the Food and Fiber Literacy project believed that Natural Resource Base was the most important issue related to our Nation's Food and Fiber Literacy project, at a rating of 2.33. Food Safety, with a rating of 2.62 was the second most important issue related to the Food and Fiber industry for the teachers. The third most important issue related to the Food and Fiber industry at a rating of 2.74 was Agricultural practices that affect the environment. Current government economic policies that impact agricultural production was the fourth most important issue related to the Food and Fiber industry at a rating of 3.78. The teachers felt that the Viability of our rural economic base at a rating of 4.32 was the fifth most important issue related to the Food and Fiber system. The least important issue for the teachers involved with the Food and Fiber literacy project was Animal Welfare with a rating of 4.87. Refer to Table 1 for totals on school subgroups.

Literacy Level

This section of chapter four consists of two different sections. These sections are the teacher literacy level, and the student literacy level.

Teacher Literacy Level

The teachers at each school responded to a series of items that were related to the Food and Fiber Framework. There are five major Framework categories: Understanding Agriculture; Historical, Geographical, and Cultural significance; Science: Food and Fiber Environmental Interdependence; Business and Economics; and Food, Health, and Nutrition.

The range of the Likert-type scale ratings from which teachers could choose were (1) strongly agree to (5) strongly disagree. Therefore, the lower the value the more they agreed with the item. Refer to Table 2 for the results of the Analysis of Variance test (ANOVA) of the three schools.

An ANOVA test was conducted on the overall perceptions and attitudes of the Food and Fiber system using the five major Food and Fiber Literacy framework categories as the classification level. The results of the One-way ANOVA test are reported in Table 2. The ANOVA was run with the significance level set at .05.

The ANOVA produced an F value of .238 for the concept area of Understanding Agriculture. This statistically indicates that there is no significant difference among the teachers at all three schools in this concept area. Means showed that the rural (Montana) teachers had a greater perception about this concept than the teachers at suburban (Oklahoma) or urban (California) school. Refer to Table 2 for further results of the analysis.

In the area of Historical, Geographical, and Cultural Significance, the ANOVA tests produced an F value of 1.594. For this concept the ANOVA showed that there was no significant difference among the teachers from all three schools. The means revealed that the urban (California) teachers had a greater perception about this concept than both groups of teachers at the rural or suburban schools. Refer to Table 2 for further results of the analysis.

For the concept area of Science: Food and Fiber-Environmental Interdependence, the ANOVA produced an F test of .260. This test proved that there is no significant difference of Food and Fiber Literacy among the teachers at all three schools. Means revealed that the suburban (Oklahoma) school teachers had a greater perception than the teachers at either the rural (Montana) or urban (California) teachers. The teachers who had the least perception regarding this area was the rural (Montana) school. Refer to Table 2 for further results of the analysis.

In the area of Business and Economics, the ANOVA produced an F test of 1.221. For this concept area the ANOVA showed that there is no significant difference among the teachers at all three schools. The means showed that the urban (California) schoolteachers had a greater perception than the teachers at the other two schools. Refer to Table 2 for further results of the analysis.

For the area of Food, Health, and Nutrition, the ANOVA produced an F test of .513. The results of the ANOVA showed that there is no significant difference among the teachers at all three schools. The results of the means showed that the teachers at the two schools, rural (Montana) and suburban (Oklahoma) schools, had a greater perception

than the teachers at the urban (California) school about this concept area. Refer to Table 2 for further results of the analysis.

Table 2. ANOVA of the overall knowledge score of the Food and Fiber system by the respondent groups

	Mean/Average [a]	Std. Deviation	df	F	Sig.
Sub 1- Understanding Agriculture				.238	.789
Townsend [c]	24.33/3.04	3.81	2		
Yale	25.05/3.13	2.01	2		
Woodland	25.12/3.13	3.37	2		
Total	24.96/3.12	2.97	2		
Sub 2- Historical, Geographical; and Cultural Significance				1.59	.213
Townsend	17.00/2.13	2.87	2		
Yale	18.62/2.33	5.03	2		
Woodland	16.73/2.09	2.51	2		
Total	17.48/2.19	3.75	2		
Sub 3- Science: Food and Fiber- Environmental Interdependence				.260	.772
Townsend	17.22/2.15	2.95	2		
Yale	16.38/2.05	2.87	2		
Woodland	16.62/2.07	2.98	2		
Total	16.63/2.08	2.89	2		
Sub 4- Business and Economics				1.221	.303
Townsend	16.11/2.01	4.70	2		
Yale	16.81/2.10	4.24	2		
Woodland	15.12/1.89	2.80	2		
Total	15.91/1.99	3.73	2		
Sub 5- Food, Health, Nutrition				.513	.601
Townsend	10.89/1.76	3.10	2		
Yale	10.86/1.76	2.03	2		
Woodland	11.96/1.50	5.30	2		
Total	11.38/1.42	4.00	2		

[a] Total Mean/Average of the concept area (8 questions)
[b] Data presented in Table 1 is rounded to the nearest hundredth of a decimal point.
[c] Group was broken into regional subgroups: Northwest-Townsend; Midwest-Yale; West-Woodland; Total-all teachers combined.
[d] Schools are coded: Northwest (Rural); Midwest (Suburban); West (Urban)
[e] Teachers rated the items: (1)strongly agree, (2) agree, (3) neutral, (4)disagree, (5) strongly disagree.

The results of the means also revealed that the teachers in general had a greater perception about the concept area of Food, Health, and Nutrition and had the least perception about the concept area of Understanding Agriculture.

The ANOVA also shows that there is no significant difference among the teachers in Food and Fiber literacy project. This statistically indicates that all of the teachers who are teaching in this project had roughly the same amount of perception about the Food and Fiber Industry.

Stepwise Regression of the five Food and Fiber Framework concept areas by the Selected Demographics

Stepwise regression for Suburban (Oklahoma) Food and Fiber Literacy teachers

The mean scores were analyzed by employing stepwise regression, utilizing the selected demographic variables as the pool of predictor variables. An alpha level was set at .05 for the criterion of inclusion in the prediction equation.

The results of the stepwise regression analysis for the five major concept areas for the Food and Fiber literacy framework for the group of teachers from Yale is presented in Table 3. In the concept area on Understanding Agriculture, one demographic variable was found to be of significant importance to the mean scores presented by the teachers at Yale. This variable produced a positive regression coefficient. The variable was: "Were you a member of FFA and/or 4-H?". Teachers who possessed this characteristic produced a higher perception score for the concept Understanding Agriculture.

For the area of Historical, geographical, and cultural significance, there were no variables that were selected to be significant positive regression coefficients for this

Table 3. Stepwise Regression Analysis of the concept areas for the Food and Fiber Literacy Framework for the Suburban (Oklahoma) teachers.

	Concept area [a]				
Variable	1	2	3	4	5
Where did you grow up?					
b	-4.46E-02	.277	1.78E-02	-8.93E-03	4.464E-02
F	.141	.898	.011	.001	.221
p	.712	.355	.918	.972	.644
R square	.007	.045	.001	.000	.011
Do you have relatives who work or live on a Farm/Ranch?					
b	6.667E-02	5.00E-02	-.196	-1.21	-.217
F	.290	.026	1.294	.214	6.284
p	.596	.874	.269	.649	.021*
R square	.015	.001	.064	.011	.249
Do you have relatives who work in a non-production agriculture business?					
b	-.160	8.33E-02	1.04E-02	.128	-.101
F	2.199	.086	.004	.292	1.308
p	.155	.772	.950	.595	.267
R square	.104	.005	.000	.015	.064
Did you take any agricultural courses in High school or College?					
b	.339	-1.55	1.65E-02	2.632E-02	-1.32E-02
F	3.733	.104	.004	.004	.007
p	.068	.750	.953	.949	.933
R square	.164	.005	.000	.000	.000
Were you a member of FFA and/or 4-H?					
b	.229	-3.47E-02	8.68E-02	-9.03E-02	-.101
F	5.159	.015	.290	.143	1.308
p	.035*	.904	.596	.710	.267
R square	.214	.001	.015	.007	.015
Agricultural practices that affect our environment.					
b	7.143E-02	-.357	.330	6.250E-02	-7.14E-02
F	.365	1.544	4.679	.062	5.76
p	.553	.229	.043*	.806	.457
R square	.019	.075	.198	.003	.029

[a] Group was coded: (1) Understanding Agriculture, (2) Historical, Geographical, and Cultural significance, (3) Science: Food and Fiber- Environmental Interdependence, (4) Business and Economics, (5) Food, Health, and Nutrition

- Significant at the .05 level

concept area. For the concept area of Business and Economics, there were no selected variables which produced a significant positive regression coefficient.

For the area of Science: Food and Fiber- Environmental Interdependence, one variable was found to have significant importance. This variable was the selection of "Agricultural practices that affect our environment" as the main issue that affected our Nation's Food and Fiber Industry. The selected variable produced a positive regression coefficient, which determined that those teachers who selected this issue produced a higher score in this concept area.

In the area of Food, Health, and Nutrition, one variable produced a significant predictor. This variable was: "Do you have relatives who work or live on a Farm and/or Ranch?". The selected variable produced a positive regression coefficient. Those teachers who possessed this characteristic produced a higher level of perception about the Food and Fiber Industry than those who did not possess this characteristic.

Stepwise regression for the Rural (Montana) Food and Fiber Literacy teachers

For the teachers at the Townsend (rural) school, the mean scores were analyzed by employing stepwise regression, utilizing the selected demographic variables as the pool of predictor variables. An alpha level was set at .05 for the criterion of inclusion in the prediction equation.

The results of the stepwise regression analysis for the five major concept areas for the Food and Fiber literacy framework for the group of teachers from Townsend is presented in Table 4.

For the concept area Understanding Agriculture, there were no selected variables that produced any significant positive regression coefficient. For the concept area of Science: Food and Fiber- Environmental Interdependence, there were no variables which produced a significant positive regression coefficient.

For the area of Historical, cultural, and geographical significance, one variable was found to have produced a positive regression coefficient. This variable was: "Do you have relatives who live and/or work on a Farm and/or Ranch?". Those teachers who possessed this variable characteristic produced a higher perception score for this area. Another variable produced a positive regression coefficient. This variable was "Agricultural practices which affect our environment". Those teachers who possessed this attitude produced a higher perception score than those teachers who did not.

In the area of Business and Economics, one variable was found to have produced a significant value for this concept. This variable characteristic was found to have produced a positive regression coefficient. This characteristic was: "Do you have relatives who work in a non-production agricultural business?". Those teachers who possess this characteristic produced a higher perception score than those who did not.

For the area of Food, Health, and Nutrition, one variable was found to have produced a significant predictor value. This variable characteristic produced a positive regression coefficient, which was: "Do you have relatives that work in a non-production agricultural business?". Those teachers who possessed this characteristic produced a higher perception score than those teachers who did not.

Table 4. Stepwise Regression Analysis of the concept areas for the Food and Fiber Literacy Framework for the Rural (Montana) teachers.

	Concept area[a]				
Variable	1	2	3	4	5
Where did you grow up?					
b	-.356	5.625E-02	-.162	.481	.312
F	1.290	.048	.400	1.602	4.227
p	.293	.833	.547	.246	.079
R square	.156	.007	.054	.186	.377
Do you have relatives who work or live on a Farm/Ranch?					
b	-.188	.562	-.205	.500	.259
F	.218	6.391	.450	1.146	1.546
p	.655	.039*	.524	.320	.254
R square	.030	.477	.060	.141	.181
Do you have relatives who work in a non-production agriculture Business?					
b	-.469	.394	6.250E-02	.931	.425
F	2.531	3.512	.056	16.123	16.056
p	.152	.103	.819	.005*	.005*
R square	.269	.334	.008	.697	.696
Did you take any agricultural courses in High school or College?					
b	-.134	.161	-.196	.786	.384
F	.109	.284	.409	3.727	4.624
p	.750	.611	.543	.095	.069
R square	.015	.039	.055	.347	.398
Were you a member of FFA and/or 4-H?					
b	-6.25E-02	.313	2.083E-02	.667	.292
F	.030	1.636	.006	3.319	2.932
p	.867	.242	.942	.111	.131
R square	.004	.189	.001	.322	.295
Agricultural practices that affect our environment.					
b	.250	-.500	-4.17E-02	-.271	-.146
F	.519	6.588	.022	.392	.558
p	.495	.037*	.885	.551	.480
R square	.069	.485	.003	.053	.074

[a] Group was coded: (1) Understanding Agriculture, (2) Historical, Geographical, and Cultural significance, (3) Science: Food and Fiber- Environmental Interdependence, (4) Business and Economics, (5) Food, Health, and Nutrition

*Significant at the .05 level

Stepwise regression for the Urban (California) Food and Fiber literacy teachers

For the teachers at the urban (California) school the mean scores were analyzed by employing stepwise regression, utilizing the selected demographic variables as the pool of predictor variables. An alpha level was set at .05 for the criterion of inclusion in the prediction equation. The results of the stepwise regression analysis for the five major concept areas for the Food and Fiber literacy framework for the group of teachers from the Urban (California) is presented in Table 5.

For the concept area of Understanding Agriculture, one variable characteristic was identified to have produced a significant predictor value. The one variable characteristic was: "Did you take any agricultural courses in High school or College?". This variable produced a positive regression coefficient. Those teachers who possess this variable characteristic produced a higher perception score for this area.

In the area of Historical, geographical, and cultural significance, there were no variable characteristics that produced a significant positive regression coefficient In the area of Science: Food and Fiber- Environmental Interdependence, there were no variable characteristics that produced a significant positive regression coefficient. In the area of Business and Economics, there were no variable characteristics that produced a significant positive regression coefficient. In the area of Food, Health, and Nutrition, there were no variable characteristics that produced a significant positive regression coefficient.

Table 5. Stepwise Regression Analysis of the concept areas for the Food and Fiber Literacy Framework for the Urban (California) teachers.

	Concept area [a]				
Variable	1	2	3	4	5
Where did you grow up?					
b	-2.067	-2.270	-2.186	-1.181	-1.530
F	.292	.590	.545	.193	.688
p	.594	.450	.468	.664	.415
R square	.012	.024	.022	.008	.028
Do you have relatives who work or live on a Farm/Ranch?					
b	1.558	2.673	3.369	2.325	1.621
F	.165	.826	1.336	.765	.775
p	.688	.373	.259	.390	.387
R square	.007	.033	.053	.031	.031
Do you have relatives who work in a non-production agriculture business?					
b	-4.656	-3.677	-2.847	2.960	-2.127
F	1.350	1.394	.816	1.097	1.183
p	.257	.249	.375	.305	.287
R square	.053	.055	.033	.044	.047
Did you take any agricultural courses in High school or College?					
b	11.417	6.719	5.237	5.661	4.312
F	4.350	2.311	1.351	1.992	2.447
p	.048*	.141	.257	.171	.131
R square	.153	.088	.053	.077	.093
Were you a member of FFA and/or 4-H?					
b	2.326	3.080E-02	-1.639	-.321	-.446
F	.154	.000	.126	.006	.024
p	.698	.995	.726	.939	.879
R square	.006	.000	.005	.000	.001
Agricultural practices that affect our environment.					
b	-1.421	-1.139	-1.688	-1.842	-1.119
F	.140	.238	.328	.484	.370
p	.712	.630	.572	.493	.549
R square	.006	.010	.013	.020	.015

[a] Group was coded: (1) Understanding Agriculture, (2) Historical, Geographical, and Cultural significance, (3) Science: Food and Fiber- Environmental Interdependence, (4) Business and Economics, (5) Food, Health, and Nutrition

* Significant at .05 level

Student Literacy Level

Kindergarten and First Grade

Data presented in Table 6 include means and percentages of the knowledge scores of the Food and Fiber Literacy Framework for the Kindergarten and First grade students for all respondents and each individual school.

The overall mean score was 51.73 out of 69 total points, and ranged from a low of 49.72 for the rural (Montana) school to a high of 54.8 for the urban (California) school. The mean percentage correct was 75.0%, and ranged from a high of 79.4% for the suburban (Oklahoma) school to a low of 72.1% for the rural (Montana) school.

Table 6. Kindergarten through First grade knowledge scores of the Food and Fiber Literacy Framework

	Total- All schools combined	Urban-California	Rural-Montana	Suburban-Oklahoma
	n=135	n=15	n=54	n=66
Mean	51.73	54.8	49.72	52.67
Percentage [a]	75.0%	79.4%	72.1%	76.3%

[a] Percentage = Mean score divided by total score.
* Total points = 69

Second through Third Grade

Data presented in Table 7 include means and percentages of the knowledge scores of the Food and Fiber Literacy Framework for the Second and Third grade students for all respondents and each individual school. The overall mean score for the Second and Third grade students was 77.13 out of a possible 101 total points, ranging from a high of

80.4 from the suburban (Oklahoma) school to a low of 71.05 from the urban (California) school. The overall percentage was 76.4%, with a high of 79.2% from the suburban school and a low of 70.3% from the urban school.

Table 7. Second through Third grade knowledge scores of the Food and Fiber Literacy Framework

	Total- All schools combined	West- Woodland	Northwest- Townsend	Midwest- Yale
	n=134	n=42	n=19	N=73
Mean [a]	77.13	71.05	79.37	80.04
Percentage	76.4%	70.3%	78.6%	79.2%

[a] Percentage = mean score divided by total score.

- Total points = 101

Fourth through Sixth Grade

Data presented in Table 8 include means and percentages of the knowledge scores of the Food and Fiber Literacy Framework for the fourth through sixth grade students for all respondents and each individual school. The overall mean score for the students in the fourth through sixth grade was 34.3 out of a possible 50 points, with a high score of 34.86 from the rural (Montana) school and a low of 33.94 from the suburban (Oklahoma) school. The overall percentage was 68.6%, ranging from a high of 69.7% from the rural school to a low of 67.9% from the suburban school. There were no instruments returned from the urban (California) school.

Table 8. Fourth through Sixth grade knowledge scores of the Food and Fiber Literacy Framework

	Total- All schools combined	West- Woodland	Northwest- Townsend	Midwest- Yale
	n=158	n=	n=63	n=95
Mean	34.3		34.86	33.94
Percentage	68.6%		69.7%	67.94%

[a] Percentage = Mean score divided by total score.
* Total Points = 50

Seventh through Eighth Grade

Data presented in Table 9 includes means and percentages of the knowledge scores of the Food and Fiber Literacy Framework for the Seventh and Eighth grade students for all respondents and each individual school. The overall mean score for the Seventh and Eighth grade students was 32.56 out of 56 total points, ranging from a high of 37.84 from the rural (Montana) school to a low of 31.78 from the urban (California) school. The overall percentage was 58.1%, with a high of 67.6% from the rural school and a low of 56.7% from the urban school.

Table 9. Seventh through Eighth grade knowledge scores of the Food and Fiber Literacy Framework

	Total- All schools combined	West- Woodland	Northwest- Townsend	Midwest- Yale
	n=645	n=502	n=76	n=67
Mean	32.56	31.78	37.84	32.45
Percentage	58.1%	56.7%	67.6%	57.9%

[a] Percentage = Mean score divided by total score.
* Total points = 56

CHAPTER FIVE

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to determine the attitudes and perceptions about our Food and Fiber System of elementary teachers in Montana, California, and Oklahoma, who teach Kindergarten through Eighth grade, in the Food and Fiber Literacy Project. This chapter is broken down into four parts; (a) Conclusions, (b) Implications, (c) Recommendations, and (d) Summary.

To fulfill the purpose of this study, the following objectives were identified.

1. Measure the Food and Fiber literacy level of elementary teachers;
2. Pre-assess students Food and Fiber literacy level; and
3. Determine the influence of selected demographic variables on the teachers' perceptions of the Food and Fiber systems.

Conclusions

The perceptions of teachers and students surveyed in the Food and Fiber Literacy framework project can only be based on the results of the Food and Fiber Literacy instruments administered (Appendix A). The conclusions of this study can only be applied to the population of this study and not to the general population. Based on the objectives and data analysis, the following conclusions were drawn:

1. There was no significant difference in the perception level of the Food and Fiber Industry among all of the groups of teachers at the three sites participating in the Food and Fiber Literacy project.
2. The teachers, as a whole, had a stronger agreement toward the concept area of Food, Health, and Nutrition than the other four concept areas. The concept area of Understanding Agriculture had the lowest level of agreement among all the teachers involved with this survey.
3. The results that can be concluded about the teachers from:

   A. Oklahoma:

      (1). Who had been members of FFA and/or 4-H had a greater perception about Understanding Agriculture if they were members of FFA and/or 4-H.

      (2). Who felt that agricultural practices affect our environment had a greater perception about the concept area of Science: Food and Fiber-Environmental Interdependence.

      (3). Who had relatives who work or live on a Farm and/or ranch had a greater perception about the concept area of Food, Health, and Nutrition.

   B. Montana:

      (1). Who had relatives that work or live on a Farm and/or ranch and felt that agricultural practices affect our environment had a greater perception in the concept area of Historical, Geographical, and Cultural significance.

(2). Had a greater perception in the concept areas of Business and Economics and Food, Health, and Nutrition, if they had relatives who work in a non-production agricultural business.

C. California:

(1). Who took agricultural courses in High school or College had a greater perception about Understanding Agriculture.

4. Students in the Kindergarten through First grade, as a whole, had an average mean score of 51.73 out of a possible 69 points for 75% for the Food and Fiber Literacy industry. This group of students had the second highest level of knowledge for the Food and Fiber Literacy Framework. Students from the Urban (California) school were more knowledgeable about the Food and Fiber industry. The students from the Rural (Montana) school were the least knowledgeable about the Food and Fiber industry.

5. Students in the Second through Third grade, as a whole, also had an average mean score of 77.13 out of a possible 101 points for 76% for the Food and Fiber system. These students had the most knowledge about the Food and Fiber industry. Students from the Suburban (Oklahoma) school were more knowledgeable about the Food and Fiber industry, whereas students from the Urban (California) school were the least knowledgeable about the Food and Fiber Industry, even though they were also late responders.

6. Students in the Fourth through Sixth grade, as a whole, had an average mean score of 34.3 out of a possible 50 points for 69% for the Food and Fiber industry.

This group of students had the second lowest knowledge level of the Food and Fiber literacy Framework. Students from the Rural (Montana) school were more knowledgeable, while the students from the Suburban (Oklahoma) school were least knowledgeable about the Food and Fiber industry.

(7) Students in the Seventh through Eighth grade, as a whole, were the least knowledgeable, an average mean score of 32.56 out of a possible 56 points for 58%, when it came to the Food and Fiber industry. Students from the Rural (Montana) school were more knowledgeable, whereas the students from the Urban (California) school were the least knowledgeable about the Food and Fiber industry.

Implications

The data collected for this study allowed the researcher to determine the following implications:

1. Agriculture in the Classroom program should consider the Food and Fiber Literacy project as a way to bring structure to integrate agriculture in the Kindergarten through Eighth grade cirriculum.
2. State Offices of Public Instruction should note that the Food and Fiber Literacy project can enhance the relationship between the Food and Fiber Industry and the teachers at the different schools.

3. State Departments of Agriculture should consider the potential of the Food and Fiber Literacy Framework for integrating agriculture into the public school system.

Recommendations

As a result of this study, the following recommendations are offered for the Future of the Food and Fiber Literacy Framework.

1. For a follow-up, perform a posttest on the same group of teachers and students at the end of the school year to see if there is a change of perceptions for the teachers and knowledge for the students.
2. The teachers should form teams to integrate the lesson plans of the Food and Fiber Framework with each class.
3. Schools should more effectively utilize the local Food and Fiber businesses to develop and meet the goals of the Food and Fiber Framework.
4. The teachers of the three schools should disseminate some of the lesson plans and information to other teachers in the different school districts to show the importance of the Food and Fiber industry.
5. At the conclusion of the Food and Fiber Literacy project, a program should be initiated to institute the Food and Fiber Literacy Framework throughout the nation.

Summary

With each passing year another generation of students and adults will be further removed from the Food and Fiber Industry. The results of this study can establish guidelines for Elementary and Secondary teachers, as well as students, about the Food and Fiber industry and the importance it plays in our society. The data provides information for the public as well as Food and Fiber industry groups regarding how much our teachers and students know about the Food and Fiber industry. Therefore, steps should be taken to enhance the Food and Fiber literacy level of those teachers and their students in this country.

Future generations will depend on the decisions made by us. If we lack the general knowledge about the Food and Fiber industry, then we as a society will fail. A national effort to increase the Food and Fiber literacy of this nation should come first. The Food and Fiber industry will be directly influenced by policies developed by individuals with limited Food and Fiber knowledge and experience. If we as a society fail to become better educated about the Food and Fiber industry, we will be putting unnecessary risk on the industry, which is so vital to the success of mankind.

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APPENDICES

Appendix A

Teacher Attitude and Perception Data Collection Instrument

on the Food and Fiber Literacy Framework

Food and Fiber Systems Literacy project

Instructions

This survey is a product of the National Food and Fiber Systems Literacy project. This survey is comprised of two sections. Section I relates to the Food and Fiber Literacy framework. Section II requests demographic information about respondents.

This pilot study is designed to provide you the opportunity to express your opinions about our Food and Fiber Systems.

By completing this survey you are helping the researchers determine the reliability and the usability of this instrument.

Take time to fill out each and every question since your responses are important to us.

Please do not record your name or address. All answers will be strictly confidential, results will be reported in groups only. Please do not omit any answers.

Directions: Read each statement and mark between the parentheses under your selection. The following choices are available.

1 = Strongly Agree
2 = Agree
3 = Neutral
4 = Disagree
5 = Strongly Disagree

Thank You

Section I

1 = Strongly Agree
2 = Agree
3 = Neutral
4 = Disagree
5 = Strongly Disagree

1.	Agriculture involves the management of forests, and their natural products.	1	2	3	4	5
2.	Food availability plays a key roll in contemporary civilization.	1	2	3	4	5
3.	Innovations have helped solve problems related to many aspects of the Food and Fiber system.	1	2	3	4	5
4.	Agricultural exports are a significant component of U.S. foreign trade.	1	2	3	4	5
5.	Food safety is a growing concern for consumers.	1	2	3	4	5
6.	Human ingenuity has solved numerous problems involved in the production, storage, and preparation of food.	1	2	3	4	5
7.	Many important historical figures, inventions, and events have emerged as a result of our constant search for the certainty of food.	1	2	3	4	5
8.	The vitality of the Food and Fiber system now and in the future depends on public understanding of this interdependence.	1	2	3	4	5
9.	The import and export of agricultural commodities is a major concern of foreign policy makers.	1	2	3	4	5

1 = Strongly Agree
2 = Agree
3 = Neutral
4 = Disagree
5 = Strongly Disagree

		SA	A	N	D	SD
10.	A variety of food is good for providing a balanced diet.	1	2	3	4	5
11.	The Food and Fiber system is <u>not</u> an integral part of most state's economy.	1	2	3	4	5
12.	Civilization's advancements have nothing to do with agricultural development.	1	2	3	4	5
13.	Geographic location, climate, and soil type generally determine the quantity and diversity of species within an ecosystem.	1	2	3	4	5
14.	The food and fiber system involves a production continuum that extends from local farms to factories, markets, and tables in every region of the globe.	1	2	3	4	5
15.	Information shapes our opinion about food.	1	2	3	4	5
16.	Global market forces affect supply and demand for agricultural products.	1	2	3	4	5
17.	Agricultural trade stimulated the development of measurement, accounting, and written communication.	1	2	3	4	5
18.	Production within the Food and Fiber system contributes to the depletion of resources.	1	2	3	4	5

1 = Strongly Agree
2 = Agree
3 = Neutral
4 = Disagree
5 = Strongly Disagree

		SA	A	N	D	SD
19.	Each step from production to consumption adds value to agricultural products.	1	2	3	4	5
20.	The major food groups are important to healthy eating.	1	2	3	4	5
21.	The Food and Fiber system does not constitute a significant number of jobs in the U.S.	1	2	3	4	5
22.	Agriculture's use of natural resources and its effect on the environment draws concern from people in every society.	1	2	3	4	5
23.	Food Production Systems, when designed to work with the environment, can reverse the effects of pollution.	1	2	3	4	5
24.	Food exports are the number one income source for America in the world market.	1	2	3	4	5
25.	Primary nutrients are important factors to healthy eating.	1	2	3	4	5
26.	A larger world population has no effect on the demand for agricultural products.	1	2	3	4	5
27.	Historically, climate and geography have determined the plants and animals that grow best in a certain region.	1	2	3	4	5
28.	The food and fiber system is dependent on non-renewable resources.	1	2	3	4	5

1 = Strongly Agree
2 = Agree
3 = Neutral
4 = Disagree
5 = Strongly Disagree

		SA	A	N	D	SD
29.	Governments work to insure that the food and fiber market system operates efficiently and provides stability to the market.	1	2	3	4	5
30.	Informing the public about nutritional information affects consumer demand for specific foods.	1	2	3	4	5
31.	Agricultural food production has kept pace with our world population growth.	1	2	3	4	5
32.	Plant varieties and animal breeds developed in the U.S. have changed eating habits in many other places of the world.	1	2	3	4	5
33.	Food and Fiber systems rely on research from many scientific fields.	1	2	3	4	5
34.	Government policies with respect to agriculture are the result of political action by groups or individuals.	1	2	3	4	5
35.	When people are physically active, their bodies use more calories than when resting.	1	2	3	4	5
36.	Agriculture is not a very large industry in America.	1	2	3	4	5
37.	Some societal issues are directly related to the food and fiber system.	1	2	3	4	5
38.	Scientific research has benefited the food and fiber industry.	1	2	3	4	5

1 = Strongly Agree
2 = Agree
3 = Neutral
4 = Disagree
5 = Strongly Disagree

		SA	A	N	D	SD
39.	International supply and demand influence the types and quality and quantity of products produced and traded around the world.	1	2	3	4	5
40.	Exercise is important in the lives of children.	1	2	3	4	5

Appendix B

Breakdown of items on the Teacher Instrument for the

Five Concept Areas related to the

Food and Fiber Literacy Framework

Teacher Collection Instrument

The Forty items on this instrument are broken down into eight items for each concept area. Here is a list of which items are in each concept area of the Food and Fiber Literacy Framework.

Understanding Agriculture:

1. Agriculture involves the management of forests, and their natural products.
6. Human ingenuity has solved numerous problems involved in the production, storage, and preparation of food.
11. The Food and Fiber System is not an integral part of most state's economy.
16. Global market forces affect supply and demand for agricultural products.
21. The Food and Fiber System does not constitute a significant number of jobs in the U.S.
26. A larger world population has no effect on the demand for agricultural products.
31. Agricultural production has kept pace with our world population growth.
36. Agriculture is not a very large industry in America.

Historical, Cultural, and Geographical Significance:

2. Food availability plays a key roll in contemporary civilization.
7. Many important historical figures, inventions, and events have emerged as a result of our constant search for the certainty of food.
12. Civilization's advancements have nothing to do with agricultural development.
17. Agricultural trade stimulated the development of measurement, accounting, and written communication.
22. Agriculture's use of natural resources and its effect on the environment draws concern from people in every society.
27. Historically, climate and geography have determined the plants and animals that grow best in a certain region.

32. Plant varieties and animal breeds developed in the U.S. have changed eating habits in many other places of the world.

37. Some societal issues are directly related to the Food and Fiber System.

Science: Food and Fiber – Environmental Interdependence:

3. Innovations have helped solve problems related to many aspects of the Food and Fiber System.

8. The vitality of the Food and Fiber System now and in the future depends on the understanding of this interdependence.

13. Geographic location, climate, and soil type generally determine the quantity and diversity of species within an ecosystem.

18. Production within the Food and Fiber system contributes to the depletion of resources.

23. Food production systems, when designed to work with the environment, can reverse the effects of pollution.

28. The Food and Fiber System is dependent on non-renewable resources.

33. Food and Fiber Systems rely on research from many scientific fields.

38. Scientific research has benefited the Food and Fiber Industry.

Business and Economics:

4. Agriculture exports are a significant component of U.S. foreign trade.

9. The import and export of agricultural commodities is a major concern of foreign policy makers.

14. The Food and Fiber System involves a production continuum that extends from local farms to factories, markets, and tables in every region of the globe.

19. Each step from production to consumption adds value to agricultural products.

24. Food exports are the number one income source for America in the world market.

29. Governments about nutrition research findings affect consumer demand for specific foods.

34. Government policies with respect to agriculture are the result of political action by groups or individuals.

39. International supply and demand influences the types and quality and quantity of products produced and traded around the world.

Food, Health, and Nutrition:

5. Food safety is a growing concern for consumers.

10. A variety of food is good for providing a balanced diet.

15. Information shapes our opinion about food.

20. The major food programs are important to healthy eating.

25. Primary nutrients are important factors to healthy eating.

30. Informing the public about nutritional information affects consumer demand for specific foods.

35. When people are physically active, their bodies use more calories than when resting.

40. Exercise is important in the lives of children.

Appendix C

Demographics

Section II

Directions: Read each statement in this section completely. Circle the most accurate response to each statement and circle.

41. What is your age?
    a. 21-30 years
    b. 31-40 years
    c. 41-50 years
    d. 51-60 years
    e. over 60 years

42. Gender
    a. Female
    b. Male

43. Did you grow up?
    a. in town/city (a population greater than 50,000)
    b. in a suburb (2500-50,000 people)
    c. in a rural area (Less than 2500 people)
    d. on a farm or ranch

44. If you live on a farm or ranch, how many acres are included?
    A. 10-50 acres
    B. 51-500 acres
    C. 501-1000 acres
    D. Over 1000 acres

45. What is the population of the town closest to your home?
    A. Under 1000
    B. 1001-2500
    C. 2501-10,000
    D. 10,001-100,000
    E. Over 100,000

46. What state do you reside in and how long have you lived there?_____

47. How many years of experience do you have in teaching?
    a. 0-5 years
    b. 6-10 years
    c. 11-15 years
    d. 16-20 years
    e. 21 plus years

48. The area of education I most closely associate myself with is_____education?
    a. Elementary
    b. Middle School
    c. Secondary

49. What is your Bachelor's degree in?_____

50. What is your highest degree or certification earned?_____

53. What kind of special endorsement do you have? (i.e., Special Education, Early childhood, Gifted/talented, etc.)_____

54. Have you received any training to conduct inservice training? a. YES b. NO

55. Do you have relatives who live or work on a farm and/or ranch? a. YES b. NO

56. Do you have relatives who work in a non-production agricultural business? a. YES b. NO

57. Did you take agricultural courses in high school or college? a. YES b. NO

58. Were you a member of FFA and/ or 4-H? a. YES b. NO

59. Where do you get most of your information regarding the Food and Fiber System?

60. Rate the following issues you believe our Nation's Food and Fiber system currently faces.

(1= most critical to address; 6= least critical to address)
_____food safety
_____animal welfare
_____agricultural practices that affect the environment
_____viability of our rural economic base
_____conservation of our natural resource base
_____current government economic policies that impact agricultural production

61. What professional organizations are you affiliated with?

62. What types of community involvement are you associated with (i.e., Church, Boys' or Girls' Club)

Appendix D

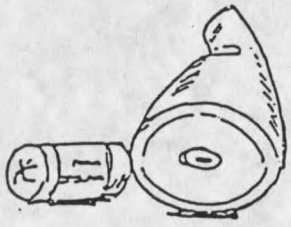
Knowledge Pretest for K-1 Students

Food & Fiber Systems Literacy

Pre-test for students in Grades K-1

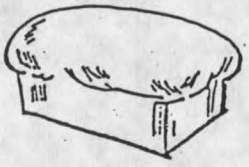
Teacher Instructions: This instrument consists of 16 questions, incorporating picture recognition answers. Please read each question to your students. The pictures all are accompanied by a written description so that you can assist students in understanding what the picture represents. If your students have trouble understanding words or pictures, please assist them. You may use your own discretion as to how much of the test to administer at one time. Feel free to spread the test out over several days.

1. We get many food items from farms and ranches. Draw a line from each food picture to the plant or animal that we get that food item from.



Ham and sausage

Wheat



Bread

Chicken

Milk, cheese, ice cream and butter

Pig

Dairy Cow

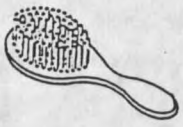
Eggs

2. Draw a line from the product in the first row to the plant or animal it comes from in the second row.

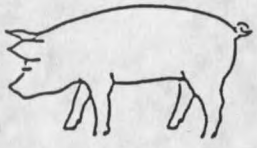
sweater

shoe

hair brush



books



pig

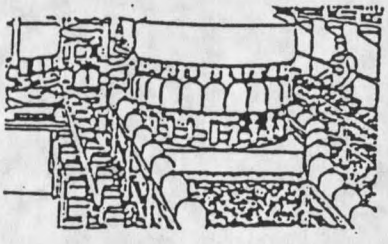
trees

sheep

cattle

3. Look at the pictures below. Draw a circle with a red crayon around the first thing that happens to produce or get milk. Draw a box with a blue crayon around the last thing that happens.

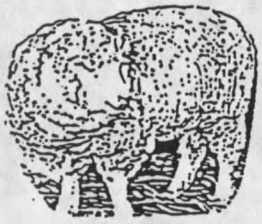
drinking milk



Processing Plant

Cow being milked

4. Use a red crayon to circle all the pictures that show something we eat. Use a blue crayon to circle all the pictures that show something we use to make clothing. Some pictures may be circled more than once.



sheep

fish

trees

vegetables

wheat

cotton

5. Use a red crayon to draw a circle around the pictures that show how people got their food 100 years ago.

hunting

grocery stores

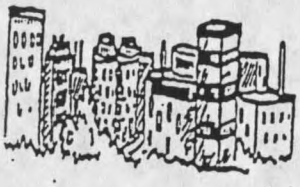
trucks

farming

6. Draw a red circle around the pictures of things you might find in a city. Draw a blue circle around the pictures of things you might find on a farm.

cattle

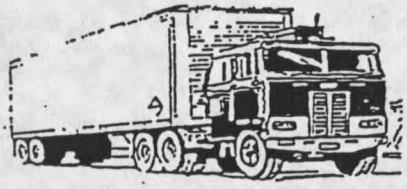
grocery stores



skyscrapers

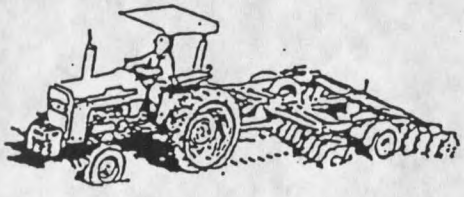
sheep

7. Use a red crayon to draw a circle around the first thing that happens when corn is grown. Use a blue crayon to draw a box around the last thing that happens when corn is grown.

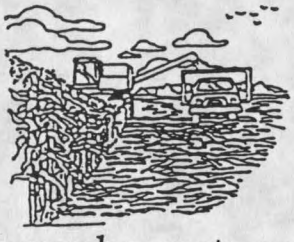


truck hauls corn
to grocery store

you buy corn
in grocery store

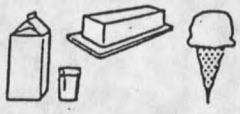


farmer plants corn

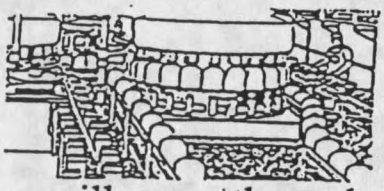


farmer harvests corn

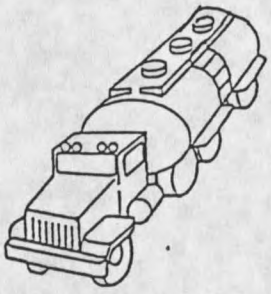
8. Use a red crayon to draw a circle around the first thing that must happen before you can have milk, ice cream or butter. Use a blue crayon to draw a box around the thing that happens next.



get milk, ice cream or butter from refrigerator



milk goes through processing plant



milk is hauled to processing plant

cow is milked

9. Use a red crayon to draw a circle around the leaves of the plant. Use a blue crayon to draw a box around the roots of the plant.