

FOOD AND FIBER SYSTEM LITERACY LEVELS  
OF BOZEMAN'S COMMUNITY FOOD CO-OP'S  
CORE CONSUMER GROUP

By

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## ABSTRACT

The purpose of this descriptive study was to assess the food and fiber system knowledge and perception levels of the core consumer group at the Community Food Co-op in Bozeman, MT. Data for this study were gathered through a survey mailed to the sample population. Of the 350 surveys mailed out, 120 useable surveys were returned for a 34.3% response rate. Data were collected in three sections: (1) food and fiber system knowledge, (2) food and fiber system perceptions, and (3) demographic information. The knowledge section consisted of 35 statements in which respondents answered True, False, or Don't Know to statements corresponding to the seven food and fiber system literacy concept areas. The perceptions section also included 35 statements to which respondents answered strongly agree, agree, neutral, disagree, and strongly disagree to statements corresponding to the seven food and fiber system literacy concept areas.

SPSS was used to analyze the data by conducting Analysis of Variance (ANOVA) and t-tests. Many conclusions were drawn from the data. The typical shopper in the core consumer group at the Community Food Co-op is a woman in her 50's with an annual household income of approximately \$60,000. Males had a significantly higher knowledge score than females. Members who had taken an adult education class (formal or non-formal) related to agriculture had significantly higher knowledge scores than those who did not. The concept area titled Natural Resources and the Environment scored the highest in knowledge, lowest in perceptions, and highest in interest for future educational opportunities. Finally, the concept area titled Agricultural Policy received the lowest knowledge scores, but the highest perception scores.

The data presented interesting implications and recommendations not only for the Community Food Co-op in Bozeman, MT, but for the agricultural education community as well. Researchers found that internet is the main source of food and fiber system news for most respondents, with newspapers as the second most used source. Future research should be conducted that examines the relationship between knowledge scores, perceptions scores, and interest levels.

## INTRODUCTION

### Background and Setting

Cooperatives have been a part of the business sector for many years. Roots are traced to a group of artisans who established the first cooperative in Rochdale, England. Most cooperatives today follow the same basic definition, values, and principles that the Rochdale pioneers created in 1844 (International Cooperative Alliance, 2009). The seven basic principles that still guide cooperatives today are: 1-voluntary and open membership, 2-democratic member control, 3-member economic participation, 4-autonomy and independence, 5- education, training, and information, 6-cooperation among cooperatives, and 7-concern for community (International Cooperative Alliance, 2009). Food cooperatives have evolved from buying clubs in which people bought in bulk to save money, to a competitive alternative to corporate supermarkets. Membership in a food cooperative means supporting a local business, local growers, and other local merchants. In addition to stimulating the local economy, members generally receive coupons, lower prices, as well as specials throughout the store that make the membership dues worthwhile (Community Food Co-op, 2009). During the food cooperative revolution of the 1970's, belonging to a cooperative was something more than just being a member. It gave the member the thought that they were a part of something bigger, a part of a movement that was defying the mainstream (Cox, 1994). While being a member of a food cooperative in 2010 does not hold as much social significance, members may still feel that they are a part of something different and progressive.

Food cooperatives described as “natural” food cooperatives sell food, which has been minimally processed with little or no additives (Cooperative Directory Service, updated Oct. 28, 2008). A 2002 study on access to food provisions in Britain, included cooperative stores because “these stores were likely to provide a range of food products, including ‘healthy’ alternatives...at reasonable prices” (Clark, Eyre, Guy, 2002, pg 2045). This documented that cooperative members had a stake in where their food comes from, how it is produced, and that customers are interested in healthy choices. These shoppers were integral parts of the food buying system. They shopped at cooperatives because they were knowledgeable and interested in the food and fiber system, and were consciously making a decision about the types of food they bought. Wilkins (1996) found a significant positive correlation between food preference for organic, seasonal, and local foods of cooperative members compared with non-cooperative members who had no preference. Attwood (2008) claimed that local agriculture is a large component of sustainability and viability within a community.

Education is a vital aspect of the food cooperative structure. A study by Fjeld and Sommer (1981), found that cooperative type grocery stores had tangible nutrition and consumer education programs while traditional supermarkets in the same locations did not. In addition, a 1984 study by Fjeld, Storer, Warholic, Sommer, and Becker concluded that the types of food purchased by cooperative shoppers were congruent with the educational programs implemented in the cooperative stores, while typical supermarket customers had no educational based buying patterns. In summary, Fjeld et al. (1984) also

found that because shoppers in cooperatives were educated about healthy alternatives, they were making healthier food selections. This showed consumers shopped at food cooperatives because they were aware of their food's origin, nutritional value, and they were choosing to educate themselves about the food and fiber system. In addition, Wansink, Westgren, and Cheney (2005) found that nutritional knowledge played an integral part in consumption patterns of particular foods. These studies indicated that specific knowledge plays a role in what types of food and in what quantities people eat. Wansink et al. (2005, pg. 265) wrote "...having knowledge does not necessarily increase how much one likes a food but is related to how likely one is to consume the food. Knowledge may not be related to preference, but it may be related to consumption." A recent study in England explored the motivations of consumers for buying local and organic food and concluded:

"Consumers expressed a wide range of economic, social, environmental and personal reasons for purchasing local organic food from the initiative, and many were quite deliberately avoiding supermarkets where possible and choosing to support the alternative food network instead. There was a strong sense of participation in an alternative infrastructure of provision based on different values to the mainstream, and consumers felt actively engaged in creating and supporting this system." (Seyfang, 2008, p. 198)

While this particular study focused on farmers' markets and community supported agriculture (CSA) produce boxes, the information is relevant to cooperative supermarkets as well. These studies illustrate that educational programs, knowledge levels, and perceptions of consumers can play an integral part in the consumption patterns and attitudes of shoppers.

In 2009, Dolliver reported that 78% of female respondents and 51% of males respondents to a national survey conducted by Better Homes and Gardens felt that healthy food made them feel better, yet 54% of female respondents and 35% of all respondents also said they eat junk food when they are depressed. Dolliver (2010) reported that 57% of respondents said they were trying to reduce the amount of processed foods they consumed and that 52% of the respondents did not buy organic.

### Knowledge and Perceptions of the Food and Fiber System

Due to the decline in profitability and international competitiveness of American agriculture, a study on agricultural education outside of the traditional vocational agricultural program was initiated in 1985. In 1988, the National Research Council's Committee on Agricultural Education in Secondary Schools published the results of that study. They found that there were too many Americans unaware of the social and economic value of agriculture in America and that it was too important of a topic to only be covered in technical career programs. The report proposed that an agriculturally literate person would understand the Food and Fiber System in relation to its history, economic, social, and environmental significance (National Research Council, [NRC] 1988).

Frick, Kahler, & Miller (1991) defined agricultural literacy as "possessing knowledge and understanding of our food and fiber system... An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic

information about agriculture” (p.52). Along with the definition, 11 broad agricultural areas were identified as the core agriculture literacy subject areas. Armed with this definition and a list of subject areas Frick, Birkenholz, & Machtmes (1995) and others (Frick, Birkenholz, Gardner, & Machtmes (1995); Wearley, Frick, & Van Shelhamer (1999)) used a refined list and began to assess various demographic groups’ knowledge and perceptions of agriculture. Research has generally focused on formal population settings such as schoolchildren, educators, and politicians. One constant among these populations is that we are all consumers of agricultural products. Everyone has eaten, worn, or bought an agricultural product. Since these studies, there has been limited research conducted in non-formal settings regarding agricultural knowledge and perceptions of consumers. Because of the explosion of cooperative grocery stores and the increased awareness of organic and local products that their consumers possess (Fjeld, et al. 1984 and Wilkins, 1996), a current study needs to be applied to the population which is concerned with these issues.

Beyond assessing knowledge and perceptions, educational interest in these topics is important as well. To explain the concept of knowledge as a paradox, Birkenholz (1999) wrote, “As people expand their knowledge base, they also increase their awareness of what they do not know (p. 17)”. As levels of knowledge grow exponentially, so does the motivation to seek answers to growing questions. Wilkins supported the idea for education by stating “knowledge and interest in regional foods have important policy implications” (Wilkins, 1996, pg 336).

### Conceptual Framework

The two theories that guide this research are phenomenology and constructivist learning theory. Phenomenology encourages us to set aside the previous contextual notions, re-examine concepts, and then look at them through a different lens (Crotty, 1998). Constructivist learning theory proposed that an individual will have built a mental model of their natural surroundings and that new ideas are assimilated into the pre-existing mental model (Naylor and Keogh, 1999).

Based on the constructivist learning theory, the members of Bozeman's Community Food Co-op possess a pre-existing mental model of the food and fiber system which drives their knowledge and perception levels. From an epistemological perspective, a member might possess certain assumptions and perceptions of agricultural, such as; Conventional or corporate farming produces food that is harmful to one's health.

### Purpose of the Study

The purpose of this study was to describe the core consumer group of the Community Food Co-op in Bozeman, Montana by assessing their level of food and fiber system knowledge and determining their perceptions of the system. This study also examined the member's interest in future educational opportunities based on the seven food and fiber system concept areas.

### Need for the Study

Research has shown that cooperative members can be influenced by educational materials such as newsletters, shelf labels, and displays and that consumption can match knowledge levels (Fjeld et al., 1984 and Wansink et al., 2005). The intent of this was to create a better understanding of consumers food and fiber system perceptions and knowledge levels, as well as and their commitment to the Community Food Co-op. The data will help guide the Community Food Co-op's selection of educational information based members' desires. Results also gave insight into the creation of possible educational opportunities for members by the cooperative itself or other educational community organizations on food and fiber system knowledge, perceptions, and interests.

### Objectives

The objectives of this study were:

1. To describe the demographics of the core consumer group of at the Community Food Co-op in Bozeman, Montana;
2. To describe the core group of shoppers' knowledge levels of the food and fiber system;
3. To describe the core group of shoppers' perceptions of the food and fiber system as a whole; and,

4. To identify the core consumer group's level of educational interest in the seven refined food and fiber system literacy subject areas.

### Assumptions

The following assumptions were applied to this study:

1. All individuals who completed the survey were honest regarding their knowledge, perceptions, and interest in the food and fiber system.
2. The food cooperative member identified in the survey was the person who filled out the survey.
3. The data collection instrument used in this research was a reliable means of collecting the necessary data to address the objectives of this study.
4. The core consumer group of the Community Food Co-op had some previous knowledge and perceptions about the food and fiber system.

### Limitations

One limitation of this study was the population chosen. Because the population was the top 1,000 shoppers who spent the most money in an identified financial quarter, they may have had more knowledge about the food and fiber system than the cooperative members who did not shop as often. Two weeks available to return the survey was a limitation because not everyone who received a survey may have had time to complete it.

### Operational Definitions

The following three operational definitions were clarified for the study:

1. Agricultural literacy: “Agricultural literacy can be defined as possessing knowledge and understanding of our food and fiber system. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture” (Frick, Kahler, & Miller 1991).
2. Agricultural literacy “refined” subject areas: “1. Agriculture’s important relationship with the environment and natural resources, 2. public policy in agriculture , 3. plant science, 4. animal science, 5. societal and global significance of agriculture, 6. processing of agricultural products, and 7. the marketing and distributing of agricultural products” (Frick , Birkenholz, & Machtmes, 1995).
3. Community Supported Agriculture (CSA): Members of a community buy vegetable subscriptions which directly support a farmer in their community. Members pay a specified amount at the beginning of the season and then receive a share of the produce each week. (Towne’s Harvest Community Supported Agriculture, 2010).

4. Cooperative: “An autonomous association of persons united voluntarily to meet the economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise.” (International Cooperative Alliance, 2009)
5. Core member: Researches defined a core member as the adjusted top 1,000 members of the Community Food Co-op who spent the most money in the first quarter of 2010.
6. Natural Food Cooperative: “Natural food cooperatives deal primarily with food products that are ‘natural’ – those produced with a minimum of processing and with little or no additives or preservatives (much of this food is also organically grown). In addition, they are usually formal co-op corporations often with thousands of member/owners. It must be emphasized that you do not have to be a member of the food co-op to shop in these stores.” (Cooperative Directory Service, 2008)
7. Food and Fiber System: The sector of the U.S. economy that includes agricultural production and all economic activities supporting or utilizing that production, including farm machinery and chemical production, and processing, manufacturing, transportation, and retailing. (Webster’s Online Dictionary, 2009)

## REVIEW OF LITERATURE

The purpose of this chapter was to present a review of the relevant literature related to this research study. The review focused on the agricultural literacy research, Food and Fiber System Literacy research, and the influence of consumer knowledge and perceptions on buying patterns.

### Agricultural Literacy Research

Due to the decline in profitability and international competitiveness of American agriculture, a study on agricultural education was initiated in 1985. In 1988, the National Research Council's Committee on Agricultural Education in Secondary Schools (NRC) published a report entitled "Understanding Agriculture-New Directions for Education" which stated that there were too many Americans unaware of the social and economic value of agriculture in America. The report proposed that an agriculturally literate person would understand the Food and Fiber System in relation to its history, economic, social, and environmental significance (National Research Council, [NRC] 1988). In 1991, Birkenholz and Maricle conducted a national survey examining adult education in agriculture. Their findings showed that adult education in agriculture is an important component to agricultural education as a whole. Birkenholz and Maricle (1991) recommended state and national opportunities to encourage adult education in agriculture. Terry, Herring, and Larke (1992) were one of the first researchers to examine knowledge and perceptions as they relate to agriculture. Terry's research focused on

fourth grade teachers in Texas and sought to determine the degree to which these teachers needed assistance in teaching agricultural concepts. Terry et al. (1992) used a single open-ended question “What is agriculture?” to assess perceptions of agriculture and 25 multiple choice questions to measure knowledge of agriculture. The knowledge section produced results of almost  $\frac{3}{4}$  of the teachers having unacceptably low scores and over 90% of the teachers felt agricultural was only farming and ranching (Terry et al. 1992).

Frick, Kahler, & Miller (1991) explicitly defined agricultural literacy as “possessing knowledge and understanding of our food and fiber system... An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture” (p.52). Along with the definition, 11 broad agricultural concept areas were identified as the core agriculture literacy subject areas. These 11 areas were (1) Agriculture’s relationship with the environment, (2) Processing agricultural products, (3) Public agriculture policies, (4) Agriculture’s relationship with natural resources, (5) Production of animal products, (6) Societal significance of agriculture, (7) Production of plant products, (8) Economic impact of agriculture, (9) Marketing agricultural products, (10) Distribution of agricultural products, and (11) Global significance of agriculture. Armed with this definition and list of subject areas Frick, Birkenholz, and Machtmes (1995) and others (Frick, Birkenholz, Gardner, and Machtmes (1995), Harris and Birkenholz (1996), and Wearley, Frick, and Van Shelhamer (1999)) used a refined list of the agricultural literacy concept areas and began to assess students, teachers, and legislators knowledge and perceptions of agriculture. The final merged agricultural concept areas as determined by Frick et al. (1995) were (1) Societal and

global significance of agriculture, (2) Public policy in agriculture, (3) Agriculture's important relationship with the environment and natural resources, (4) Plant science, (5) Animal science, (6) Processing of agricultural products, and (7) Marketing and distributing of agricultural products (Frick, et al, 1995). The same study that determined the seven refined concept areas also assessed the perceptions and knowledge of rural Indiana High School students, urban inner-city Michigan High School students, rural Missouri adults, and urban Missouri adults. Frick, et al. (1995) reported over 29.5% of adult respondents, both urban and rural, answered "incorrect" or "don't know" to the agricultural knowledge items in the survey. They also concluded that respondents who lived on a farm were more knowledgeable about agriculture than their rural counterparts, who in turn were more knowledgeable than those who live in an urban area. Finally, it was found that those with a higher education scored higher in the knowledge section than those with a lower level of education. Frick, Birkenholz, Gardner, and Machtmes (1995) reported that the rural Indiana High School students had significantly higher knowledge scores than their urban inner-city peers. Conversely, Frick, Birkenholz, and Machtmes (1995) in a different study that used the same survey instrument, determined that 4-H members living on farms with a background in agriculture scored lower on the knowledge portion than their peers without that background. In 1996, Harris and Birkenholz researched secondary school educators' knowledge and perceptions of the agricultural industry. The study focused on the differences between groups of educators, mainly administrators and teachers, of different subjects including agriculture, language arts, mathematics, science, and social studies. Results of this study found that agriculture

teachers were the most knowledgeable and had the most positive perceptions of the agriculture industry, while language arts and mathematics teachers were the least knowledgeable and had the lowest perceptions. Overall, the study found that all the educators surveyed were knowledgeable and had a positive attitude of the industry. Wearley et al. (1999) used the same survey instrument to assess knowledge and perceptions of elected officials in the 54<sup>th</sup> legislature in Montana. The researcher concluded that elected officials had a fairly positive view of agriculture. These legislators also believed that agricultural education would become increasingly important in the future. Recently, Reidel, Wilson, Flowers, and Moore (2007) used the survey instrument on urban high school students with a pre-test/post-test to assess whether enrollment in an introductory agricultural education class had an effect on knowledge and perceptions. They found that enrollment in the introductory class did have a slight positive affect on knowledge scores of urban students although post-test scores were still relatively low. In addition, their research concluded that perceptions of agriculture were not affected by enrollment in the agricultural education class (Reidel et al, 2007). Research which used this instrument has generally focused on formal population settings such as schoolchildren, educators, and politicians. One study in Louisiana sought to assess the knowledge and perceptions of the general public in that state. Richard's (2009) research revealed that the public of Louisiana was moderately knowledgeable about agriculture. Knowledge scores for the rural and urban residents very almost identical. One constant among the populations in these studies is that they are all consumers of agricultural products.

### Food and Fiber System Literacy Research

Another outcome of the NRC's report entitled "Understanding Agriculture-New Directions for Education" (1988) was the design of the Food and Fiber Systems Literacy (FFSL) Framework, which was meant to introduce agricultural concepts into existing curricula in the K-12 system (Leising and Zilbert, 1994). This framework identified what an agriculturally literate high school graduate should understand. In 2001, Leising, Pense, and Igo set out to assess the change in knowledge based on including the FFSL Framework into kindergarten through twelfth grade classrooms. Leising et al. (2001) created multiple surveys to correspond to the appropriate grade level being tested. The surveys were written to complement the five themes of the FFSL Framework: (1) Food and Fiber Systems: Understanding Agriculture, (2) History, Culture, and Geography, (3) Science-Agricultural and Environmental Interdependence, (4) Business and Economics, and (5) Food, Nutrition, and Health. Through pre-test and posttest measures, they found that knowledge scores were significantly higher in grades two through eight for students who had received FFSL Framework instruction versus those who had not. Pense et al. (2005) used the survey instrument based on the FFSL Framework previously mentioned. The authors suggested further research to find out why no change was observed in the first grade group. Another study Pense and Leising (2004), based on the FFSL Framework, examined the agricultural knowledge of high school students. Researchers found, similar to Frick, Birkenholz, and Machtens (1995), students from rural areas had a significantly FFSL lower score than those from urban and suburban schools (Pense &

Leising, 2004). A study in 2005 assessed agricultural knowledge increase after implementation of Agriculture in the Classroom (AITC) programs (Pense, Leising, Portillo, & Igo). The pre-test post-test results concluded that knowledge did increase with implementation of AITC programs. A follow up study by Pense, Beebe, Leising, Wakefield, and Steffen (2006) found that students enrolled in an agricultural education class had a higher level of overall knowledge about agriculture than possessed by their general education peers. Unlike the original study, researchers found that students enrolled in urban or suburban schools scored lower in agricultural knowledge than their rural counterparts. Unfortunately, no further research was conducted to examine why these results occurred.

Harmon and Marezki (2006) conducted a research study which assessed high school students' food system knowledge, attitudes, and experiences. They created a survey instrument which included the following knowledge concept areas; (1) agricultural history and economics, (2) agriculture and inputs, (3) food, fuel, and sustainability, (4) components of the food system, (5) nutrition and health, (6) food origins, (7) Pennsylvania foods and seasonality, (8) causes of hunger in the U.S., and (9) food safety. Results from this study showed that students living in a rural area or farm had a higher knowledge score than their peers who did not live in a rural area or on a farm (Harmon & Marezki, 2006).

The multitude of studies since the early 1990's have produced variable results. Some studies indicated higher knowledge and perception scores for those living in a rural area (Harmon & Marezki, 2006a; Frick, Birkenholz, Gardner, & Machtmes, 1995). In

contrast, Frick Birkenholz, and Machtmes (1995) and Pense and Leising (2004) found those students living in a rural area produced lower knowledge scores. Although living situations seemed to have given various results to agricultural knowledge, previous experience and/or enrollment in an agricultural class has been shown to positively affect agricultural knowledge (Pense et al, 2005; Pense et al, 2006).

### Influence of Knowledge and Perceptions on Consumer Buying Patterns

In 2009, Dolliver reported that 78% of female respondents and 51% of males respondents to a national survey by Better Homes and Gardens felt that healthy food made them feel better, yet 54% of female respondents and 35% of respondents also said they eat junk food when they are depressed. Dolliver (2010) reported that 57% of respondents said they were trying to reduce the amount of processed foods they consumed, but that 52% of the respondents did not buy organic. These survey results showed the inconsistency of knowledge and desire to eat healthy, with current habits of regular grocery store shoppers.

A recent study by Freedman and Connors (2010) found positive (though not statistically significant) results that nutrition information labels and educational pamphlets affect buying patterns of college-aged students. Sales of specific nutritionally healthy tagged items increased during the study period (Freedman & Connors, 2010). This study confirmed Wansink, Westgren, and Cheney's (2005) findings that nutritional information does play an integral role in consumer buying patterns. A publication from

the USDA and the Cooperative State Research, Education and Extension Service stated that participation in a farm to school program increased students' awareness and knowledge of the importance of eating fruits and vegetable. Evaluations from this program showed an increase in consumption of healthy foods (Kish, 2008). Similarly, Dahm, Samonte, and Shows (2009) discovered that positive attitudes, knowledge, and perceptions of organic products do have an impact on college students' eating habits. Dahm, et al's (2009) research showed that an increase in knowledge and perceptions can increase consumption of particular foods. In a report by the University of New Hampshire Extension service entitled "Buying Products Directly From Farmers and Valuing Agriculture; Behavior and Attitudes of New Hampshire Shoppers", Manalo, Sciabarrasi, Haddad, and McWilliam Jellie (2003) found that 78% of respondents agreed that consumers have an influence on what fruits and vegetables are grown locally. This research showed that the knowledge and perceptions of consumers may have an effect on local agricultural policy and economy. In 2006, Seyfang conducted research examining the reasons why people bought organic produce through a produce cooperative. Their results found that consumers not only made choices based on personal tastes and health concerns, but also on social, economic, and environmental reasons (Seyfang, 2006). Consumers may be aware that their choices have an effect on the environment. Harmon and Maretzki (2006b) conclude that knowledge and attitudes have an effect on behavior, which affects the larger food system, but that attitudes can be contradictory to behaviors:

“As this survey evaluation shows, food system attitudes can be contradictory. The youth surveyed felt that hunger is a problem, but did not support food assistance programs; they thought farmland should be protected but liked to see newly developed strip malls. Like all consumers, they found it difficult to see how choices in one part of the food system make consequences in the other parts. Most of us cannot see how our individual behaviors are part of bigger food system problems”

Harmon and Maretzki’s conclusion related the importance of educating the public about agriculture to ensure agricultural decisions are made with knowledge, not emotion.

### Conceptual Framework

The constructivist learning theory states that ideas and perceptions are not absorbed from information exactly as presented; they are integrated into a pre-existing mental model (Naylor and Keogh, 1999). Garmston and Wellman (1994) discussed constructivist learning theory in the context of educators. They offered the notion that the educator and student relationship is not as important as the relationship between the content itself and the learner. This means that given same information, two people from different backgrounds can take away different information and perceptions about what that information means to them. Trexler and Hess (2005) described how they used this process in a understanding student learning:

“I actively sought to understand my students’ background knowledge about the topic at hand. I used this background as a bridge to connect with the new information I wanted them to learn (p. 13).”

Phenomenology is also a theory that seeks to describe how learning occurs, but in contrast to constructivist learning theory. Crotty (1998) explained that phenomenology is a way to set aside previous knowledge in order to gain a new perspective. Smith described phenomenology as the study of phenomena and the way we experience things (2009). This theory has been used to guide research in a vast array of subjects and disciplines. Edwards, Cable, Williamson, Lambert, and Shipp (2009) used this theory to explain the relationship between people and their environment. They sought to examine the perceptions of the person and environment as separate entities related to how they fit in the workplace. Phenomenology is used to explain the phenomena of how and why a person feels comfortable in a specific environment. Edwards et al. described this as,

“...the theoretical logic by which the perceived person and environment are combined into perceived discrepancies and perceived fit and by which perceived discrepancies are linked to perceived fit (p. 803).”

Epistemology is the study of how people know that they know something. Hofer and Pintrich (1997, p. 88) explained it as “how individuals come to know, the theories and beliefs they hold about knowing.” They further examined previous literature to divide epistemological research into three categories: (1) the difference in gender and how it relates to their way of “knowing”, (2) what individuals believe knowledge is and how they know, and (3) a system of beliefs independent of one another may influence cognition. Epistemology creates a condition by which if a person changes their view of

knowledge, they will most likely change how they gain knowledge. To support this Gariglietti (1997) surveyed secondary students in a cross-sectional and longitudinal research and found that the less students believed in quick learning, the higher their GPA's were.

These theories and frameworks may give insight into the population described in this research. Consumers, who shop primarily at the Community Food Co-op, do so for a reason. The theories presented here do not explain specifically why they choose the Community Food Co-op as their primary source for food, but they might be an introduction into do why they think the way they do. Information presented to these members in an educational setting will be absorbed into their current mental model and may not be taken exactly as presented.

### Summary

Agriculture is an important industry in our country. After an initial report by the NCR in 1988, several studies sought to address the issues of agricultural literacy with educators, students and legislators (Terry et al. (1992), Frick et al. (1991), Frick et al. 1995, Harris & Birkenholz (1996), Wearley et al. 1999). Inconsistent results were found relative to knowledge and perception levels compared to agricultural background. Food and Fiber System Literacy was addressed and again produced variable results, although one constant was the involvement in an agricultural education class did have a positive affect on knowledge (Leising & Zilbert, (1994), Pense & Leising, (2004), Pense et al.

(2005), and Harmon & Marezki (2006)). Various experience by each of these demographic groups plays into how and why they answered they way they did. Constructivist learning theory and phenomenology seeks to explain why people have the thoughts and perceptions that they do.

## METHODOLOGY

This study employs descriptive survey research. Leedy and Ormrod explain descriptive survey research to be used to identify the characteristics of an observed situation as it is with no controls. The researchers choose this method because they wanted to describe the core consumer group at the Community Food Co-op and determine their knowledge and perceptions levels as they currently are.

### Population Description

The Bozeman's Community Food Co-op includes approximately 22,000 members in their database computer system. The general manager stated that about 15,000 were considered active customers. The Board of Directors and other employees had no criteria defining what made a member active or inactive, other than the fact that active members shopped at the cooperative about once a month. This could mean they visited once a month (or even less) and bought one item. Because of this inconsistency in buying patterns, the target population for this study was limited to the core group of shoppers that spent the most money at the Community Food Co-op. The computer system at the Community Food Co-op allowed the staff to track the amount of money spent at the cooperative during a particular period. The core group of shoppers was limited to the 1,000 shoppers who spent the most money during the first financial quarter of 2010. The range of money spent during this period for this group of shoppers was between \$601.64

and \$6,569.27. According to the Community Food Co-op's criteria, the core shopper population generally bought most of their groceries at this store.

### Sampling procedure

Gay and Airasian (2003) recommended sampling size should be based on population size. It was suggested that a population of 500 have a sample size of 50 percent and a population of 1,500 have a sample size of 20 percent. The population of core shoppers at the Community Food Co-op was determined to be exactly 1,000. The sample size for this population was 35 percent, or 350. The computer system generated a list of the top 1150 shoppers at the Community Food Co-op for the first financial quarter of 2010. Employees, Board of Directors, and their spouses were removed from the list to eliminate bias from the sample. The list was then reduced to the adjusted 1,000 top shoppers and entered into Microsoft Excel™. Through a random selection process, 350 names were chosen as the sample.

### Instrument Design

Frick, Kahler, and Miller (1991) found eleven agricultural literacy subject areas and sub-areas that every U.S. citizen should know if agriculturally literate. In subsequent studies, Frick, Birkenholz, and Machtmes (1995) and Wearley, Frick, and Van Shelhamer (1996) used a refined list of the seven agricultural literacy subject areas to create a survey

which measured knowledge and perceptions of agriculture. These seven subject areas were identified and defined as; (1) Societal and global significance of agriculture, (2) Public policy in agriculture (3) Agriculture's important relationship with the environment and natural resources, (4) Plant science, (5) Animal science, (6) Processing of agricultural products, and (7) Marketing and distributing of agricultural products (Frick, et al, 1995).

The first section of the survey consisted of 35 statements, which measured knowledge by asking respondents to answer True, False, or Don't Know to various statements that coincided with each of the seven concept areas. Section two of the survey also consisted of 35 statements in which participants responded strongly agree, agree, neutral, disagree, or strongly disagree to statements that corresponded to the seven agricultural literacy subject areas. Permission was obtained from Dr. Martin Frick to use this survey instrument in the study. In addition, these agricultural literacy subject areas were included in the survey instrument for individuals to rank which subjects they would like to learn more about. Finally, the third section of the instrument requested respondents to provide personal and demographic information. This information provided insight into the background of the respondents and other demographic information such as gender, FFA or 4H experience, length of time as a member of the Co-op, amount of money spent each month at the Co-op, and other stores the respondent purchased groceries. A panel of experts from the university as well as the Community Food Co-op's management team reviewed the instrument to ensure current content validity. Content validity was the extent that the survey measured what it was supposed to measure (Leedy and Ormrod, 2005). Reliability was the instrument's consistency to

gain similar results with each use (Leedy & Ormrod, 2005). Prior reliability of the knowledge section was assessed by calculating a Kuder-Richardson 20 (KR-20) coefficient because the data in this section was dichotomous. The KR-20 coefficient for the knowledge section was .85. The perception section of the survey was assessed by using the Cronbach's alpha coefficient. The final Cronbach's alpha coefficient calculated for the perceptions section was .90 (Frick et al., 1995). Houser explains that these coefficients may range from 0.0 to +1.00 and that the higher the number, the more reliable the test (2008). It is further explained that a Kuder-Richardson 20 or Cronbach's alpha coefficient of above .7 is acceptable (Houser, 2008). A pilot study was conducted using 41 members of the Towne's Harvest Community Supported Agriculture program in Bozeman, MT. Researchers felt the people participating in this organization closely matched those who might be in the core consumer group of the Community Food Co-op. Suggestions from the pilot study respondents were used to re-word some of the questions to make them easier to understand.

Review of the survey instrument by the Institutional Review Board (IRB) at Montana State University is required. The IRB conducted reviews of research to ensure the rights and wellbeing of human subjects involved in medical and behavioral research. The Chair of the IRB approved Exempt Status for this research on March 12, 2010; therefore research continued.

Data Collection

Data collection followed Dillman's Tailored Design Methods of survey collection (Dillman, Smyth, & Christian, 2008). The randomly selected shoppers received a postcard in the mail explaining the survey instrument, which included an informed consent. Postcards were sent via US Postal Service on August 13, 2010, including a test postcard sent to the researcher, and was received three days later. On August 23, 2010 the complete survey was sent out via US Postal Service. Respondents were asked to return their completed surveys to a box located at the Community Food Co-op or through a postage-paid return envelope with a deadline of September 17, 2010 to be entered into a raffle for a chance to win one of three \$100 gift cards. To ensure confidentiality, the only identifying information available to the researchers were member numbers. The winning member numbers were sent to Community Food Co-op staff who issued the winning gift cards. Reminder post-cards were sent to those who had not returned the by September 13, 2010 to help increase the response rate. One-hundred seven surveys were returned by the September 17<sup>th</sup> deadline. Thirteen surveys were returned within the week of September 20-September 24, 2010 and were marked as late. Statistical analysis showed there was no difference between regular and late respondents so all were pooled and analyzed together for a final response count of 120. The final response rate was 34.3%.

### Data Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) 18.0 software and Microsoft Excel™. The data collection period was from August 23, 2010 to September 17, 2010. Researchers found no difference between on-time respondents and late respondents (those collected between September 20 and Sept 24, 2010); therefore, data were pooled for a final response count of 120 (34.3%). No attempt was made to contact non-respondents. Data were downloaded into Microsoft Excel™ and SPSS™ to calculate means, and standard deviations. In addition to the descriptive statistics, crosstabs, t-tests, and ANOVAs were calculated to analyze different subsets of the population and their relationships.

## RESULTS OF THE STUDY

The purpose of this research was to describe the core consumer group of the Community Food Co-op; assess their knowledge and perceptions of the food and fiber system; and to determine their interests in future educational programs. The results presented address the objectives of the study. The objectives for this study were:

1. To describe the demographics of the core consumer group of at the Community Food Co-op in Bozeman, Montana;
2. To describe the core group of shoppers' knowledge levels of the food and fiber system;
3. To describe the core group of shoppers' perceptions of the food and fiber system as a whole; and,
4. To identify the core consumer group's level of educational interest in the seven refined food and fiber system literacy subject areas.

### Respondent Demographics

The population for this study was the adjusted top 1,000 shoppers during the first financial quarter of 2010. Of the 350 members that received the survey in the mail, there were 120 useable responses. The response rate was 34.3% (n=120). These respondents were 17.1 % male (n=117) and 82.9 % female (n=117). The largest group of respondents, 31.4 % (n=37) were between the ages of 51 and 60, while the age ranges of 31 to 40 and 41 to 50 each had 22 % (n=26) of the respondents. Most respondents, 54.6

% (n=65), shopped at the Community Food Co-op more than once a week with 32.8 % (n=39) spending between \$26.00 and \$50.00 per visit. Almost 91% (n=108) of respondents had been a member of the Community Food Co-op for over three years. A Fifty-five respondents (48.7%) had an annual household income of over \$60,000 and 74 respondents (63.2%) resided less than five miles from the store. Table 1 examined the relationship between annual household income and amount spent per visit. Most of the respondents (72.6%), regardless of income, spent between \$1.00 and \$100.00 per visit, while only 5 respondents (4%) spent more than \$200.00 per visit. Only seven of the respondents (6%) had an annual household income of less than \$20,000 per year.

Eighty-nine percent of respondents chose to shop at the Community Food Co-op because they offer organic (n=107) and local products (n=83, 69.2%). Produce was the number one item that the respondents bought with 109 responses; milk, eggs, and other chilled items received 91 responses; and bulk items received 89 responses. Other items that received less responses were; meat and seafood with 66 responses, wellness items with 56 responses, deli/to-go items with 55 responses, packaged food with 49 responses, and beer/wine with 42 responses. Other businesses that respondents shopped at included Farmers' Markets (n=63), Town and Country (n=62), Costco (n=50), Heeb's East Main Grocery (n=38), Safeway (n=37), Rosauer's (n=22), Albertson's (n=22), Van's IGA (n=6), Wal-Mart (n=6), and Smith's (n=5).

Table 1  
*Annual Household income versus amount spent per visit*

| Amount Spent Per Visit | Annual Household Income |                   |                   |                   |                   |           | n   |
|------------------------|-------------------------|-------------------|-------------------|-------------------|-------------------|-----------|-----|
|                        | <\$20,000               | \$20,000-\$30,000 | \$31,000-\$40,000 | \$41,000-\$50,000 | \$51,000-\$60,000 | >\$60,000 |     |
| \$1-\$25               | 3                       | 0                 | 3                 | 3                 | 1                 | 1         | 10  |
| \$26-50                | 2                       | 6                 | 4                 | 2                 | 4                 | 20        | 39  |
| \$51-\$100             | 1                       | 0                 | 2                 | 5                 | 6                 | 19        | 33  |
| \$101-\$200            | 1                       | 1                 | 1                 | 4                 | 8                 | 11        | 26  |
| More than \$200        | 0                       | 0                 | 1                 | 0                 | 0                 | 4         | 5   |
| Total                  | 7                       | 7                 | 11                | 14                | 19                | 55        | 113 |

Another portion of the demographic section of the survey asked participants about their experience and background with agriculture. Only eight of the respondents (6.9%) stated they grew up on a farm or ranch and 15 (12.9%) grew up in a rural area, while the remaining respondents stated they grew up in a town, city, or suburb. Forty-five (38.1%) of the core consumer group members had relatives who worked on a farm and 39 (33.1%) had relatives who worked in an agribusiness. A very low number of the respondents completed a course related to agriculture in high school and only one person responded “yes” to being a member of FFA. In contrast, 21 respondents responded “yes” to being a member of 4-H. Nineteen of 118 respondents answered “yes” to the question “Have you

ever taken an adult education class (formal or non-formal) related to agriculture?” The mean length of time living in Montana for this group of respondents was 17.7 years.

Respondents were asked to identify the source of their food and fiber system news. They were able to choose multiple sources including newspapers, newsmagazines, radio, television, and internet. The internet was the most widely used source with 69 responses, followed closely by newspapers (n=52) and news magazines (n=46). Thirty-two respondents indicated that radio was a source for food and fiber news and 11 respondents indicated that television was their source for food and fiber system news. A follow-up question was posed to determine what types of internet sites this population used as their source food and fiber system news. Overwhelmingly, respondents used two types of internet sites; 41 respondents stated they used Yahoo, Google, and MSN as search engines to find food and fiber system information and 38 respondents said they go directly to the Community Food Co-op’s home page ([www.bozo.coop](http://www.bozo.coop)) for news. Only six people used the Cooperative Extension Service and only four people accessed USDA online to receive news information. Six respondents stated they used Facebook to learn about the food and fiber system. Table 2 described the relationship between age and source for food and fiber system news. Respondents aged 19-50 used the internet as their main source for food and fiber system news, while respondents aged 51 and over used newspapers.

Table 2  
*Age versus source for Food and Fiber System News*

| Age     | Source for News |            |            |       |          | N* |
|---------|-----------------|------------|------------|-------|----------|----|
|         | Newsmagazines   | Newspapers | Television | Radio | Internet |    |
| 19-30   | 3               | 3          | 0          | 3     | 7        | 16 |
| 31-40   | 9               | 7          | 3          | 11    | 23       | 53 |
| 41-50   | 7               | 12         | 3          | 4     | 14       | 40 |
| 51-60   | 17              | 21         | 2          | 11    | 18       | 69 |
| Over 60 | 9               | 9          | 3          | 2     | 7        | 30 |
| Total   | 45              | 52         | 11         | 31    | 69       |    |

Note: Respondents were allowed to choose more than one source. This accounts for the inconsistency of n.

### Knowledge and Perception Scores

The first two sections of the survey included statements to assess knowledge and perceptions of the Food and Fiber System. Participants were asked to circle T for True, F for False, and DK for Don't Know. Correct responses earned one point whereas incorrect or "don't know" responses earned zero points. Questions one through 35 were added for each participant to calculate an overall knowledge score. Possible scores were zero (for no correct responses) to 35 (for all responses answered correctly). The scores ranged from a low score of 10 (28.6%) to a high score of 31 (88.6%). The mean score for all respondents was 23.55 (67.3%). See Table 3.

The perceptions section asked respondents to circle SA for Strongly Agree, A for Agree, N for neutral, D for disagree, and SD for strongly disagree to 35 statements corresponding to the seven food and fibers system concept areas. Responses were given the following point values: Strongly Agree (SA) = 1, Agree (A) =2, Neutral (N) = 3, Disagree (D) =4, Strongly Disagree (SD) = 5. Reversed coding was used on statements written in a negative manner. Possible perception scores were 35 to 62 (very positive perception); 63 to 90 (positive perception); 91 to 118 (neutral perception); 119 to 146 (negative perception); and 147 to 175 (very negative perception). The lowest score for this sample was 37 (very positive perception), the highest score was 106 (neutral perception) and the mean score was 83.15 (positive perception). See Table 3.

Table 3  
*Summary of Knowledge and Perception Scores*

| Category     | N   | Low Score | High Score | Mean Score | SD   |
|--------------|-----|-----------|------------|------------|------|
| Knowledge*   | 120 | 10        | 31         | 23.55      | 4.66 |
| Perception** | 120 | 37        | 106        | 83.15      | 9.81 |

\*Note: Possible knowledge scores range from 0-35, with 0 corresponding to low knowledge levels and 35 corresponding high knowledge levels.

\*\*Note: Possible perceptions scores range from 35-175 with 35 corresponding to positive perceptions and 175 corresponding to negative perceptions.

Table 4 showed the overall mean knowledge scores for the seven food and fiber system concept areas. In addition, Tables 4-9 revealed the percentage of correct, incorrect, and don't know responses for each statement in the seven concept areas. See Appendix D for correct answers to statements in the knowledge section. For ease of reporting, the titles of concept areas were shortened to Significance of Agriculture (Societal and global significance of agriculture), Agricultural Policy (Public policy in

agriculture), Natural Resources and the Environment (Agriculture's important relationship with the environment and natural resources), Plant Science (Plant Science), Animal Science (Animal Science), Processing (Processing of agricultural products), and Marketing and Distribution (Marketing and distributing of agricultural products).

The concept area with the highest percentage of correct responses was Natural Resources and the Environment at 85.2% correct, while the concept area with the lowest percentage of correct responses was Plant Science with 57.6% correct. Percentage of correct responses for other concept areas were 79.8% for Marketing and Distribution, 68.8% for Animal Science, 61.4% for Processing, 61.2% for Significance of Agriculture, and 59.1% for Agricultural Policy. All concept areas had correct responses which were greater than 50%.

Table 4  
*Overall Mean Knowledge Score by Concept Area*

| Concept Area                         | N   | Mean Score | Std. Deviation | % Correct |
|--------------------------------------|-----|------------|----------------|-----------|
| Significance of Agriculture          | 120 | 3.0583     | 1.07137        | 61.2      |
| Agricultural Policy                  | 119 | 2.9496     | 1.15604        | 59.1      |
| Natural Resource and the Environment | 118 | 4.2627     | 0.73296        | 85.2      |
| Plant Science                        | 118 | 2.8983     | 1.27695        | 57.6      |
| Animal Science                       | 115 | 3.4609     | 1.04535        | 68.8      |
| Processing                           | 116 | 3.1121     | 1.10155        | 61.4      |
| Marketing and Distribution           | 119 | 4.0000     | 1.06564        | 79.8      |

Data in Table 5 depicted the overall mean knowledge score for the Significance of Agriculture concept area. Less than half (40.8%) of the respondents knew that there were fewer farmers in the U.S. today than there were ten years ago, while less than a quarter (24.2%) of the respondents knew that the average U.S. farm size was not larger than 500 acres. Significance of Agriculture concept area and 61.2% correct answers.

Table 5  
*Significance of Agriculture Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements   | % Correct | % Incorrect | % Don't Know | N   |
|---|-----------|-------------|--------------|-----|
| There are more new farmers in the U.S. than there were 10 years ago.      | 40.8      | 26.7        | 32.5         | 120 |
| U.S. research has improved farming methods in other countries.            | 63.3      | 14.2        | 22.5         | 120 |
| Thousands of people in the world die of starvation each year.             | 99.2      | 0.8         | 0.0          | 120 |
| The average U.S. farm size is larger than 500 acres.                      | 24.2      | 37.5        | 38.3         | 120 |
| Several countries depend on U.S. agricultural exports for food and fiber. | 78.3      | 1.7         | 20.0         | 120 |
| Concept Average   | 61.2      | 16.2        | 22.7         |     |

Data in Table 6 revealed the responses for the Agriculture Policy concept area. The statement with the highest percent of correct responses was “Local laws and regulations have little effect on farmers” (88.2%) with False as the correct response. The majority of respondents (50.9%) and (52.5%) circled “don’t know” to the statements “Less than 2 percent of the U.S. gross national product is from agriculture” and “One of every five jobs in the U.S. is related to agriculture.” Just over 59% of the answers in the Agricultural Policy concept area were correct.

Table 6  
*Agriculture Policy Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements   | % Correct | % Incorrect | % Don't Know | N   |
|---|-----------|-------------|--------------|-----|
| Less than 2 percent of the U.S. gross national product is from agriculture. | 23.3      | 25.8        | 50.9         | 120 |
| One of every five jobs in the U.S. is related to agriculture.               | 29.2      | 18.3        | 52.5         | 120 |
| Local laws and regulations have little effect on farmers.                   | 88.2      | 4.2         | 7.6          | 119 |
| U.S. agricultural policies influence food prices in other countries.        | 87.4      | 0.0         | 12.6         | 119 |
| Government subsidy payments to farmers are used to stabilize food prices.   | 67.5      | 14.2        | 18.3         | 120 |
| Concept Average   | 59.1      | 12.5        | 28.4         |     |

The Natural Resource and Environment concept area responses were shown in Table 7. This was the concept area with the highest overall score with 85.2% correct. The only statement in the knowledge section in which 100% of respondents answered correctly was “Water, soil, and minerals are important in agriculture.” The lowest percentage of correct responses for this concept area was “Many farmers use tillage practices that conserve the soil” with 47.1%. All other statements in this concept area had over 90% of the respondents answer correctly.

Table 7  
*Natural Resources and the Environment Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements  | % Correct | % Incorrect | % Don't Know | N   |
|--|-----------|-------------|--------------|-----|
| Soil erosion does <u>not</u> pollute U.S. lakes and rivers.        | 91.6      | 4.2         | 4.2          | 120 |
| Many farmers use tillage practices that conserve the soil.         | 47.1      | 26.9        | 26.0         | 119 |
| Farming and wildlife cannot survive in the same geographical area. | 95.0      | 2.5         | 2.5          | 120 |
| Animal wastes are used to increase soil fertility.                 | 92.4      | 4.2         | 3.4          | 119 |
| Water, soil, and minerals are important in agriculture.            | 100.0     | 0.0         | 0.0          | 120 |
| Concept Average  | 85.2      | 7.6         | 7.2          |     |

Table 8 summarized the percentage of correct responses to the statements in the Plant Science concept area. Over 59% of the respondents answered four of the five statements correctly. Only 31.7% of respondents responded correctly to the statement “Profits increase as farmers strive for the maximum crop yields.” Almost 58% of the statements in this concept area were answered correctly.

Table 8  
*Plant Science Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements   | % Correct | % Incorrect | % Don't Know | N   |
|---|-----------|-------------|--------------|-----|
| The use of pesticides has increased the yield of crops.         | 59.7      | 21.0        | 19.3         | 119 |
| Plant products are the main source of human foods.              | 69.2      | 19.2        | 11.6         | 120 |
| Biotechnology has increased the pest resistance of plants.      | 60.8      | 15.8        | 23.4         | 120 |
| Profits increase as farmers strive for the maximum crop yields. | 31.7      | 42.5        | 25.8         | 120 |
| Very little of the grain produced in the U.S. is exported.      | 66.4      | 4.2         | 29.4         | 119 |
| Concept Average   | 57.6      | 50.5        | 21.9         |     |

The percentage of correct and incorrect answers in the Animal Science concept area were summarized in Table 9. Ninety-seven and one-half percent of respondents knew that hamburger did not come from the meat of pigs. The majority of respondents either answered incorrectly or did not know that “Biotechnology has increased animal production in the U.S.” The average percent correct for this concept area was 68.8%.

Table 9  
*Animal Science Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements                                   | % Correct | % Incorrect | % Don't Know | N   |
|---|-----------|-------------|--------------|-----|
| Animal health and nutrition are important to farmers.     | 72.8      | 13.6        | 13.6         | 118 |
| Animals can be a valuable source of medical products.     | 53.8      | 15.1        | 31.1         | 119 |
| Animals eat foodstuffs that cannot be digested by humans. | 71.6      | 16.7        | 11.7         | 120 |
| Biotechnology has increased animal production in the U.S. | 47.9      | 14.3        | 37.8         | 119 |
| Hamburger is made from the meat of pigs.                  | 97.5      | 0.0         | 2.5          | 118 |
| Concept Average   | 68.8      | 11.94       | 15.7         |     |

Table 10 depicted the knowledge statements answered correctly and incorrectly by respondents in the Processing concept area. The concept area had 61.4% correct response and over 50% of respondents correctly answered every question except one. Only 39% of the respondents knew that “Using grain alcohol for fuel reduces the U.S. dependence on foreign oil.” Most of the respondents, 90.7%, knew that “Pasteurization uses heat to kill bacteria in milk.”

Table 10  
*Processing Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements  | % Correct | % Incorrect | % Don't Know | N   |
|--|-----------|-------------|--------------|-----|
| Food safety is a major concern of the food processing industry.          | 50.8      | 38.4        | 10.8         | 120 |
| Homogenization uses heat to kill bacteria in milk.                       | 64.2      | 23.3        | 12.5         | 120 |
| New products have been developed using surplus grains.                   | 62.2      | 1.7         | 36.1         | 119 |
| Pasteurization uses heat to kill bacteria in milk.                       | 90.7      | 1.7         | 7.6          | 119 |
| Using grain alcohol for fuel reduces the U.S. dependence on foreign oil. | 39.0      | 35.6        | 25.4         | 118 |
| Concept Average  | 61.4      | 23.2        | 18.5         |     |

The last concept area, Marketing and Distribution was shown in Table 11 and had 79.8% of its statement answered correctly. Two statements received over 90% correct answers. Thirty-five percent of respondents answered “Don’t Know” to the statement “Grain exports are usually transported between continents by airplane” which is a false statement.

Table 11  
*Marketing and Distribution Knowledge Statements Answered Correctly and Incorrectly*

| Concept Area Statements  | % Correct | % Incorrect | % Don't Know | N   |
|--|-----------|-------------|--------------|-----|
| Processing increases the cost of food products.                                  | 80.0      | 10.8        | 9.2          | 120 |
| The U.S. does not sell its feed grains on the world market.                      | 70.8      | 3.4         | 25.8         | 120 |
| Grain exports are usually transported between continents by airplane.            | 60.0      | 5.0         | 35.0         | 120 |
| An efficient food distribution system is essential to the agricultural industry. | 93.3      | 2.5         | 4.2          | 120 |
| Transportation and storage affects the supply of agricultural products.          | 95.0      | 0.8         | 4.2          | 119 |
| Concept Average  | 79.8      | 4.4         | 15.7         |     |

The perceptions section asked respondents to circle SA for Strongly Agree, A for Agree, N for neutral, D for disagree, and SD for strongly disagree. Responses were given the following point value; Strongly Agree (SA) = 1, Agree (A) =2, Neutral (N) = 3, Disagree (D) =4, Strongly Disagree (SD) = 5. Coding was reversed for statements written in a negative manner. Table 12 summarized the lowest score (most positive perception), highest score (most negative perception) and mean score for each Food and Fiber System concept area. The concept area with the most positive perceptions and lowest mean score was Agricultural Policy, while the concept area with the most negative perceptions and highest mean score was Natural Resources and the Environment. Two concept areas tied for lowest score by one individual (most positive perceptions) and they were Agricultural Policy and Marketing and Distribution with 6 (possible scores were 5 to 25). Two concept areas also tied for highest score by one individual (most negative perceptions) and they were Natural Resources and the Environment and Animal Science with 24 (possible scores were 5 to 25).

Table 12  
*Respondents' Perceptions About Each Concept Area*

| Concept Area                          | Lowest Score (positive perception) | High Score (negative perception) | Mean Score | SD   | N   |
|---------------------------------------|------------------------------------|----------------------------------|------------|------|-----|
| Significance of Agriculture           | 8                                  | 18                               | 12.80      | 2.60 | 119 |
| Agricultural Policy                   | 6                                  | 16                               | 11.34      | 1.97 | 117 |
| Natural Resources and the Environment | 10                                 | 24                               | 16.05      | 3.06 | 117 |
| Plant Science                         | 10                                 | 20                               | 14.06      | 2.15 | 116 |
| Animal Science                        | 7                                  | 24                               | 15.37      | 2.97 | 116 |
| Processing                            | 9                                  | 22                               | 15.38      | 2.38 | 116 |
| Marketing and Distribution            | 6                                  | 20                               | 12.83      | 2.53 | 113 |

Note: The lowest possible score was 5 and the highest possible score was 25. A lower score indicates a more positive perception. A higher score indicates a more negative perception.

Independent samples t-tests were conducted with knowledge and perceptions scores using demographic variables. Only two variables were found significant. The mean knowledge scores were significantly higher for males than were for females ( $p=.000$ ). The t-test revealed a difference ( $p=.055$ ) between male and female perception scores. In addition, the mean knowledge scores were significantly higher for those who had taken an adult education class (formal or non-formal) related to agriculture than for those who had not ( $p=.033$ ). See Tables 13 and 14.

Table 13  
*Results for Gender Comparison t-tests*

| Score      | n    |        | Mean    | SD      | Mean    | SD      | t      | p     |
|------------|------|--------|---------|---------|---------|---------|--------|-------|
|            | Male | Female |         |         |         |         |        |       |
| Knowledge  | 20   | 97     | 26.2500 | 2.86310 | 23.0619 | 4.76929 | 3.972  | .000* |
| Perception | 20   | 97     | 80.0500 | 8.58073 | 84.1959 | 8.72095 | -1.941 | .055  |

Note: df for Knowledge Score was 44.103 and for Perception Score it was 115. Scores for the knowledge section ranged from 0 to 35. Scores for the perception section ranged from 35-175.

\* denotes significance at the <.05 level.

Table 14  
*Results for Attendance in an Adult Agricultural Education Class Comparison t-tests*

| Score      | n   |    | Mean    | SD      | Mean    | SD       | t     | p     |
|------------|-----|----|---------|---------|---------|----------|-------|-------|
|            | Yes | No |         |         |         |          |       |       |
| Knowledge  | 19  | 99 | 25.1053 | 3.05314 | 23.2121 | 4.87240  | 2.215 | .033* |
| Perception | 19  | 99 | 81.5789 | 8.05064 | 83.6263 | 10.02913 | -.838 | .403  |

Note: df for Knowledge Score was 38.219 and for Perception Score it was 116. Scores for the knowledge section ranged from 0 to 35. Scores for the perception section ranged from 35-175.

\* denotes significance at the <.05 level.

### Educational Interests

The final question on the survey asked respondents to rank the seven agricultural literacy concepts in order of interest. A rank of one by respondents showed the most interest in learning more about that particular concept area while a rank of seven indicated little to no interest in learning more about that particular concept area. Mean scores for each concept area were analyzed. The concept with the most interest for future learning

opportunities with the lowest mean score of 2.65 was “Natural Resources and the Environment”. Other concept area scores were “Significance of Agriculture” with a mean score of 3.66, “Processing” (3.70), “Agricultural Policy” (3.71), “Plant Science” (3.82), “Animal Science” (4.94), and “Marketing and Distribution” (5.41). Table 15 shows the mean score and standard deviation for each concept area (lower scores indicated more interest, while higher scores indicated less interest). Frequency tables were also used to analyze educational interest in the seven concept areas. Table 16 examined each concept area and how many people ranked it one through seven. Thirty-three respondents (33%) ranked Natural Resources and the Environment as the number one concept area they wanted to learn more about, while 42 (42%) respondents ranked Marketing and Distribution as the last concept area they wanted to learn more about.

Table 15  
*Overall Mean Interest Score by Concept Area*

| Concept Area                          | N   | Mean Score | Std. Deviation |
|---------------------------------------|-----|------------|----------------|
| Significance of Agriculture           | 100 | 3.66       | 1.765          |
| Agricultural Policy                   | 100 | 3.71       | 2.100          |
| Natural Resources and the Environment | 101 | 2.65       | 1.578          |
| Plant Science                         | 101 | 3.82       | 2.002          |
| Animal Science                        | 101 | 4.94       | 1.708          |
| Processing                            | 101 | 3.70       | 1.792          |
| Marketing and Distribution            | 101 | 5.41       | 1.761          |

Note: A higher score indicates a lower interest, while a lower score indicates a higher interest. Possible scores ranged from 1 to 7.

Table 16  
*Frequency Ranking of Educational Interests*

| Concept Area                                   | n<br>Ranked<br>as 1 | n<br>Ranked<br>as 2 | n<br>Ranked<br>as 3 | n<br>Ranked<br>as 4 | n<br>Ranked<br>as 5 | n<br>Ranked<br>as 6 | n<br>Ranked<br>as 7 | Total<br>n |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------------|
| Significance<br>of Agriculture                 | 9                   | 21                  | 24                  | 13                  | 17                  | 6                   | 10                  | 100        |
| Agricultural<br>Policy                         | 19                  | 19                  | 13                  | 11                  | 9                   | 17                  | 12                  | 100        |
| Natural<br>Resources<br>and the<br>Environment | 33                  | 21                  | 17                  | 14                  | 10                  | 6                   | 0                   | 101        |
| Plant Science                                  | 21                  | 8                   | 15                  | 17                  | 14                  | 16                  | 10                  | 101        |
| Animal<br>Science                              | 1                   | 13                  | 8                   | 15                  | 18                  | 24                  | 22                  | 101        |
| Processing                                     | 16                  | 13                  | 18                  | 16                  | 17                  | 18                  | 3                   | 101        |
| Marketing<br>and<br>Distribution               | 3                   | 6                   | 6                   | 14                  | 15                  | 13                  | 42                  | 99         |

Note: 1 equals highest interest level and 7 equals lowest interest level.

## CONCLUSIONS, IMPLICATIONS, AND RECCOMENDATIONS

The purpose of the study was to assess the level of Food and Fiber System knowledge and perceptions of the adjusted top 1,000 shoppers at the Community Food Co-op in Bozeman, MT. A random sample of 350 core consumers received the survey and 120 useable surveys were returned for a response rate of 34.3%. Conclusions of this study are reported as they relate to the objectives. All conclusions made can only be applied to the population, which was surveyed and not generalized to the general population.

Specific objectives of this study were:

1. To determine the demographics of the core consumer group at the Community Food Co-op in Bozeman, Montana;
2. To determine the core group of shoppers' knowledge levels of the food and fiber system;
3. To determine the core group of shoppers' perceptions of the food and fiber system as a whole; and,
4. To identify the core consumer group's level of educational interest in the seven refined food and fiber system literacy subject areas.

The data analysis brought about the following conclusions:

### Demographics of the Core Consumer Group

The typical shopper in the core consumer group at the Community Food Co-op is a female between the ages of 51 and 60 with annual household income of more than \$60,000. She has been a member for more than three years and usually shops more than once a week spending between \$26 and \$50 per visit. The core consumer group parallels Wilkins (1996) findings that consumers who shop at a cooperative have a preference for organic and local foods, as this was the core consumer group's two main reasons for shopping at the Community Food Co-op. In addition, the main type of food bought was produce and chilled items (milk, cheese, and eggs). The internet was by far the most used source for Food and Fiber System news. Many respondents already use the Community Food Co-op's website, but continued use and expansion of the site is vital. The Community Food Co-op should begin to use email and the internet as its primary source of communication with its members. One immediate recommendation is to include an email address blank on the member registration form. Internet and email communication is not only wanted and needed by its members, it is a more sustainable way to communicate. Currently on the website coupons, recipes, and some locally written articles are included on the website. Links to peer-reviewed journal articles about agriculture should be included as well as sources of other research-based information. Furthermore, the agriculture industry as a whole should look to the internet as its main source for educating the public. Every agricultural producer and company should not only have a website where it educates its consumers about their particular products or

commodities, but also about the industry as a whole. Grocery stores and educational groups should also begin to use the internet as their primary source for sharing food and fiber system news. It is recommended that grocery stores gather email addresses along with store shopper information. With changing technology, this is the wave of the future and an important way to include younger audiences. One problem is that only six respondents stated using the Cooperative Extension Service website as an access to food and fiber system news. This is unfortunate because this is a reliable source of researched based information. Education to local grocery stores about the Cooperative Extension Service and what it offers is vital to dissemination of correct, research-based information. Although the internet was used by most of the population, groups may still want to consider use of newspapers for their secondary source of delivering information.

### Knowledge Levels

The core consumer group is knowledgeable, but not very knowledgeable about the food and fiber system. None of the shoppers in the core consumer group scored above 90% on the knowledge section of the survey. Twenty-eight (23.3%) respondents scored between 80% - 89%, 44 (36.67%) scored between 66% and 79%. Males had significantly ( $P=.000$ ) higher knowledge scores than females in the respondent group. This may be due to the smaller amount of male respondents in the study. In addition, significantly ( $P=.033$ ) higher knowledge scores were received by those respondents who have taken a class (formal or non-formal) related to agriculture. Very few respondents had taken this

type of class and research has shown that knowledge about a particular food may increase consumption of that food (Wansink et al., 2005). In addition, the respondents in this sample were generally not a part of 4-H or FFA, which are organizations that educate youth on agriculturally related issues. Therefore, it is recommended that the Community Food Co-op begin offering regular agriculture and nutrition education classes for adults and youth. Local and national agriculture statistics such as the average U.S. farm size is smaller than 500 acres and that less than two percent of the U.S. gross national product comes from agriculture should be included. This fits in well with the fifth cooperative principle of education, training, and information. Manalo et al. (2003) showed the importance of knowledge and perceptions on influencing what vegetables could be grown locally. Members need to understand the accurate size and scope of the agriculture industry, not only in their region, but also in the nation. In addition, the United States Department of Agriculture, the Montana Department of Agriculture, and the Cooperative Extension Service should consider this benefit and expand their educational opportunities. Collectively, if these organizations can increase knowledge of agriculture, better policy decisions can be made both locally and nationally. Significant differences were found between those consumers who had taken an education course related to agriculture and those who had not. Constructivist learning theory explains that the experience of taking an education course related to agriculture influences thoughts and perceptions of agriculture. Further research should be conducted to see if this holds true with other populations. It seems obvious that completing an educational class in a certain subject would increase knowledge, but it needs to be researched in other contexts.

### Perception Levels

On average, the top thousand shoppers at the Community Food Co-op have a relatively high perception of the Food and Fiber System. However, perceptions varied from very high to neutral. None of the shoppers had low perceptions of the Food and Fiber System. The concept area, which scored had the most negative perceptions, was Natural Resources and the Environment. Paralleling Manalo's et al. research (2003), about consumers being about to make change within their local community, the concept with the most positive perception level was Agricultural Policy. This shows that these consumers feel they have a stake in where their food comes from and that their perceptions may make a difference in the future. Because there were no significant findings in this particular study regarding perceptions, it is suggested that future research re-investigate with a larger population. Similar to the constructivist learning theory and epistemology, research should focus on why and how consumers have the perceptions they do.

### Areas of Educational Interest

Respondents wanted to learn most about Natural Resources and the Environment compared to the other six food and fiber system concept areas, yet this was the same concept area that had the lowest overall perception. In addition, this was the concept area which had the highest average knowledge scores. This dichotomy may be explained by

shoppers being unhappy with current practices in natural resources and the environment and being interested in changing them. In addition, Birkenholz's (1999) Sphere of Knowledge theory may explain why the concept area with the highest knowledge scores also produced the highest level of interest for future educational opportunities. The theory stated that the more you know; the more you realize there is still more to know. Workshops, newsletter articles, and educational opportunities should to be created in the concept area of Natural Resources and the Environment. The core consumer group is most interested in this subject and already has a high knowledge level so topics for instruction must meet their needs. In addition, the research showed that those respondents who had taken an agriculturally-related class had higher knowledge scores; therefore, it is recommended that educational opportunities offered by the Community Food Co-op include non-formal classes and programs.

Interestingly, the concept area with the lowest knowledge scores (Agricultural Policy), also had the most positive perceptions of the seven concept areas. The Community Food Co-op members however, have only an average interest in learning more about this concept area. Manalo et al. explained that consumers felt they had an effect on what vegetables were grown locally (2003). Congruent with Manalo, the member may feel they have an effect on the local economy and agricultural industry, yet they do not have the knowledge to back it up. It is a paradox that needs to be explored further by future research.

The Community Food Co-op management should conduct an in-depth needs assessment of educational interests of its members. This could be done with focus groups,

surveys, or personal interviews. This would allow the Community Food Co-op to tailor its educational materials to meet the needs of their shoppers and meet the fifth cooperative principle of education. It is recommended that the survey used for this research be applied to the entire Community Food Co-op population. There were no significant findings to show that the higher knowledge scores in Natural Resources and the Environment concept area had any relation to the high level of interest in that same concept area. Similarly, there were no significant finding to show that the most positive perceptions of Agricultural Policy had any relation to low knowledge scores. Regardless, it is suggested that research be conducted to determine if there is a cause and effect relationship between knowledge and interest, knowledge and perceptions, and perceptions and interest in particular food and fiber system concept areas.

Much of the previous research in knowledge and perceptions of agricultural and Food and Fiber System Literacy has been conducted in formal settings with educators, youth, and legislators (Terry et al. (1992), Frick et al. (1991), Frick et al. 1995, Harris & Birkenholz (1996), Wearley et al. 1999). More research needs to be conducted with other food consumer groups. This research should begin by examining knowledge and perceptions of traditional grocery store shoppers, then expand to include other cooperative type grocery stores. Future research should be conducted that compares the knowledge and perceptions of these two types of consumers. This may give insight into the U.S. population as a whole and may give opportunity for creating wide-spread informal educational opportunities.

REFERENCES CITED

- Attwood, L. (2008) Idaho's bounty: New food co-op helps meet growing demand for locally produced foods. *Rural Cooperatives*. 47 (3),4-7 & 36. Retrieved from <http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=3&hid=119&sid=c7bb15b8-fb47-4cd4-984d-4ad184a50afa%40sessionmgr104>
- Birkenholz, R. (1999) *Effective adult learning*. Illinois: Interstate Publishers, Inc.
- Birkenholz, R.J. & Maricle, G.L. (1991). Adult education in agriculture: A national survey [Electronic version]. *Journal of Agricultural Education*. 32 (4) 19-24. doi:10.5032/jae.1991.04019
- Clarke, G., Eyre, H., Guy, C. (2002). Deriving indicators of access to food retail provision in British cities: Studies of Cardiff, Leeds, and Bradford [Electronic version]. *Urban Studies*, (39)11, 2041-2060. doi: 10.1080/0042098022000011353
- Community Food Co-op. (n.d). Membership. Retrieved October 15, 2009, from <http://www.bozo.cooperative>
- Cooperative Directory Service. (2008, October 28). What is A Cooperative? Retrieved October 15, 2009, from <http://www.cooperativedirectory.org>
- Cox, C. (1994). *Storefront Revolution: Food coops and the counterculture*. New Jersey: Rutgers University Press
- Crotty, M. (1998) *Foundations of Social Research*. London: SAGE Publication, Ltd.
- Dahm, M.J., Samonte, A.V., & Shows, A.R. (2009) Organic foods: Do eco-friendly attitudes predict eco-friendly behaviors? *Journal of American College Health*. 58 (3) 195-202. Retrieved from <http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=3&hid=119&sid=9722d87c-921a-4966-a9e1-7652b4fd0b9b%40sessionmgr111>
- Dillman, D., Smyth, J.D., Christian, L.M. (2008) *Internet, mail, and mixed-mode surveys: The tailored design method* (3<sup>rd</sup> ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Dolliver, M (2009) What we think of food. *MediaWeek*, 19 (23)
- Dolliver, M. (2010) How people pick foods. *MediaWeek*, 20(5).
- Edwards, J.R., Cable, D.M., Williamson, I.O., Lambert, L.S., & Shipp, A.J. (2006) Phenomenology of fit: Linking the person and environment to the subjective experience of person-environment fit. *Journal of Applied Psychology*, (91) 4, 802-827. doi: 10:1037/0021-9010.91.4.802

- Fjeld, C., Sommer, R. (1981) Ideas for Point-of-Purchase Nutrition Education. *Journal of Nutrition Education*, 13(4), 135-136.
- Fjeld, C., Storer, J., Warholic, J., Sommer, R., Becker, F., (1984) Food intake frequencies of food cooperative shoppers. *Journal of Nutrition Education*, 16(3), 142-144.
- Freedman, M.R., & Connors, R. (2010) Point of purchase nutrition information influences food-purchasing behaviors of college students: A pilot study [Electronic version]. *Journal of the American Dietetic Association*, 110 (8), 1222-1226. doi: 10.1016/j.jada.2010.05.002
- Frick, M.J., Birkenholz, R.J., H., Machtens, K. (1995a) 4-H Knowledge and perception of agriculture. *Journal of Agricultural Education*, 36 (3), 43-49. doi: 10:5032/jae.1995.03043
- Frick, M.J., Birkenholz, R.J., Gardner, H. & Machtmes, K. (1995b). Rural and urban inner-city high school student knowledge and perception agriculture. *Journal of Agricultural Education*, 36 (4), 1-9. doi: 10:5032/jae.1995.04001
- Frick, M.J., Birkenholz, R.J., H., Machtmes, K. (1995c) Rural and urban adult knowledge and perceptions of agriculture . *Journal of Agricultural Education*, 36 (2), 44-53. doi: 10:5032/jae.1995.02044
- Frick, M.J., Kahler, A.A., Miller, W.W. (1991) A definition and the concepts of agricultural literacy. *Journal of Agricultural Education*, 32(2), 49-57. doi: 10:5032/jae.1991.02049
- Garmston, R., & Wellman, B. (1994) Insights from constructivist learning theory. *Educational Leadership*, 51 (7), 84. Retrieved from [http://find.galegroup.com.proxybz.lib.montana.edu/gtx/infomark.do?&contentSet=IAC-Documents&type=retrieve&tabID=T002&prodId=ITOF&docId=A15414355&source=gale&srcprod=ITOF&userGroupName=mtlib\\_1\\_1123&version=1.0](http://find.galegroup.com.proxybz.lib.montana.edu/gtx/infomark.do?&contentSet=IAC-Documents&type=retrieve&tabID=T002&prodId=ITOF&docId=A15414355&source=gale&srcprod=ITOF&userGroupName=mtlib_1_1123&version=1.0)
- Gay, L. R., & Airasian, P. (2003) *Educational research: Competencies for analysis and application* (7<sup>th</sup> ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.
- Harmon, A.H. & Maretzki, A.N. (2006a) A survey of food system knowledge, attitudes, and experiences among high school students. *Journal of Hunger & Environmental Nutrition*, 1 (1), 59-82

- Harmon, A.H. & Maretzki, A.N. (2006b) Assessing food system attitudes among youth: Development and evaluation of attitude measures. *Journal of Nutrition Education and Behavior*, 38 (2), 91-95
- Harris, C.R., & Birkenholz, R.J. (1996) Agricultural literacy of Missouri secondary school educators. *Journal of Agricultural Education*, 37 (2), 63-71  
doi: 10:5032/jae.1996.02063
- Hofer, B.K., & Pintrich, P.R. (1997) The development of epistemological theories: Beliefs about knowledge and knowing the their relation to learning. *Review of Educational Research*, 67 (1), 88. Retrieved from <http://jstor.org/stable/1170620>
- Houser, J. (2008) *Nursing Research*. Sudbury, MA: Jones and Barlett.
- Igo, C.G., Leising, J.G., Frick, M.J. (1999) A case assessment of standards and benchmarks for implementing food and fiber systems literacy. *18<sup>th</sup> Annual Western Region Agricultural Education Research Conference*. 218-230
- International Cooperative Alliance. (n.d). History of the Movement. Retrieved October 15, 2009, from <http://www.ica.coop>
- Kish, S. (2008) Fresh food program promotes healthy eating habits among children. *Cooperative State Research, Education, and Extension Service*.
- Leedy, P.D., & Ormrod, J.E. (2005) *Practicle Research* (8<sup>th</sup> Ed.). Upper Saddle River, New Jersey: Pearson Education, Inc.
- Leising, J.G., Pense, S.L., & Igo, C.G. (2001) An assessment of student agricultural literacy knowledge based on the food and fiber systems literacy framework. *28<sup>th</sup> Annual National Agricultural Education Research Conference*. 259-268.
- Leising, J.G., & Zilbert, E.E. (1994) Validation of the California agricultural literacy framework. *Proceedings of the National Agricultural Education Research Meeting*, USA, 21, 112-119.
- Manalo, A.B, Sciabarrasi, M.R., Haddad, N.A., & McWilliam Jellie, G. (2003) Buying products directly from farmers and valuing agriculture; Behavior and attitudes of New Hampshire shoppers. *University of New Hampshire Extension Service*.
- National Research Council, Board on Agriculture, Committee on Agricultural Education in Secondary Education. (1998). *Understanding agriculture: New directions for agricultural education*. Washington, DC: National Academy Press.

- Naylor, S. and Keogh, B. (1999) Constructivism in the classroom: Theory into practice. *Journal of Science Teacher Education*, 10(2), 93-106
- Nunnally, J. (1978) Psychometric theory. New York; McGraw Hill
- Pense, S.L., Beebe, J.D., Leising, J.G., Wakefield, D.B., & Steffen, R.W. (2006) The agricultural literacy of urban/suburban and rural twelfth grade students in five Illinois high schools: An ex post facto study. *Journal of Southern Agricultural Education Research* 56 (1) 5-17
- Pense, S.L. & Leising, J.G. (2004) An assessment of food and fiber systems knowledge in selected Oklahoma high schools. *Journal of Agricultural Education*. 45 (3) 86-96. doi: 10.5032/jae.2004.03086
- Pense, S.L., Leising, J.G., Portillo, M.T., & Igo, C.G. (2005) Comparative assessment of student agricultural literacy in selected agriculture in the classroom programs. *Journal of Agricultural Education* 46 (3) 107-118  
doi: 10.5032/jae.2005.03107
- Reidel, J., Wilson, E., Flowers, J., Moore, G. (2007) Effects of an introductory agricultural education course on agricultural literacy and perceptions of agriculture in urban students. *Journal of Southern Agricultural Education Research*, 57 (1)
- Richard, J.B. (2009) The agricultural industry as perceived by members of the general public of Louisiana (Unpublished doctoral dissertation). Louisiana State University, Louisiana.
- Schommer, M., Calvert, C., Gariglietti, G., & Bajaj, A. (1997) The development of epistemological beliefs among secondary students: A longitudinal study. *Journal of Educational Psychology*, (89) 1, 37. doi: 10:1037/0022-0663.89.1.37
- Seyfang, G. (2006) Ecological citizenship and sustainable consumption: Examining local organic food networks. *Journal of Rural Studies*, 22, 383-395.  
doi: 10.1016/j.jrurstud.2006.01.003
- Seyfang, G. (2008) Avoiding Asda? Exploring consumer motivations in local organic food networks. *Local Environment*, 13(3) ,187-201
- Smith, D.W. (2009) Phenomenology. *The Stanford Encyclopedia of Philosophy (Summer 2009 Edition)* Edward N. Zalta (ed.). Retrieved from <http://plato.stanford.edu/archives/sum2009/entries/phenomenology/>

- Terry, R., Herring, D.R., & Larke Jr. A. (1992) Assistance needed for elementary teachers in Texas to implement programs of agricultural literacy. *Journal of Agricultural Education*, 33 (2) 51-60. doi: 10.5032/jae.1992.02051
- Towne's Harvest Community Supported Agriculture (2010) About CSA. Retrieved December 9, 2010, from <http://www.townesharvest.montana.edu>
- Trexler, C.J., & Hess, A.J. (2005) Constructivist teaching: Developing constructivist approaches to the agricultural education class. *Agricultural Education Magazine*, 77 (5), 12-13. Retrieved from <http://www.naae.org/links/agedmagazine/archive/Volume77/v77i5.pdf>
- Wansink, B., Westgren, R.E., Cheney, M. M. (2005) Hierarchy of nutritional knowledge that relates to the consumption of a functional food. *Nutrition* 21, 264-268.
- Webster's Online Dictionary (2009) Food and Fiber System. Retrieved October 15, 2009, from <http://www.websters-online-dictionary.org>
- Wearley, M., Frick, M.J., Van Shelhamer, C. (1999) Montana Legislator's Knowledge and Perception of Agriculture. *NACTA Journal*, 31 (March), 31-37.
- Wilkins, J.L. (1996) Seasonality, food origin, and food preference: a comparison between food cooperative members and nonmembers. *Journal of Nutritional Education*, 28(6), 329-337. doi: 10/1016/S0022-3182(96)70122-X

APPEDICES

APPENDIX A

INTRODUCTORY POST-CARD



«First Name» «Last Name»  
 «Address»  
 «City», «State»  
 «Zip Code»



## A message from the Co-op

DEAR «First Name» «Last Name»,

In a joint effort, Bozeman's Community Food Co-op and JoLynn Miller, a graduate student at Montana State University in the Division of Agricultural Education, are asking you to participate in a research study designed to assess your knowledge and perceptions of the Food and Fiber system. You have been chosen to participate because you are a vital member of the Community Food Co-op in Bozeman, MT. Please be looking for the survey to arrive in the mail within the next week. You can either return the survey with the pre-addressed stamped envelope or to the Customer Service desk at the Community Food Co-op during regular business hours. Thanks for your time and commitment to this important issue!

406-587-1919 ext. 38, Main Office

APPENDIX B

SURVEY INSTRUMENT WITH INFORMED CONSENT

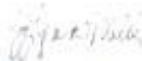
Dear member number <<Member Number>>.

As mentioned earlier by postcard, you have been chosen to participate in a research study to assess your knowledge and perceptions of the Food and Fiber System\*. Information gathered in this study, will be used to better understand not only what members of the Community Food Co-op know and think about the Food and Fiber System, but will provide insight into their interests for future educational programs. With this information, Bozeman's Community Food Co-op will be able to write newsletter articles based on those interests, and possibly plan for future educational programs.

Completing the survey should take 15-20 minutes. The study is voluntary. If you agree to participate, your responses will be anonymous and confidential. This is why the letter is addressed to your member number, and not your name. As an incentive for you to participate, the Community Food Co-op has generously donated three \$100.00 gift cards to the cause. All surveys returned to the researchers (either by mail or at the Community Food Co-op Customer Service Desk) by **FRIDAY, SEPTEMBER 17** will be entered into the raffle. Winners will be chosen at random. There is no consequence for non-participation in this research. There are no risks beyond the minimal associated with your participation in this study.

If you have questions regarding this research, data collection, analysis process, or plans for dissemination of results, you may contact JoLynn Miller at [jolynn.miller@msu.montana.edu](mailto:jolynn.miller@msu.montana.edu) or Dr. Martin Frick at (406) 994-5773 or email: [mfrick@montana.edu](mailto:mfrick@montana.edu). If you have questions or concerns about your rights as a human subject involved in this research, you may contact Dr. Mark Quinn, Institutional Review Board Chairperson, at (406) 994-4707, or email: [mquinn@montana.edu](mailto:mquinn@montana.edu).

Your completion and submission of the survey to the researchers represents your consent to serve as a subject in this research. It is also understood that you may later refuse to participate, and that you may withdraw from the study at anytime. Thank you in advance for your willingness to participate!



JoLynn Miller



Dr. Martin Frick

\* Webster's Online Dictionary (2009) defines the Food and Fiber System as the sector of the U.S. economy that includes agricultural production and all economic activities supporting or utilizing that production, including farm machinery and chemical production, and processing, manufacturing, transportation, and retailing.

## Section I

Directions: Please read each statement carefully. Circle T if you think the statement is TRUE, F if you think the statement is FALSE, and DK if you DON'T KNOW. Please respond to ALL statements.

Example: Plants need water to grow.

T F DK

If you know this statement is TRUE, circle T. If you know this statement is FALSE, circle F. If you are unsure if the statement is true or false, circle DK for DON'T KNOW.

- |  |   |   |    |
|--|---|---|----|
| 1. There are more new farmers in the U.S. than there were 10 years ago.        | T | F | DK |
| 2. Less than 2 percent of the U.S. gross national product is from agriculture. | T | F | DK |
| 3. Soil erosion does <u>not</u> pollute U.S. lakes and rivers.                 | T | F | DK |
| 4. The use of pesticides has increased the yield of crops.                     | T | F | DK |
| 5. Animal health and nutrition are important to farmers.                       | T | F | DK |
| 6. Food safety is a major concern of the food processing industry.             | T | F | DK |
| 7. Processing increases the cost of food products.                             | T | F | DK |
| 8. U.S. research has improved farming methods in other countries.              | T | F | DK |
| 9. One of every five jobs in the U.S. is related to agriculture.               | T | F | DK |
| 10. Many farmers use tillage practices that conserve the soil.                 | T | F | DK |
| 11. Plant products are the main source of human foods.                         | T | F | DK |
| 12. Animals can be a valuable source of medical products.                      | T | F | DK |
| 13. Homogenization uses heat to kill bacteria in milk.                         | T | F | DK |
| 14. The U.S. does not sell its feed grains on the world market.                | T | F | DK |
| 15. Thousands of people in the world die of starvation each year.              | T | F | DK |
| 16. Local laws and regulations have little effect on farmers.                  | T | F | DK |
| 17. Farming and wildlife cannot survive in the same geographical area.         | T | F | DK |
| 18. Biotechnology has increased the pest resistance of plants.                 | T | F | DK |
| 19. Animals eat foodstuffs that cannot be digested by humans.                  | T | F | DK |
| 20. New products have been developed using surplus grains.                     | T | F | DK |
| 21. Grain exports are usually transported between continents by airplane.      | T | F | DK |
| 22. The average U.S. farm size is larger than 500 acres.                       | T | F | DK |
| 23. U.S. agricultural policies influence food prices in other countries.       | T | F | DK |
| 24. Animal wastes are used to increase soil fertility.                         | T | F | DK |
| 25. Profits increase as farmers strive for the maximum crop yields.            | T | F | DK |
| 26. Biotechnology has increased animal production in the U.S.                  | T | F | DK |
| 27. Pasteurization uses heat to kill bacteria in milk.                         | T | F | DK |

- |  |   |   |    |
|--|---|---|----|
| 28. An efficient food distribution system is essential to the agricultural industry. | T | F | DK |
| 29. Several countries depend on U.S. agricultural exports for food and fiber.        | T | F | DK |
| 30. Government subsidy payments to farmers are used to stabilize food prices.        | T | F | DK |
| 31. Water, soil, and minerals are important in agriculture.                          | T | F | DK |
| 32. Very little of the grain produced in the U.S. is exported.                       | T | F | DK |
| 33. Hamburger is made from the meat of pigs.   | T | F | DK |
| 34. Using grain alcohol for fuel reduces the U.S. dependence on foreign oil.         | T | F | DK |
| 35. Transportation and storage affects the supply of agricultural products.          | T | F | DK |

□

## Section II

Directions: Please read each statement carefully. Then circle the letter that best corresponds with your thoughts. Please respond to ALL statements.

S=Strongly Agree  
 A=Agree  
 N=Neutral  
 D=Disagree  
 SD= Strongly Disagree

Example: All Farmers live beyond their means. S A N D SD

If you agree with this statement, circle the letter "A".

## Statements

- |  |   |   |   |   |    |
|--|---|---|---|---|----|
| 36. U.S. citizens spend a higher percent of their income on food than people in other countries. | S | A | N | D | SD |
| 37. Agriculture employs a large number of people in this country.                                | S | A | N | D | SD |
| 38. Pesticides can be used safely when producing food.   | S | A | N | D | SD |
| 39. Organic production methods are a realistic alternative to using pesticides.                  | S | A | N | D | SD |
| 40. Confinement is an acceptable practice when raising livestock.                                | S | A | N | D | SD |
| 41. Consumers prefer processed foods to raw products.  | S | A | N | D | SD |
| 42. Developing countries need help to be able to store food safely.                              | S | A | N | D | SD |
| 43. People are moving away from rural areas due to changes in agriculture.                       | S | A | N | D | SD |
| 44. Farmers earn too much money.   | S | A | N | D | SD |
| 45. Not all land is suitable for farming.  | S | A | N | D | SD |
| 46. Biotechnology has increased the yield of crops in developing countries.                      | S | A | N | D | SD |
| 47. Farmers take good care of their animals.   | S | A | N | D | SD |
| 48. Processing adds value to farm products.  | S | A | N | D | SD |
| 49. Farmers should develop new and innovative marketing strategies.                              | S | A | N | D | SD |

|  |   |   |   |   |    |
|--|---|---|---|---|----|
| 50. A strong agricultural industry is more important than military power.        | S | A | N | D | SD |
| 51. Agricultural exports help to reduce the U.S. trade deficit.                  | S | A | N | D | SD |
| 52. Agricultural practices are harmful to the environment.                       | S | A | N | D | SD |
| 53. Raising hybrid plants results in higher yields.                              | S | A | N | D | SD |
| 54. Farmers are concerned about the humane treatment of animals.                 | S | A | N | D | SD |
| 55. Processing food products is a benefit to consumers.                          | S | A | N | D | SD |
| 56. The U.S. should allow free trade with other countries for food products.     | S | A | N | D | SD |
| 57. The world food supply has increased as a result of improved food technology. | S | A | N | D | SD |
| 58. The U.S. needs a steady supply of food and fiber goods to remain strong.     | S | A | N | D | SD |
| 59. Only organic methods should be used to produce food.                         | S | A | N | D | SD |
| 60. Farmers should not use chemicals in crop production.                         | S | A | N | D | SD |
| 61. Animals have the same rights as people.                                      | S | A | N | D | SD |
| 62. Processing adds greater cost to the food compared to the raw product.        | S | A | N | D | SD |
| 63. Farmers have no control over food prices.                                    | S | A | N | D | SD |
| 64. Developing countries have no control over food prices.                       | S | A | N | D | SD |
| 65. The government should exert more control over farming.                       | S | A | N | D | SD |
| 66. Agriculture is the greatest polluter of our water supplies.                  | S | A | N | D | SD |
| 67. Agriculture has become too mechanized.                                       | S | A | N | D | SD |
| 68. Animals should not be used for food.   | S | A | N | D | SD |
| 69. Farm grains are becoming an important energy source in the U.S.              | S | A | N | D | SD |
| 70. Developing countries need help in distributing food among needy people.      | S | A | N | D | SD |

□

## Section III

Directions: Please read each statement or question carefully and circle the most accurate response.

Example: Which state do you live in?

- a. Wyoming
- b. Idaho
- c. Montana

If you live in **Montana**, circle the letter "C".

71. Select the range that best represents your age group.
- a. 19-30 years
  - b. 31-40 years
  - c. 41-50 years
  - d. 51-60
  - e. Over 60 years

72. What is your gender?
- Male
  - Female
73. Select the range that best represents your annual household income.
- Less than \$20,000
  - \$20,000-\$30,000
  - \$31,000-\$40,000
  - \$41,000-\$50,000
  - \$51,000-\$60,000
  - More than \$60,000
74. How many years have you been a member of Bozeman's Community Food Co-op?
- 0-2 years
  - 3-5 years
  - 6-10 years
  - 11-15 years
  - Over 15 years
75. How often do you shop at the Community Food Co-op? Choose the answer that best describes your shopping frequency.
- Once a week
  - More than once a week
  - Once a month
  - Twice a month
  - Once every two months
76. How much money do you typically spend per shopping visit to Bozeman's Community Food Co-op?
- \$1-\$25
  - \$26-\$50
  - \$51-\$100
  - \$101-\$200
  - More than \$200
77. How many people in your household do you shop for, including yourself?
- 1
  - 2
  - 3
  - 4
  - 5
  - More than 5

78. How far do you travel from home to shop at Bozeman's Community Food Co-op?
- Less than 5 miles
  - 6 -10 miles
  - 11-20 miles
  - More than 20 miles
79. Besides the Community Food Co-op, what other food stores do you most often frequent? Please circle all that apply.
- Safeway
  - Vans IGA
  - Heeb's East Main Grocery
  - Rosauers
  - Smith's
  - Albertson's
  - Walmart
  - Town and Country
  - Costco
  - Farmers' Markets
  - Other (please specify) \_\_\_\_\_
80. Which of the following items constitute most of your purchases at Bozeman's Community Food Co-op? Please circle all that apply.
- Deli/To-Go foods
  - Meat and Seafood
  - Produce
  - Bulk items
  - Beer and Wine
  - Milk and Eggs (other chilled items)
  - Packaged foods (including frozen)
  - Wellness (i.e., supplements, shampoo, soap)
81. What of the following factors most closely represents the reason why you shop at the Community Food Co-op?
- Being a part of a cooperative
  - Buying local
  - Organic products
  - Knowledgeable staff
  - Proximity to home/work
  - Other (please specify) \_\_\_\_\_
82. Where did you grow up?
- On a farm or ranch
  - In a town or city
  - In a suburb
  - In a rural area

83. How long have you lived in Montana (in years)? \_\_\_\_\_
84. Have you ever taken an adult education class (formal or non-formal) related to agriculture?
- Yes
  - No
85. Do you have relatives who live or work on a farm?
- Yes
  - No
86. Do you have relatives who work in an agricultural business?
- Yes
  - No
87. Did you take agricultural courses in high school?
- Yes
  - No
88. Were you a member of 4-H?
- Yes
  - No
89. Were you a member of FFA?
- Yes
  - No
90. Which of the following groups do you think most often educates Montanans about the Food and Fiber System and the environment? Please circle all that apply.
- Cooperative Extension Service
  - College of Agriculture at MSU
  - Montana Department of Agriculture
  - Agriculture in Montana Schools
  - Secondary Agricultural Education Programs
  - Farm and Ranch interest groups (i.e., Farm Bureau, Commodity Groups)
  - Other governmental agencies (i.e., USDA)
  - Science education in schools
  - Local non-profit organizations
  - Other (please specify) \_\_\_\_\_
91. Through which of the following media do you most often access Food and Fiber System news?
- News magazines
  - Newspapers
  - Television
  - Radio
  - Internet

92. Which internet site do you rely on most often for Food and Fiber System news?
- Yahoo, Google, MSN (search engines)
  - Yahoo, Google, MSN (news services)
  - Facebook
  - Twitter
  - CNN
  - USDA
  - Bozeman's Community Food Co-op's homepage ([www.bozo.coop](http://www.bozo.coop))
  - Cooperative Extension Service ([www.extension.montana.edu](http://www.extension.montana.edu))
  - Other (please specify) \_\_\_\_\_
93. Please rank (1 through 7) the following issues according to which you think is the most critical to address. 1=most critical to address and 7=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
  - \_\_\_\_\_ Biotechnology
  - \_\_\_\_\_ Other (please specify) \_\_\_\_\_
94. Please rank (1 through 7) the following subject areas according to which you would like to learn more about. 1= most interested and 7=least interested
- \_\_\_\_\_ Agriculture's important relationship with the environment and natural resources
  - \_\_\_\_\_ Public policy in agriculture
  - \_\_\_\_\_ Plant science (science of crop, vegetable, fruit, and ornamental plant production)
  - \_\_\_\_\_ Animal science (science of livestock and poultry production for meat, dairy, and egg products)
  - \_\_\_\_\_ Societal and global significance of agriculture
  - \_\_\_\_\_ Processing of agricultural products (creation of an edible/useable products from harvest to sale)
  - \_\_\_\_\_ The marketing and distributing of agricultural products

Thank you for your participation!

Remember to drop the completed survey off at the Customer Service Desk  
at the Community Food Co-op during regular business hours  
or place it back in the pre-paid return envelope for  
your chance to win one of three \$100 gift cards for use at  
Bozeman's Community Food Co-op!!!

APPENDIX C

REMINDER POST-CARD



<<First Name>> <<Last Name>>

<<Address>>

<<City>>, <<State>>

<<Zip Code>>



## A message from the Co-op

DEAR <<First Name>> <<Last Name>>,

In a joint effort, Bozeman's Community Food Co-op and JoLynn Miller, a graduate student at Montana State University in the Division of Agricultural Education, asked you to participate in a research study designed to assess your knowledge and perceptions of the Food and Fiber system. Two weeks ago you were sent a survey in the mail. You can either return the survey with the pre-addressed stamped envelope or to the Customer Service desk at the Community Food Co-op during regular business hours. If you do so before SEPTEMBER 17th, you will be entered into a raffle to win one of three \$100 gift cards for use at the Community Food Co-op. Thanks for your time and commitment to this important issue!

406-587-1919 ext. 38, Main Office

APPENDIX D

CORRECT ANSWERS FOR THE KNOWLEDGE  
SECTION OF THE SURVEY

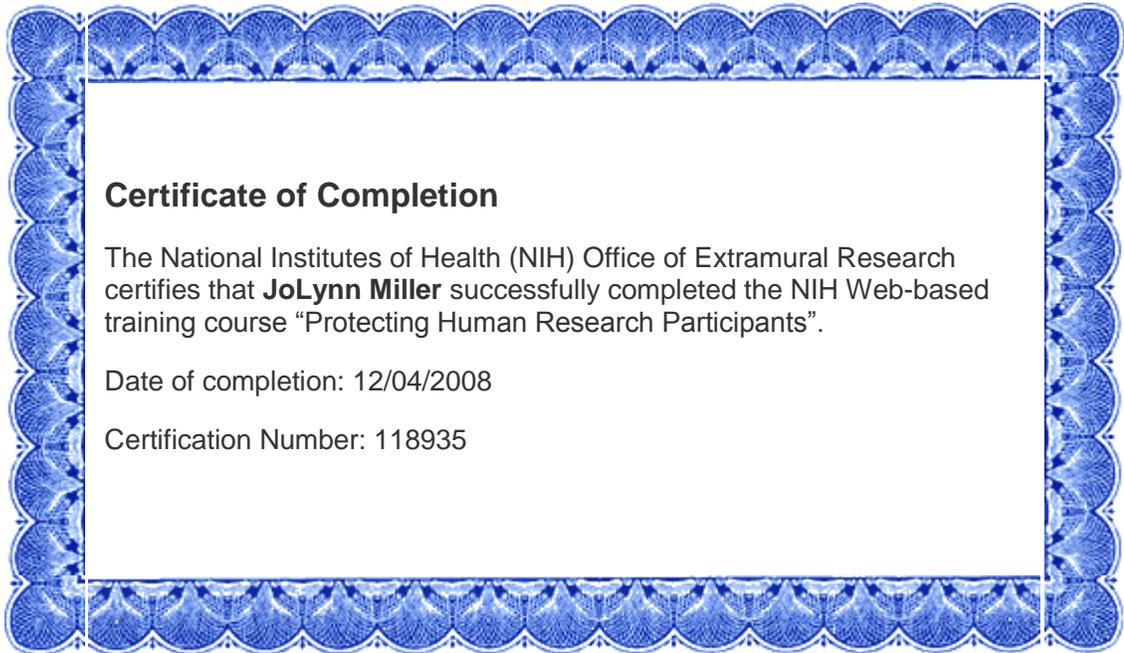
## Correct Answers for the Knowledge Section of the Survey

1. There are more new farmers in the U.S. than there were 10 years ago. (False)
2. Less than 2 percent of the U.S. gross national product is from agriculture. (True)
3. Soil erosion does not pollute U.S. lakes and rivers. (False)
4. The use of pesticides has increase the yield of crops. (True)
5. Animal health and nutrition are important to farmers. (True)
6. Food safety is a major concern of the food processing industry. (True)
7. Processing increases the cost of food products. (True)
8. U.S. research as improved farming methods in other countries. (True)
9. One of every five jobs in the U.S. is related to agriculture. (False)
10. Many farmers use tillage practices that conserve the soil. (True)
11. Plant products are the main source of human foods. (True)
12. Animals can be a valuable source of medical products. (True)
13. Homogenization uses heat to kill bacteria in milk. (False)
14. The U.S. does not sell its feed grains on the world market. (False)
15. Thousands of people die of starvation each year. (True)
16. Local laws and regulations have little effect on farmers. (False)
17. Farming and wildlife cannot survive in the same geographical area. (False)
18. Biotechnology has increased the pest resistance of plants. (True)
19. Animals eat foodstuffs that cannot be digested by humans. (True)
20. New products have been developed using surplus grains. (True)
21. Grain exports are usually transported between countries by airplane. (False)

22. The average U.S. farm size is larger than 500 acres. (False)
23. U.S. agricultural policies influence food prices in other countries. (True)
24. Animal wastes are used to increase soil fertility. (True)
25. Profits increase as farmers strive for maximum crop yields. (False)
26. Biotechnology has increased animal production in the U.S. (True)
27. Pasteurization uses heat to kill bacteria in milk. (True)
28. An efficient food distribution system is essential to the agricultural industry. (True)
29. Several countries depend on U.S. agricultural exports for food and fiber. (True)
30. Government subsidy payments to farmers are used to stabilize food prices. (True)
31. Water, soil, and minerals are important in agriculture. (True)
32. Very little of the grain produced in the U.S. is exported. (False)
33. Hamburger is made from the meat of pigs. (False)
34. Using grain alcohol for fuel reduces the U.S. dependence of foreign oil. (True)
35. Transportation and storage affects the supply of agricultural products. (True)

APPENDIX E

IRB TRAINING CERTIFICATE



**Certificate of Completion**

The National Institutes of Health (NIH) Office of Extramural Research certifies that **JoLynn Miller** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 12/04/2008

Certification Number: 118935