8-2007

The Effectiveness of a Dynamic Interdisciplinary Food Safety Curriculum Targeted on Middle School Students in Scott County

Sarah M. Johnson
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Sarah M. Johnson entitled "The Effectiveness of a Dynamic Interdisciplinary Food Safety Curriculum Targeted on Middle School Students in Scott County." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agriculture and Extension Education.

Carrie Ann Fritz, Major Professor

We have read this thesis and recommend its acceptance:

Randol G. Waters, Janie Burney

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by Sarah M. Johnson entitled "The Effectiveness of a Dynamic Interdisciplinary Food Safety Curriculum Targeted on Middle School Students in Scott County." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural and Extension Education.

Dr. Carrie Ann Fritz, Major Professor

We have read this thesis
and recommend its acceptance:

Dr. Randol G. Waters
Dr. Janie Burney

Accepted for the Council:

Carolyn R. Hodges, Vice Provost and
Dean of the Graduate School

(Original signatures are on file with official student records.)

The Effectiveness of a Dynamic Interdisciplinary Food Safety Curriculum Targeted on Middle School Students in Scott County

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Sarah M. Johnson
August 2007

Dedication

This thesis is dedicated to my parents, Karen and Allen Johnson, to my sisters Stephanie, Sara and Heather, and all those who have guided me along my path for always encouraging and pushing me forward to achieve my goals in this life.

Acknowledgements

I would like to express my sincere appreciation to those who have helped me in achieving completion of my graduate study. I would especially like to thank my Graduate Advisor, Dr. Randol Waters. Dr. Waters helped me stay on track, had countless meetings to keep my feet moving forward and shared his wise words of encouragement with me. I would like to thank my Thesis Advisor, Dr. Carrie Ann Fritz, for taking time from her other engagements to help my thesis writing and providing much needed counsel on looking ahead to what lies next. And to Dr. Janie Burney who served on my thesis committee, I thank her for helping in the process of data collection, countless revisions, and always making time to lend a helping hand, Without these people my thesis work would not have been as enjoyable and rewarding, I give you thanks as you went through my endeavors by my side.

In addition, I would like to thank Jennifer Richards, Ashley Pedigo, and those on the Food Safety Project for their aid in data analysis and other support. My thesis project was a lot more successful with their support and helping hands through a number of meetings, emails and phone calls.

I would also like to thank my parents, Al and Karen Johnson, and countless friends for their unending love and support as I spent a few years on completion of my graduate study. Their support and encouragement has meant a lot to me and for them I am very grateful.

Brief Abstract

The focus of this study was to provide a comparison of data collected from seventh grade students on food safety knowledge who have been through USDA's National Integrated Food Safety Initiative program with those seventh grade students who have had no formal school instruction on this topic. Middle school students were specifically targeted because they are more likely to synthesize this information in a way that will lead to the development of new behaviors.

The population consisted of seventh grade students at Burchfield, Fairview, Huntsville and Oneida Middle Schools. Burchfield and Huntsville were the two schools used as the comparison group.

The following conclusions were based on findings of this study:

1. There were some substantive increases in post-test scores for the treatment group.
2. The treatment group increased in all areas from pre-test to post-test. The areas included: Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge.
3. The data suggests this interdisciplinary food safety curriculum has made a positive impact on the treatment group. The scores after the program record higher overall than the comparison group scores.
4. The data showed that the treatment group had retained the knowledge, skills and behaviors six weeks after the treatment was administered.

5. Data revealed that the overall mean score for the treatment group pre-test was higher (+7.24) than the post-test score of the comparison group.
6. There was some evidence to suggest that the treatment group had more knowledge than the comparison group before the treatment, except in science, however the gain score afterwards shows the program successful.
7. A comparison of the treatment group and comparison group, revealed an overall increase in the mean score increase of 10.04 points for the treatment group, as an impact of this interdisciplinary food safety program.
8. After going through a one week food safety program, the student's knowledge, skills and behaviors increased, thus strengthening the evidence that the program had a positive impact on the students.

Table of Contents

1 Introduction:

1.1 Need:

"Foodborne illness affects millions of children each year, but is almost 100 percent preventable" (Centers for Disease Control, as cited in Hammerschmidt, P., Andrews, S., Murphy, A., Youatt, J., & Sawyer, C., 1995). Annually in the United States, Centers for Disease Control and Prevention (CDC) estimated there were 76 million cases of foodborne illnesses, which causes 325,000 hospitalizations and 5,000 deaths, at a cost of $19 to $37 billion each year (Mead, PS., Slutsker, L., Kietz, V., McCaig, LF., Bresee, JS., Shapiro, C., Griffin, PM., & Tauxe, RV., 1999). Food safety is not taught in our public schools because of the priority given to state curriculum standards for core academic areas and due to high stakes accountability testing, there is little time to cover subjects not in the core areas.

Our youth need to be educated on how serious foodborne illnesses are, how they can be prevented and need to be taught food safety; by educators they see everyday in school. "Hygiene habits are formed at an early age, affecting food-handling practices for a lifetime" (Herringshaw & Largo as cited in Guion, L., Simonne, A., & Easton, J., 2004). Youth are in the category labeled "high risk," by the CDC because they are more likely to acquire foodborne illness and suffer more serious complications than adults (Food Safety Education Conference, 2006). The key to reducing foodborne illness is to

educate children, especially the young, who are the food preparers of the future (Haapala, I. & Probart, C., 2004, p.71). To address this need, a National Integrated Food Safety Initiative (NIFSI) Grant was awarded to Tennessee. The Food Safety in the Classroom curriculum was developed and implemented in two of the six schools in Scott County, Tennessee: Fairview and Oneida Middle Schools. This curriculum integrated food safety concepts into state standards for core subjects to ensure they are taught in school classrooms.

The intent of this research was to show the effects of incorporating food safety education into the existing 7th grade Tennessee curricula. The curriculum in this study was designed to integrate food safety into the already established state curriculum standards to enhance student knowledge, skills and behaviors related to food safety. To ensure effectiveness, research needed to be conducted to determine students' retention of the food safety topics taught.

1.2 Purpose:

The overall purpose of this study was to assess the effectiveness of the Food Safety in the Classroom Curriculum with regard to its ability to increase 7th grade students' knowledge in science, language arts, math and social studies core courses, as well as their knowledge of proper food handling skills and behaviors. To facilitate the purpose, the following objectives were developed:

1. Describe the differences in pre-test and post-test scores on all six dependent variables studied for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).
2. Describe the difference in post-test scores for the treatment and comparison groups on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).
3. Describe the difference in post-test scores and follow-up test scores on all six dependent variables for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).
4. Describe the difference in pre-test scores for the treatment group and post-test scores for the comparison group on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).

1.3 Scope/ Limitations:

This study was limited to 7th grade middle school students in Scott County, Tennessee. Since the middle schools studied consisted of 99 percent Caucasian children, they did not represent the general population. This study does not address whether race, gender, ethnicity or income impacted student performance or perceptions but only seeks to answer student knowledge, skills and behaviors related to food safety.

Some disadvantages related to using the survey method in this study are considered limiting factors. The survey lacked flexibility, which can lead to questions unanswered, and to a lower response rate than face-to-face interviews. In addition, it does not provide a record of spontaneous reaction.

Some disadvantages related to internal validity include, threat of history and interaction of testing. A threat of history can be explained by specific events occurring between the first and second measurements of the groups in addition to the experimental variable. Threat of history is a factor since there was a three month period between post-test collections among two of the four schools studied. But, food safety topics are not included in the schools curriculum and there were no special guest speakers that came to visit any of the schools being studied during that three month period, so this should not be a major threat in the study.

Another possible threat to internal validity is interaction of testing. The study used a pre-test post-test design, which allowed students to remember questions and answers and score well on the post-test. However, students were not told answers after either testing, creating a less likely chance of threat to testing.

The schools selected for this research study were from different areas of the county and their student populations varied in size. However, the schools all had identical state standards, textbooks, block scheduling and core subject's curriculum.

2 Review of Literature:

2.1 Introduction:

Annually in the United States, Centers for Disease Control and Prevention (CDC) estimated that there are 76 million cases of foodborne illnesses, which causes 325,000 hospitalizations and 5,000 deaths, at a cost of $19 to $37 billion each year (Mead, PS., et al., 1999). "Hygiene habits are formed at an early age, affecting food-handling practices for a lifetime" (Herringshaw & Largo as cited in Guion, L., Simonne, A., & Easton, J., 2004). Currently, media, magazines, internet, friends and family are sources from which our youth learn about food safety. This review of literature examined the history of food safety, recently reported foodborne outbreaks, school absenteeism, trends in food handling practices, professional education related to educating our youth and an overview of the Food Safety in the Classroom curriculum.

2.2 History of Food Safety:

More than 100 years ago, consumers relied on the expertise of the corner butcher for the quality and safety of the meat and poultry they served their families (Eamich, 2006, p.13). The regulatory system for ensuring food safety and quality in the United States consists of local, state, federal, and international agencies. The federal system alone consists of various laws and involves 12 different agencies, including the newly formed Office of Homeland Security ("Food Safety & Technology," 2004). The system of government agencies forms one of the most thorough and effective food safety

systems in the world. Collectively they perform four chief functions: establishment of safety standards, monitoring and inspection, enforcement and tracking food safety problems. The Federal agencies included are: 1) Department of Health and Human Services (which includes the Food and Drug Administration that handles all food safety in produce, seafood, packaged and processed food, pesticides, seafood and animal health products); 2) Centers for Disease Control and Prevention; 3) National Institutes of Health; 4) United States Department of Agriculture (which includes the Food Safety and Inspection Service that handles all food safety in meat, poultry and eggs and the Food Safety Inspection Service National Residue Program); 5) Environmental Protection Agency; 6) Department of Commerce; 7) Federal Trade Commission; and 8) Office of Homeland Security ("Food Safety & Technology," 2004).

Some major agricultural states have their own comprehensive inspection systems with strict safety standards, one state in particular, California, sells half of the United States produce and spends more than $40 million annually to regulate and monitor pesticide use ("Food Safety & Technology," 2004, p.5). Therefore, consumers rely on the dedication and expertise of more than 7,600 Food Safety and Inspection Service program personnel (Eamich, 2006, p.13). To ensure food quality the Meat Inspection Act of 1906, later known as the Federal Meat Inspection Act, laid the foundation for the food safety system which today collects and analyzes more than 80,000 samples for *E.coli* O157:H7, *Listeria monocytogenes* and *Salmonella* annually (Eamich, 2006, p.13). Also important are the 1957 Poultry Products Inspection Act; Humane Slaughter Act of 1958;

Egg Products Inspection Act of 1970; and the Humane Methods of Slaughter Act of 1978, which added new oversight responsibilities to FSIS inspection program personnel.

After the 9/11 terrorist attacks on the United States, FSIS deployed a specialized inspection force under the Office of International Affairs (OIA). In 2003, FSIS trained 20 import surveillance liaison officers (ISLO's) and assigned them to port cities across the United States to better ensure the safety and security of imported meat and poultry products (Eamich, 2006, p.14). These ISLO's and import inspectors are responsible for 4.3 billion pounds of meat and poultry products and 8.4 billion pounds of egg products presented for reinspection daily (Eamich, 2006, p.14). Mark Stanley, Director of Import Inspection stated, "We saw the creation of ISLO's as an opportunity to bridge the gap between products arriving at points of entry and when new products are presented for reinspection (Eamich, 2006, p.14)." But the overall challenging goal of the FSIS remains the same through the years, to anticipate and quickly respond to food safety and food defense challenges before they affect public health (Masters, 2006, p.5).

In the 1990's the Hazard Analysis and Critical Control Point, or HACCP, inspection system was developed to focus on using a preventive and scientific approach to counteract the unseen world of deadly bacteria such as *E.coli* O157:H7, *Listeria monocytogenes* and *Salmonella* (Payne, 2006, p.16). According to the data from the Centers for Disease Control and Prevention, the number of reported cases of foodborne illnesses from *E. coli* O157:H7 was down 29 percent in 2005, in comparison to 1996, and for *Listeria monocytogenes*, there was a 32 percent decrease over the same period (Payne,

2006, p.17). Dr. Richard A. Raymond, Under Secretary for Food Safety, a physician and longtime public health official stated that, "The future demands that we be able to focus more on things that the human eye cannot see, things the nose cannot smell and things the fingers cannot feel" (Payne, 2006, p.16).

In 1985, the United States Department of Agriculture (USDA) Meat and Poultry hotline started offering a toll-free service for answering consumer questions associated to meat, poultry and egg products. The Hotline has received and responded to more than two million calls over the past 21 years (Eamich, 2006, p.15). Food Safety Specialists answer these calls and provide bilingual specialists for non-English speaking consumers (Eamich, 2006). In 2004, to reach an increasing Internet-savvy audience, FSIS launched "Ask Karen." This is an interactive virtual representative, "Karen," and is available 24 hours a day, 7 days a week to respond to personalized food safety questions from consumers worldwide. This "Ask Karen" database holds more than 9,300 food safety questions and their respective answers, which comes from more than 20 years of research and experience (Williamson, 2006, p. 22).

Also, health educators periodically meet, learn and discover more on food safety education at the annual Food Safety Education Conference. In September 2006 more than 600 food safety educators, public health officials and medical professionals from eight countries, 48 states and three United States territories gathered in Denver, Colorado for the Food Safety Education Conference ("National Food Safety Educator's Network," 2006). The conference objectives were: to provide current surveillance and

epidemiological data on foodborne illness; to develop strategies to enhance food safety knowledge, skills, and abilities in general and at-risk populations; to increase attitudinal and behavioral modification in general and at-risk populations; and to demonstrate the latest science-based safe food handling principles and practices ("Food Safety Education Conference, Registration Information," 2006, p. 2). Attendees tackled the question of how to improve food safety practices among those who are "at-risk" for foodborne illness and other important food safety issues. Nearly one in five Americans fall into the "at-risk" demographic ("Food Safety Education Conference, Registration Information," 2006).

2.3 Education:

Several agricultural agencies are involved in food safety education on the state level. They include boards of health, departments of human or social services, state universities, and environmental and sanitation agencies ("Food Safety & Technology," 2004, p.5). On average, state departments of agriculture spend $3.5 million each year on food safety programs, or 22 percent of their budgets ("Food Safety & Technology," 2004, p.5). The Food Safety Inspection Service has developed an extensive network of accessible consumer education and outreach programs that provide key food safety information that is always readily available. Karlease Kelly, Director of Center for Learning stated, "Thanks to Web-based training programs such as *AgLearn*, they now have training programs available before the ink dries on new polices (Eamich, 2006,

p.15). So now even our educators have updated access to the latest food safety information.

Consumers have a vital role in ensuring their own food safety. Once food is purchased from the supermarket, handling, storage, and cooking practices can have a huge impact on ones own health. Consumers have to be responsible for their own food safety and make educated choices about their preparation and eating habits. Government officials and health experts consistently rate foodborne illness as the greatest food safety threat ("Food Safety & Technology," 2004, p.6). Cases of foodborne illness are likely to be underreported because many people assume they have the flu and do not visit a physician. The Centers for Disease Control (CDC), the federal agency that collects and distributes information on foodborne illnesses, estimated that 5,000 Americans die each year from foodborne illnesses, 76 million people get sick and more than 300,000 are hospitalized (Mead, PS. et al., 1999). Five basic groups of foodborne illness agents or contaminants are: bacteria, viruses, parasites, food toxins, and unknown sources. The main types of bacteria that are responsible for most reported cases of foodborne illness include: *Botulinum, Clostridium perfingens, E. coli, Listeria monocytogenes, Salmonella species,* and *Staphylococcus* ("Food Safety & Technology," 2004, p.8). Public health experts believe unsanitary food preparation practices are key contributors to outbreaks. Errors made in shopping, transporting, storing, preparing, or serving food can permit bacteria to survive and grow. Consumer interest in food safety in the United States and worldwide is greater than ever and is covered regularly by the news media ("Food Safety & Technology," 2004, p.9).

Hammerschmidt, Andrews, Murphy, Youatt and Sawyer's (1995) research found that foodborne illness affects millions of children each year, but is almost 100 percent preventable. To assist with the foodborne illness prevention plan, an inter-department research and outreach team at Michigan State University developed a program called Operation RISK (Hammerschmidt et al., 1995). This food safety education program supplies leaders with background information for themselves and activities for use with youth ages 9 to 11 years. Following the program implementation surveys were given to assess knowledge about safe food handling practices. These surveys were distributed to two 4-H clubs and administered before and after completion of the program to determine the effectiveness of Operation RISK. The results of knowledge indicated a need for improvement in food handling information of members. The pretest results showed that members were not knowledgeable about how or why to wash hands, why cold foods needed to be kept cold, how foods packed in a lunch could be kept cold, or how to identify unsafe foods. Self-reported practices of members prior to receiving safe handling instruction indicated that only about one-third washed their hands "every time" before packing a lunch; 41 percent washed them each time before eating at school. Reported from the pre-test data, 97 percent ate unwashed fruit, 40 percent do not throw away unsafe food, and 32 percent ate leftover foods from an unrefrigerated lunch. Some positive change resulted in these food handling practices, decreasing the gap between what students should do and were doing. For example, more students reported they never taste food that might be unsafe, never consume leftover meat, eggs, or dairy foods from an unrefrigerated lunch, or throw away unsafe food. In conclusion, 4-H members were not knowledgeable about basic food handling principles (handwashing, how and why to

keep food safe, and how to evaluate the safety of food) before instruction, but significant improvement occurred after participating in Operation RISK (Hammerschmidt et al., 1995).

Many consumers receive information on foods and nutrition from the news media; therefore, journalists play an essential role in delivering food safety information to consumers. In December 1995, a multi-disciplinary team of Extension faculty from Arizona, Nevada, New Mexico, and Utah developed a food safety resource manual for news reporters. The purpose of this manual was to advance the capability of consumers to make informed, responsible decisions related to food safety and quality by helping enhance the media's understanding and reporting of these issues (Benedict, Baker, Brennand, Deer, Dodds, & Krysl, 1995, p.2). The manual included suggested readings, a dictionary of terms, a subject index and an area-specific resource directory for each participating state (Arizona, Nevada, New Mexico and Utah) listing names/phone numbers of Cooperative Extension faculty and other local agencies. The recipients in these states consisted of reporters and news directors working in print and broadcast media, serving urban and rural areas. The reporters were mailed a brief survey on the usefulness, readability, organization, and content of the manual. Sixty-four percent found the information useful and forty-five percent found the dictionary of terms useful. About half of the reporters used the manual after a three-month period and it was found that 100 percent deemed it important to know about food safety experts and the availability of food safety material.

A booklet titled, An Ounce of Prevention Keeps Germs Away, Seven Keys to a Safer Healthier Home was developed by the Centers for Disease Control to assist families with low-cost steps to help stop many infectious diseases before they happen. According to Centers for Disease Control and Prevention about 10 million United States adults ages 18-69 were unable to work during 2003 due to health problems and *Salmonella* infections were responsible for an estimated 1.4 million illnesses. Infectious diseases cost the United States $120 billion a year and more than 160,000 people in the United States die each year from infectious diseases (CDC-An Ounce of Prevention, 2006, p.7).

To help educate youth, about the importance of safe food handling the United States Department of Agriculture launched its Food Safety Mobile. The Food Safety Mobile was introduced in March 2003 by Agricultural Secretary Ann M. Veneman and Under Secretary for Food Safety Dr. Elsa A. Murano (The Food Safety Educator, 2003, p. 1). The USDA Food Safety Mobile travels throughout the continental United States showing up at state and county fairs, schools, libraries, grocery stores, cooperative extension offices and special events sponsored by the United States Department of Agriculture (The Food Safety Educator, 2003). Agriculture Secretary Veneman stated, "The tour and the Mobile will help educate millions of people about the risks associated with mishandling food and how they can reduce their risks of foodborne illness" (The Food Safety Educator, 2003, p.1). Secretary Murano emphasized, "Foodborne illness is preventable. We want to empower consumers through education, and the USDA Food

Safety Mobile will provide us with face-to-face access to millions of consumers" (The Food Safety Educator, 2003, p. 1).

2.4 Absenteeism:

Guinan, McGuckin & Ali's (2002) study sought to determine the effectiveness of a comprehensive handwashing program, entitled, "Buddies Handwashing Program." With more than 144 million missed school days per year due to sickness, it is easy to see how crucial it is to control absenteeism (Guinan, McGuckin & Ali, 2002). Absenteeism defined is the number of episodes of illness per child per month (Guinan et al., 2002, p.218). Proper hand hygiene is the most effective way to stop the spread of illness-causing germs (Guinan et al., 2002, p.217). When students and teachers are absent from school they have lost learning opportunities, school funding is reduced and increased costs for substitute teachers. Five independent elementary schools in Pennsylvania were enrolled in the study, with each school providing two test and two control classrooms of the same grade. The educational components included: 10-minute talk on the importance of handwashing, when to wash hands, and when to remind your buddy to wash his or her hands. Also, there was a video on micro-organisms and disease transmission. After the video, each student received a "Buddies Handwashing Pamphlet." Every test classroom was equipped with a dispenser of instant hand sanitizer. During the program, proper handwashing techniques with hand sanitizers were demonstrated, and each student was asked to wash his or her hands. Teachers were instructed to ask why their students were absent and it was important for the parent/guardian to tell the teacher if the absenteeism

was due to a personal situation. Absenteeism data were collected by the teachers for three months after launching of the program (Guinan et al., p.218). Absenteeism data has revealed the cost-savings linked with a reduction in absenteeism was $13,850 per quarter. The yearly projected savings would be $167 per student enrolled. This study has shown that a program of education and placement of a hand sanitizer in the classroom has the potential to save a school $24,300 per year (Guinan et al., 2002, p. 219).

Schools, like hospitals, have significant factors for the transmission of micro-organisms and cross-contamination, such as a close environment, non-living objects serving as vehicles of transmission, and often inadequate equipment for handwashing (Guinan et al., 2002). According to U.S. Center for Disease Control (as cited in Guinan et al., 2002) the number of lost school days annually among kindergarten through twelfth-grade students was reported to be 164 million days, with an average of 4.5 days a year per student. Guinan et al., 2002 affirmed that teaching children proper hand hygiene and providing hand sanitizers can be effective in decreasing absenteeism. However, to implement a program, administrative support must be acquired and funding for this program must be secured. In addition mandatory handwashing programs reduced acute gastrointestinal illnesses in elementary school-age children. Kimel's study (as cited in Guinan et al., 2002) found that classroom presentations and follow-up programs about handwashing resulted in a considerable reduction in absenteeism due to illness during the two months after the presentations. Hammond and colleagues (as cited in Guinan et al., 2002) reported similar results in a population of more than 6,000 elementary-age students

representing 18 public schools in four states. Handwashing helped to reduce colds at a child-care center when education on handwashing was required in the curriculum.

A study conducted by Thompson (2004), tested the effects of alcohol hand sanitizer on elementary school absences. In the winter of 2003, this project was initiated in five second grade classrooms and one first/second combination classroom, involving 138 children. Three classrooms served as the control group and three as the test group. The test classrooms received an age appropriate interactive learning session about the transfer of microorganisms as well as an explanation and demonstration of proper handwashing techniques and use of alcohol hand sanitizer. The teachers recorded the number of days absent per child due to illness, with illness defined as cold, flu, conjunctivitis, and gastrointestinal symptoms. The results concluded that the overall reduction in absenteeism due to illness was 28 percent for students who used the alcohol hand gel sanitizer, compared with the students in the control classrooms. The days absent per student were 3.20 in the control classrooms and 2.30 in the test classrooms. This study concluded that handwashing helped reduce illness of students, thus reducing days of absenteeism (Thompson, 2004, p. E127).

2.5 Reported Food Handling Practices:

According to Harringshaw & Largo (as cited in Guion, Simonne & Easton, 2004) hygiene habits are formed at an early age, affecting food-handling practices for a lifetime. In a study conducted by Endres, Welch & Perseli's (as cited in Guion et al., 2004), older

youth (teens) should be targeted for food safety education because more high school students are employed in restaurants than any other industry, yet they often receive little information about food safety or ways to prevent foodborne illnesses. Therefore, children and youth are at the appropriate teachable age for food safety education (Guion et al., 2004, p. 2).

One in four people in the United States contracts foodborne illness each year (Guion et al., 2004, p.1). Buzby, Roberts, Lin & MacDonald (as cited in Guion et al., 2004) reported high medical costs ($2.3 – $4.3 billion annually) associated treating these illnesses. When analyzing loss of productivity and wages, the cost is estimated to be $6.9 billion each year. Marriot (as cited in Guion et al., 2004) confirmed that when a case of foodborne illness resulting in death will cost approximately $42,300.

Endres, Welch & Perseli (as cited in Guion et al., 2004) determined to effectively educate young people, the delivery must be innovative and delivered in a manner that is quick and engaging. A study conducted by Guion et al. (2004) stated many Extension Food Safety Specialists and county Extension faculty across the nation seek to deliver food safety programs to 4-H and other youth, recognizing children and youth are among the most susceptible groups to foodborne illness. One-third of the respondents indicated their received information about food safety comes from their parents and friends (Guion et al., 2004). Surprisingly, nearly one-third of the respondents indicated they had not received any information or instruction on food safety. Most respondents reported wanting more information related to food safety. Overall, youth were interested in

learning more about food handling practices, attending a food safety program and attending a food safety field trip. In this study, numerous 4-Hers stated they preferred to learn about food safety on field trips or tours, in 4-H club settings and third preference being through the computer/CD format (Guion et al., 2004, p.6).

In Haapala & Probart's (2004) study, they explored the current level of food safety knowledge, perceptions, and safety of food-handling behaviors among middle school students. The design of this study was baseline food safety knowledge, perceptions, and food-handling behaviors assessed as a part of a five-week education intervention to incorporate computer-assisted food safety instruction into middle school family and consumer sciences curricula in the Spring of 2000. Haapala and Probart (2004) reported that of the foodborne illness outbreaks in the United States in which the site of mishandling has been reported, 79 percent implicated food from commercial or institutional establishments and 20 percent from homes. An estimated 25 percent of these may possibly have been avoided by safe food handling practices.

According to the Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food--- 10 States, United States conducted in 2005, foodborne illnesses are a substantial health burden in the United States (Vugia, 2006). The Foodborne Diseases Active Surveillance Network (FoodNet) of CDC's Emerging Infections Program collects data from 10 states regarding diseases caused by enteric pathogens transmitted commonly through food. FoodNet measures and monitors the occurrence of these infections by conducting active, population-based surveillance for

laboratory-confirmed illness. These 10 states include: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee. In 2005, a total of 16,614 laboratory-confirmed cases of infections in FoodNet surveillance areas were identified as follows; *Salmonella* (6,471 cases), *Campylobacter* (5,655), *Shigella* (2,078), *Cryptosporidium* (1,313), STEC O157 (473), *Yersinia* (159), STEC non-O157 (146), and *Listeria* (135), *Vibrio* (119), and *Cyclospora* (65) (Vugia, 2006, p.393). Of those incidences 59 percent were reported to have been associated with restaurants (Morbidity and Morality Weekly Report, 2006). The incidence of cases of bacterial infection and postdiarrheal hemolytic uremic syndrome (HUS) for Tennessee in 2005 are as follows: *Campylobacte*r= 6.98, *Listeria*= 0.19, *Salmonella*= 13.74, STEC O157= 0.78, HUS= 2.34. Tennessee ranks below average in all categories except *Salmonella*, which is the fourth highest of all ten states (Vugia, 2006, p.392-393).

The Journal of American Dietetic Association published a research article titled, A Camera's View of Consumer Food-Safety Behavior in 2004. In this study 92 consumers were recruited and videotaped in their home. The findings showed that overall, subjects did not follow the Fight BAC! recommendations for safe food handling, which states to always clean, separate, cook and chill food. It was reported that one-third of subjects did not attempt to clean surfaces during food preparation. Nearly all subjects cross-contaminated raw meat, poultry, seafood, eggs, and/or unwashed vegetables with ready-to-eat foods multiple times during food preparation. Unwashed hands were the most common cross-contamination cause. Countless subjects undercooked the meat and

poultry entrees. Very few subjects used a food thermometer (Hansen, Anderson & Shuster, 2004).

The Food and Drug Administration conducted a consumer poll in June 1998 on food safety issues ("Fightbac," 1998). They reported that 84 percent of the consumers said that washing hands and surfaces was the most important thing to do in the kitchen to keep food safe from germs. Only 28 percent named cooking foods adequately and a mere 11 percent of the people considered separating to avoid cross-contamination as important. Both men (74 percent) and women (87 percent) correctly washed their hands and surfaces. Only 22 percent of consumers regularly used a thermometer when cooking roasts, six percent when cooking chicken, and three percent when cooking hamburgers. Additionally, 47 percent of consumers said they owned a thermometer. When asked what the temperature of ground beef should be cooked to, only one-third answered correctly, the other two-thirds answered incorrectly saying 250 degrees F (34 percent), 125 degrees F (16 percent), and 90 degrees F (9 percent) ("Fightbac," 1998). Another study in the *Journal of Food Protection* by Redmond & Griffith (2003) suggested the procedures associated with food safety are inadequately performed and there is a great need to develop effective food safety education programs to target and help consumers improve their understanding and implementation of specific food safety practices (Redmond & Griffith, 2003).

A study by Hillers, Mederios & Kendall (2003) stated, to be effective in reducing the incidence of foodborne illness, consumers need information about behaviors that will

decrease exposure to foodborne pathogens. The experts ranked use of the thermometer to keep foods at a safe temperature and prevent illness caused by *Bacillus cereus, Clostridium perfringens, Staphylococcus aureus, Campylobacter jejuni, Salmonella species, Escherichia coli O157:H7, Toxoplasma gondii,* and *Yersinia enterocolitica* as the first needed behavior. The second important behavior was cross-contamination caused from improper handwashing and other methods of cross-contamination that result in sickness related to major foodborne pathogens (Hillers, Medeiros & Kendall, 2003). Research was conducted by Whaley, Tucker, Sharp & Knipe (2005) on preferred communication sources and food-related risks. Respondents ranked physicians and university scientists as the most trustworthy sources for information on food safety issues, while television and newspapers were the favored media channels (Whaley, Tucker & Knipe, 2005). This data should be used in creating and delivery food safety programs. This study shows that our education needs to be research based and also placed on television commercials to reach more audiences.

Fein, Lin, Jordan & Levy (1995) published research on Foodborne Illness: Perceptions, Experience, and Preventative Behaviors in the United States. In both surveys respondents were asked whether they or someone in their household had experienced, within a specified time frame, any kind of sickness that they considered to be caused by eating spoiled or unsafe food. The results shown that in both surveys, three times as many respondents in the youngest age group (18 to 39 years) experienced a perceived foodborne illness as those in the oldest age group (60 years and older). Restaurants were the most repeatedly mentioned place where the food thought to have

caused an illness was prepared. At home, the most frequently mentioned factors of foodborne illnesses were the use of leftovers and improper cooling, but inadequate reheating was seldom mentioned. The results of this study prove that people who think they have experienced a recent foodborne illness report more awareness and concern about food-safety issues. A recent foodborne illness episode is likely to sensitize a person to food safety issues and may provide opportunities for helpful education.

Eves, Bielby, Egan, Lumbers, Raats & Adam's (2006) study sought to show evaluations of food hygiene knowledge and self-reported behaviors of school children, assessment of children's attitudes towards food hygiene and evaluation of barriers to the adoption of appropriate food hygiene behaviors. The areas of weakness were related to cooking, understanding bacteria microorganisms and food poisoning. Data reported that temperature control was an area researched and 63 percent of the students identified cooking food properly to kill bacteria as important, but only 33 percent correctly identified the temperature for holding cooked food, and just 54 percent knew the correct temperature for a refrigerator. Another issue was cross-contamination, 59 percent knew raw meat should be stored below cooked meat but only 42 percent of the students knew that you cannot tell if food is contaminated with food poisoning bacteria, and their knowledge of micro-organisms was very limited. In Key Stage 3, (11-14 years), it was found that hand-washing was most commonly practiced when hands were thought to be dirty, rather than before or after certain activities. Researchers found that food hygiene does not appear in the curriculum for this age group, but within science. Teachers have indicated that the best approach to teach this subject is through hands-on activities (Eves

et al., 2006, p.717). It was previously found that health-related interventions involving the classroom, and also changes in the environment and family involvement, are likely to be more effective than classroom-based initiatives alone, as stated from a study conducted by Lister-Sharp, Chapman, Stewart-brown & Sowden (as cited in Eves et al., 2006). Food hygiene education needs to be fun and relate to real life, and provide opportunities to practice what is learned. For educators, especially classroom teachers, they will require adequate training and need to expand their activities into the students' homes (Eves, Bielby, Egan, Lumbers, Raats & Adams, 2006, p. 719).

2.6 Recorded Outbreaks:

According to the Webster's dictionary (Gove, 1986), an outbreak is a sudden or violent breaking out of activity. The epidemiologists define outbreaks in foodborne illness as two or more cases of illness. Recent outbreaks in foodborne illnesses have made consumers more interested and alarmed in food handling practices. Foodborne illnesses have occurred and occur everyday, but until people seek medical attention; many food-related illnesses go unnoticed and unrecorded. Barbara Masters, FSIS Administrator, stated the following:

> "Protecting the safety of our meat, poultry, and egg products supply is no small task. Approximately 7,600 full-time personnel cover nearly 6,000 slaughter and processing plants. We conduct antemortem and postmortem inspection procedures at 1,700 slaughter establishments to ensure public health requirements are met in processing 140 million head of livestock, 9.4 billion poultry carcasses and about

4.3 billion pounds of liquid egg products on an annual basis. We also have approximately 200 microbiologists, chemists and veterinary pathologist's staff, three laboratories and maintain the highest international standards of excellence" (Masters, 2006, p. 5).

According to a report published in USA Today (2006), there was a dominant health story in 2006. It was found that the foods that are supposed to keep us in peak health: spinach, carrots, lettuce and tomatoes- might instead kill us. Robert Tauxe, Chief of the Food-Borne Disease section of the Centers for Disease Control and Prevention in Atlanta stated that the interesting part was what didn't happen. Meat, poultry and eggs, which in the past have been the major cause of food-borne illnesses, have been cleaned up and are no longer the source of major problems (Weise, 2006, p.4D). The produce industry is now undergoing the similar consolidation, centralization and moving in the direction of factory farming which is what the meat industry did in the 1980's and 1990's (Weise, 2006). Today, a solo point of contamination can rapidly be spread across large volumes of produce. Data has shown that from June to December 2006 numerous outbreaks across the United States have occurred from *Salmonella, Botulinum* and *E.coli*. Reports of *Salmonella* from tomatoes in 19 states caused 106 people to be ill in June-August 2006 and, in September 2006, there were 183 cases of *Salmonella* reported from tomatoes that reached 21 states (Weise, 2006, p. 4D). In July 2006, salmonellosis was associated with frozen entrees that contain raw chicken, a total of 34 cases across the United States (Cohen, 2006). The Food Safety Inspection Service (FSIS) believes that in some cases, consumers may not have realized that the breading on these products have

been pre-browned meaning their frozen entrees contain raw chicken. FSIS stepped in and requires new labels for these products that clearly state that they contain raw chicken and must be fully cooked to a safe minimum internal temperature of 165 degrees F (Cohen, 2006). As these outbreaks occur it creates a greater awareness in the label regulations and requirements are modified according to how the average consumer uses the product, changes are made as foodborne outbreaks occur. Only one outbreak of botulism was reported in September 2006 with six cases which were traced back to the source: carrot juice (Weise, 2006).

E.coli cases were reported in June 2006, with 73 people affected, the source was iceberg lettuce served at Wendy's (Weise, 2006). Again in September 2006, a deadly strain found in fresh spinach from California killed three and caused sickness in more than 200 people in 25 states. Among the ill persons, 53 percent were hospitalized, 27 people developed a type of kidney failure called hemolytic-uremic syndrome (HUS). Of those who developed HUS, 31 percent were children less than 18 years old ("Outbreak From Fresh Spinach," 2006). In October 2006, 30 people in Canada became ill from a strain of *E.coli* in romaine lettuce that was discovered to be from California (Weise, 2006). In December 2006, 71 cases were reported in five states from contaminated lettuce served at Taco Bell and in the same month in Iowa and Minnesota, 80 people became ill from lettuce served at Taco John's restaurants (Weise, 2006).

Since these outbreaks, the Food and Drug Administration developed the Lettuce Safety Initiative, in August 2006, as a reaction to the recurring outbreaks of *E. coli*

O157:H7 connected with fresh and fresh-cut lettuce ("U.S. Food and Drug Administration," 2006). The Initiative is intended to diminish public health risks by focusing on the product, agents, and areas of concern about safety of lettuce to the industry. The Initiative supports the goals of the 2004 FDA Produce Safety Action Plan, which is intended to minimize the occurrence of foodborne illness associated with consumption of fresh produce ("U.S. Food and Drug Administration," 2006).

2.7 Food Safety in the Classroom Curriculum:

The Food Safety in the Classroom curriculum is an innovative curriculum designed to deliver food safety education through hands-on activities with real world applications. These food safety lessons meet the Tennessee state performance standards and are taught in science, language arts, math and social studies, lasting one week. Each class lesson is coordinated with the other classes and each day builds upon the previous. For example, in science the students will demonstrate and explain the appropriate use and care of a compound light microscope, examine and describe plant and animal cells using a compound light microscope, watch a presentation on the introduction to bacteria, participate in a bacterial growth experiment, prepare and stain wet mount slides with their own germs and make a cell model using a tortilla. In language arts students will recognize key concepts of safe food handling: clean, cook, chill and separate, locate and analyze written information on *Salmonella* poisoning to prepare a press release educating the public on prevention of *Salmonella* poisoning, demonstrate mastery of writing process by composing, editing and revising multiple drafts of a press release, critique

food handling and preparation scenarios for proper food safety skills and predict possible outcomes of improper food handling. In math students will create and interpret bar graphs using real world data, determine the mean, median, mode and range for data sets recorded in Science class, construct stem-and-leaf plots and scatter plots to analyze and understand data, describe the difference between bacterial and human growth, and demonstrate the concept of generation times using examples of real life scenarios to decide if the food is safe to eat. In social studies the students will be involved in watching a presentation on foodborne illnesses: risk and prevention, investigate the four major bacteria that cause foodborne illness using the FDA webpage, use geographic skills to create a map of *Salmonella* outbreaks, and use maps to locate and research different countries across the world to compare the life expectancy, gross domestic product per capita and infant mortality rate to make predictions on any correlations found relating to food safety.

2.8 Summary:

Everyone needs food safety information no matter what age. Although research has proven that the earlier a person learns food safety the healthier they will be. Patnoad & Pivarnik (as cited in Eves et al., 2006) noted the importance of intervening early as behaviors are more easily changed at a young age. School-based education should, in theory, reach all members of society. Input at this stage may intervene before poor habits are established by providing direction as behaviors are learned for the first time, as well as providing an environment where young people can influence and be influenced

by peers, from a study by Moon et al., Curtis & Willis et al., (as cited in Eves et al., 2006). Educators need to reach the youth with key messages on safe food handling and proper hygiene techniques (Eves et al., 2006, p.707). According to Pinfold (as cited in Eves et al., 2006), children educated in an effective way while at school may become adults who observe good hygiene practices. Children might also act as facilitators of good hygiene practices in the home through messages conveyed to family members. Dr. Richard Raymond, Under Secretary for Food Safety, said "We are protecting public health through a safer food supply, and I know we can make further progress in fighting foodborne illness" (Payne, 2006, p. 17).

3 Procedures & Methodology

3.1 Introduction

The overall purpose of this study was to assess the effectiveness of the Food Safety in the Classroom Curriculum with regard to its ability to increase 7th grade students' knowledge in science, language arts, math and social studies core courses, as well as their knowledge of proper food handling skills and behaviors. To facilitate that purpose, the following objectives were developed:

1. Describe the differences in pre-test and post-test scores on all six dependent variables studied for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).
2. Describe the difference in post-test scores for the treatment and comparison groups on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).
3. Describe the difference in post-test scores and follow-up test scores on all six dependent variables for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).

4. Describe the difference in pre-test scores for the treatment group and post-test scores for the comparison group on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge).

The Institutional Review Board of the University of Tennessee approved this study October 31, 2006.

3.2 The Population/Sample

The population for this study included all 7th grade students at Burchfield, Huntsville, Fairview and Oneida Middle School. Each student was given equal opportunity to voluntarily participate in the study. The population consisted of 239 students and was generated from the school attendance database in the superintendent's central office. The comparison group which the researcher surveyed was constructed of every 7th grade student registered at the selected schools, Burchfield and Huntsville Middle School. The treatment group, was constructed of every 7th grade student registered at the selected schools, Fairview and Oneida Middle School and were surveyed by Jennifer Richards, Education Coordinator, USDA NIFSI Food Safety Project at the University of Tennessee.

The study used Non-Probability sampling, as the intended purpose was not to generalize to the entire United States population, but to use the findings to compare schools of the actual sample group being studied. This research used convenience sampling as the researcher simply chose the closest persons or intact groups, such as school classes.

Selection of schools, included in this study, was accomplished by selecting schools within Scott County that have a similar student population. These factors included class size, economic background, race and ethnicity. The treatment sample was taken from Fairview school located in Huntsville, TN. and Oneida school of Oneida, TN. So the researcher chose as comparison schools, schools within those towns that have similar economic and race characteristics. The comparison schools chosen were Huntsville school, located in Huntsville, TN. and Burchfield located in Oneida, TN. So, the treatment group had one school from Huntsville, TN. and one school located in Oneida, TN. Same for the comparison group one school located in Huntsville, TN. and the other school located in Oneida, TN. According to the United States Census Bureau Fact Finder (2000), the town population of Oneida, TN. is estimated at 3,615 people; 98.3 percent white, 0 percent black, 0.1 percent American Indian, 0.4 percent Asian and 0.3 percent Hispanic. The demographics of Huntsville, TN. include a population of 981 people; 96.9 percent white, 1.1 percent black, 0.6 percent American Indian and 0.3 percent Hispanic. Oneida, TN. has a median household income of $23,767 and Huntsville, TN. has a median household income of $20,069. Both towns had similar poverty levels: Oneida,

TN. families below poverty level with related children under 18 years estimated 26 percent and for Huntsville, TN., 24.4 percent ("United States Census Bureau", 2000). All four sampling schools had an average class size of 19 students. Therefore, Burchfield and Huntsville Middle School were selected as comparison schools to Fairview and Oneida Middle Schools, which were part of the treatment sample. The sample for the field test of the instrument included a middle school in Knox County, Tennessee.

3.3 Instrumentation

The survey instrument used to collect quantitative data for the study was a survey in the form of a questionnaire. The survey instrument consisted of 64 questions divided into three sections. The first section focused on science knowledge, language arts knowledge, math knowledge, and social studies knowledge. The second section focused on food handling skills knowledge and the third section consisted of questions to identify respondents' knowledge of food handling behaviors. Survey questions utilized multiple choice, true/false and Likert-type questions with a 4-pt. Likert-type scale. (See Appendix F). The pre-test, post-test and follow-up all used the same survey instrument.

The survey instrument was developed by Jennifer Richards, Education Coordinator, USDA NIFSI Food Safety Project at the University of Tennessee. Subject area experts from the University of Tennessee evaluated the instrument for test construct, readability and grade level appropriateness. Two instruments were developed to assess pre and post test science knowledge, language arts knowledge, math knowledge, social studies

knowledge, food handling skills knowledge and food handling behaviors knowledge. A total of 24 questions were designed to measure students' attitudes and perceptions. To save class time, the survey was divided into two different forms, field test Form A and Form B. Form A contained half the perception questions and half the end of the unit exam questions, while Form B contained the remaining questions. See Appendices (A and B).

The survey instrument was tested for instrument reliability, consistency and instrument validity, using fifty-one 7th grade students from a middle school in Knox County, Tennessee. A total score was generated for each field test and an item analysis was performed on each question. End of exam questions, which were greater than 70 percent or less than 40 percent of students responded correctly, were flagged and reexamined for level of difficulty and misleading answer choices. The internal consistency coefficient for attitudinal scales was calculated and found field test Form A had a Chronbach Alpha of 0.87 and Form B had a Chronbach Alpha of 0.83. Also a test, re-test was administered August 18, 2006 and August 28, 2006. The analysis was computed and found Form A: $p=0.127$ and Form B: $p=0.075$. Therefore, no significant difference was found between the pre and post-test survey instruments, which shows the instrument was reliable, measuring the same thing from one administration to the next.

3.4 Design of the Study

A descriptive research design that provided quantitative data was employed using ex post facto research. A survey was developed and used to create a report to describe the population being studied. The treatment used was administered by another research team and that data was used in determining the findings. Pre-post tests were used as well as post-test comparison

This study was also experimental research because the sample was identified, treatment administered and the differences were described after. The study was conducted in the individual school classrooms, as to not disturb their learning environment.

A total of 109 pre-test surveys, 110 post-test surveys and 102 follow-up surveys were collected by Jennifer Richards, Education Coordinator, USDA NIFSI Food Safety Project at the University of Tennessee from the treatment schools, Oneida and Fairview. The information cover sheet and consent forms were separated and responses became anonymous. See Appendices (C-E). Pre-test surveys were distributed to Oneida and Fairview schools prior to the treatment; Oneida's treatment began in September 2006 and Fairview's treatment began in October 2006. The consent forms were delivered to the 7th grade students one month prior to testing and collected the day of the treatment. All students participated in the food safety program but only those students with signed consent forms participated in the testing. The pre-tests were administered first, the day of

the treatment, before the treatment began. Post-tests were administered two days after treatment, for Oneida this was in September 2006 and in October 2006 for Fairview. The treatment lasted seven days, the pre-tests and post-tests were distributed during the same month. The follow-up surveys were distributed and collected six weeks after the treatment; both Oneida and Fairview schools conducted these surveys in November 2006. The follow-up surveys were administered during the first ten minutes of class as to not disrupt their teaching period just as the pre and post test. The data was later compiled and analyzed. These surveys were all administered by the NIFS research team. The treatment group had a calculated pre-test response rate of 75 percent, post-test of 76 percent, and follow-up of 70 percent.

Post-test surveys for the comparison schools, Burchfield and Huntsville, were administered by the researcher in the exact same procedure as the NIFS research team, using the same survey instrument; two months after the follow-up surveys were administered to the treatments schools. In January 2007, the comparison groups were surveyed. See Appendix (F) for a copy of the survey. The researcher administered a post-test survey to each seventh grade class from Burchfield and Huntsville school, during the first ten minutes of class as to not disrupt their teaching period. Only those who had completed a letter of consent and had it signed by their parents received a survey. These consent forms were delivered to the 7th grade students one month prior to testing. The school name was the only identification on the survey, no personal identification was shared. Data was collected using a questionnaire. Identical copies of

the survey, information sheet, parent consent form and student assent letter were delivered and distributed to the comparison schools by the researcher. See Appendices (C-E). The cover sheet explained the purpose of the study that participation was voluntary and the child's grade would not be affected, and assured respondents confidentiality of survey results would be maintained. The researcher gathered all the completed student surveys that same class period and compiled and analyzed the data. The researcher collected 54 post-test surveys, which created a response rate of 58 percent. See Appendix (G) for the survey test answers.

3.5 Data/Statistical Analysis

All data was analyzed using the Statistical Package for the Social Sciences for Windows (SPSS 14.0). Descriptive statistics were deemed appropriate to analyze objective one, two, three and four.

4 Presentation & Discussion of data

4.1 Introduction

This chapter is organized around the four objectives of the study. A complete and detailed discussion of findings related to each objective is reported. The population frame of 239 students was generated from the schools attendance database; 145 for the treatment schools and 94 for the comparison schools. A total of 109 pre-test surveys, 110 post-test surveys and 102 follow-up surveys were collected from the treatment schools, Oneida and Fairview; the average response rate is 73 percent. Post-test surveys for the comparison schools, Burchfield and Huntsville Middle Schools, were administered by the researcher two months after the follow-up surveys were administered at the treatment schools. Post-test surveys from the comparison schools totaled 54, for a 57 percent response rate.

4.2 Findings

The first objective sought to describe the differences in pre-test and post-test scores on all six dependent variables studied for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge). Through statistical analysis the comparison group pre-tests were compared to post-tests from the treatment group, in attempt to justify generalizing from the respondents to the sample.

Data in Table 1 describes the mean scores and standard deviation totals of the treatment group pre-test and post-test. The data in Table 1 was collected from the treatment schools, a total of 108 pre-test participant surveys and 108 post-test participant surveys were collected and recorded into Table 1.

As reported in Table 1, the mean scores for the four knowledge areas (Science, Language Arts, Math and Social Studies) had a slight increase in scoring from pre-test to post-test. There was a mean increase of 1.94 per knowledge area, which caused an overall mean score increase of 7.77 within these four knowledge areas comparing pre-test (M= 21.90) to post-test scores (M= 29.67). In comparing the food handling skills pre-test and post-test, there was a slight (1.85) difference in mean scores. In comparing the pre-test and post-test mean scores for food handling behaviors, the mean score increased slightly by 2.93. Although the standard deviation was slightly high, (4.03) on pre-tests and (3.52) on post-test scores, this demonstrates a wider range of student survey answers on food handling behaviors. The overall mean score for the pre-test totaled 60.01 and 72.56 for the post-test. Overall the treatment groups' mean score improved (12.55) from pre to post-test.

The second objective sought to describe the difference in post-test scores for the treatment and comparison groups on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling

Table 1: Comparison of pre-test and post test scores on all six dependent variables studied for the treatment group

Dependent Variables	Pre-test Treatment Group N	Pre-test Treatment Group M	Pre-test Treatment Group S.D.	Post-test Treatment Group N	Post-test Treatment Group M	Post-test Treatment Group S.D
*Science Knowledge	108	5.14	1.44	108****	7.63	1.40
*Language Arts Knowledge	108	4.76	1.61	108****	7.23	2.07
*Math Knowledge	108	5.86	1.56	108****	7.14	1.80
*Social Studies Knowledge	108	6.14	2.10	108****	7.67	2.04
**Food handling Skills	28*****	10.61	1.50	28*****	12.46	1.57
***Food Handling Behaviors	28*****	27.50	4.03	28*****	30.43	3.52
Overall Mean Score	-	60.01	-	-	72.56	-

*Knowledge Areas (Science, language arts, math and social studies) mean scores could have ranged from 0 to 10.
**Food Handling Skills mean scores could have ranged from 0 to 15.
***Food Handling Behaviors mean scores could have ranged from 1 to 36.
****Although there were 110 post-test, 2 were dropped because this was a paired analysis.
*****The Food Handling Skills and Behavior survey questions were only completed by one school, the students forgot to complete the back portion of the survey.

Skills Knowledge and Food Handling Behaviors Knowledge). Data in Table 2 describes the mean scores and standard deviation totals of the treatment group post-test and comparison group post-test. The data in Table 2 was collected from the treatment group; a total of 110 post-test participant surveys and the comparison group 54 post-test surveys, the data was collected and recorded.

According to Table 2, comparing the four knowledge areas (Science, Language Arts, Math and Social Studies) of the post-test scores for the treatment group and comparison group, there was a difference observed for all knowledge areas. The mean post-test scores overall in the four knowledge areas (Science, Language Arts, Math, Social Studies) of the treatment group was higher (11.28), compared to the mean post-test scores of the comparison group. A low comparison was demonstrated with the scores in the food handling skills, with a (2.25) difference in the post-test scores of the treatment group compared to those of the comparison group. The same trend was observed with regards to the food handling behavior scores, a (3.71) difference was observed between the mean post-test score of the treatment group and the comparison group. The standard deviation recorded for the food handling behaviors was higher compared to the rest of the dependent variables studied. The standard deviation of the post-test treatment group was 4.71, while the standard deviation of the post-test comparison group was 5.60. The overall mean score for the post-test of the treatment group totaled 69.80 compared to 52.52 for the comparison group, an increase of 17.28. So, overall the treatment group scored higher on all components tested than the comparison group.

Table 2: Comparison of post-test scores for the treatment and comparison groups on all six dependent variables

Dependent Variables	Post-test Treatment Group N	Post-test Treatment Group M	Post-test Treatment Group S.D.	Post-test Comparison Group N	Post-test Comparison Group M	Post-test Comparison Group S.D
*Science Knowledge	110	7.65	1.39	54	5.37	1.89
*Language Arts knowledge	110	7.22	2.05	54	4.22	1.56
*Math knowledge	110	7.15	1.79	54	4.11	1.59
*Social Studies Knowledge	110	7.65	2.05	54	4.69	1.88
**Food handling Skills	110	11.47	2.72	54	9.22	1.93
***Food Handling Behaviors	100****	28.65	4.71	54	24.94	5.60
Overall Mean of Scores	-	69.80	-	-	52.52	-

*Knowledge Areas (Science, language arts, math and social studies) scores could have ranged from 0 to 10.
**Food Handling Skills scores could have ranged from 0 to 15.
***Food Handling Behaviors scores could have ranged from 1 to 36.
****Some students chose not to answer the Food Handling Behavior survey questions.

The third objective sought to describe the difference in post-test scores and follow-up test scores on all six dependent variables for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge). Data in Table 3 describes the mean scores and standard deviations for the treatment groups' post-test and follow-up test. The data in Table 3 was collected from the treatment group, a total of 102 post-test participant surveys and 102 post-test participant surveys were analyzed. As reported in Table 3, the mean scores for science, language arts, social studies, food handling skills and food handling behaviors all had a slight increase in scoring from post-test to follow-up; while the math mean score actually decreased from 7.09 in the post-test treatment group and 6.89 in the follow-up treatment group, a slight (0.20) drop in score.

The same trend was observed in comparing the standard deviations; a low range of scoring was calculated in comparing the treatment group post-tests and follow-up tests. Also as reported in Table 3, there was a minimal increase in food handling skills and food handling behaviors. Food handling skills post-test mean score totaled 11.45 compared to the follow-up score of 12.18, an increase of 0.73. Food handling behavior mean scores slightly increased with a post-test mean score of 28.77 and 29.19 for the follow-up, an increase of 0.42. The standard deviation totaled for post-test and follow-up scores was higher than the other dependent variables. The post-test standard deviation totaled was 4.70 and the follow-up totaled 4.53, which demonstrated a wider range of scores. But, the overall mean score for the treatment group follow-up (71.18) was higher than the

Table 3: Comparison of post-test scores and follow-up test scores on all six dependent variables for the treatment group

Dependent Variables	Post-test Treatment Group N	Post-test Treatment Group M	Post-test Treatment Group S.D.	Follow-up Treatment Group N	Follow-up Treatment Group M	Follow-up Treatment Group S.D
*Science Knowledge	102****	7.71	1.37	102	8.04	1.54
*Language Arts Knowledge	102****	7.17	2.05	102	7.19	1.82
*Math Knowledge	102****	7.09	1.82	102	6.89	1.85
*Social Studies knowledge	102****	7.66	2.06	102	7.70	1.97
**Food handling Skills	102****	11.45	2.75	102	12.18	1.85
***Food Handling Behaviors	93*****	28.77	4.70	93*****	29.19	4.53
Overall Mean Score	-	69.84	-	-	71.18	-

*Knowledge Areas (Science, language arts, math and social studies) scores could have ranged from 0 to 10.
**Food Handling Skills scores could have ranged from 0 to 15.
***Food Handling Behaviors scores could have ranged from 1 to 36.
****Although there were 110 post-test, 8 were dropped because this was a paired analysis.
*****Some students chose not to answer the Food Handling Behavior survey questions.

treatment group post-test (69.84). Overall, the mean score for the post-test and follow-up increased by 1.34.

The fourth objective sought to describe the difference in pre-test scores for the treatment group and post-test scores for the comparison group on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge). Data in Table 4 describes the mean scores and standard deviation totals for the treatment group pre-test and comparison group post-test. The data in Table 4 was collected from the treatment schools, a total of 109 pre-test participant surveys and 54 post-test comparison group participant surveys were collected.

A comparison of the pre-test scores for the treatment group and the post-test scores for comparison group of the four knowledge areas (Science, Language Arts, Math and Social Studies) showed a slight difference (Table 4). The mean science post-test score for the comparison group was slightly higher, (0.24) than the pre-test score of the treatment group. Both groups had a low standard deviation of 1.89 for the comparison group and 1.43 for the treatment group. The language arts mean scores had a difference of 0.55, with the treatment group pre-test scoring a slight higher mean score of 4.77 and the comparison group post-test score of 4.22. The math mean score for the treatment group pre-test was slightly higher (5.83), compared to 4.11 of the comparison group post-test, a difference of 1.71. The only difference was observed with regards to the social

Table 4: Comparison of pre-test scores for the treatment group and post-test scores for the comparison group on all six dependent variables

Dependent Variables	Pre-test Treatment Group N	Pre-test Treatment Group M	Pre-test Treatment Group S.D.	Post-test Comparison Group N	Post-test Comparison Group M	Post-test Comparison Group S.D
*Science Knowledge	109	5.13	1.43	54	5.37	1.89
*Language Arts Knowledge	109	4.77	1.60	54	4.22	1.56
*Math Knowledge	109	5.83	1.59	54	4.11	1.59
*Social Studies Knowledge	109	6.10	2.13	54	4.65	1.88
**Food handling Skills	29****	10.52	1.55	54	9.22	1.93
***Food Handling Behaviors	29****	27.41	3.99	54	24.94	5.60
Overall Mean Score	-	59.76	-	-	52.52	-

*Knowledge Areas (Science, language arts, math and social studies) scores could have ranged from 0 to 10.
**Food Handling Skills scores could have ranged from 0 to 15.
***Food Handling Behaviors scores could have ranged from 1 to 36.
****The Food Handling Skills and Behavior survey questions were only completed by one school, the students forgot to complete the back portion of the survey.

studies score. The mean score for the treatment group pre-test (6.10) and the comparison group post-test mean score (4.65), had a difference of 1.45. The same trend was observed with regard to the food handling skills score with a slight difference of 1.30. The mean pre-test score for the treatment group was slightly higher totaling 10.52 and the mean post-test score for the comparison group totaled 9.22. Both the standard deviations were under 2.00. The mean scores for the food handling behaviors recorded a 2.47 difference in scores. The pre-test mean score for the treatment group (27.41) was slightly higher than the post-test comparison group score (24.94). The standard deviations for both groups were recorded, the treatment group total (3.99) and the comparison group total (5.60), which reveals that both groups had a wider range of scores in the food handling behavior variable than the other variables. The overall mean score for the treatment group pre-test totaled 59.76 and the comparison group post-test totaled 52.52. The treatment group pre-test scores were recorded as slightly higher by 7.24, than the post-test scores of the comparison group.

5 Conclusions & Recommendations

5.1 Introduction

More than 100 years ago, consumers relied on the expertise of the corner butcher for the quality and safety of the meat and poultry they served their families (Eamich, 2006, p.13). According to Centers for Disease Control and Prevention about 10 million United States adults ages 18-69 were unable to work during 2003 due to health problems. *Salmonella* infections are responsible for an estimated 1.4 million illnesses each year. Infectious diseases cost the United States $120 billion a year.

Food safety is not taught in our public schools because of the priority given to state curriculum standards for core academic areas and due to high stakes accountability testing, there is little time to cover subjects not in the core areas. Our youth need to be educated on how serious foodborne illnesses are and how they can be prevented. "Hygiene habits are formed at an early age, affecting food-handling practices for a lifetime" (Herringshaw & Largo as cited in Guion, L., Simonne, A., & Easton, J., 2004). With more than 144 million missed school days per year due to sickness, it is easy to see how crucial it is to control absenteeism (Guinan, McGuckin & Ali, 2002). Government officials and health experts consistently rate foodborne illness as the greatest food safety threat ("Food Safety & Technology," 2004, p.6).

This chapter is divided into three sections, conclusions, recommendations for further study and general recommendations. The conclusions are based on the findings of

this study and are listed by objective. The recommendations for further study are to be used as a guide for future researchers to continue this study, as well as the general recommendations.

5.2 Conclusions

The first objective was to describe the differences in pre-test and post-test scores on all six dependent variables studied for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge). Positive patterns emerged in the comparison of pre-test and post-test scores of the treatment group. In the four knowledge areas, science, language arts, math and social studies, all mean scores increased from pre to post-test. [Science had the greatest increase followed by language arts, social studies and lastly math]. The overall mean score for food handling skills also increased slightly as well as the food handling behaviors. The overall mean score increased from 60.01 to 72.56, a small increase for this treatment group. Although the total possible points equal 91, the post-test scores of the treatment group show that this interdisciplinary food safety curriculum increased the 7th grade students' knowledge, skills and behaviors on the food safety topics.

The second objective sought to describe the difference in post-test scores for the treatment and comparison groups on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling

Skills Knowledge and Food Handling Behaviors Knowledge). The results from this comparison revealed that the post-test scores for the treatment group were higher in all testing areas than the post-test scores of the comparison group. In the four knowledge areas, science, language arts, math and social studies, the treatment group post-test scores were higher than the comparison group. The post-test score was also higher for the food handling skills and food handling behaviors for the treatment group as compared to the comparison group. The overall mean post-test score was higher for the treatment group (69.80) than that of the comparison group (52.52), a minor increase for this treatment group. This data showed that this interdisciplinary food safety curriculum has made a positive impact on the treatment group.

The third objective was to describe the difference in post-test scores and follow-up test scores on all six dependent variables for the treatment group (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge). The study revealed some minor increases among the treatment group follow-up test as compared to their post-test. The overall mean score increased slightly by 1.34. In all areas of the follow-up, the scores increased slightly, except math, when the score decreased slightly. Data showed the treatment group had retained the knowledge, skills and behaviors six weeks after the treatment was administered. Actually with a slight increase in follow-up test scores, the treatment group had revealed 7th grade students can maintain and improve on information received in the school setting through educational classes.

The fourth objective sought to describe the difference in pre-test scores for the treatment group and post-test scores for the comparison group on all six dependent variables (Science Knowledge, Language Arts Knowledge, Math Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge). These scores should be relatively similar, because at this time of testing both groups have had no formal education on food safety, and the treatment group had not received their treatment. The overall mean score for the treatment group pre-test was higher (+7.24) than the post-test score of the comparison group. In the four knowledge areas, science, language arts, math and social studies, the treatment group pre-test scores were slightly higher except in science. The comparison group post-test score for science totaled higher than the pre-test score for the treatment group. However, in food handling skills and behaviors, the pre-test score for the treatment group was higher. There was some evidence to suggest that the treatment group had more knowledge than the comparison group before the treatment, except in science. A comparison of the treatment group and comparison group, reveals an overall mean score increase, as an impact of the interdisciplinary food safety program.

The following conclusions were based on the findings of this study:

1. There were some substantive increases in post-test scores for the treatment group.
2. The treatment group increased in all areas from pre-test to post-test. The areas included: Science Knowledge, Language Arts Knowledge, Math

Knowledge, Social Studies Knowledge, Food Handling Skills Knowledge and Food Handling Behaviors Knowledge.

3. The data suggests this interdisciplinary food safety curriculum has made a positive impact on the treatment group. The scores after the program record higher overall than the comparison group scores.
4. The data showed that the treatment group had retained the knowledge, skills and behaviors six weeks after the treatment was administered.
5. Data revealed that the overall mean score for the treatment group pre-test was higher (+7.24) than the post-test score of the comparison group.
6. There was some evidence to suggest that the treatment group had more knowledge than the comparison group before the treatment, except in science, however the gain score afterwards shows the program successful.
7. A comparison of the treatment group and comparison group, revealed an overall increase in the mean score increase of 10.04 points for the treatment group, as an impact of the interdisciplinary food safety program.
8. After going through a one week food safety program, the student's knowledge, skills and behaviors increased, thus strengthening the evidence that the program is having a positive impact on the students.

5.3 Recommendations for Further Study

It would be of interest to conduct a study to compare this interdisciplinary food safety curriculum to another food safety curriculum with similar topics which is

implemented in a single subject classroom instead of across all subject lines. The findings would further support whether students learn and retain more information if it is taught across all disciplines or in just one subject class.

Studies researching specific characteristics such as, ethnicity, age, gender and parent education level, should be conducted to identify if these characteristics influence the child's knowledge, skills and behaviors and/or retention of knowledge, skills and behavior related to food safety. Information from this type of study could be used to design programs to reach populations with these distinct characteristics.

5.4 General Recommendations

Specific efforts should be made to expand the use of this Interdisciplinary Food Safety Program to all middle schools. Greater efforts should be made to increase the level of knowledge of the interdisciplinary food safety program among teachers and curriculum directors throughout the state and country. The development and delivery fits the Tennessee state standards, making this program perfect to be used in Tennessee middle schools.

Greater emphasis should be given to promotional materials to market this Interdisciplinary Food Safety curriculum to increase the public's knowledge an awareness of such a useful curriculum. Teachers and other educators need to be made

aware of such possibilities as this program; it can adapted to many teaching styles and customized to fit their need.

References

American FactFinder. (2000). *United States Census Bureau.* Retrieved June 2, 2007, http://factfinder.census.gov/servlet/SAFFFacts?

Benedict, J., Baker, P., Brennand, C., Deer, H., Dodds, M., Krysl, L., Kvasnicka, W., Leontos, C., Nipp, P., Omaye, S., Parks, P.& Sorenson, C. (1995, December). News reporters as a target audience for extension food safety programs. *Journal of Extension, 33(6),* 1-7.

Centers for Disease Control and Prevention. (2006). *E.Coli 0157:H7 Outbreak from fresh spinach*. Retrieved September 22, 2006, from http://www.cdc.gov/foodborne/ecolispinach/current.htm

Centers for Disease Control and Prevention. (2006). *An ounce of prevention keeps the germs away: Seven keys to a safer healthier home.* p.1-7. [Brochure]. Retrieved July 26, 2006, from www.cdc.gov/ounceofprevention

Cohen, S. (2006, July). FSIS issues public health alert for frozen, stuffed, raw chicken products. *FSIS Alert.* Retrieved July 12, 2006, from http://www.fsis.usda.gov/

Eamich, A. (2006, Fall). A century of progress in food safety. *Be Foodsafe, The FSIS Magazine,* 12-15.

Eves, A., Bielby, G., Egan, B., Lumbers, M., Raats, M. & Adams, M. (2006). Food hygiene knowledge and self-reported behaviours of UK school children (4-14 years). *British Food Journal, 108(9),* 706-720.

Fein, S., Lin, J., Jordan, C. & Levy, A. (1995). Foodborne illness: Perceptions, experience, and preventive behaviors in the United States. *Journal of Food Protection, 58(12),* 1405-1411.

Food safety education conference. (2006, October). *National Food Safety Educator's Network, EdNet*. Retrieved November 1, 2006 from http://www.fsis.usda.gov

Gove, P. (Ed.). (1986). *Merriam-Webster's Third New International Dictionary*. Massachusetts: Merriam Webster Inc.

Guinan, M., McGuckin M., and Ali Y. (2002). The effect of a comprehensive handwashing program on absenteeism in elementary schools. *American Journal of Infection Control 30(4),* 217-220.

Guion, L., Simonne, A., & Easton, J., (2004). Youth perspectives on food safety. *Journal of Extension, 42(1),* 1-8.

Haapala, I. & Probart, C. (2004). Food safety knowledge, perceptions, and behaviors among middle school students. *Journal of Nutrition Education and Behavior, 36(2),* 71-76.

Hammerschmidt, P., Andrews, S., Murphy, A., Youatt, J., & Sawyer, C. (1995). Change in safe food handling knowledge and practices of 4-H members. *Journal of Extension, 33(1),* 1-5.

Hansen, K., Anderson, J., and Shuster, T. (2004). A camera's view of consumer food-safety behavior. *The Journal of the American Dietetic Association, 1(2).* Retrieved July 25, 2006, from http://www.fightbac.org/content/view/142/5/

Hillers, V., Medeiros, L. and Kendall, P. (2003). Consumer food-handling behaviors associated with prevention of 13 foodborne illnesses. *Journal of Food Protection, 66 (10),* 1893-1899. Retrieved July 25, 2006, from http://www.fightbac.org/content/view/119/5/

Hitting the Highways. (2003). *The Food Safety Educator, 8(2),* 1-12.

International Food Information Council (2004, May). *Food Safety & Technology*, 1-14. Retrieved July 26, 2006, from http://ific.org/food/

Lettuce safety initiative. (2006, August 23). *U.S. Food and Drug Administration.* Retrieved September 22, 2006 from http://www.cfsan.fda.gov/~dms/lettsafe.html

Masters, B. (2006, Fall). Meeting today's challenges. *Be FoodSafe, The FSIS Magazine*, 5.

Mead, PS., Slutsker, L., Kietz, V., McCaig, LF., Bresee, JS., Shapiro, C., Griffin, PM., & Tauxe, RV. (1999). Food-related illness and death in the United States (statistical data included), *Emerging Infectious Diseases Journal, (5), 607-625*.

Payne, K. (2006, Fall). Future goals for FSIS. *Be FoodSafe, The FSIS Magazine*, 16-18.

Reaching At-Risk Audiences, Food Safety Education Conference, Registration Information. (2006). Retrieved July 2006, from mail-out,1-15.

Redmond, E. & Griffith, C. (2003). Consumer food handling in the home: A review of food safety studies. *Journal of Food Protection, 66 (1),* 130-161. Retrieved from http://www.fightbac.org/content/view/141/5/

Snapshot of consumer behavior and attitudes. (1998, June). *FightBac!* Retrieved July 25, 2006, from http://www.fightbac.org/content/view/148/5/

Thompson, K. (2004, May). The effects of alcohol hand sanitizers on elementary school absences. *American Journal Infection Control*, E127.

Vugia, D., Cronquist, A., Hadler, J., Tobin-D'Angelo, M., Blythe, D., Smith, K., Thornton, K, Morse, D., Cieslak, P., Jones, T., Holt, K., Guzewich, J., Henao, O., Scallan, E., Angulo, F., Griffin, P., Tauxe, R. & Barzilay, E. (2006, April 14). Preliminary foodnet data on the incidence of infection with pathogens transmitted commonly through food—10 states, United States, 2005. *Morbidity and Morality Weekly Report, 55(14)*, 392-395. Retrieved July 26, 2006, from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5514a2.htm?s_cid=mm5514a2_e

Weise, E. (2006, December 26). Food Safety: The produce section produced new perils. *USA Today*, pp. 4D.

Whaley, S., Tucker, M., and Knipe, L. (2005). Preferred communication sources and food-related risks: A statewide analysis. *Ohio State University.* Retrieved July 25, 2006, from http://fightbac.org/content/view/144/5/

Williamson, C. (2006, Fall). Future goals for FSIS. *Be FoodSafe, The FSIS Magazine*, 22.

Appendices

Appendix A

Sample Field Test Survey Instrument
Form A

For the following statements: Circle "1" if the statement is **TRUE.** Circle "2" if the statement is **FALSE.**		TRUE	FALSE
1	It is important to wash my hands before preparing or eating food.	1	2
2	It is possible to wash my hands thoroughly without the use of soap.	1	2
3	When preparing food, it is okay to use the same surfaces (cutting board, counter top) and utensils for meats and vegetables.	1	2
4	It is okay to eat pizza that has been sitting out on the counter all night as long as I warm it up first.	1	2
5	Most people go to the doctor when they get food poisoning.	1	2
6	More people are hospitalized each year with food poisoning than with the flu.	1	2
7	Almost all food-poisonings are preventable.	1	2
8	Food-poisonings only occur in third world countries.	1	2
9	If I clean a surface with soap and water, it will kill all the bacteria.	1	2

For the following statements, circle the choice that applies **most** often. **1 -** The statement is *usually* true. **2 -** The statement is *sometimes* true. **3 -** The statement is *rarely* true. **4 -** The statement is *never* true.		Usually	Sometimes	Rarely	Never
10	I feel that I know how to correctly handle my food so that I do not become sick.	1	2	3	4
11	When preparing food, I carefully follow temperature and time directions on the food packaging labels.	1	2	3	4
12	If necessary, I could properly handle a variety of meats and vegetables to prepare a safe meal for my family.	1	2	3	4

Read each of the following statements or questions below and circle the BEST answer from the choices given.

16) How do bacteria get the nutrients they need to survive?

a) Some make their own energy from sunlight.

b) Some scavenge their nutrients from the environment around them.

c) Some attach other living things.

d) All of these are true.

17) A pathogen is:

a) A bacteria that helps in digestion.

b) A bacteria used to make pepperoni.

c) A bacteria that can make you sick.

d) A bacteria used to make medicines.

18) Which of the following is considered a bacterial "hot zone" in your house?

a) Kitchen

b) Living Room

c) Bedroom

d) Closets

19) The MOST IMPORTANT thing you can do to keep from getting sick from bacteria is to:

a) Refrigerate leftovers.

b) Wash your hands

c) Frequently wipe kitchen surfaces.

d) Use a hand sanitizer.

20) Which is the BEST example of cross-contamination?

a) Not reheating food properly.

b) Leaving food sitting at room temperature for too long.

c) Using the same knife to cut raw chicken and vegetables.

d) None of the above.

13) Which of the following is NOT true about bacteria?

a) They are microscopic.

b) They are made up of only one cell.

c) They can be found on most surfaces.

d) All bacteria can make you sick.

14) Which of the following is NOT one of the three basic shapes of bacteria?

a) Circular

b) Bacilli

c) Spiral

d) Cocci

15) When bacteria grow they:

a) Grow in size from an infant to an adult.

b) Grow in number, not in size.

c) Require more and more food to grow larger.

d) Eventually get too big and die.

21) Leftover foods should be refrigerated within:

a) 30 minutes. b) 1 hour.

c) 2 hours. d) 3 hours.

22) Bacteria grow most rapidly in temperatures of:

a) At zero degrees. b) Below 40 degrees.

c) Above 140 degrees. d) Between 40-140.

23) It is okay to eat raw cookie dough:

a) anytime. The raw eggs will not hurt you. b) only if the cookie dough is store bought.

c) only if the cookie dough is homemade. d) never. Raw cookie dough puts you at risk for Salmonellosis.

24) The safest way to defrost frozen meat is to:

a) set it out on the counter. b) place it in the refrigerator.

c) cook it while it is frozen. d) None of the above.

25) To make sure that your hamburger is safe to eat it should be cooked to an internal temperature of

a) 160 F. b) 180 F.

c) 200 F. d) 212 F.

26) A data set with data points of (1, 2, 3, 4, & 5) would have a mean of:

a) 2.5 b) 3.0

c) 3.5 d) 5

27) A data set with the data points of (16, 17, 22, 22, 25, & 30) would have a mode of:

a) 6 b) 14

c) 22 d) 26.4

28) A foodborne illness is

a) any illness that humans get from food. b) an illness you are born with.

c) only preventable with a vaccine. d) cannot be passed from one person to another.

29) Which of the following can cause a foodborne illness?

a) Bacteria b) Viruses

c) Parasites d) All of these can cause a foodborne illness.

30) Which of the following is NOT a common symptom of foodborne illnesses?

a) Chest pains b) Diarrhea

c) Vomiting

d) Headache

31) You should wash your hands

a) after using the bathroom.

b) before handling food.

c) more frequently when someone around you is sick.

d) All of these are true.

32) Most foodborne outbreaks are caused by

a) not keeping food hot or cold enough.

b) poor personal hygiene (not washing your hands).

c) cross-contaminating raw and cooked foods.

d) All of these are true.

Appendix B

Sample Field Test Survey Instrument
Form B

For the following statements: Circle "1" if the statement is **TRUE.** Circle "2" if the statement is **FALSE.**		TRUE	FALSE
1	Water can make me sick.	1	2
2	Bacteria are very small organisms that live in air, food, water, and on all surfaces.	1	2
3	Food stored in the refrigerator cannot grow bacteria.	1	2
4	There are bacteria in my food that can make me sick if my food is not handled correctly.	1	2
5	All bacteria can make me sick.	1	2
6	I can recognize the most common symptoms of food poisoning.	1	2
7	A bacteria cell is different from an animal cell because the bacteria cell does not have a nucleus.	1	2
8	Bacterial growth means an orderly increase in the number of bacteria.	1	2
9	To prevent cross contamination, it is important to keep raw meat, poultry, and seafood away from other foods in the grocery cart and refrigerator.	1	2

For the following statements, circle the choice that applies **most** often. **1 -** The statement is *usually* true. **2 -** The statement is *sometimes* true. **3 -** The statement is *rarely* true. **4 -** The statement is *never* true.		Usually	Sometimes	Rarely	Ne
10	I wash my hands before preparing or eating food.	1	2	3	4
11	When I see an adult handling food improperly, I point out her or his mistakes.	1	2	3	4
12	I can identify foods that have a higher risk of making me sick.	1	2	3	4

Read each of the following statements or questions below and circle the BEST answer from the choices given.

16) The best way to avoid getting sick from a pathogen is to:

a) Rinse your hands in cold water for 5 seconds.
b) Wash your hands in warm water with soap for 20 seconds.
c) Avoid touching any surface.
d) Wipe your hands on a dish towel.

17) Bacterial cells are different from animal cells in that bacteria cells:

a) Contain DNA.
b) Have a cell wall.
c) Do not have a nucleus.
d) Contain cytoplasm

18) The safest way to tell if a hamburger is cooked to the proper temperature is to:

a) Use a food thermometer.
b) Check the inside to see if it is still pink.
c) Burn the outside of the burger.
d) None of the above.

19) The purpose of a press release is to:

a) Track outbreaks of foodborne illnesses.
b) Share information or news with the media.
c) Determine the cause of a foodborne illness.
d) Sell products or services.

20) Which of the following is NOT part of a press release?

a) Title page.
b) Contact information.
c) Headline.
d) Dateline.

13) An example of indirect contact is:

a) Touching the desk and then touching your eyes, mouth, or nose.
b) Hugging your parents.
c) Shaking hands with a friend.
d) Getting a kiss on the cheek from Aunt Mildred.

14) Which of the following is NOT a food made using helpful bacteria?

a) Pickles
b) Eggs
c) Pepperoni
d) Sauerkraut

15) All of the following are pathogens EXCEPT:

a) Lactobacillus
b) Salmonella
c) E. coli
d) Listeria

21) When writing a press release you should:

a) Tell the audience that the information is intended for them and why they should read it.

b) Start with a brief description of the news, and then explain who announced it, and not the other way around.

c) Avoid excessive use of adjectives and fancy language.

d) All of these are true.

22) All of the following are possible outcomes of not handling food properly EXCEPT:

a) Getting sick and requiring medical attention.

b) Not getting sick at all.

c) Getting sick for a few days and then feeling better.

d) All of these are true.

23) A data set with data points of (6, 7, 7, 10, & 16) would have a range of:

a) 5

b) 7

c) 9.2

d) 10

24) A data set with data points of (2, 4, 6, 8, & 10) would have a median of:

a) 5

b) 5.6

c) 6

d) 8

25) Jimmy is exactly 5 feet tall. His height at 4x and 10x would be:

a) 5 ft and 10 ft

b) 9 ft and 15 ft

c) 20 ft and 50 ft

d) 20 ft and 40 ft

26) If a bacteria's generation time was 10 minutes, how many bacteria would there be after one hour?

a) 1

b) 6

c) 32

d) 64

27) The difference between a sample and a population is:

a) a sample is selected from a population.

b) a population is selected from a sample.

c) a sample refers to people and a population refers to objects.

d) There is no difference between a population and a sample.

28) The life expectancy rate in a country is

a) the number of people expected to die each year.

b) the average number of years a person in that country can expect to live.

c) the quality of life a person in that country can expect.

d) None of the above.

29) A country's gross domestic product per capita tells us:

a) how much debt a country has.

b) what kind of government a country has.

c) how much money the average person in that country makes each year.

d) how many hospitals a country has.

30) A country's infant morality rate tells us:

a) the number of babies that will die before their first birthday.

b) the number of babies born with deformities or diseases.

c) the number of children who will start school that year.

d) None of the above.

31) Which of the following does NOT need to be done in order to avoid foodborne illnesses?

a) Make sure that all food is thoroughly cooked.

b) Throw away all leftovers.

c) Refrigerate all leftovers immediately.

d) Separate meat and veggies when preparing foods.

32) When researching outbreaks of foodborne illnesses it is important to know:

a) the location of the outbreak.

b) the number of reported cases of illness.

c) the likely cause of the outbreak.

d) All of these are true.

Appendix C

Sample Information Sheet

Parent/Guardian of
<<Student>>
<<Address>>
<<City, State, Zip>>

Dear Parent/Guardian:

Your child is being invited to voluntarily participate in a group survey of students related to the Food Safety Education project being conducted in their school system. The purpose of this evaluation is to assess the effectiveness of the Food Safety Education program serving 7th grade students in Scott County Schools.

Every year, 76 million Americans contract a foodborne illness. Healthcare expenses and loss of productivity results in an estimated cost of 19 to 37 billion dollars annually. The seriousness of these illnesses causes an average of five thousand deaths per year. These are appalling statistics because proper food handling practices could virtually eliminate incidents of foodborne illness.

This study will provide information that future students, teachers, educators, and community members can use to understand the impact of food safety education in their school system. Benefits to your child's participation include the collection of information that could be used to improve this program. There is minimal risk to your child's participation in this evaluation.

Confidentiality of survey results will be maintained. Students will not be asked to put their name on the survey. Data will be stored securely and only made available to the evaluation team at the University of Tennessee. Once the study is complete the data will be shredded and destroyed.

Your child's participation is completely voluntary. However, his/her participation would be greatly appreciated. After reviewing the consent form, if you agree that your child my participate in this study, please sign one copy of the form and return it to school with your child.

Sarah Johnson, Graduate Student and Dr. Carrie Ann Fritz, an Assistant Professor in Agricultural and Extension Education, will be working on this study. If you have any questions, please feel free to contact us at sjohn25@utk.edu, cfritz@utk.edu or (865) 974-4830.

Sincerely,

Sarah Johnson
Graduate Student
Agriculture and Extension Education

Dr. Carrie Ann Fritz
Assistant Professor
Agricultural and Extension Education

Appendix D

Sample Informed Consent

Informed Consent Form

The effectiveness of a Dynamic Interdisciplinary Food Safety Curriculum targeted on Middle School students in Scott County.

Introduction:

Your child is being invited to voluntarily participate in a group survey of students related to the Food Safety Education project in their school system. The purpose of this evaluation is to assess the effectiveness of the Food Safety Education program serving the 7th grade students in Scott County.

Information About Participants' Involvement In The Study:

Your child's involvement in the study will include participating in a 15-minute group survey during December 2006 under the following circumstances:

1. The school system has approved the evaluation, and will invite your child's voluntary participation.
2. The survey will be scheduled/conducted at their school during a time suitable to all participants.
3. An evaluation will be conducted by your local University of Tennessee (UT) Extension Agent.
4. Your child's participation in this research study will not effect his/her grade in any class.

Risks:

There is minimal risk to your child's participation in this evaluation.

Benefits:

This study will provide information for future students, teachers, educators, and community members to understand the impact of food safety education on their school system. The benefit of your child's participation include a collection of information that will be used to improve this program.

Confidentiality:

Confidentiality of survey results will be maintained. Students will not be asked to put their name on the survey. Data will be stored securely in a locked cabinet in 325C Morgan Hall and only made available to the primary investigators at the University of Tennessee. Once the study is complete the data will be shredded and destroyed.

Contact Information:

If you have any questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researcher, Sarah M. Johnson, at 2420 Congress Pkwy. S. Apt. 608, Athens, TN. 37303 or (423) 745-2852. If you have any questions about your rights as a participant, contact Research Compliance Services at the Office of Research at (865) 974-3466.

Participation:

Your child's participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at anytime without penalty and without loss of benefits to which they are otherwise entitled.

Consent

I have read the above information. I have received a copy of this form. I agree to participate in this study.

Parent/Guardian
Signature_____ Date_____

Investigator
Signature_____ Date_____

Appendix E

Sample Student Assent Letter

ASSENT: STUDENT GROUP SURVEY

Dear Student:

Hello, my name is Sarah Johnson and I work for the University of Tennessee Extension. I am asking you to consider participating in a Food Safety survey of students in the 7th grade in Scott County. The primary purpose of the survey is to explore what students already know about food safety without formal teaching at school. Therefore, you will be asked to answer twenty questions related to food safety and the survey will take about 15 minutes of your time to complete. Your participation in the project is completely voluntary and you can respond by saying, "I don't want to answer questions anymore."

You will receive a survey of sixty-four questions. Questions one through forty are multiple choice, forty-one through fifty-five are true and false statements, and questions fifty-six through sixty-four are statements which ask you to rate your response. Please understand that your name will not be put on the survey and no one will be able to identify who responded to the survey. Most importantly, your participation in the research project will have no effect on your grade.

Thank you for participating and at anytime you can withdraw from this study.

If you have any questions related to the study, you may contact the Primary Investigator:

Sarah M. Johnson
2420 Congress Pkwy. S. Apt. 608
Athens, TN. 37303
(423) 745-2852
sjohn25@utk.edu

ASSENT:

I have read the above information and I agree to participate in the student survey.

_____ _____
STUDENT NAME (Please print your name) (Date)

_____
STUDENT SIGNATURE (Please sign your name)

Appendix F

Sample Survey Instrument

Food Safety in the Classroom – Student Assessment

Directions: Read each of the following statements or questions below and choose the **BEST** answer from the choices given.

Science

1) Which of the following is NOT true about bacteria?

- O They are microscopic.
- O They are made up of only one cell.
- O They can be found on most surfaces.
- O All bacteria can make you sick.

2) Which of the following is NOT one of the three basic shapes of bacteria?

- O Circular
- O Bacilli
- O Spiral
- O Cocci

3) When bacteria grow they:

- O Grow in size from an infant to an adult.
- O Grow in number, not in size.
- O Eventually get too big and die.
- O Require more and more food to grow larger.

4) How do bacteria get the nutrients they need to survive?

- O Some make their own energy from sunlight.
- O Some scavenge their nutrients from the environment around them.
- O Some attach to other living things.
- O All of these are true.

5) A pathogen is:

- O A bacterium that helps in digestion.
- O A bacterium used to make pepperoni.
- O A bacterium that can make you sick.
- O A bacterium used to make medicines.

6) An example of indirect contact is:

- O Touching the desk and then touching your eyes, mouth, or nose.
- O Getting a kiss on the cheek from Aunt Mildred.
- O Shaking hands with a friend.
- O Hugging your parents.

7) Which of the following is NOT a food made using helpful bacteria?

- O Pickles
- O Eggs
- O Pepperoni
- O Sauerkraut

8) All of the following are pathogens EXCEPT:

- O Salmonella
- O Lactobacillus
- O E. coli
- O Listeria

9) The best way to avoid getting sick from a pathogen is to:

- O Rinse your hands in cold water for 5 seconds.
- O Wash your hands in warm water with soap for 20 seconds.
- O Avoid touching any surface.
- O Wipe your hands on a dish towel.

10) Bacterial cells are different from animal cells in that bacteria cells:

- O Contain DNA.
- O Have a cell wall.
- O Do not have a nucleus.
- O Contain cytoplasm.

Food Safety in the Classroom – Student Assessment

Language Arts

11) Which of the following is considered a bacterial "hot zone" in your house?

- O Kitchen
- O Living Room
- O Bedroom
- O Closets

12) The MOST IMPORTANT thing you can do to keep from getting sick from bacteria is to:

- O Refrigerate leftovers.
- O Wash your hands.
- O Frequently wipe kitchen surfaces.
- O Use a hand sanitizer.

13) Which is the BEST example of cross-contamination?

- O Using the same knife to cut raw chicken and vegetables.
- O Leaving food sitting at room temperature for too long.
- O Not reheating food properly.
- O None of the above.

14) Leftover foods should be refrigerated within:

- O 30 minutes
- O 1 hour
- O 2 hours
- O 3 hours

15) Bacteria grow most rapidly at temperatures of:

- O At zero degrees.
- O Below 40 degrees.
- O Above 140 degrees.
- O Between 40-140.

16) The safest way to tell if a hamburger is cooked to the proper temperature is to:

- O Use a food thermometer.
- O Check the inside to see if it is still pink.
- O Burn the outside of the burger.
- O None of the above.

17) The purpose of a press release is to:

- O Track outbreaks of foodborne illnesses.
- O Share information or news with the media.
- O Determine the cause of a foodborne illness.
- O Sell products or services.

18) Which of the following is NOT part of a press release?

- O Title page.
- O Contact information.
- O Headline.
- O Dateline.

19) When writing a press release you should:

- O Tell the audience that the information is intended for them and why they should read it.
- O Start with a brief description of the news, and then explain who announced it, and not the other way around.
- O Avoid excessive use of adjectives and fancy language.
- O All of these are true.

20) Which of the following is a possible outcome of NOT handling food properly?

- O Getting sick and requiring medical attention.
- O Getting sick for a few days and then feeling better.
- O Not getting sick at all.
- O All of these are possible outcomes.

Food Safety in the Classroom – Student Assessment

Math

21) It is okay to eat raw cookie dough:

- O anytime. The raw eggs will not hurt you.
- O only if the cookie dough is store bought.
- O only if the cookie dough is homemade.
- O never. Raw cookie dough puts you at risk for salmonellosis.

22) The safest way to defrost frozen meat is to:

- O set it out on the counter.
- O place it in the refrigerator.
- O cook it while it is frozen.
- O None of the above.

23) To make sure that your hamburger is safe to eat it should be cooked to an internal temperature of:

- O 160 F.
- O 180 F.
- O 200 F.
- O 212 F.

24) A data set with data points of (1, 2, 3, 4, & 5) would have a mean of:

- O 2.5
- O 3.0
- O 3.5
- O 5

25) A data set with the data points of (16, 17, 22, 22, 25, & 30) would have a mode of:

- O 6
- O 14.0
- O 22
- O 26.4

26) A data set with data points of (6, 7, 7, 10, & 16) would have a range of:

- O 5
- O 7.0
- O 9.2
- O 10

27) A data set with data points of (2, 4, 6, 8, & 10) would have a median of:

- O 5
- O 5.6
- O 6
- O 8

28) Jimmy is exactly 5 feet tall. His height at 4x and 10x would be:

- O 5 ft and 10 ft
- O 9 ft and 15 ft
- O 20 ft and 50 ft
- O 20 ft and 40 ft.

29) If a bacterium's generation time was 10 minutes and you started with one bacterium, how many bacteria would there be after one hour?

- O 1
- O 6.0
- O 32
- O 64

30) The difference between a sample and a population is:

- O a sample is selected from a population.
- O a population is selected from a sample.
- O a sample refers to people and a population refers to objects.
- O There is no difference between a population and a sample.

Food Safety in the Classroom – Student Assessment

Social Studies

31) A foodborne illness is
- O any illness that humans get from food.
- O an illness you are born with.
- O only preventable with a vaccine.
- O cannot be passed from one person to another.

32) Which of the following can case a foodborne illness?
- O Bacteria
- O Viruses
- O Parasites
- O All of these can cause a foodborne illness.

33) Which of the following is NOT a common symptom of foodborne illnesses?
- O Chest pains
- O Diarrhea
- O Vomiting
- O Headache

34) You should wash your hands
- O after using the bathroom.
- O before handling food.
- O more frequently when someone around you is sick.
- O All of these are true.

35) Most foodborne outbreaks are caused by:
- O not keeping food hot or cold enough.
- O poor personal hygiene (not washing your hands).
- O cross-contaminating raw and cooked foods.
- O None of the above.

36) The life expectancy rate in a country is:
- O the number of people expected to die each year.
- O the average number of years a person in that country can expect to live.
- O the quality of life a person in that country can expect.
- O None of the above.

37) A country's gross domestic product per capita tells us:
- O how much money the average person in that country makes each year.
- O what kind of government a country has.
- O how much debt a country has.
- O how many hospitals a country has.

38) A country's infant mortality rate tells use:
- O the number of babies that will die before their first birthday.
- O the number of babies born with deformities or diseases.
- O the number of children who will start school that year.
- O None of the above.

39) Which of the following does NOT need to be done in order to avoid foodborne illnesses?
- O Make sure that all food is thoroughly cooked.
- O Throw away leftovers.
- O Refrigerate all leftovers immediately.
- O Separate meat and veggies when preparing foods.

40) When researching outbreaks of foodborne illnesses it is important to know:
- O the location of the outbreak.
- O the number of reported cases of illness.
- O the likely cause of the outbreak.
- O All of these are true.

Food Safety in the Classroom – Student Assessment

For the following statements: Fill in the appropriate Bubble if the statement is **TRUE** or **FALSE**.		TRUE	FALSE
41	It is possible to wash my hands thoroughly using only water.	O	O
42	When preparing food, it is okay to use the same surfaces (cutting board, counter top) and utensils for meats and vegetables.	O	O
43	It is okay to eat pizza that has been sitting out on the counter all night as long as I warm it up first.	O	O
44	Most people go to the doctor when they get food poisoning.	O	O
45	More people are hospitalized each year with food poisoning than with the flu.	O	O
46	Almost all food-poisonings are preventable.	O	O
47	Food-poisonings only occur in under developed countries.	O	O
48	If I clean a surface with soap and water, it will kill all the bacteria.	O	O
49	Water can make me sick.	O	O
50	Bacteria cannot grow in foods stored in the refrigerator.	O	O
51	There are bacteria in my food that can make me sick if my food is not handled correctly.	O	O
52	All bacteria can make me sick.	O	O
53	A bacteria cell is different from an animal cell because the bacteria cell does not have a nucleus.	O	O
54	Bacterial growth means an orderly increase in the number of bacteria.	O	O
55	To prevent cross contamination, it is important to keep raw meat, poultry, and seafood away from other foods in the grocery cart and refrigerator.	O	O

For the following statements, fill in the bubble of the choice that applies **most** often. The statement is *never* true. The statement is *rarely* true. The statement is *sometimes* true. The statement is *usually* true.		Never	Rarely	Sometimes	Usually
56	I feel that I know how to correctly handle my food so that I do not become sick.	O	O	O	O
57	When preparing food, I carefully follow temperature and time directions on the food packaging labels.	O	O	O	O
58	If necessary, I could properly handle a variety of meats and vegetables to prepare a safe meal for my family.	O	O	O	O
59	I wash my hands before preparing or eating food.	O	O	O	O
60	When I see an adult handling food improperly, I point out her or his mistakes.	O	O	O	O
61	I can identify foods that have a higher risk of making me sick.	O	O	O	O
62	I use hand sanitizer to clean my hands	O	O	O	O
63	I wash my hands after each time I use the restroom.	O	O	O	O
64	I can recognize the most common symptoms of food poisoning.	O	O	O	O

Thank you for participating in this survey.

Appendix G

Sample Survey Instrument Answers

Directions: Read each of the following statements or questions below and choose the **BEST** answer from the choices given.

Science

1) Which of the following is NOT true about bacteria?

- They are microscopic.
- They are made up of only one cell.
- They can be found on most surfaces.
- All bacteria can make you sick.

2) Which of the following is NOT one of the three basic shapes of bacteria?

- Circular
- Bacilli
- Spiral
- Cocci

3) When bacteria grow they:

- Grow in size from an infant to an adult.
- Grow in number, not in size.
- Eventually get too big and die.
- Require more and more food to grow larger.

4) How do bacteria get the nutrients they need to survive?

- Some make their own energy from sunlight.
- Some scavenge their nutrients from the environment around them.
- Some attach to other living things.
- All of these are true.

5) A pathogen is:

- A bacterium that helps in digestion.
- A bacterium used to make pepperoni.
- A bacterium that can make you sick.
- A bacterium used to make medicines.

6) An example of indirect contact is:

- Touching the desk and then touching your eyes, mouth, or nose.
- Getting a kiss on the cheek from Aunt Mildred.
- Shaking hands with a friend.
- Hugging your parents.

7) Which of the following is NOT a food made using helpful bacteria?

- Pickles
- Eggs
- Pepperoni
- Sauerkraut

8) All of the following are pathogens EXCEPT:

- Salmonella
- Lactobacillus
- E. coli
- Listeria

9) The best way to avoid getting sick from a pathogen is to:

- Rinse your hands in cold water for 5 seconds.
- Wash your hands in warm water with soap for 20 seconds.
- Avoid touching any surface.
- Wipe your hands on a dish towel.

10) Bacterial cells are different from animal cells in that bacteria cells:

- Contain DNA.
- Have a cell wall.
- Do not have a nucleus.
- Contain cytoplasm.

Language Arts

11) Which of the following is considered a bacterial "hot zone" in your house?

- ✌ Kitchen
- ✌ Living Room
- ✌ Bedroom
- ✌ Closets

12) The MOST IMPORTANT thing you can do to keep from getting sick from bacteria is to:

- ✌ Refrigerate leftovers.
- ✌ Wash your hands.
- ✌ Frequently wipe kitchen surfaces.
- ✌ Use a hand sanitizer.

13) Which is the BEST example of cross-contamination?

- ✌ Using the same knife to cut raw chicken and vegetables.
- ✌ Leaving food sitting at room temperature for too long.
- ✌ Not reheating food properly.
- ✌ None of the above.

14) Leftover foods should be refrigerated within:

- ✌ 30 minutes
- ✌ 1 hour
- ✌ 2 hours
- ✌ 3 hours

15) Bacteria grow most rapidly at temperatures of:

- ✌ At zero degrees.
- ✌ Below 40 degrees.
- ✌ Above 140 degrees.
- ✌ Between 40-140.

16) The safest way to tell if a hamburger is cooked to the proper temperature is to:

- ✌ Use a food thermometer.
- ✌ Check the inside to see if it is still pink.
- ✌ Burn the outside of the burger.
- ✌ None of the above.

17) The purpose of a press release is to:

- ✌ Track outbreaks of foodborne illnesses.
- ✌ Share information or news with the media.
- ✌ Determine the cause of a foodborne illness.
- ✌ Sell products or services.

18) Which of the following is NOT part of a press release?

- ✌ Title page.
- ✌ Contact information.
- ✌ Headline.
- ✌ Dateline.

19) When writing a press release you should:

- ✌ Tell the audience that the information is intended for them and why they should read it.
- ✌ Start with a brief description of the news, and then explain who announced it, and not the other way around.
- ✌ Avoid excessive use of adjectives and fancy language.
- ✌ All of these are true.

20) Which of the following is a possible outcome of NOT handling food properly?

- ✌ Getting sick and requiring medical attention.
- ✌ Getting sick for a few days and then feeling better.
- ✌ Not getting sick at all.
- ✌ All of these are possible outcomes.

Math

21) It is okay to eat raw cookie dough:

- anytime. The raw eggs will not hurt you.
- only if the cookie dough is store bought.
- only if the cookie dough is homemade.
- never. Raw cookie dough puts you at risk for salmonellosis.

22) The safest way to defrost frozen meat is to:

- set it out on the counter.
- place it in the refrigerator.
- cook it while it is frozen.
- None of the above.

23) To make sure that your hamburger is safe to eat it should be cooked to an internal temperature of:

- 160 F.
- 180 F.
- 200 F.
- 212 F.

24) A data set with data points of (1, 2, 3, 4, & 5) would have a mean of:

- 2.5
- 3.0
- 3.5
- 5

25) A data set with the data points of (16, 17, 22, 22, 25, & 30) would have a mode of:

- 6
- 14.0
- 22
- 26.4

26) A data set with data points of (6, 7, 7, 10, & 16) would have a range of:

- 5
- 7.0
- 9.2
- 10

27) A data set with data points of (2, 4, 6, 8, & 10) would have a median of:

- 5
- 5.6
- 6
- 8

28) Jimmy is exactly 5 feet tall. His height at 4x and 10x would be:

- 5 ft and 10 ft
- 9 ft and 15 ft
- 20 ft and 50 ft
- 20 ft and 40 ft.

29) If a bacterium's generation time was 10 minutes and you started with one bacterium, how many bacteria would there be after one hour?

- 1
- 6.0
- 32
- 64

30) The difference between a sample and a population is:

- a sample is selected from a population.
- a population is selected from a sample.
- a sample refers to people and a population refers to objects.
- There is no difference between a population and a sample.

Social Studies

31) A foodborne illness is

- ✌ any illness that humans get from food.
- ✌ an illness you are born with.
- ✌ only preventable with a vaccine.
- ✌ cannot be passed from one person to another.

32) Which of the following can case a foodborne illness?

- ✌ Bacteria
- ✌ Viruses
- ✌ Parasites
- ✌ All of these can cause a foodborne illness.

33) Which of the following is NOT a common symptom of foodborne illnesses?

- ✌ Chest pains
- ✌ Diarrhea
- ✌ Vomiting
- ✌ Headache

34) You should wash your hands

- ✌ after using the bathroom.
- ✌ before handling food.
- ✌ more frequently when someone around you is sick.
- ✌ All of these are true.

35) Most foodborne outbreaks are caused by:

- ✌ not keeping food hot or cold enough.
- ✌ poor personal hygiene (not washing your hands).
- ✌ cross-contaminating raw and cooked foods.
- ✌ None of the above.

36) The life expectancy rate in a country is:

- ✌ the number of people expected to die each year.
- ✌ the average number of years a person in that country can expect to live.
- ✌ the quality of life a person in that country can expect.
- ✌ None of the above.

37) A country's gross domestic product per capita tells us:

- ✌ how much money the average person in that country makes each year.
- ✌ what kind of government a country has.
- ✌ how much debt a country has.
- ✌ how many hospitals a country has.

38) A country's infant mortality rate tells use:

- ✌ the number of babies that will die before their first birthday.
- ✌ the number of babies born with deformities or diseases.
- ✌ the number of children who will start school that year.
- ✌ None of the above.

39) Which of the following does NOT need to be done in order to avoid foodborne illnesses?

- ✌ Make sure that all food is thoroughly cooked.
- ✌ Throw away leftovers.
- ✌ Refrigerate all leftovers immediately.
- ✌ Separate meat and veggies when preparing foods.

40) When researching outbreaks of foodborne illnesses it is important to know:

- ✌ the location of the outbreak.
- ✌ the number of reported cases of illness.
- ✌ the likely cause of the outbreak.
- ✌ All of these are true.

For the following statements: Fill in the appropriate Bubble if the statement is **TRUE** or **FALSE.**		TRUE	FALSE
41	It is possible to wash my hands thoroughly using only water.		
42	When preparing food, it is okay to use the same surfaces (cutting board, counter top) and utensils for meats and vegetables.		
43	It is okay to eat pizza that has been sitting out on the counter all night as long as I warm it up first.		
44	Most people go to the doctor when they get food poisoning.		
45	More people are hospitalized each year with food poisoning than with the flu.		
46	Almost all food-poisonings are preventable.		
47	Food-poisonings only occur in under developed countries.		
48	If I clean a surface with soap and water, it will kill all the bacteria.		
49	Water can make me sick.		
50	Bacteria cannot grow in foods stored in the refrigerator.		
51	There are bacteria in my food that can make me sick if my food is not handled correctly.		
52	All bacteria can make me sick.		
53	A bacteria cell is different from an animal cell because the bacteria cell does not have a nucleus.		
54	Bacterial growth means an orderly increase in the number of bacteria.		
55	To prevent cross contamination, it is important to keep raw meat, poultry, and seafood away from other foods in the grocery cart and refrigerator.		

For the following statements, fill in the bubble of the choice that applies **most** often. The statement is *never* true. The statement is *rarely* true. The statement is *sometimes* true. The statement is *usually* true.		Never	Rarely	Sometimes	Usually
56	I feel that I know how to correctly handle my food so that I do not become sick.				
57	When preparing food, I carefully follow temperature and time directions on the food packaging labels.				
58	If necessary, I could properly handle a variety of meats and vegetables to prepare a safe meal for my family.				
59	I wash my hands before preparing or eating food.				
60	When I see an adult handling food improperly, I point out her or his mistakes.				
61	I can identify foods that have a higher risk of making me sick.				
62	I use hand sanitizer to clean my hands				
63	I wash my hands after each time I use the restroom.				
64	I can recognize the most common symptoms of food poisoning.				

Thank you for participating in this survey.

Vita

Sarah M. Johnson was born November 2, 1981 in Harvey Illinois to Allen and Karen Johnson. She graduated from Plainfield High School in Plainfield, Illinois in May 1999. She graduated from Tennessee Technological University, Cookeville Tennessee with a Bachelor of Science degree in Human Ecology in May of 2003. While attending TTU, she played Varsity Softball, made the Dean's List and the Ohio Valley Conference Commissioners Honor Roll, was involved with the Omicron Delta Kappa honor society, received the 2003 TTU Family and Consumer Sciences Education Outstanding Student Award, served as Student Admissions Representative and was active in Fellowship of Christian Athletes.

After graduating, she worked with the University of Extension in Scott County, Tennessee for three years being responsible for the 4-H youth program and Adult Family and Consumer Science programming. While in this position she entered into the Master of Science program in Agricultural and Extension Education to begin her graduate study. In September 2003, she transferred to UT Extension in McMinn County where she programs with adult audience in the areas of health, nutrition, food safety and family economics.

Presently, she lives in Athens, Tennessee. She recently is employed by the University of Tennessee Extension, as a Family and Consumer Science Agent. She coaches youth softball and is actively involved in community events. In her spare time she enjoys water sports on the lake.