DEVELOPMENT OF A FOOD SAFETY EDUCATION PROGRAM ON CD/ROM FOR 4TH, 5TH, AND 6TH GRADE CHILDREN

by

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ABSTRACT

This research created an interactive, multimedia, food safety education program on CD/ROM for fourth through sixth grade school children. The project was divided into three stages: 1) a survey to assess children's needs, 2) program development, and 3) Beta-testing the program with content experts and the targeted audience.

A needs assessment survey was administered to children, 9 to 12 years of age, who were members of a 4-H, Boys and Girls Clubs, or after school program. The survey collected demographic data, food handling frequencies/practices, handwashing habits, and computer usage/media preferences. Children were found to be active in food handling/preparation and stated they knew the definition of food safety. Many, however, were unsure of the meaning of cross-contamination, how to use a thermometer, and were inconsistent with safe handwashing practices. Almost 92% of respondents reported using the computer daily, weekly, or monthly and 91% liked using the computer for learning.

To facilitate design of the food safety education program, current food safety education programs were reviewed. At the time, there were limited numbers of programs directed at children and even fewer computer-based.

A multimedia specialist assisted in the creation of the food safety education program on CD/ROM titled, "Kid Chef and the Clean Kitchen Crew." The program was divided into four chapters: 1) food safety and foodborne illness, 2) handwashing importance and handwashing techniques, 3) foodborne

pathogens, and 4) food safety practices from purchase to cooking to serving. Interactive and multimedia components were used throughout the program.

Beta-testing with experts from food safety, multimedia, education, extension, and technology ensured that the program was factual and appropriate for fourth through sixth grade students. Additional Beta-testing with ten children in the targeted age group illustrated acceptance, ease of understanding, and navigation. Changes were made prior to each subsequent critique.

The reviewers and target audience indicated the CD format was acceptable for presenting food safety education. Recommendations included increasing the amount of animation, video clips, questions, and translation into Spanish. It is further suggested that the program be tested for effectiveness via a pre/post test design.

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CHAPTER I

INTRODUCTION

This chapter provides a brief overview of: (a) background information, (b) problem statement and purpose, (c) justification, and (d) research questions and objectives related to this study.

Background

The Foodborne Diseases Active Surveillance Network (FoodNet) estimates that there are 76 million reported cases of foodborne illness in the United States (U.S.) yearly with approximately 5,000 of these occurrences resulting in death (Mead et al., 1999). Increased consumption of processed food and importation of produce from other countries has made the U. S. population more susceptible to potentially dangerous microorganisms (King, 1997). Introduction of these microorganisms into the food supply increases chances of foodborne illness. Some segments of the population, such as the immune-compromised, pregnant women, older adults, and children, are more vulnerable to foodborne illness than others (United States Department of Agriculture [USDA]-Food Safety and Inspection Service [FSIS], 2003). Children are highly susceptible because of underdeveloped intestinal tracks that allow for faster pathogenic absorption (Buzby, 2001; Laliberte, 1995).

According to the 2000 Census, the U.S. population is 281,421,906 with 25.7% being children under the age of 18 (United States Bureau of Census 2000-US, 2001). In Kansas, children under 18 constitute 26.5% of the state's 2,688,418 residents (United States Bureau of Census 2000-KS, 2001).

Changing American lifestyles and increasing numbers of dual- working and single parent families have resulted in many of these children being left alone before and after school (Clark & Foote, 2004; Smith, 2000; Williams, 1992). These children are taking an active role in snack or meal preparation (Clark & Foote, 2004; Haapala & Probart, 2004; Keith, 1991). Younger siblings, those at high risk of foodborne illness, may also be consumers of these snacks and meals. Learning proper food handling practices at an early age is essential for children in protecting themselves and their families from foodborne illness.

Education and training in the basic principles of food safety could greatly reduce the risk of foodborne illness. Food safety education programs that teach children basic sanitation and proper food handling can be effective at a young age (Haapla & Probart, 2004; Pivarnik, Partnoad, & Giddings, 1994; Youatt, Andrews, Hammerschmidt, Sawyer, & Murphy, 1996). Cross contamination, the proper use of a thermometer, and time and temperature abuse are important food safety facts for fourth through sixth grade children to know. Food safety education at an early age is thought to be essential in developing proper food handling practices that can be utilized for life (Haapla & Probart, 2004; Youatt et al., 1996).

Teaching children between the ages of 9 and 12 can be effective because they are eager to learn, enjoy hands-on activities, and are still young enough to change and develop new habits (Haapala & Probart, 2004; Hunter, 1995; Medeiros, Hillers, Kendall, & Mason, 2001; Youatt et al., 1996). Early intervention food safety education and training can be successful. Life skill

education programs that target this age group have been found to be successful in increasing children's knowledge and are effective in changing their behavior (Cody & Hogue, 2003; Pivarnik et al., 1994; Youatt et al., 1996). Utilization of interactive, multimedia components in such educational programs can make learning the subject fun, interesting and engaging (Endres, Welch, & Perseli, 2001).

Problem Statement

The majority of present food handling training is targeted to adults in the food service and the food processing industries. Children aged 9 to 12 are assuming an increasing role in food preparation at home and must learn the concepts of proper food handling to avoid the risk of foodborne illness (Fishman, Pearson, & Reicks, 1999; Haapala & Probart, 2004; Keith, 1991). Hunter (1995) estimated that 21% of all foodborne illness occurs in the home. In 1999, Audits International, a food safety auditing firm, conducted a home based food safety audit and found that 69% of homes had critical violations in their food handling practices. It was discovered that the main reason behind these violations was inadequate food safety education (Audits International, 2002). Early food safety education could provide a knowledge base essential to developing proper food handling habits and the reduction of foodborne illness.

Purpose of Study

The purpose of this study was to develop an interactive, multimedia food safety education program on CD/ROM for children in grades fourth through sixth grades. Previous studies involving children in nutrition and food safety education

programs have shown these programs are effective in increasing nutrition and food safety knowledge (Cody & Hogue, 2003; Cullen, Bartholomew, & Parcel, 1997; Fishman et al., 1999; Haapala & Probart, 2004; Pivarnik et al., 1994; Youatt et al., 1995). This increase in food safety knowledge should better prepare children for safe home food preparation. The incorporation of different media, such as video, animation, and photographic images, along with interactive activities will engage and motivate the child to learn. Computer-based, multimedia programs with interactive components are timely, interesting, and informative.

Justification for This Study

A review of food safety education programs revealed that few were directed at children between the ages of 9 and 12 years of age. Presently, there is no child-specific food safety education program in the state of Kansas. Some university, federal, state, and private entities have developed food safety training programs for children, but these have generally targeted preschool or high school audiences (National Agricultural Library [NAL], 2004; Pivarnik et al., 1994; Youatt et al., 1996). Some organizations have incorporated food safety training into child nutrition education programs (Cullen et al., 1997). Many programs were developed in the early 1990's with some being created as recently as 2002. Few of these programs are interactive, multimedia programs and generally consist of a booklet, poster, games, or coloring activities. A limited number have a computer floppy disc or video to accompany the written curriculum (NAL, 2004).

Some food safety education websites, targeted at children have been created, but may offer limited use due to their requirement of Internet accessibility.

Some food safety education programs are adequate but expose children to only very basic food safety information. Evaluations collected during the development and presentation of one program, aimed at third through fifth graders, found that the children considered the program unchallenging (Youatt et al., 1996). Researchers also found that after training, these children understood the proper food handling procedures but did not know the reasoning behind these practices (Youatt et al., 1996). Presenting the names of common foodborne pathogens, the foods associated with them, and learning the measures necessary to reduce or eliminate their growth may help children understand the relationship between these two factors.

In the past, children have not been targeted for food safety education programs. However, the “Farm to Table Food Safety Initiative Report to the President” specifically targets this group to receive increased food safety education. Also, this initiative recommends that food safety education be incorporated into school curricula (Food and Drug Administration [FDA], 1998).

Research in food safety is ongoing and many changes have been made over the last several years. Because some of these food safety programs were created several years ago, information within the program may be outdated. There is a need for a current, comprehensive food safety education program directed at preteens that will address the: Who, What, Why, When and How of food safety. It is essential that the program explain foodborne illness and its

causes, foodborne pathogens and associated foods, the importance of hygiene, and proper food handling procedures. Presenting food safety and nutrition education via an interactive multimedia computer-based program has proven to make the learning process less complicated, factual, and fun (Endres et al., 2001; Gould & Anderson, 2000). Early intervention food safety education will better equip children with the necessary life skill of safe food preparation.

Objectives of Research

Specific objectives included:

1. Determine the present food safety knowledge of fourth through sixth graders.
2. Determine the handwashing practices of fourth through sixth graders.
3. Determine the frequency of computer usage and media preferences of fourth through sixth graders.
4. Develop an interactive, multimedia food safety education program on CD-ROM that will be acceptable to this audience.
5. Beta-test the CD with technology, food safety, and education experts for content accuracy and age appropriateness.
6. Beta-test the CD-ROM with 10 students in the fourth through sixth grades for content and delivery acceptance.
7. Modify program content in accordance with feedback received during Beta-test.

Research Questions

Specific questions to be addressed were:

1. What are the food handling frequencies of children in grades four through six?
2. What is the baseline food safety knowledge of children in grades four through six?
3. What are the handwashing practices of children in grades four through six?
4. Will education, food safety, and technology experts accept a food safety education program delivered in an interactive, multimedia format?
5. Will a food safety education program presented on CD/ROM be acceptable to this audience?

References

Audits International. (2002). *Audits International's home food safety survey*. Retrieved February 22, 2003, from http://www.audits.com/Report.html

Buzby, J. (2001). Children and microbial foodborne illness. *Food Review, 24*(2), 32-37.

Clark, L. & Foote, R. (2004). Building basic living skills in youth-Kid's chef school. *Journal of Extension, 42*(3). Retrieved July 12, 2004, from http://www.joe.org/joe/2004june/iw5.shtml

Cody, M. & Houge, M. (2003). Results of the home food safety-it's in your hands 2002 survey: comparisons to the 1999 benchmark survey and healthy people 2010 food safety behaviors objective [Electronic version]. *Journal of the American Dietetic Association, 103*(9).

Cullen, K., Bartholomew, L. & Parcel, G. (1997). Girl scouting an effective channel for nutrition education. *Journal of Nutrition Education, 29*(2), 86-91.

Endres, J., Welch, T. & Perseli, T. (2001). Use of a computerized kiosk in an assessment of food safety knowledge of high school students and science teachers. *Journal of Nutrition Education, 22*(1), 37-42.

Fishman, A., Pearson, K. & Reicks, M. (1999). Gathering food and nutrition information from migrant farmworker children through in-depth interviews. *Journal of Extension, 37*(5). Retrieved January 14, 2002, from http://www.joe.org/joe/1999october/rb3.html

Food and Drug Administration. (1998). *Food safety from farm to table: A national food safety initiative: Report to the President, May 1997*. Retrieved April 26, 2002, from http://vm.cfsan.fda.gov/~dms/fsreport.html

Gould, S. & Anderson, J. (2000). Using interactive multimedia nutrition education to reach low income persons: An effectiveness evaluation. *Journal of Nutrition Education, 32*(4), 204-213.

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

Hunter, T. (1995). Overlooked threats of foodborne illness. *Consumer's Research Magazine, 78*(10), 14-19.

Keith, M. (1991). *Kids, Food, and Safety. National Network for Child Care*. Retrieved March 23, 2002, from http://www.nncc.org/Health/sac11_kid.food.safe.html

King, P. (1997). School feeders pluck strawberries from menus. *Nation's Restaurant News, 31*(15), 1,4.

Laliberte, R. (1995). How safe is your child's food? *Parents, 70*(5), 30-32.

Mead, P, Slutsker, L, Dietz, V, McCaig, L, Bresee, J, Shapiro, C, Griffin, P. & Tauxe, R. (1999). *Food-Related Illness and Death in the United States: Centers for Disease Control and Prevention*. Retrieved August 31, 2002, http://www.cdc.gov/ncidod/eid/vol5no5/mead.htm

Medeiros, L., Hillars, V., Kendall, P. & Mason, A. (2001). Evaluation of food safety education for consumers. *Journal of Nutrition Education, 33*(1) (Suppl.), 27-34.

National Agricultural Library. (2004). *Food safety teaching materials for kids.* Retrieved August 9, 2004, from http://www.nal.usda.gov/fnic/foodborne/kids.htm

Pivarnik, L., Partnoad, M. & Giddings, M. (1994). A food safety curriculum for second and third grade elementary students. *The Journal of the American Dietetic Association, 94*(8), 865-868.

Smith, K. (2000). *Census bureau says 7 million grade-school children home alone. United States Census Bureau*. Retrieved April 14, 2002, from http://www.census.gov/Press-Release/www/releases/archives/children/000532.html

United States Bureau of the Census 2000-KS. (2001). *Kansas Population Quick Facts*. Retrieved May 18, 2002, from http://quickfacts.census.gov/qfd/states/00000.html

United States Bureau of the Census 2000-US. (2001). *U.S. Population Quick Facts*. Retrieved May 18, 2002, from http://quickfacts.census.gov/qfd/states/20000.html

United States Department of Agriculture/Food Safety Inspection Service. (2003). *Food safety and food security: What consumers need to know*. Retrieved October 29, 2003, from http://www.fsis.usda.gov/oa/topics/foodsec_cons.htm

United States Department of Health and Human Services. (2002). Can your kitchen pass the food safety test? *FDA Consumer Magazine, July*. Retrieved January 7, 2003, from http://www.fda.gov/fdac/features/895_kitchen.html

Williams, D. (1992). DIRECT's Population Study Series: Characteristics of the Labor Force: Women in the Work Force, Including Presence of Children 1950 through 1990, United States and Kansas. *DIRECT's Population Study Series 4*, 1-3: Manhattan, KS: Kansas State University Cooperative Extension Service.

Youatt, J., Andrews, S., Hammerschmidt, P., Sawyer, C. & Murphy, A. (1996). RISK Raiders: A food safety hypermedia software game for students (Grades 3-5). *Journal of Nutrition Education, 28*(3), 181A.

CHAPTER II

REVIEW OF LITERATURE

Introduction

A review of current literature was conducted to understand the incidence of foodborne illness outbreaks, the importance of food safety education and training, and the effectiveness of food safety multimedia education programs for children. At the time, few food safety education programs for children existed so a comprehensive review to determine the effectiveness of nutrition education programs was conducted. In addition, a review of interactive multimedia programs identified the components that make these programs successful. Results of the literary query are presented in this chapter.

Foodborne Illness

Frequency

The Centers for Disease Control and Prevention (CDC), the United States Department of Agriculture (USDA), and the Food and Drug Administration (FDA) have formed a collaborative partnership in an effort to identify and track the incidence of foodborne illness in this country. This collaborative effort has resulted in the development of the Foodborne Diseases Active Surveillance Network or FoodNet. The network includes ten reporting sites, documents the number of cases, frequency of outbreak, and location of food related illnesses. It is estimated that there are 76 million reported cases of foodborne illness in the United States (U.S.) yearly with approximately 5,000 of these occurrences

resulting in death (Mead et al, 1999). Exact figures are difficult to obtain due to similarities between foodborne illnesses and other intestinal ailments.

Expense

It is estimated that foodborne illness costs $6.9 billion in medical expenses a year. Children, age 10 and under account for approximately $2.3 billion of those expenses (Buzby, 2001). It is however, difficult to accurately measure the cost because of the number of factors involved. In an effort to fill this need, the Economic Research Service of the USDA has created an online calculator that allows input of these factors and calculates the cost estimates for five specific pathogens. An example is Salmonella, which accounts for over $3 billion in economic loss per year (Economic Research Service/USDA [ERS/USDA], 2004).

Foodborne illness and death is not only a problem in the United States but one of global proportion. The World Health Organization/Europe (2004) has developed a tracking system similar to FoodNet. WHO/Europe recognizes the importance of tracking foodborne illnesses and creates and disseminates educational materials throughout Europe. These materials inform food producers and consumers of current foodborne illness trends and ways that they can prevent or avoid them (World Health Organization Regional Office for Europe [WHO/Europe], 2004).

Causes

Foodborne disease-causing agents are classified as bacteria, viruses, parasites, and food toxins and cause illness when ingested. Pathogenic microorganisms are considered to be the greatest threat to safe food

(International Food Information Council [IFIC], 2004). Reducing the introduction of pathogenic organisms at the farm level and destruction of them at the consumer level are essential in preventing foodborne illness. Ensuring a safe food supply chain is the ongoing effort of the “Farm to Table Food Safety Initiative” (FDA, 1998). This program supports the idea that food safety at the production, manufacturing, and consumer level can be achieved through increased education, training, and implementation of control procedures.

The Centers for Disease Control (CDC) in Atlanta has reported that there are over 250 illnesses transmitted by food (CDC-Foodborne, 2003). Illnesses caused by infections of Campylobacter, E-coli 0157:H7, Listeria, Salmonella, Shigella, Vibrio, and Yersinia are included in active surveillance by FoodNet (CDC-Foodnet, 2003). While some of these pathogenic microorganisms are naturally occurring, others are introduced by raw sewage in irrigation water or fecal contamination during processing (King, 1997).

Some pathogenic bacteria and viruses are introduced into the food stream by human contact with food. The most common of these pathogens are Salmonella typhi, Shigella, Staphylococcus aureus, Streptococcus pyogenes, Hepatitis A virus, and Norwalk and Norwalk-like virus. These pathogens can contaminate food through fecal-oral transmission, by touching pimples then food or by sneezing or coughing on food (Ollinger-Snyder & Matthews, 1996).

There are certain conditions needed for bacterial survival and multiplication. Bacteria thrive in a warm, moist, generally non-acidic environment and can live in aerobic or anaerobic conditions. These criteria, coupled with

time, create the perfect environment for bacteria to multiply and reach unacceptable levels in food. When contaminated food is eaten, it can result in foodborne illness or even death. Creating and maintaining strict controls at every point in the food production chain can eliminate or control bacterial growth (Stevenson & Bernard, 1995; CDC-Foodborne, 2003). Consumers' knowledge of proper food handling practices and consistent use of these procedures can protect them from foodborne illness (Haapala & Probart, 2004).

Affected Populations

Some populations have been identified as more vulnerable to food-related illness than others. Very young children, older adults, and those who are immune-compromised are at greatest risk for foodborne illnesses or death (USDA-FSIS, 2003). Young children are more vulnerable to foodborne illness because their intestinal tracts are not yet fully developed, allowing for faster pathogenic absorption (Buzby, 2001; Laliberte, 1995).

Media coverage of children dying from eating hamburgers contaminated with E-coli 0157:H7 has brought to the forefront the importance of food safety concerning children. The CDC estimates that this strain of E-coli alone causes 73,000 illnesses and 61 deaths a year (CDC-Escherichia, 2004). In 2002, there were 32 cases of E-coli 0157:H7 reported in Kansas, with the majority of cases occurring in children between 5 and 14 years old. Children under the age of 14 also comprised the majority of the 284 cases of Campylobacteriosis and the 354 cases of Salmonellosis reported in 2002 ("Reportable Diseases in Kansas", 2002).

Food Safety Training and Education

Sources of Food Safety Information

Encouragingly, the majority of food-related illnesses and death could be controlled or eliminated. Increased food safety education and training has been identified as the key (Christine, 1994; ERS, 2004). Knowledge and consistent use of proper food handling techniques will reduce or prevent the incidence of foodborne illness (Haapala & Probart, 2004; Medeiros et al., 2001).

Surveys and questionnaires have been used to gain understanding of where consumers obtain food safety information. Buzby and Ready (1996) found that 71.3% of individuals received food safety facts from television news and 70.1% from reading newspapers. Government publications accounted for only 16.5% of the information received about food safety, but consumers' trust in these publications was greater than in information gathered from television and newspaper articles. The FDA and USDA have made a concerted effort to create and update materials to educate both industry and consumers about food safety and foodborne illness (Buzby & Ready, 1996; NAL, 2004).

Need for Food Safety Education

Food safety training and education programs have been found to be an effective tool in teaching food processors and food handlers the proper procedures for safe food production (Howes, McEwen, Griffiths, & Harris, 1996; Wie & Strohbehn, 1997). Food safety education has been identified as the key to decreasing foodborne illness. Keeping foods safe is the joint responsibility of

government, industry, and consumers (“Medical Letter on the CDC & FDA”, 2000).

Increased food safety education for consumers, especially children, is necessary for protection from foodborne illness. This sector of the population has been historically undereducated in the dangers associated with food preparation (FDA, 1998). A home food safety survey conducted by Audits International in 1999 found that 69% of the 121 homes audited had a least one critical violation and an average of 3.2 major violations that could cause foodborne illness (Audits International, 2002). The survey identified lack of food safety education as the contributory factor for these violations.

The Partnership for Food Safety Education was formed in 1997, in an effort to fill the consumer food safety education void. This collaboration includes governmental agencies, industry, professional, and consumer organizations whose goal is to develop programs and materials for educating consumers about proper food handling and avoidance of foodborne illness (“Partnership for Food Safety Education”, 2004). The Fight BAC™ campaign developed by this partnership has been one of the most successful and visible programs in the United States. Specific areas addressed by this campaign are; wash--hands and surface’s often: separate--don’t cross contaminate: cook--to proper temperature: chill-refrigerate immediately (“Partnership for Food Safety Education-FightBac™,” 2004). The Fight BAC™ campaign provides published materials and a comprehensive website of current information, games, and links to other food safety education sites.

The Federal Inspection and Safety Service's Thermy™ campaign (FSIS, 2004) was created after research concerning consumers' perceptions of doneness of hamburger patties. A study at Kansas State University in 1998 found that hamburger patties turned brown before they were cooked to a safe internal temperature (FSIS-Educator, 2004). This prompted the need to educate consumers about the importance of using a thermometer to adequately measure the safe temperatures of foods.

These ongoing programs are targeted at a broad spectrum of consumers and have small components for children. A continued effort must be made in creating youth-specific programs that teach basic food safety principles, because children are the food handlers of the future (Haapala & Probart, 2004).

Children and Food Preparation

Children are taking an active role in food preparation. In a survey addressing food safety knowledge and food handling behaviors, Haapala and Probart (2004) found that 92% of the 178 middle school participants prepared meals or snacks at home. The University of Illinois Cooperative Extension Service found that 95% of 8 to 12 year olds, with mothers working in and outside of the home, prepared at least some of their own meals or snacks (Keith, 1991). Hammerschmidt, Andrews, Murphy, Youatt, and Sawyer (1995) conducted a survey with third through fifth graders, 60 girls and 17 boys, in Michigan. The survey results showed that 85% of these students, 70% of them with parents or daycare providers, prepared their own after school snacks. Another study conducted with 22 migrant farm children in Minnesota found that each child was

responsible for meal preparation at least once a day. Generally, these 9 to 12 year olds prepared breakfast or lunch with little or no adult supervision (Fishman, et al., 1999).

Children and Food Safety Education

Researchers found that even though children were involved in several phases of food preparation, they did not possess basic food safety knowledge (Happala & Probart, 2004). Currently, the majority of food related programs targeted at children were nutrition-based. Some of these programs include small food safety components that address hand washing and keeping hot foods-hot and cold foods-cold (Cullen, et al., 1997; Pivarnik, et al., 1994; Youatt et al., 1996). Specific information such as the cause and prevention of foodborne illness was absent from these nutrition-based programs.

Food safety education at an early age is a chance to increase knowledge and develop proper food handling practices for life. Present lifestyles and family composition often leave children with little guidance on safe food preparation techniques in the home. Involving children in a food safety education program could better prepare them to be safe food handlers, whether it is in home preparation or in future employment in the food service industry (Haapala & Probart; Hunter, 1995, 2004).

The “Home Food Safety-It’s in your Hands” Survey, conducted in 1999 and 2002 and sponsored by the American Dietetic Association, found that only 36% of the 1000 plus participants who had children under 18 believed their children had adequate food safety knowledge (Cody & Hogue, 2003). This is

evidenced by a study conducted in Illinois, which found that children in the fourth and fifth grades were participating in several unsafe food handling practices. These practices included eating raw cookie dough, tasting food and licking fingers while cooking, and eating and drinking after family members (Barclay, Greathouse, North, & Cale, 2001).

The Department of Health and Human Services (2002) stated that foodborne illness resulting from home preparation might be a bigger problem in the future. The identified reason is consumers' hurried lifestyles and unfamiliarity with basic food safety principles. Seventy percent of the 1000 participants in a home food safety survey reported that they didn't think it common for foodborne illness to occur in the home. Of this group, however, 82% believed it very important for them to have information about food safety training in the home (Cody & Hogue, 2003).

Hunter (1995) stated that an estimated 21% of all foodborne illnesses result from improper food handling in the home kitchen. Many of these cases go unreported making it difficult to know the true number of foodborne illnesses originating from home food preparation. There is a need for food safety education regarding home food preparation based on the findings of the Audits International Home Food Safety Survey (2002). Fishman et al. (1999) found that when children were asked what made food unsafe, they were unable to respond. Educating consumers on the relationship between improper preparation procedures, storage practices, and pathogenic growth could eliminate some of this ignorance and reduce the incidence of foodborne illness.

Expanding Food Safety Education

The 1998 National Food-Safety Initiative Report recommended increased implementation of food safety procedures from farm to table, including increased food safety research, training, and education (FDA, 1998). Adults and children are two groups targeted for increased education. Implementing food safety education programs into school curriculums, one of the most important goals of the initiative, began in fiscal year 1998. Development and continuation of these programs is the joint responsibility of the FDA, CDC, FSIS of the USDA, and Cooperative State Research, Education, and Extension Service (CSREES).

The Department of Health and Human Services has created Healthy People 2010, a comprehensive plan to increase quality and years of life and eliminate health disparities by the year 2010. This plan focuses on 28 major areas, with food safety and the reduction of foodborne illness listed as the 10th goal (Healthy People, 2004).

The cooperative effort to educate industry as well as consumers about food safety is evidenced in the strength and breadth of such organizations as the Partnership for Food Safety Education and other industry-based organizations. They have recognized and emphasized the importance of continuous, current food safety education for everyone, from production to consumption.

Kansas Children

According to the 2000 Census, the United States population is 281,421,906 with 25.7% being children under the age of 18 (United States

Bureau of Census 2000-US, 2001). In Kansas, children under 18 constitute 26.5% of the state's 2,688,418 residents (United States Bureau of Census 2000-KS, 2001). Kansas figures have shown a steady rise in the number of women in the work force as well as those with dual working parents. In 1999, there were 578,340 married couple families in Kansas, with 53% of them reporting dual working parents. Nontraditional or single parent families accounted for 128,466 households with 58.6% of these families having a single working parent (Office of Local Government, 2004). Nationwide, in 2002, four of every five mothers with school-aged children were in the paid workforce, an increase from two of five in 1970 (American Federation of Labor, 2002). Rising numbers of dual working parents, single parent families, and mothers in the workforce increase the likelihood that children are preparing their own snacks, packing lunches, and participating in meal preparation.

The Office of Epidemiological Services-Kansas Department of Health tracks a number of illnesses, some food related, and reports them each year. In 1997 there were 200 cases of Campylobacteriosis and 284 in 2002. Children under the age of 14 accounted for three times more of these cases than any other age group. In 1996 and 2002, children also accounted for the greatest number of E-coli 0157:H7 cases reported. Salmonellosis affected children at a higher rate than other age groups with 70 cases per 100,000 Kansans in 1996 and 56.5 per 100,000 in 2002 ("Reportable Diseases in Kansas", 1996, 2002). This data is consistent with previous research that found that children are more highly susceptible to foodborne illness (Hess, 1997; Laliberte, 1995).

Educating Children

Learning Theories

There are several different approaches to teaching children nutrition and food safety. Two major behavioral theories are Cognitive Development Theory (CDT) and Social Cognitive Theory (SCT). Cognitive development theory states that the chronological age of a child affects his or her ability to categorize, generalize, and understand causal relationships between events (Lytle et al., 1997). Social learning strategies also consider the influence of environment and personal knowledge upon behavior (Lytle et al., 1997). An individual's behavior is determined by an interrelationship between previous knowledge and external events (Baldwin & Faliciglia, 1995).

SCT, takes into account both cognition and the environment and is one of the most popular behavior-based learning theories used in teaching nutrition to children (Lytle et al., 1997). Baldwin and Falciglia (1995) found that behavior can be changed by a person setting small goals and achieving them. These behavioral changes also can be maintained by additional or increased instruction. In the teaching of food safety, this could include shorter instructional periods over a set time frame. These shorter periods of instruction allow children to sustain their attention. This theory also would support advanced training at a later developmental stage (Baldwin & Falciglia, 1995). At this advanced age, more difficult food safety concepts could be introduced and learned.

Haapala & Probart (2004) have suggested that the Protection Motivation Theory could be used to teach food safety education. This theory is used to

increase peoples' health-related behaviors. According to this theory, individuals are motivated by the severity of the threat facing them. This, coupled with their ability to effectively address the threat, motivates them to change their behaviors. Rogers (1975) found that encountering a severe threat in conjunction with possessing the positive ability to face it results in desired behavior change. If the threat is high but the ability to deal with it is low, there is limited behavior change (Rogers, 1975). Presenting the dangers of foodborne illness and improper food handling (the threat), then presenting the proper ways of avoiding illness and handling food (the ability to overcome) empowers children and other consumers with the knowledge they need to address the threat. Theoretically, their food handling skills improve because they are trying to combat foodborne illness.

The Information Processing Theory suggests that the human mind consists of four basic elements: sensory organs (eyes, ears, nose, mouth, and skin/touch), short-term memory, long-term memory, and muscle system. This theory can be applied to computer-based learning in that the computer takes inputs, processes them, and generates outputs, much like a human brain. Humans touch, hear, and see interactive components of computer-generated information and process them. This sequence of events assists in subsequent learning of new information. Because this theory is so closely connected to the way the human brain works, it can be applied directly to the development of interactive multimedia computer education programs (Bagui, 1998).

The Cooperative State Research, Education, and Extension Service (CREES) of the USDA published a handbook that lists the developmental

characteristics of children. Ages are divided into four different groups: 5-8, 9-11, 12-14 and 15-19. These age guidelines are used to develop 4-H programs and insure that programs are age appropriate. Characteristics of children aged 9-11 are that they are active, enjoy group activity, and have rapidly changing interests. They are eager to try new things, are extremely curious, prefer material presented in short segments, and need recognition and praise for their work (CSREES, 1992).

Marketing research has found the importance of children's input when developing products for their use. Children have certain demands and are outspoken about what they want (McGee, 1997). Understanding their needs, capabilities, and desires is essential for product development. Getting the information directly from the source, the children themselves, is time and cost effective. Focus groups, personal interviews, and observational studies are some of the most effective ways of gaining insight into children's abilities. Research panels, especially effective for the 6 to 12 age group, are being used to obtain information about children. Although the information may not always be generalizable, the panel can provide insight into the participants' needs and capabilities (Hennessey & Heary, 2001; McGee, 1997).

Basic knowledge of learning theories, the capabilities, and mind-set of the audience is essential for development of a food safety program for children. Information must be age appropriate and engaging to be effective (Baldwin & Falciglia, 1995). Talking with children and understanding their likes and dislikes

is a cost-effective way of gathering information that can be used in the development of a curriculum (Hennessey & Heary, 2001; McGee, 1997).

Nutrition Education Programs for School Aged Children

Although there has been a recent increase in food safety education programs targeted at children, there is still limited research about the success of these programs. To gain insight into the effectiveness of early education intervention in elementary-age children, several nutrition education studies were reviewed. Some of these programs included an abbreviated food safety education component.

Cullen, et al. (1997) tested the effectiveness of a four-week fruit and vegetable nutrition program and the importance of early education and building good habits with Girl Scouts in the fourth through sixth grades. The hypothesis for the study stated that fruit and vegetable intake was influenced by self-efficacy, cognition, barriers to consumption, family norms, and personal preference. The study design had a control and intervention group. Exposing the girls to nutritional information along with hands-on activities increased their consumption and acceptance of fruits and vegetables, while the control group reported no such gain. The increase, however, did not carry over to the follow-up test which found that even though the girls had learned the benefits of fruit and vegetable consumption, other family-based factors in their lives didn't change, making it difficult to maintain their increased intake (Cullen et al., 1997). Such studies reinforce the need to educate children and family members about the benefits of

nutritionally sound and safe food handling practices, which leads to increased self-efficacy.

McKenzie et al. (1996) conducted a study that measured reduced nutrient intake when consuming a reduced fat diet. The randomly-selected participants were children 4 to 10 years of age assigned to four groups: two controls and two interventions. One intervention group received verbal nutritional counseling from a registered dietitian while the other had a take home tutorial requiring parental involvement. Data were collected by use of a 24-hour dietary recall: one at baseline and another at three months. While no significant reductions were found in the other three groups, the group with tutorial/parental involvement showed the greatest reductions in cholesterol and energy intake, solidifying the importance of parental support and guidance in reinforcing educational programming.

To understand the factors affecting the incorporation of a nutrition education program into a regular elementary school curriculum, Probart, McDonnell, Achterberg, and Anger (1997) conducted a study with sixth, seventh, and eighth grade teachers from different disciplines. A convenience sample of teachers was divided into two groups and asked to implement a nutrition education program into their core curriculum. One group of educators attended program workshops; the other received grants to encourage program implementation. Participation in the education program was voluntary for those attending the workshops but mandatory for grant schools. The three success factors expected to impact the program were, the teacher, environment, and

education. Information concerning the satisfaction with the program, the barriers to teaching, and number of lessons taught was collected. The teachers had extensive teaching experience but few had nutrition education knowledge. Of the lessons taught, home economics and elementary teachers taught the most with 80% of all teachers teaching at least one lesson. Course implementation was directly related to the number of nutrition classes the teachers had taken; the greater number of courses, the more they implemented the program. An interest in the subject contributed to the comfort of teaching and number of lessons taught (Probart et al., 1997). Creating an interest and providing instruction in a subject such as food safety will encourage teachers to take a proactive approach in implementing this type of programming into their daily curriculum.

Stroble (1997) conducted a study to test the effect that teachers, school, and the community had on fourth graders, nutrition and health knowledge. The factors identified that affect this knowledge included type of school curriculum, amount of time spent teaching nutrition, the teacher's rating of the program, the level of nutrition education the teacher had, the number of children who qualified for "free" or "reduced" school lunch, the amount of money the parents raised for the school, and per student spending. The researcher hypothesized that children receiving nutrition education as a part of their regular curriculum were better prepared to respond to societal problems and performed better in school, and that the teacher's perception of the course and willingness to teach nutrition would influence the success of the program.

A multiple choice and open-ended response exam was given along with regular testing of the core curriculum. It was found that as a child's knowledge of health related issues increased, so did their overall academic ability. The teacher's perception of the educational program and the socioeconomic level of the community also increased the children's health knowledge. This suggests the importance of implementing nutrition and health-related education into the curriculum while encouraging teachers and parental involvement in the educational process. As found in the previous study (Probart et al., 1997), the teacher's prior education in nutrition contributed to his or her acceptance and comfort in delivering the message. Providing assistance to the teachers with course preparation increased acceptance of the program resulting in higher nutrition scores of the fourth graders. Since parental and community factors were directly related to the success of this program, it is necessary for these groups to be involved in development and implementation of education programs in the schools (Stroble, 1997).

The role of schools, parental involvement, and continued education in learning nutrition and food safety is addressed in a study with Boys and Girls Clubs in Arizona (Shassian & Hapl, 2000). This orangization recognized that nutrition and food safety education are essential life skills that can improve health and well being if continually reinforced. Thirty-six low-income third and fourth graders participated in four one-hour lessons over a two-week period. Lessons included identification of foods and their placement in the Food Guide Pyramid, serving sizes, measuring, low fat food choices, and basic food safety. A pre and

posttest were given at the first and last lesson, respectively. The average score increased from 59% to 80%. The tests consisted of Pyramid questions, portion sizes, and nutrient content of food. It also was recognized that these lessons alone would not be effective in the long term without reinforcement from parents, school foodservice, and educators. All were identified as important in increasing and maintaining the children's' new found knowledge (Shassian & Hapl, 2000).

Outcomes of these studies can be applied to food safety program development by providing a framework for program construction and suggestions for delivery. Factors such as teachers' motivation to teach the material, community and parental involvement, interactivity, continuing education, and reinforcement affect the success of children's educational programs (McKenzie et al, 1996; Probart et al., 1997; Shassian & Hapl, 2000; Stroble, 1997). These factors should be reflected in the development and implementation of a food safety curriculum.

Food Safety Education for Children

Researchers from Michigan State University (Youatt et al., 1996) successfully developed a food safety education program for children in 1996. This program was targeted to elementary children in grades third to fifth. The program incorporated a computer game, videotape, audiocassette, take-home assignments for family involvement, and an instructional manual for teachers. A previous needs assessment conducted with Michigan third graders supported the need for a food safety education program. The researchers recognized the increased incidence of foodborne illness and its relationship to children involved

in snack, lunch, and meal preparation. They stated that there was limited food safety information or education targeted at this age group. The needs assessment also indicated that children did not understand the relationship between improper food handling and foodborne illness. Training was needed in proper hand washing, time and temperature abuse of foods, and when and why food should be discarded.

The computer game was effective because it provided children with immediate feedback to their responses. Food handling situations were developed into a mystery story line with the child assuming the role of a detective. If a correct response was given to a situation, auditory positive feedback was provided. If the answer was incorrect, a narrative was used to remind the child of the proper answer or procedure for that situation. Knowing "why" to do things rather than "what" to do was emphasized and found to be more effective in increasing the number of correct responses.

The program was highly acceptable to the students and teachers. In pilot testing the program, 67% of the students said it was easy to use and 75 % of the teachers said the children enjoyed the game. The teachers' concern over the simplicity of some of the material resulted in modification of the final game version. Although 50% of the students didn't feel they had learned much, they had a significant increase in their food safety knowledge after using the program. Knowledge of hand washing techniques and the reason foods should remain cold had the most significant increase. Youatt et al. (1996) found that there was a

greater change in knowing “what” to do than “why” to do it and why safe food handling was so important to good health.

In 1994, educators form the University of Rhode Island developed a food safety education program for second and fourth grade students. Pilot testing was initially performed with second and third graders and later expanded to third and fourth grade multicultural-bilingual students. The purpose of this research was to develop, measure acceptance, and effectiveness of a food safety program for elementary children. Students’ knowledge increase was measured by a pre and posttest consisting of 15 questions. The pilot test pre test and posttest scores increased from 75% to 91%, respectively. The mean examination score improved from 62% to 83% in the expanded test with older students.

The researchers also evaluated acceptance of the program with the children and teachers by providing evaluation tools using hedonic and Likert scales. The teachers’ comments and suggestions resulted in revisions of certain aspects of the program. This revised program was later presented to an English as a second language class to test for use with a culturally diverse population (Pivarnik, et al., 1994).

All audiences found the program to be acceptable and effective, but teachers expressed concerns with teaching the subject themselves. They preferred that individuals with greater food safety knowledge deliver the programming because they would be better prepared to answer difficult questions.

As a result of this study, Pivarnik et al. (1994) stated that it was feasible to develop an effective food safety education program that would teach children, at an early age, the skills to protect themselves from foodborne illness. They concluded that presenting the program in a fun and interactive medium can increase its acceptability to diverse audiences.

Current Food Safety Educational Materials: A comparison

A review of current food safety education materials targeted to children was conducted. A comparison of educational components, date of development, and targeted audience was completed and appears in Table2.1.

Interactive/Multimedia Education

Popularity

Multimedia programs developed for children are ever increasing in popularity. These programs include games, educational materials or what is being called “edutainment.” It is estimated that at least 28% of the personal computing markets are children under the age of 18 (Taiman, 1997). The growth of CD-ROM and other multimedia programs is an indication of the popularity of computer-based interactive games and educational materials.

There is a limited amount of quantitative research that has been conducted on the effectiveness of teaching children with an interactive CD-ROM. Because the technology is relatively new, the majority of research to evaluate the acceptance of learning from a CD-ROM format has been qualitative (Glasgow, 1996a; Ngai & Chan, 1998; Ryba, Selby & Nolan, 1995). Several studies have found that children are very accepting of learning with a multimedia format that

includes a combination of graphics, animation, video clips, and sounds (Glasgow, 1996a, 1996b; Matthew, 1996; O'Bannon, 1997).

Effectiveness

Glasgow (1996a, 1996b, 1997) wrote a series of articles discussing the success factors associated with motivating young readers by presenting storybooks on CD-ROM. The first factor addressed is the extensive storage capacity of CD-ROMs. Because video, graphics, and music require large amounts of memory, CD-ROMs have become the most viable medium for storing and presenting multimedia programs. These discs are able to store an equivalent of 500,000 pages of text (Glasgow, 1996a).

The second factor, and one that is reiterated often, is the multi-sensory appeal of these multimedia storybooks. The interaction of music, text, animation, and graphics captures the children's attention and encourages them to continue interacting with the program. Because today's children are more technologically advanced than previous generations, they have grown up to expect more than conventional printed books. Multimedia appeals to the senses and gives the child a feeling of "being there." Glasgow (1996a) warns that the use of "fun" media does not discount the need for text. The visual and auditory stimulus involved in multimedia should act as a reinforcement of the story that is being told.

Glasgow (1996a) found that the third motivating factor in using multimedia CD-ROMs was the child's control over the program. Children could start, slow or stop the program when they deemed necessary. Being in control increased their

confidence and encouraged the use of their problem-solving and decision-making skills.

There was some concern over children getting lost in the play aspect of the program. Were they more interested in the interaction with the program's activities or the story being presented? Glasgow (1996b, 1997) addresses the need for more research in this area. She stated that if the children are allowed to first explore the program then directed to move on, this problem could be alleviated. Overall, it was found that presenting children with storybooks on an interactive CD-ROM increased their interest in reading. In addition, it helped build the social and cognitive skills necessary for reading comprehension and communication.

Halal and Liebowitz (1994) discussed the importance of multimedia and its impact on the future of education. They addressed several ways of transferring knowledge to students but specifically pointed out five advantages to teaching with interactive multimedia. The educational programs used in their analysis were directed at older students but some of the same educational advantages were found to apply to younger students (Glasgow, 1996b; Matthew, 1997). The first advantage was the convenience of learning with this medium. Unlike a lecture format, an instructor did not have to present the program to the students, allowing the student to utilize the CD-ROM as their scheduled permitted. The second advantage was the control the student had over the program and the ability to stop and start the program. The third advantage was the entertaining way in which material was presented. The use of multimedia held the students'

attention, increased their desire to finish the program, and allowed greater retention of information. The fourth advantage was that a videodisc could operate a vast amount of programs, thus increasing its versatility. Fifth, each student is presented with the same information in the same format so testing could be measured more effectively.

A review of programs in New Zealand found that educators use multimedia programs to teach physically and intellectually disabled children (Ryba et al, 1995). The use of multimedia was found to be effective in increasing both language and social skills, and the childrens' ability to control the program gives them a feeling of self-actualization, increasing their confidence. The freedom that these types of programs allow makes it easier for children to proceed and learn at their own pace.

It is, however, necessary for the teacher to provide encouragement and guidance in moving through the programs. Students who worked in pairs on the computer also exhibited an increase in social skills. These students began helping each other and even developed new ways of assisting their partners in learning difficult concepts. The nonjudgmental nature of computers allows the student to utilize them without intimidation (Ryba et al, 1995). This discussion identified the same advantages of using multimedia in education as pointed out by Glasgow (1996a, 1996b, 1997) and Halal and Liebowitz (1994).

A study conducted in Hong Kong with third to seventh grade biology students tested the effectiveness of teaching children by CD-ROM. The program presented in this multimedia format was the dissection and organ identification of

frogs (Ngai & Chan, 1998). The program assisted in alleviating two problems: the expense of dissecting real frogs, and the difficulty the students experienced in viewing their teacher's instruction in the proper dissection procedures. The CD-ROM included animation, text, graphics, video, and an interactive activity to facilitate learning. The interactive portion of the program was a question and answer session, which tested the students' knowledge gain. Qualitative analysis was conducted to better understand the acceptability and problems associated with teaching children by interactive CD-ROM. In evaluating the program, the students' comments were solicited and the program developer's reflections on the creative process were viewed. Students found the program to be easy to install on their computers, attractive, and interesting. They enjoyed the animation, art design, and sound effects. The dissection process was clearly shown and learning by CD-ROM was considered convenient. Overall, the interactive CD/ROM proved to be an effective learning tool.

Matthew (1997) conducted a study to determine whether the use of storybooks on CD-ROM increased the comprehension levels of third grade students. A matched pair (37 pairs) sample was used. The students were carefully matched so that their reading comprehension levels were similar and the study was divided into two experiments.

In the first experiment, one student of the matched pair read print books while the other read books on CD-ROM. Prior to reading, the children met and developed questions that they would answer after completing the books. All students read the same books whether they were in print or on CD-ROM. At the

conclusion of the reading, the students met and answered their pre-reading questions. They also wrote a short story retelling the story they had just read. Doctoral students coded the short story and questions so that quantitative analysis could be conducted. T-tests were run to determine the difference in reading comprehension based on the answers to the questions. There was no significant difference in the printed or CD-ROM reading groups. When t-tests were run on the short stories however, there was a significant difference in the comprehension levels of children. The reading scores of children using the CD-ROM were significantly higher. This was attributed to the multi-sensory interactive experience that the CD-ROM affords.

In the second experiment, the children who previously read print books were asked to read the books on CD-ROM. These students followed the same procedures as the previous test group except that only the short story retellings were coded and used for analysis. Analysis of variance compared the student's scores from reading the printed book and the book on CD-ROM. The CD-ROM comprehension scores were significantly higher. The conclusion of this study was that the use of books on interactive CD-ROM could improve children's reading comprehension. The explanation for this significant increase was the use diverse media components in presenting the story, thus heightening the students' interest. The researchers found that the children had an increased interest in the story presented. The importance of having a teacher present was also discussed. Having a teacher monitor the students was necessary so that the programs' sensory activities did not divert them from reading the story. The

teacher's guidance increased the effectiveness of the multimedia program (Matthews, 1997).

Adam and Wild (1997) also conducted a study using storybooks on CD-ROM. This research studied the attitudinal effect of presenting storybooks on CD-ROM to primary school children. A pre/post-test Likert scale questionnaire was used to collect data. The sample for this study consisted of 45 third grade children, some who enjoyed reading and some who did not. All students were given a pretest questionnaire to determine their attitudes toward reading. Based on their answers, control and intervention groups were formed, insuring that each group had reluctant and willing readers. Each child read a minimum of 20 minutes every other day for four weeks and kept a log of his or her reading activity. After four weeks the children completed another questionnaire, and interviews were conducted with the most reluctant readers. The pre and post-questionnaire scores of the control and intervention groups were analyzed using independent sample two tailed t-tests (Adam & Wild, 1997). There were no significant differences in the comprehension scores of children who read printed books and those on CD-ROM. There was, however, an increase in each child's attitude toward reading. Adam and Wild (1997) expressed some concern over the length of time that this increased interest in reading would last and suggested an expanded study that would measure how long this new interest in reading would last.

A cooperative study conducted by schools in McPherson, Kansas, and Romeville, Louisiana, tested the effectiveness of teaching the interrelationship of

U.S. history, government, social studies, and geography on CD-ROM ("From Kansas to Louisiana…,"1995). Participants in this study were high school students, divided into learning teams, and presented coursework via an interactive CD-ROM. Each team was assigned topics that had to be researched using print and electronic media and they were required to make presentations about these topics at year-end. The test scores of students using the CD-ROM were higher with only 4% making less than a B, than those in traditionally structured classes where 18% made less than a C.

The second portion of this same study was conducted in Romeville, Louisiana, where first through sixth grade classes were presented with a science curriculum on CD-ROM. Previous reading and writing curricula presented in this format were found to be successful. The highly interactive format of these programs increased the children's interest and willingness to learn. These motivational factors are consistent with findings from other research where the acceptance and effectiveness of teaching with CD-ROMs was explored.

Development of Interactive/Multimedia Programs

The use and importance of educating with interactive multimedia CD-ROMs is growing (Beerman, 1996; O'Bannon, 1997). Because of the incorporation of text, music, graphics, animation, and video, there is an increased attraction for students. This appeal captures the students' interest and encourages them to continue with the learning process. Multimedia CD-ROMs are becoming increasingly important in teaching abstract or complex subjects (Beerman, 1996). Interactivity allows the students to participate in the learning

experience rather than merely sitting and listening to a verbal presentation given by a teacher. These multimedia programs reduce the intimidation some students feel when applying newly gained knowledge (Beerman, 1996; Glasgow, 1996a, 1996b; Ryba et al, 1995). The requirement of the student to use problem-solving and decision-making skills are some of the most attractive aspects of teaching with interactive multimedia (Ryba et al, 1995).

Royer and Royer (2002) reinforce this finding when they suggest that multimedia programming presents information coupled with an application component. This engagement assists the students in understanding the full scope of the learning experience by having them think critically about the information and its application. Multiple responses or scenarios should be provided so that the student is forced to make decisions and support those decisions. Implementation of such criteria will make the program more effective in providing the student with the complete spectrum of gaining and applying new knowledge (Royer & Royer, 2002).

Duebel (2003) states that educational multimedia programming must not be developed intuitively but must be based on learning theories, which set the criteria necessary for program success. She discusses specific criteria needed in the development of an interactive multimedia program. An example includes the presentation of information in small segments that can be easily processed by the user. Information must be sequential in nature, engaging, and provide assistance when questions arise. The students must feel they have control when using the program so they can stop, start, and slow the program as necessary.

Awareness of these concepts and incorporation of them into the development of a computer-based educational program will assist in increasing the effectiveness and acceptance of such programs (Duebel, 2003).

Educational multimedia is not without its critics, however. Schank, Korcuska, and Jona (1995) discussed the need to expand the educational paradigm of "interactive" from merely "clicking a button to go to the next screen." The authors believed that the introduction of interactive multimedia can be effective if the developers of authoring systems were less general and not as concerned with using technology for fancy presentations. They state that learning is goal directed, failure driven, case based, and achieved by doing. Therefore, the authoring system programmers must provide for these needs. Specifically, the systems must be motivating to their users, enticing them to use the program for learning purposes. The program must be related to real world situations and as life-like as possible to be the most effective in teaching. The use of real-time and 3D graphics fulfills this need and is necessary in effectively educating with interactive multimedia programs.

Figure 2.1 Food Safety Education Programs Reviewed

Program Name	Publication Date	Organization-Author	Program Component	Audience	Content/Areas Covered
Chances and Choices with Food	1992	Marla Reicks-Minnesota Extension Service	Curriculum, video, handouts	4th-6th grades	Comprehensive food safety from purchasing to storage, pesticides and additives
The Danger Zone	Un-known	USDA/FSIS	Video	Youth 7th-9th grades	Handwashing, food contamination, time/temp abuse, foodborne illnesses and associated food
Discovering Food Safety: Detective Mike Robe's Fantastic Journey	1992 & 1996	Lori Pivarnik, Martha Partnood-University of Rhode Island Extension Food Science and Nutrition Dept.	Curriculum, posters, video, slides, puppet show, games Parental component	Preschool, 2nd-3rd grades, Parents	Handwashing, time/temp abuse, basic food safety, foodborne illness
Don't Get Caught Dirty Handed	1996	Centers for Disease Control and Prevention	Posters, stickers, fact sheets, brochures	2nd-3rd grades	Handwashing as a disease preventative
Don't Get Bugged by a Foodborne Illness	1996 & 1998	Alice Henneman-University of Nebraska-Lincoln Extension Service	Game, flyers, posters	Consumers, children, youth, adolescents	Germs, basic food safety, foodborne illness, handwashing
Fight Bac-Presenter's Guide	1999	Partnership for Food Safety Education	Curriculum, song, poems, game, puppets	1st-3rd grades	Handwashing, fruit and vegetable safety, storage, sanitation
Fight Bac-Ongoing Campaign	1998 Up-dated often	Partnership for Food Safety Education	Web-based food safety source, posters	Consumers of all ages	Pathogenic microorganisms, food safety, handwashing

Figure 2.1 Food Safety Education Programs Reviewed Continued

Program Name	Publication Date	Organization-Author	Program Component	Audience	Content/Areas Covered
Food Safety at Home, School, and When Eating Out	1997	USDA/FSIS and the Chef and Child Foundation of the American Culinary Federation, Inc.	Coloring Book	4 to 8 year olds	Bacteria, handwashing, food handling, time/ temp abuse
Food Safety Consumer	Un-known	April Mason-Purdue University Extension Service	Series of Brochures	Consumers, children	Foodborne illness, storage of foods, chemicals and food additives
Food Safety Express	1993	University of Missouri-Extension Food and Nutrition	Curriculum, video, activity manual	Preschool and Kindergarten Children	Germs, foodborne illness, handwashing
Safe Food: It's Your Job Too!	1997	Peggy Sherry and the Food Safety Project-Iowa State University Extension	Web-based food safety education Program with interactive activities	Consumers, high school, children	Foodborne illness, critical control points, pathogenic growth, temp danger zone
Glitter Bug	Un-known	Brevis – Salt Lake City, UT	Glitter lotion with ultraviolet light, stickers	Consumers of all ages and foodservice/ Production employees	Handwashing techniques
Glo-Germ	Un-known	Glo-Germ Co. Moab, UT	Ultraviolet oil or powder with light, stickers	Consumers of all ages and foodservice/ Production employees	Handwashing techniques
The Incredible Journey from Hen to Home	1991	American Egg Board Park Ridge, IL	Curriculum, game, bookmarks, activities	4^{th}-6^{th} grades	Cross contamination, handwashing, food storage, nutrition

Figure 2.1 Food Safety Education Programs Reviewed Continued

Program Name	Publication Date	Organization-Author	Program Component	Audience	Content/Areas Covered
Kan Mc Kan the Food Safety Man	1997	Willie Burgess-Purdue University Extension Service	Video, activity guide	Youth, adolescents children, consumers	Handwashing, time/temp abuse, receiving food, storage
Kids World	Un-known	North Carolina Dept. of Agriculture and Consumer Service	Web-based food safety and nutrition, interactive games	Youth and Adolescents	Comprehensive food safety program, foodborne illness, handwashing
Kitchen Safety Game	1995	Pineapple Appeal, Inc. Owatonna, MN	Board game with questions	6^{th}-9^{th} grades	Food safety, kitchen safety, handwashing, sanitation
Let's Have a Killer Cookout-NOT!	1997	Mark Tamplin-Institute of Food and Ag Sciences University of Florida	CD/ROM Interactive, multimedia, evaluation component	4^{th}-12^{th} grade	Full spectrum food safety, purchasing, preparation, storage
Meeting the Needs of Bilingual and Low Literacy Youth	1995	April Mason-Purdue University Extension Service	Video, Audio cassette, lessons	4^{th}-6^{th} grades, especially low literacy	Bacteria, handwashing, foodborne illness
The Mystery of the Poisoned Panther Picnic	1992	April Mason-Purdue University Extension Service	Video, game pieces, fact sheets	4^{th}-6^{th} grades	Foodborne illness, time/temp abuse, pathogenic growth
Operation Risk	1992	Pat Hammer-schmidt Michigan State University Extension	Video, curriculum, posters, audiocassette, computer disc	3^{rd} -5^{th} grades	Foodborne illness, food handling time/temp abuse, handwashing-Comprehensive program

Figure 2.1 Food Safety Education Programs Reviewed Continued

Program Name	Publication Date	Organization-Author	Program Component	Audience	Content/Areas Covered
Safe Food for Children	1992	Mary Clarke Paula Peters-Kansas State University-Extension Human Nutrition	Video, leader's guide, stickers, magnets, certificate	Child care providers	Handwashing, food purchasing, preparation, storage, sanitation, pathogens
Safe or Sorry	2002	Tracy Zerwas-Minnesota Department of Health	Videos, curriculum, skit supplies	5^{th}-6^{th} grades	Foodborne illness, bacteria, time/temp abuse, handwashing
Students Serving it Safe	1998	Molly Mound Michelman, Claudia Probart, Elaine McDonnell-Pennsylvania State University-Dept. of Nutrition	CD-ROM interactive multimedia	6^{th} to 9^{th} grades, food service personnel	Comprehensive food safety, foodborne illness, handwashing, sanitation
Thermy Campaign	2000	USDA/FSIS	Web-based programs, flyers, magnets, posters	Consumers of all ages	Food safety, time/temp abuse, thermometer use

Source: National Agricultural Library. (2004). *Food safety teaching materials for kids.* Retrieved August 9, 2004, from http://www.nal.usda.gov/fnic/foodborne/kids.htm

References

Adam, N. & Wild, M. (1997). Applying CD-ROM interactive storybooks to learning to read. *Journal of Computer Assisted Learning, 13*(2), 119-132.

American Federation of Labor. (2002). *Facts about working women.* Retrieved February 4, 2003, from http://aflcio.org/yourjobeconomy/women/factsaboutworkingwomen.cfm

Audits International. (2002). *Audits International's home food safety survey*. Retrieved February 22, 2003, from http://www.audits.com/Report.html

Bagui, S. (1998). Reasons for increased learning using multimedia. *Journal of Educational Multimedia and Hypermedia, 7*(1), 3-18.

Baldwin, T. & Falciglia, G. (1995). Application of cognitive behavioral theories to dietary change in clients. *The Journal of the American Dietetic Association, 95*(11), 1315-1317.

Barclay, M., Greathouse, K., North, T., & Cale., L. (2001). Food handling knowledge and practices of 4th and 5th grade students: a key to better sanitation. *Journal of Child Nutrition Management, 25*(2), 72-75.

Beerman, K. (1996). Computer-based multimedia: New directions in teaching and learning. *Journal of Nutrition Education, 28*(1), 15-18.

Buzby, J. (2001). Children and microbial fooborne illness. *Food Review, 24*(2), 32-37.

Buzby, J. & Ready, R. (1996). Do consumer's trust food-safety information? *Food Review, 19*(1), 46-49.

CDC-Escherichia. (2004). *Escherichia coli O157:H7.* Centers for Disease Control. Retrieved August 28, 2004, from http://www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli_g.htm

CDC-Foodborne. (2001). *Foodborne illness.* Centers for Disease Control. Retrieved June 11, 2003, from http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_t.htm

CDC-Foodnet. (2003). *What is foodnet?* Centers for Disease Control. Retrieved September 2, 2003, from http://www.cdc.gov/foodnet/what_is.htm

Christine, B. (1994). Confronting food safety risks. *Risk Management, 41*(9), 71-72.

Cody, M. & Houge, M. (2003). Results of the home food safety-it's in your hands 2002 survey: comparisons to the 1999 benchmark survey and healthy people 2010 food safety behaviors objective [Electronic version]. *Journal of the American Dietetic Association, 103*(9).

Cooperative State Research, Education and Extension. (1992). *Curriculum development for issues programming. A National Handbook for Extension Youth Development Professionals.* United States Department of Agriculture. (Pulication number unknown).

Cullen, K., Bartholomew, L. & Parcel, G. (1997). Girl scouting an effective channel for nutrition education. *Journal of Nutrition Education, 29*(2), 86-91.

Duebel, P. (2003). An investigation of behaviorist and cognitive approaches to instructional multimedia design. *Journal of Educational Multimedia and Hypermedia, 12*(1), 63-90.

Economic Research Service-USDA. (2004). *Foodborne illness cost calculator.* Retrieved August 30, 2004, from http://www.ers.usda.gov/Data/Foodborneillness/

Fishman, A., Pearson, K. & Reicks, M. (1999). Gathering food and nutrition information from migrant farmworker children through in-depth interviews. *Journal of Extension, 37*(5). Retrieved January 14, 2002, from http://www.joe.org/joe/1999october/rb3.html

Food and Drug Administration. (1998). *Food safety from farm to table: A national food safety initiative: Report to the President, May 1997*. Retrieved April 26, 2002, from http://vm.cfsan.fda.gov/~dms/fsreport.html

From Kansas to Louisiana, multimedia is creating a new look in the classroom. (1995, April). *The Journal (Technological Horizons in Education), 22*(9), 58-60.

FSIS/USDA. (2004). *The Thermy™ Campaign.* Retrieved June 27, 2004, from http://www.fsis.usda.gov/thermy/index.htm

FSIS/USDA-Educator. (2004). *Cook with Thermy™: When cooking by color is misleading.* Retrieved June 27, 2004, from http://www.fsis.usda.gov/oa/educator/edu_color.pdf

Glasgow, J. (1996). It's my turn! Motivating young readers. Part 1. *Learning and Leading with Technology, 24*(3), 20-23.

Glasgow, J. (1996). It's my turn! Motivating young readers. Part 2. *Learning and Leading with Technology, 24*(4), 18-20.

Glasgow, J. (1997). It's my turn! Motivating young readers. Part 3. *Learning and Leading with Technology, 24*(5), 22-25.

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

Halal, W. & Liebowitz, J. (1994). Telelearning: The multimedia revolution in education. *Futurist, 28*(6), 21-26.

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. Retrieved March 15, 2003, from http://www.joe.org/joe/1995february/rb2.html

Healthy People. (2004). *Healthy people 2010-what are its goals?* Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services. Retrieved July 19, 2004, from http://www.healthypeople.gov/About/goals.htm

Hennessey, E. & Heary, C. (2001, April). *Using focus group discussion with children: A comparison of three age groups.* Poster session presented at the Biennial Meeting of Society for Research in Child Development, Minneapolis, MN.

Hess, M. (1997). Attention to food safety-should not wait for a crisis. *The Journal of the American Dietetic Association, 97*(6), 625.

Howes, M., McEwen, S., Griffiths, M. & Harris, L. (1996). Food handler certification by home study: Measuring changes in knowledge and behavior. *Dairy Food and Environmental Sanitation, 16*(11), 737-744.

Hunter, T. (1995). Overlooked threats of foodborne illness. *Consumer's Research Magazine, 78*(10), 14-19.

International Food Information Council Foundation. (2004). *Backgrounder-Food safety & foodborne illness.* Retrieved July 5, 2004, from http://www.ific.org/food/safety/index.cfm

Keith, M. (1991). *Kids, Food, and Safety. National Network for Child Care*. Retrieved March 23, 2002, from http://www.nncc.org/Health/sac11_kid.food.safe.html

King, P. (1997). School feeders pluck strawberries from menus. *Nation's Restaurant News, 31*(15), 1,4

Laliberte, R. (1995). How safe is your child's food? *Parents, 70*(5), 30-32.

Lytle, L., Eldridge, A., Kots, K., Piper, J., Williams, S., & Kalina, B. (1997). Children's interpretation of nutrition messages. *Journal of Nutrition Education, 29*(3), 128-136.

Matthew, K. (1996). Using CD-ROMs in the language arts classroom. *Computers in the Schools, 12*(4), 73-81.

Matthew, K. (1997). A comparison of the influence of interactive CD-ROM storybooks and traditional print storybooks on reading comprehension. *Journal of Research on Computing in Education, 29*(3), 263-275.

McGee, T. (1997, January). Getting inside kid's heads. *American Demographics*, 53-59.

McKenzie, J., Dixon, L.B., Smiciklas-Wright, H., Mitchell, D., Shannon, B., & Tershakovec, A. (1996). Change in nutrient intakes, number of servings, and contributions of total fat from food groups in 4 to 10 year old children enrolled in a nutrition education study. *Journal of the American Dietetic Association, 96*(9), 865-873.

Medeiros, L., Hillars, V., Kendall, P. & Mason, A. (2001). Evaluation of food safety education for consumers. *Journal of Nutrition Education, 33*(1) (Suppl.), 27-34.

Medical letter on the CDC & FDA. (2000). *Education most effective means of combating food poisoning,* 14-15. Retrieved January 14, 2002, from InfoTrac Web: Health Reference Center-Academic-A64571710, Electronic database. No longer available at Kansas State University.

National Agricultural Library. (2004). *Food safety teaching materials for kids.* Retrieved August 9, 2004, from the National Agricultural Library Web site: http://www.nal.usda.gov/fnic/foodborne/kids.htm

Ngai, J. & Chan, K. (1998). A study on the use of interactive multimedia courseware in the learning of rat dissection. *Journal of Educational Technology Systems, 26*(3), 235-242.

O'Bannon, B. (1997). CD-ROM integration peaks student interest in inquiry. *Computers in the Schools, 13*(3/4), 127-134.

Office of Local Government. (2004). Extracted from the U.S. Census-2000. Contact-John Leatherman. Department of Agricultural Economics. Kansas State University-321 Waters Hall, Manhattan, KS 66506

Olinger-Snyder, P. & Matthews, M. (1996). Food safety: Review and implications for dietitians and dietetic technicians. *The Journal of the American Dietetic Association, 96*(2), 163-168.

Partnership for food safety education. (2004). *About us*. Retrieved August 12, 2004, from http://www.fightbac.org/who_we_are.cfm

Partnership for food safety education-FightBac™. (2004). *Four Steps*. Retrieved August 12, 2004, from http://www.fightbac.org/foursteps.cfm

Pivarnik, L., Partnoad, M. & Giddings, M. (1994). A food safety curriculum for second and third grade elementary students. *The Journal of the American Dietetic Association, 94*(8), 865-868.

Probart, C., McDonnell, E., Achterberg, C. & Anger, S. (1997). Evaluation of implementation of an interdisciplinary nutrition curriculum in middle schools. *Journal of Nutrition Education, 29*(4), 203-209.

Reportable Diseases in Kansas. (1996). *Epidemiology and trends*. Kansas Department of Health and Environment-Office of Epidemiologic Services. Topeka, KS. Retrieved November 7, 2002, from http://www.kdhe.state.ks.us/epi/download/as96/as96-toc.html

Reportable Diseases in Kansas. (2002). *Epidemiology and trends*, 21, 30, 79, 80. Kansas Department of Health and Environment-Office of Epidemiologic Services. Topeka, KS. Retrieved September 7, 2004, from http://www.kdhe.state.ks.us/epi/download/disease_summary/dissum02.pdf

Rogers, R. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91*, 93-114.

Royer, R & Royer, J. (2002). Developing understanding with multimedia. *Learning and Leading with Technology, 29*(7), 40-45.

Ryba, K., Selby, L., & Nolan, P. (1995). Computers empower students with special need. How technology is transforming teaching. *Educational Leadership, 53*(2), 82-85.

Schank, R., Korchuska, M., & Jona, M. (1995). Multimedia applications for education and training: Revolution or red herring? *ACM Computing Surveys, 27*(4), 633-635.

Shassian, A., & Hampl, J. (2000). Life skills in the boys and girls club: Opportunities for nutrition education. *Journal of Nutrition Education, 32*(5), 285 B.

Stevenson, K. & Bernard, D. (Eds.). (1995). *HACCP, Establishing Hazard Analysis Critical Control Point Programs: A Workshop Manual*. Washington, D.C: The Food Processors Institute.

Stroble, L. (1997). Factors associated with fourth grade health education scores on the Maine educational assessment. *Journal of School Health, 67*(2), 56-62.

Traiman, S. (1998). Kids' multimedia sees a growth spurt. *Billboard, 110*(7), 76-79.

United States Bureau of the Census 2000-KS. (2001). *Kansas Population Quick Facts*. Retrieved May 18, 2002, from http://quickfacts.census.gov/qfd/states/00000.html

United States Bureau of the Census 2000-US. (2001). *U.S. Population Quick Facts*. Retrieved May 18, 2002, from http://quickfacts.census.gov/qfd/states/20000.html

United States Department of Agriculture/Food Safety Inspection Service. (2003). *Food safety and food security: What consumers need to know*. Retrieved October 29, 2003, from http://www.fsis.usda.gov/oa/topics/foodsec_cons.htm

Wie, S. H., Strohbehn, C.H. (1997). The impact of a sanitation food safety course on attitudes and knowledge of hospitality students. *Journal of Hospitality and Tourism Education, 9*(2), 65-73.

World Health Organization Regional Office for Europe. (2004). Food safety/ issues in the European region. Retrieved August 19, 2004, from http://www.who.dk/foodsafety

Youatt, J., Andrews, S., Hammerschmidt, P., Sawyer, C. & Murphy, A. (1996). RISK Raiders: A food safety hypermedia software game for students (Grades 3-5). *Journal of Nutrition Education, 28*(3), 181A.

CHAPTER III

METHODOLOGY

Introduction

The development of the interactive, multimedia CD was threefold. The first phase consisted of conducting a needs assessment survey and reviewing existing programs. Phase two involved the creation of the program including layout, design, and content development. Beta testing the CD with content experts and representatives of the targeted audience comprised phase three of this project.

Human Subjects Approval

Because this project involved research with youth, approval was requested and granted by the Kansas State University Human Subjects Review Board (Appendix A) prior to initiation. An informational letter (Appendix B) explaining the project was presented to the parent or guardian and a signed Parental Permission Slip (Appendix B) was secured before presenting any portion of the program to the child.

Needs Assessment Survey

Medeiros, et al. (2001) stated that the development of a program should be based upon the specific needs of the targeted audience. Determination of needs can be achieved through an assessment survey. The needs assessment instrument for this study was developed by the researcher and reviewed for comprehension and age appropriate language by educators and children within the targeted audience (Appendix C). The survey tool was pilot tested with 10

children for readability. All participants were enrolled in after school programs. No changes to the survey instrument were necessary.

The needs assessment tool consisted of multiple-choice and open-ended questions. Section one of the instrument requested demographic information, the child's role and frequency in home food preparation, as well as a list of food preferences. Section two asked if the child understood the meaning of foodborne illness and various food safety terms. It also inquired about their personal food handling and handwashing practices. The third section consisted of questions about computer usage, educational delivery methods, and media preferences.

Survey recipients were children in the fourth, fifth or sixth grade, generally 9 to 12 years of age. All were participants of after-school programs, 4-H, or Boys and Girls Clubs in Manhattan and Riley County, KS. Contact was made with club leaders to determine dates for administration of the questionnaire. The researcher conducted the needs assessment at individual school/club venues.

Data collected from the needs assessment questionnaire were analyzed using the Statistical Package for Social Sciences software Version 8 (1998). Means and frequencies were computed on the food handling, handwashing, and computer use frequency of the participants. Similar analyses were performed to better understand the childrens' basic food safety knowledge, reasons for washing hands, media choices, and their learning benefits. Information gained from the needs assessment was utilized in tailoring the program to children, aged 9 to 12.

Review of Existing Food Safety Education Programs

To better understand information currently available to the audience, a review of food safety and nutrition education programs was conducted. This was accomplished by using a computer search of various databases. Many sources provided a comprehensive list of programs developed by governmental, public, and private organizations. Generally, sites listed a program synopsis, intended audience, year developed, price, and contact information for each existing program. Copies of the most pertinent programs for this audience were obtained. Some of these programs were in CD/ROM format, such as “Let’s have a Killer Cookout…NOT!” (1997), produced by the University of Florida and, “Students, Serving it Safe,” developed by The Pennsylvania State University (1998). Other programs were in print medium such as “Don’t Get Bugged by a Foodborne Illness. Play it Safe,” developed by the University of Nebraska, Lincoln (1998). Some contained printed materials, games, and videotape such as those developed by The Partnership for Food Safety Education and entitled, “Fight BAC® Your Game Plan for Food Safety (2004). Each of these programs, along with others, was reviewed for content information, media usage, language, and navigational ability, if applicable.

Program Development

The needs assessment survey data and program reviews were used to determine areas of food handling to be covered in the program. To gain a better idea of the program flow, a storyboard layout was constructed. The storyboard was reviewed and revised throughout the program development. A multimedia

expert and graphic artists were enlisted to assist in the design and technological creation of the program. Asymetrix (now Click2Learn) Toolbook II Assistant ® Version 6.5 (1998), a multimedia software program, was used to create the foundation of the program. Because of increased software capabilities the food safety education program was later converted to Asymetrix-Toolbook II Instructor ® Version 8 (2000).

Program content was divided into four chapters. Chapter one provided introductory information about food safety, foodborne illness, potentially hazardous foods, microbial growth, and internal temperatures of food. Chapter two covered the importance of handwashing and its technique. Chapter three introduced six common foodborne pathogens, their characteristics, and foods associated with them. Chapter four explained safe food handling, “Dos” and “Don’ts, “ including food purchasing, storage, washing, cooking, serving, cooling, and storage of leftovers. Real life scenarios and photographic images were used throughout the program contributing to its practicality.

Six animated characters helped convey food safety concepts. Each character was dressed as a chef and represented diverse ethnic backgrounds. To give each character distinction, children were recruited to record audio tracts of their voices.

Each chapter contained text and audio recordings to assist with slow or limited readers. To engage the child, interactive components such as click and drag activities, fill in the blank and multiple-choice questions were incorporated into all chapters. Video segments, music clips, graphic, and photographic

images made the program more realistic to the viewer. Since many of the photographic images were taken by the researcher, any image containing a human subject was required to have a photo release form completed prior to use in the CD's content (Appendix D). Permission to use copyrighted images from various sources was obtained before their use within the program.

Content Expert Review

Nearing completion of the food safety education program, content experts from several disciplines reviewed it using various criteria. Research and Extension Specialists who work with this target group provided feedback for content accuracy, age-appropriate language, and the ability to utilize this program in conjunction with current nutrition education programs. Food safety experts ensured program content accuracy and ease of use. Multimedia education, foodservice management professors, and elementary school teachers examined the program for use of audio, media, and interactive components, content accuracy, and age appropriate language, respectively. Technological experts assessed the program for ease of navigation, use of media, interactivity, and effective use of instructions concerning program delivery.

Targeted Audience Review

Upon completion of the content experts' review, ten children, aged 9 to 12 evaluated the food safety education program and provided feedback about the subject matter, age-appropriate language, use of audio, video, photographic images, and interactive components. Participants were timed to determine

completion rates for each chapter but were not pressured to finish the program within a certain timeframe.

Content Revision

Qualitative feedback was collected from each critique and resulted in immediate revisions in the program, which were made prior to review by subsequent experts. Each reviewer answered a series of open-ended questions concerning his or her impression of the program content, acceptability, applicability, and ease of use. Additional comments and suggestions about the CD were encouraged.

References

Asymetrix ToolbookII® Assistant Version 6.5 (1998). [Computer software]. Click 2 Learn, Bellevue, WA.

Asymetrix ToolbookII® Instructor Version 8 (2000). [Computer software]. Click 2 Learn, Bellevue, WA.

Henneman, A. (1998). *Don't get bugged by a foodborne illness. Play it safe*. Lincoln, NE: Lincoln Cooperative Extension, The University of Nebraska, Lincoln.

Medeiros, L., Hillars, V., Kendall, P. & Mason, A. (2001). Evaluation of food safety education for consumers. *Journal of Nutrition Education, 33*(1) (Suppl.), 27-34.

Michelman, M., Probart., McDonnell, E. (1998). *Students serving it safe*. [CD-ROM]. University Park, PA: Department of Nutrition. The Pennsylvania State University.

Statistical Package for Social Sciences (SPSS) for Windows Version 8 [Computer Software]. (1998). Chicago, IL: SPSS Inc.

Tamplin, M. (1997). *Let's have a Killer Cookout-NOT!* [CD-ROM]. Institute of Food and Agricultural Sciences, Gainesville, FL: University of Florida.

The Partnership for Food Safety Education. (2004). *Fight Bac®. Your game plan for food safety*. [On-line]. Retrieved August 12, 2004, from http://fightbac.org/grades_4_8.cfm

This Chapter will be submitted as a manuscript to the *Journal of Nutrition Education and Behavior* to be published as a report and is formatted as such.

Chapter IV

DEVELOPMENT OF AN INTERACTIVE MEDIA FOODSAFETY EDUCATION CD

INTRODUCTION

Currently the Foodborne Diseases Active Surveillance Network (FoodNet) estimates that there are 76 million reported cases yearly of foodborne illness in the United States (U.S.), with approximately 5,000 of these occurrences resulting in death.[1] Increased consumption of processed food and importation of produce from other countries have increased exposure of our population to potentially dangerous microorganisms, increasing the chance of foodborne illness.[2] Children are a high-risk population for foodborne illness, but food safety education programs developed for this group are limited.

Fast-paced American lifestyles and increasing numbers of dual income and single-parent families have resulted in many children being left alone before and after school.[3] As a result, children are taking a more active role in preparing snacks or meals.[4] Proper food safety education in conjunction with the basics of food preparation is essential to protect children from foodborne illness.

Education has been identified as the most effective way to avoid foodborne illness.[5] Previous food safety education programs for children have been successful in teaching proper food handling techniques, and research has

indicated that children are more receptive to programs that use various types of media and interactive activities to teach unfamiliar concepts. [6-8]

The purpose of this report is to discuss the developmental process of an interactive multimedia food safety education program on CD/ROM for children in fourth, fifth, and sixth grades. To facilitate development of the program, a review of existing programs and a needs assessment survey were conducted.

DEVELOPMENTAL PROCESS

Conducting a review of existing programs. Although increased food safety education in the schools was addressed in the "Farm to Table Food Safety Initiative Report to the President",[9] there are currently few programs developed to specifically meet the needs of fourth, fifth, and sixth grades. To better understand if food safety education programs were available for this market, a database search was conducted.[10-13] Generally, databases listed information about each program's content, format, targeted audience, cost, and contact information.

The search found that most programs were developed for preschool, high school, or adult audiences and were primarily a text based curriculum with a series of lessons. Some of the programs were in a game format while others had audio and video components. Only a few of the programs were computer based using either a web or CD/ROM format.[10-13] The programs reviewed were found to be simplistic and unchallenging for preteens. Although many of them addressed food safety concepts, they failed to or only briefly discussed why these practices should be followed.

At the time of this study, two food safety education programs in a CD/ROM format were found.[14,15] These programs, along with several Internet-based food safety education programs, were reviewed for adequacies and limitations.[12,16,17] One CD/ROM program had navigational problems while the other program addressed children in a non-commercial foodservice setting rather than in a home-based food handling situation. The second program contained some engaging interactive activities and diverse types of media. The web-based educational sites were attractive and provided a wealth of interactive games and activities. Sophisticated graphics and animation added to the appeal of these sites. The limitation of these sites was the requirement that the user have Internet accessibility.

After reviewing these programs, a need was identified for a comprehensive, home-based, food safety education program targeted at fourth, fifth, and sixth grade school children. The program goal was to present food handling topics in an engaging and interactive format to increase the interest and involvement of the student. The use of examples and situations pertaining to home-based food safety would make the program more realistic to the user.

Conducting a needs assessment survey. Prior to development of program content, a needs assessment survey was conducted. Information from the survey insured that relevant topics were covered and that the specific needs of this audience were met. The targeted sample size was 100 children. Of the 80 who completed the questionnaire, 42 were female and 38 were male. All participants were in the fourth, fifth or sixth grades, and were 9 to 12 years of

age. Each of the children was a member of 4-H, Boys and Girls Clubs, or after school programs. These groups have been previously identified as viable avenues for food safety and nutrition education programs. [18,19]

The survey gathered information on demographics, frequencies of food preparation, and food safety and foodborne illness knowledge. Questions about handwashing practices, computer usage, and preferences for learning new concepts were included.

Table 4.1 illustrates that the respondents were active in food preparation. Eighty-six percent of the students cooked meals and 92% prepared snacks daily or weekly. These results support previous research that found 85% of students in the same age group prepared their own snacks, even when a childcare provider was home.[19] The majority could not define cross contamination (85%) and did not understand the causes of foodborne illness (59%).

Respondents were inconsistent with their handwashing practices (Table 4.2). Forty-five percent of the children reported that they washed their hands prior to touching food, and 76% reported that they sometimes or never washed their hands after playing with pets.

Ninety-one percent of the students stated that they liked using the computer for learning new concepts, 80% used a computer in their homes, and 76% reported that they used a computer, at home or school, on a daily/weekly basis. The children reported that music (66%), graphics (65%), video (58%), and interactivity (58%) were some of their favorite forms of media used in computer based programs. Other computer use data appears in Table 4.3.

Decisions about program content and creation of the CD. Information gathered from the needs assessment survey provided insight into the specific needs and best delivery method for this audience. Because children in this age group are generally computer savvy, an interactive, multimedia program was determined to be the most motivating and effective way to present the concepts associated with food safety, foodborne illness, cross contamination, thermometer usage, and the importance of consistent handwashing.

Program content was outlined in detail and served as a guideline to insure that food safety concepts were presented in logical sequence. A storyboard guided the flow and transition of the program screens and contained text, images, animation or audio that would be presented on each screen. The storyboard served as a blueprint, but was altered several times during the developmental process.

Upon completion of the outline and storyboard, a multimedia specialist was consulted to determine which software program to use. Asymetrix (now Click2Learn) Toolbook II Assistant ® (version 6.5)[20] was chosen to build the foundation of the program. Because of increased software capabilities, program content was later converted to Asymetrix (now Click2Learn) Toolbook II Instructor ® (version 8.0).[21] The specialist provided technological support and assistance with imaging, video, audio, and animation. University graphic art students developed backgrounds for each chapter and created six multicultural animated characters. To make the characters more realistic, students in the

fourth, fifth, and sixth grades recorded audio for their voices. The researcher provided all other content material, text, scripting, and narration.

"Kid Chef and the Clean Kitchen Crew" was created as four chapters, each building upon the previous chapter's information. The first chapter incorporated three subchapters to facilitate learning of the various concepts. Dividing the program into six shorter segments was beneficial to this young audience and allowed the program to be viewed over several sessions rather than one long one. A chapter preview and summary was provided at the beginning and end of each chapter. Figure 4.1 illustrates an overview of the food safety program content.

Chapter one contained an overview of food safety, its importance and the causes of foodborne illness. The discussion included potentially hazardous foods, how they become contaminated, and the conditions necessary for bacterial growth. Chapter two covered the importance of and proper techniques of handwashing. Photographic images combined with information based on childhood scenarios encouraged the child to become more aware of situations where handwashing is important.

Chapter three introduced the child to foodborne pathogens that may affect their food supply. Six pathogenic microorganisms, some of which may have been familiar to the child from television or printed articles, were presented. A description of the pathogen, the illness it causes, and symptoms associated with the illness were introduced. Pictures of implicated foods included a pop-up picture of the organism growing in a petri dish. Chapter four provided an

overview of home based food safety from food selection to cooking, serving, and storage. Food safety concepts presented in the previous chapters were applied to everyday situations.

Each chapter used photographic images, graphics, video clips, audio, or animation to add interest to the program. These types of visual stimuli coupled with interactive activities have been found to challenge the interest of this age group.[21] Text and narration continued throughout the program. The narration assisted in conveying the more difficult terminology and food safety concepts. Interactive components included multiple-choice, fill in the blank, and click and drag activities. All activities were based on real life scenarios associated with this age group.

PROGRAM REVIEWS--BETA TESTING

Beta-testing with content experts. Prior to finalization of the program, 12 experts from various fields Beta-tested the program and provided feedback about its content. The program was delivered via laptop or personal computer. Reviewers were given instructions for the program and asked to provide feedback concerning their areas of expertise, program layout, and navigational difficulties. Changes to the program were made according to the feedback and prior to subsequent evaluations.

Extension educators evaluated the program for age-appropriate language and fit with current nutrition education programming. Multimedia educators critiqued the sequencing, age appropriateness, and ability to hold the child's attention. Food safety specialists and educators evaluated the program's food

safety concepts for accuracy and timeliness. Elementary school teachers provided feedback on the ability of fourth through sixth graders to understand and retain the ideas presented, and the viability of incorporating food safety into their curriculum. Finally, technology experts viewed the program and eliminated any remaining navigational or technological problems.

Beta-testing with the targeted audience. Upon completion of the evaluations, children 9 to 12 years of age Beta-tested the food safety education program and provided feedback about their experience. Ten children; six girls, and four boys, representing various ethnic and socio-economic backgrounds were recruited. Although the program was designed for viewing over several occasions, time constraints dictated that the children view and evaluate it in one session.

Delivery was made on an individual basis via laptop or desktop PC and in the presence of the researcher. The child was presented the CD with instructions for accessing the program. Each child was timed to gain an understanding of how long it would take to complete each chapter or subchapter. Visual observation of the child gave new insight into their interest level and helped determine areas in which the child encountered navigational or comprehension problems.

After viewing the program, the children answered a series of questions about the navigation, use of media, interactive activities, age appropriate language, overall acceptance, and suggested improvements or changes to the program. All changes were made before submitting the program to another child.

LESSONS LEARNED

Lessons learned during the developmental process. Computer-based education is a rapidly growing and effective way of teaching many audiences. However, several considerations must be addressed prior to embarking upon the development of such programs.

Because the development of computer-based programs can be time and labor intensive, adequate funding must be secured prior to initiation of the development process. This funding will assist in acquiring the necessary technological and human resources needed to complete the project.

Technological limitations of the creator must be considered. If limited, enlistment of a multimedia specialist is advised to assist with software applications, animation, image, video, and audio quality. Such experts also are essential in the finalization and production of the project. The use of a professional photographer and videographer can improve the quality of the images used within the program.

After the technological and financial decisions are made, it is essential to prepare a detailed outline and storyboard to manage the information and format in which the program is presented. Maintaining organization throughout the developmental process is essential in saving both time and money. Cataloging and labeling photographic images, video, and audio clips is recommended for easy access. These media, if not original to the program, must be labeled with the originating source. If copyrighted material is used, written approval must be secured prior to incorporation in the program content. Giving credit to the

originator of all previously produced material is essential. A model of the developmental process is provided in Figure 4.2.

Lessons learned during Beta-testing. Conducting evaluations with a diverse group of experts insured that the program content was accurate and appropriate for the identified audience. Evaluators from specific fields provided a broad knowledge base, field expertise, and different perspectives on presenting subject matter.

Experts from various fields agreed that food safety was an important topic and found this an effective way to deliver the information necessary for learning safe food handling. They found the program engaging and that animation, photographic images, and home-based situations helped clarify food safety ideas. The reviewers felt that the language was age appropriate and the interactivity made the program acceptable for this audience. One expert found the handwashing chapter especially important because they interact with students who are inconsistent with their handwashing practices.

Feedback gathered from the experts' evaluations of the food safety program resulted in a limited number of changes, which included grammatical or spelling errors, and clarification of directions. Identifiers were added to icons in the program and technological glitches corrected. Some evaluators requested additional information to facilitate opening the program. Technology and multimedia experts suggested upgrading image quality and using a professional to shoot images in the future. Many of the existing photo images were taken out of the program, adjusted, and re-entered. One evaluator suggested the re-

recording of the lead character with a more interesting and enthusiastic voice. To accomplish this task, a new child was recruited and his voice replaced the existing character's voice. Many of these experts suggested incorporating the animated characters throughout the program rather than just in the first chapter.

Some suggested changes did not occur due to software or time constraints. Changes not made included enlargement of the viewing screen and incorporation of the animated characters throughout the program. These changes proved too time and labor intensive for the project. All feasible changes were made prior to the presentation to the targeted audience.

The most notable difference between Beta-testing with children and adults was the students' ability to access and navigate the program with little difficulty. The children identified the video clips, animation, and interactive activities as their favorite portions of the program. They commented that the use of photographic images presented next to discussions of food safety concepts increased their understanding. One child stated that she really enjoyed the program because she saw mistakes that she and her family were making in her own home. The use of audio helped the children with the pronunciation of difficult words, especially in the third chapter, which discussed foodborne pathogens.

All but two of the children agreed the program was too long but viewing it in smaller segments would be acceptable. Many of the children stated that they would have preferred the animated characters to appear throughout the program. Only one participant thought the program was boring and that the narrator talked

too much, preferring to read the text instead. Another child found spelling and grammatical mistakes that were overlooked by all previous reviewers.

Timing the children showed that completion of the entire program generally spanned an hour and a half. Each chapter or subchapter took less than 30 minutes with the majority of them taking 15 minutes to complete. This is within guidelines for programs created for this age group. The attention span for this group is 20 to 30 minutes, so chapters should stay within those limits to be most effective. [23]

Changes that would make this program better include increasing the size of the program's viewing screen and including more animation and interactivity. Enlisting a videographer, photographer, and professional graphic artist would improve image quality and provide a polished appearance to the program. A cost-benefit determination, regarding these areas, should be made prior to development of a program.

Recommended future research, development, and uses for a food safety education program on CD. An expanded study to test this program for acceptance and effectiveness is recommended. Testing food safety knowledge prior to and after viewing the program would give an indication of its effectiveness while follow up studies would determine knowledge retention. Additional testing could be conducted with middle school and lower level high school students. Translation of the program into Spanish is another suggestion and would make the program available to a greater audience.

Food safety education can be taught in conjunction with science, social science, and family and consumer sciences classes. Interactive multimedia food safety education programs can be presented at 4-H, Boys and Girls Clubs, after school programs, Scouting meetings, or on an individual basis. Because nutrition and food safety education are natural partners, this program could be integrated into pre-existing nutrition education curricula. Teaching food safety education in conjunction with nutrition education at a young age is essential in helping children build effective and safe food handling habits.

Multimedia programs may be time-consuming to produce but can be an enjoyable task to undertake. Using various types of media coupled with interactive components engages the student, is highly accepted by this audience, and is successful in teaching subject matter that may be difficult to otherwise convey.

REFERENCES

1. Mead PS, Slunker L, Dietz V, et al. Food-related illness and deaths in the United States: Emerging infectious diseases. Centers for Disease Control and Prevention. Available at: http://www.cdc.gov/ncidod/eid/vol5no5/mead.htm Accessed January 15, 2004.
2. King, P. School feeders pluck strawberries from menus. Nation's Restaurant News, 1997; 31: 1,4.
3. Fishman A, Pearson K, Reicks M. Gathering food and nutrition information from migrant farmworker children through in-depth interviews. J of Ext 1999:37:5 Available at: http://www.joe.org/joe/1999october/rb3.html
4. Keith, M. Kids, food, and safety. National Network for Child Care, University of Illinois Cooperative Extension. Available at: http://www.NNCC.org/ Health/sacll_kid.food.safe.html Accessed January 10, 2001.
5. Education most effective means of combating food poisoning. Center for Science in the Public Interest-Report. Medical Letter on the CDC and FDA via InfoTrac Web: Health Reference Center-Academic-A64571710, Retrieved Jan 14, 2002; 14-15.

6. Pivarnik L, Partnoad M, Giddings, M. A food safety curriculum for second and third grade elementary students. J Am Diet Assoc 1994;94:8,65-68.
7. Youatt J, Andrews S, Hammerschmidt P, Sawyer, C. Murphy, A. RISK Raiders: A food safety hypermedia software program for students (Grades3-5). J Nutr Edu 1996; 28:181A.
8. Endres J, Welch T, Perseli T. Use of a computerized kiosk in an assessment of food safety knowledge of high school students and science teachers. J Nutr Edu 2001;33:37-41.
9. Food and Drug Administration. Food safety from farm to table: A national food safety initiative: Report to the President, May 1997. Available at: http://www.cfsan.fda.gov/~dms/fsreport.html Accessed July, 10, 1994.
10. Food safety teaching materials for kids. National Agricultural Library. [database online]. Available: http://www.nal.usda.gov/fnic/foodborne/kids.htm: Accessed September, 1, 2004.
11. Extension Education Food Safety [database online]. Michigan State University. Available at: http://www.msue.msu.edu/msue/imp/modfs/modfsc.html Accessed December 5, 1998.

12. Kids World-Food Safety [educational website]. North Carolina Department of Agriculture and Consumer Services. Available at: http://www.ncagr.com/cyber/kidsworld/ Accessed September 1, 2004.
13. Gateway to government food safety information [database online]. United States Food and Drug Administration. Available at: http://www.foodsafety.gov/~fsg/fsgkids.html Accessed September 1, 2004.
14. Tamplin M, Jones P, Hoover T. Let's Have a Killer Cookout…Not! 2nd edition. [program on CD/ROM]. University of Florida, Home Economics Dept. Lighthouse Education and Design. August 1997.
15. Michelman M, Probart C, McDonnell E. Students serving it safe. [program on CD/ROM]. The Pennsylvania State University, Dept. of Nutrition, College of Health and Human Development; 1998.
16. Safe food it's your job [educational website]. Iowa State University Extension. Available at: http://www.extension.iastate.edu/foodsafety/educators/lessons.cfm?articleID=17&parent=2 Accessed December 10, 2001 and September 1, 2004.
17. For Kids, Teens, & Educators [educational website]. Food and Drug Administration/Center for Food Safety and Applied Nutrition. Available at: http://www.cfsan.fda.gov/~dms/educate.html Accessed August 12, 2004.

18. Shassian A, Hampl J. Life skills in the boys and girls club: Opportunities for nutrition education. J Nutr Educ 2000;32:285B.
19. Hammerschmidt P, Andrews S, Murphy A, Youatt J, Sawyer C. Change in safe food handling knowledge and practice of 4-H members. J of Ext 1995;33. Available at: http://www.joe.org/joe/1995february/rb2.html. January 14, 2004.
20. Asymetrix (now Click2Learn) Toolbook II Assistant [computer program] version 6.5, 110-110th Ave NE, Bellevue, WA 98004-5840, 1999.
21. Asymetrix (now Click2Learn) Toolbook II Instructor [computer program] version 8.0, 110-110th Ave NE, Bellevue, WA 98004-5840, 2001.
22. Matheson D, Spranger K. Content analysis of the use of fantasy, challenge, and curiosity in school-based nutrition education programs. J Nutr Edu 2001;33:10-16.
23. United States Department of Agriculture, Cooperative State Research, Education and Extension Service. Curriculum development for issues programming. A national handbook for extension youth development professionals (publication number unknown). 1992.

Table 4.1 Food handling frequencies and food safety knowledge of the targeted audience.

VARIABLE	n=80	%
Frequency Making Snacks		
Daily	53	67
Weekly	20	25
Monthly/Yearly/Never	7	8
Allowed to Cook Meals		
Yes	69	86
No/No Response	11	14
How Often Cook Meals		
Daily/Weekly	26	33
Monthly/Yearly	45	56
Never/No Response	9	11
Know What Food Safety Is		
Yes	56	70
Not Sure/No	24	30
Know What Foodborne Illness is		
Yes	52	65
Not Sure/No	28	35
Know What Causes Foodborne Illness		
Yes	33	41
Not Sure/No	47	59
Know What Cross-Contamination Means		
Yes	12	15
Not Sure/No	68	85
Use Same Surface for Food		
Always/Sometimes	32	40
Never/Not Sure	48	60
What Internal Temperature Means		
Yes	20	25
Not Sure/No	60	75
How to Use Thermometer		
Yes	24	30
Not Sure/No	56	70

Table 4.2 Handwashing practices results from needs assessment survey.

VARIABLE	n=80	%
Hands Washed Before Handling Food		
Always	36	45
Sometimes	42	53
Never/Not Sure	2	2
Hands Washed After Using Bathroom		
Always	44	55
Sometimes	31	39
Never/Not Sure	5	6
Hands Washed After Touching Pets		
Always	19	24
Sometimes	32	40
Never/Not Sure	29	36
Know Why to Wash Hands		
Yes	75	94
Not Sure/No	5	6

Table 4.3 Computer usage frequencies, media and learning preferences determined from the needs assessment survey.

VARIABLE	n=80*	%
Preferred ways of learning		
Hands-on Activity	48	60**
Reading	46	58
Video	45	56
Lecturing	32	40
Use of home computer		
Yes	64	80
No	13	16
No Response	3	4
Use of any computer		
Daily	32	42
Weekly	26	34
Monthly	12	16
Yearly	1	1
Don't Use	6	7
Like computers for learning		
Yes	73	91
No	5	6
Missing	2	3
Preferences for computer games		
Interactive	46	58
Mystery	43	54
Information then Questions	43	54
Build or Create Something	31	39
Games That Require no Thinking	30	38
Computer learning benefits		
Music	53	66
Graphics	52	65
Control/Start and Stop	50	38
Video	46	58
Animation	45	56
Questions	43	54

* Numbers may vary based on responses

** Multiple responses allowed, percentages based on 80 responses

Figure 4.1 Contents of the "Kid Chef and the Clean Kitchen Crew" CD.

Chapter I-Introduction

Overview of food safety and foodborne illness

1A

- What and why should we study food safety?
- What is a foodborne illness?
- Whom does foodborne illness affect?

1B

- What causes foodborne illness and how does it occur?
- Where do pathogens come from and how they get in or on our food?
- What is cross contamination?

1C

- What conditions are necessary for bacterial growth?
- What is a potentially hazardous food?
- What does FAT-TOM and temperature danger zone mean?

Chapter 2-Handwashing

Importance of and proper steps for effective handwashing

- Who, What, Why, When, Where, and How of handwashing
- Proper handwashing procedures
- Interactive handwashing quiz

Chapter 3-Bacteria Meanies

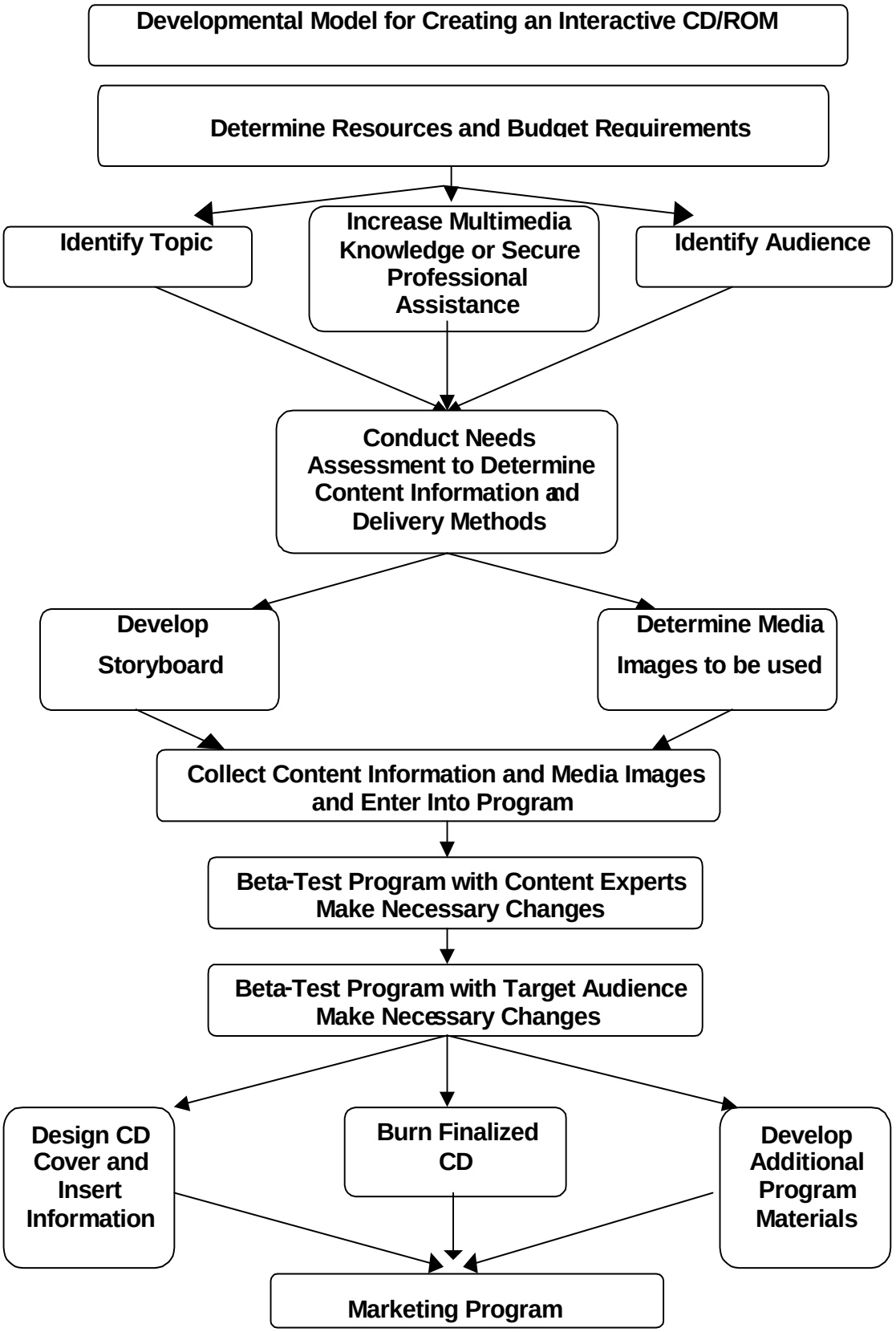
Introduction to foodborne pathogens and illnesses caused

- Names of common foodborne pathogens
- The foods associated with these pathogens
- Names of foodborne illnesses and their symptoms

Chapter 4-Doing it Right

- Practical lessons in proper food safety from shopping to storing
- Selecting, storing, washing, and thawing foods properly
- Avoiding cross contamination
- Cooking and thermometer usage
- Cooling, serving, reheating and storing leftovers
- Cleaning and sanitizing kitchen utensils and surfaces

Figure 4.2


Developmental Model for Creating an Interactive CD/ROM
Determine Resources and Budget Requirements
Identify Topic
Increase Multimedia Knowledge or Secure Professional Assistance
Identify Audience
Conduct Needs Assessment to Determine Content Information and Delivery Methods
Develop Storyboard
Determine Media Images to be used
Collect Content Information and Media Images and Enter Into Program
Beta-Test Program with Content Experts Make Necessary Changes
Beta-Test Program with Target Audience Make Necessary Changes
Design CD Cover and Insert Information
Burn Finalized CD
Develop Additional Program Materials
Marketing Program

Chapter V

SUMMARY, LIMITATIONS, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE STUDY

Summary

With an ever-widening food supply chain, which increases the introduction of foodborne pathogens and chances of foodborne illness, it is necessary that consumers be proactive in learning safe food preparation techniques. Many adult consumers are lacking basic food safety knowledge, and are therefore unable to teach their children safe ways of handling food. Changing American lifestyles and the increasing number of dual working parents also contributes to this problem.

Children between the ages of 9 and 12 are taking an active role in food preparation. Learning basic food safety at an early age can build a lifetime of safe food handling habits. The challenge is to make these concepts interesting, age appropriate, interactive, and fun, thereby increasing the child's desire to learn and develop effective food handling habits. Additionally, children can share their new found food safety knowledge with others, to protect them from foodborne illness.

Research Purpose

The purpose of this research was to develop a food safety education program for children 9 to 12 years old that is age appropriate and acceptable to this audience. Because children in this group are generally computer literate, it was

decided that an interactive, multimedia CD/ROM would be the most effective way to deliver the topic of food safety. The project was divided into three major stages: 1) a survey of children to assess their needs, 2) the development of the program, and 3) a Beta-test of the program with content experts and target audience members.

Specific objectives of this study included:

1. Determine the present food safety knowledge of fourth through sixth graders.
2. Determine the handwashing practices of fourth through sixth graders.
3. Determine the frequency of computer usage and media preferences of fourth through sixth graders.
4. Develop an interactive, multimedia food safety education program on CD-ROM that would be acceptable to this audience.
5. Beta-test the CD with technology, food safety, and education expects for content accuracy and age appropriateness.
6. Beta-test the CD-ROM with 10 students in the fourth through sixth grades for content and delivery acceptance.
7. Modify program content in accordance with feedback received during Beta-test.

Specific questions addressed in this research were:

1. What are the food handling frequencies of fourth through sixth graders?
2. What is the baseline food safety knowledge of fourth through sixth grade school children?

3. What are the handwashing practices of fourth through sixth grade school children?
4. Will education, food safety and technology experts be accepting of a food safety education program delivered in an interactive, multimedia format?

Needs Assessment

A needs assessment survey was conducted with 100 children ages 9 to 12. All participants were members of 4-H or Boys and Girls Clubs or attended after school programs. An 80% response rate to the survey provided insight into food handling frequencies and handwashing practices of this age group. In addition to baseline food safety knowledge, computer and media preferences also were obtained.

Survey results of the 80 children found that those in this group are active in food preparation with 92% preparing snacks on a daily or weekly basis and 86% helping to prepare meals. Sixty-five percent of the respondents stated that they knew the meaning of foodborne illness, but 59% felt they did not know/were unsure what caused it. The children lacked knowledge of cross contamination; 85% did not know or were unsure of its meaning, many (40%) stated that they used the same surface to prepare raw and cooked foods. The majority (75%) admitted that they did not know or were not sure of the definition of internal temperature and 70% did not know how to use a thermometer.

When asked about their handwashing practices, 55% of the students admitted that they sometimes or never wash their hands before handling food. Surprisingly, 94% claimed that they knew why they must wash their hands, yet

45% of the youths sometimes or never washed after using the bathroom. Handwashing after playing with pets was never or only sometimes completed by 76% of the respondents.

When asked about computer usage, 80% of the children responded that they use a home computer, 76% use one on a daily or weekly basis, and 91% identified it as the preferred learning tool. When asked, the children selected music, audio, graphics, video, and animation as forms of media they preferred in computer based programs.

Program Development

Information gained from the needs assessment survey provided the structural framework for the educational CD. Food safety knowledge areas found to be weak were covered thoroughly. These areas included handwashing, cross contamination, temperature-taking techniques, and proper internal cooking temperatures of food. The use of home-based scenarios assisted in making the topics more meaningful to this audience. Several media forms including animation, music, audio, photographic, and graphic images increased interest in the program. Interactive components also encouraged participation in the program because immediate feedback response was provided.

Beta-testing the Program

Before finalization of the food safety educational CD/ROM a Beta-test was conducted. Testing consisted of two phases: 1) reviews of the program by content experts and 2) reviews by representatives of the targeted audience.

Content experts represented areas of multimedia and elementary education, extension nutrition education, food safety, and multimedia technology. Each expert viewed the program and provided feedback about the format, age appropriateness, and accuracy of the program content. Feedback was positive about the program content and delivery format. Suggested changes included re-recording the voice of one of the animated characters, spelling and grammatical corrections, and clarification of some navigational directions in the program. Changes were made prior to presenting the program to the next reviewer. The addition of more animation and interactive activities was suggested but not completed because of time constraints.

The second Beta-test was conducted with representatives of the targeted audience. Boys and girls in the fourth, fifth, and sixth grades evaluated the program and provided feedback about the subject matter and presentation. The majority of children made positive comments, stating that the program was interesting and that they liked the interactive components. The animated characters, audio, and video clips were the children's favorite media formats. Because of time limitations, the children completed the program in one session, not the recommended viewing time frame. Many thought the program was too long to be completed this way but agreed that delivery in shorter segments would be ideal. As with the adult reviewers, the children would like to see more animation and interactive activities. Feasible changes were made prior to presenting the program to the next child.

Limitations

Limitations are expected with every research project. This project proved to have several limitations but provided many opportunities to increase the researcher's knowledge base.

Sampling size of needs assessment participants was reduced slightly because of the difficulty in scheduling time with the students. The needs assessment surveys were delivered at club or group settings. Many had crowded agendas, making it difficult to get the 15 minutes necessary for questionnaire completion. Some of the 4-H Clubs met only once a month, which proved to be a scheduling problem. Often children would forget to return the parental permission slip necessary for survey participation, resulting in repeated trips to a collection site for completion of the questionnaire. Of the targeted 100 children, 80 completed the survey. The results of the needs assessment survey are representative of this group of children and not generalizable to other children.

The researcher's computer, multimedia, and technological knowledge proved to be a limitation but also proved to be an avenue for learning and increasing knowledge base. To initiate this educational opportunity a multimedia education class was completed prior to development of the program. This class became an essential component in the layout of the storyboard and in deciding which media to use. Enlisting the expertise of a multimedia expert familiar with extension education programs contributed to the completion of the interactive multimedia CD.

Time became a factor in several areas, including familiarization with software capabilities, factors affecting image and audio quality, and the actual inputting of program content. Creating multimedia projects is rewarding but time consuming for both novice and expert. Creation of animation and interactive activities along with recording of audio was the most time-consuming of the media components used in the program.

Although this project was funded generously, multimedia projects are expensive to produce. This is especially the case if the equipment and the content developer are not available. Additional funding would provide computer software and digital photographic equipment that could have provided better quality images for the program content. The expense of multimedia projects must be taken into consideration prior to embarking upon their creation.

Conclusions and Implications

It is evident from the needs assessment that fourth through sixth grade children are in need of food safety education. In addition, findings from the literature review indicated that children are taking an active role in food preparation (Fishman, et al., 1999; Haapala & Probart, 2004; Hammerschmidt et al, 1995; Keith, 1991). The early introduction of food safety education and reinforcement of proper food handling practices can foster the development of safe food handling habits (Christine, 1994; Medeiros, Hillers, Kendall and Mason, 2001). Participants from this survey lacked basic food safety knowledge, including the meaning of cross contamination, proper internal temperatures, thermometer usage, and the causes of foodborne illness. A thorough discussion

of handwashing importance and procedures must be provided so that the children can better understand the consequences of poor personal hygiene.

Development and testing of this project has shown that delivering educational messages via an interactive, multimedia CD/ROM is acceptable to both children and content experts. This reinforces findings in the literature that found food safety and nutrition education programs delivered via multimedia to be successful in increasing basic knowledge (Cullen et al., 1997; Pivarnik et al., 1994: Youatt et al., 1995). Although development of these programs can be financially expensive and time and labor intensive, the completed product is worth the cost. The possession of technological skills, computer, and media equipment within an organization can reduce the amount of time and expense necessary to create these programs. Partnerships with groups in possession of financial and technological resources can also be effective in creating multimedia projects.

Children of this generation are technologically advanced and desire action and interaction to increase their interest in educational programs. The use of interactive multimedia educational programs can be acceptable and effective in teaching children basic life skills such as safe food preparation. Food safety education and nutrition education are natural partners in teaching children the healthy and safe way to handle the food they consume. Development of nutrition education programs in an interactive multimedia format can be just as effective as food safety education and should be a consideration. A natural venue for delivery of such programs is Boys and Girls and 4-H Clubs, Boy and Girl scouts

(Shassian and Hampl, 2000), and after school programs. Additionally food safety education can be incorporated into science, social science, and consumer science curricula.

Recommendations for Future Study

Although this food safety education program was tested for content accuracy and audience acceptance, further study should be conducted to test the program for effectiveness in teaching food safety concepts. A pretest/posttest design could be used for this purpose. A follow up study could be used to assess retention of knowledge and actual food handling practices. Additional acceptance and efficacy testing of this program should be considered with middle and high school students.

Several requests have been made for this program to be translated into Spanish to increase its use with a broader audience. This would be a viable venture but considered only after testing the program's efficacy.

References

Christine, B. (1994). Confronting food safety risks. *Risk Management, 41* (9), 71-72.

Fishman, A., Pearson, K. & Reicks, M. (1999). Gathering food and nutrition information from migrant farmworker children through in-depth interviews. *Journal of Extension, 37* (5). Retrieved January 14, 2002, from http://www.joe.org/joe/1999october/rb3.html

Haapla, 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. Retreived March 15, 2003, from http://www.joe.org/joe/1995february/rb2.html

Keith, M. (1991). *Kids, Food, and Safety. National Network for Child Care*. Retrieved March 23, 2002, from http://www.nncc.org/Health/sac11_kid.food.safe.html

Medeiros, L., Hillars, V., Kendall, P. & Mason, A. (2001). Evaluation of food safety education for consumers. *Journal of Nutrition Education, 33*(1) (Suppl.), 27-34.

Shassian, A., & Hampl, J. (2000). Life skills in the boys and girls club: Opportunities for nutrition education. *Journal of Nutrition Education, 32*(5), 285 B.

APPENDICES

APPENDIX A

Kansas State University Human Subject Approval Form

K-STATE
Kansas State University
Office of Research and
Sponsored Programs
103 Fairchild Hall
Manhattan, KS 66506 - 1103
785-532-6195
Fax: 785-532-5944

TO: Betsy Barrett Proposal Number: 1578
Hotel, Restaurant, Institution Management and Dietetics
Justin Hall

FROM: Clive Fullagar, Chair
Committee on Research Involving Human Subjects

DATE: September 9, 1998

RE: Proposal #1578, entitled "Development and Testing of Food Safety Education Using CD-ROM for Third Through Sixth Grade Children."

The Committee on Research Involving Human Subjects has reviewed and approved the proposal identified above. In giving its approval, the Committee has determined that:

☒ There is no more than minimal risk to the subjects.
☐ There is greater than minimal risk to the subjects.

This approval applies only to the proposal currently on file and is effective for one year from the date of this memo. Any change affecting human subjects must be approved by the Committee prior to implementation. All approved proposals are subject to review, which may include the examination of records connected with the projects. Unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects and, if the subjects are KSU students, to the Director of the Student Health Center.

Prior to involving human subjects, properly executed informed consent must be obtained from each subject or from an authorized representative. Each subject must be furnished with a copy of the informed consent document for his or her personal records, and documentation must be kept on file for at least three years after the project ends. The identification of particular human subjects in any publication is an invasion of privacy and requires a separately executed informed consent. A copy of your informed consent documentation as approved by the Committee is enclosed.

Cfullagar

APPENDIX B

Informational Letter to Parent and Parental Permission Slip

Dear Parent,

There are an estimated 6 to 33 million cases of foodborne illness reported in the United States each year. Children are identified as a high-risk group for contracting foodborne illness. Research shows that early intervention food safety education and proper food handling can reduce the causes of foodborne illness.

Your permission is requested for your child to participate in research conducted at Kansas State University in conjunction with the Cooperative Extension Service. This research will measure the effectiveness of a food safety education program presented using an interactive CD/ROM. The program will consist of several areas of food safety education.

Participation in this study is purely voluntary. To insure complete anonymity and confidentiality, your child's name will not be used in this study. All data collection will be presented in summary form only. Any questions about the rationale or method of this study may be directed to Toni Jo Bryant, Dept. of Hotel, Restaurant, Institutional Management and Dietetics, 103 Justin Hall, Kansas State University, 532-2214.

If there are any questions about the rights of subjects in this study or about the manner in which the study is conducted, contact Clive Fullagar, Chair, Committee on Research Involving Human Subjects, 103 Fairchild Hall, Kansas State University at 532-6195.

I encourage you to allow your child to participate in this research. It has been developed to help protect our children. Attached is a parental permission slip, please complete and return it to the school or club meeting (date will be specified). Thank you for your cooperation.

Toni Jo Bryant

Parental Permission for Child's
Participation in a Food Safety Education Program

This is a request for permission to allow your child to participate in the Food Safety Education Program developed on CD/ROM for Fourth, Fifth and Sixth Grade Students. The program will be delivered in three 30-minute increments. Only one permission slip is necessary for your child's participation in all three-program deliveries. Your child's name will not be associated with any portion of the program thus insuring complete anonymity and confidentiality. Results will be presented in summary form only. A request for results of the study may be made by contacting Toni Bryant at the address below.

My child's participation in this study is purely voluntary. I understand that my refusal to grant permission for their participation will involve no penalty or loss of benefits to which they are otherwise entitled and that they may discontinue participation at any time.

If I have questions about the rationale or method of the study, I understand that I may contact Toni Jo Bryant, Department of Hotel, Restaurant, Institutional Management and Dietetics, 103 Justin Hall, Kansas State University, 532-2214.

If I have questions about the rights of subjects in this study or about the manner in which the study is conducted, I may contact Clive Fullager, Chair, Committee on Research Involving Human Subjects, 103 Fairchild Hall, Kansas State University, 532-6195.

_____

My child (full name) _____

School or Club Name_____

has my permission to participate in the Food Safety Education Program using a CD/ROM format and to participate in the hands-on activities. These activities will not include the actual handling or eating of food.

Parent/Guardian Name (Printed)_____

Signature_____

Date_____ Phone # (Day) _____

(Evening)_____

APPENDIX C

Needs Assessment Questionnaire

Needs Assessment
Food Safety Education Program

Code # _____

1. **How old are you? _____**

2. **What is your gender? (Circle one answer for the following questions)**
   A. Girl
   B. Boy

3. **What grade are you in?**
   A. Fourth
   B. Fifth
   C. Sixth

4. **How often do you make your own snacks when you are at home?**
   A. Everyday
   B. At least one day a week
   C. At least three times a month
   D. Occasionally, a few times a year
   E. Never

5. **Do your parents or guardians allow you to prepare meals?**
   A. Yes
   B. No

6. **If yes, how often do you help prepare meals at home?**
   A. Everyday
   B. At least one day a week
   C. At least three times a month
   D. Occasionally, a few times a year
   E. Never

7. **Do your parents or guardians show <u>you</u> ways of keeping food safe so that it doesn't make you sick?**
   A. Yes
   B. No
   C. Sometimes
   D. I'm not sure

8. **What kinds of foods do you like to eat or cook? (Check all that apply)**

Frozen Foods
__Chicken Nuggets
__Pizza
__Pretzels (Big)
__Vegetables/Stir-Fry Mixed
__Cheese Sticks (Breaded)
__Fish Sticks
__Other_____
_____

Fresh/Deli Meats
__Baked Chicken
__Hamburger Patties
__Pork Chops
__Hot Dogs
__Lunch Meat (Ham, Bologna)
__Tacos w Hamburger
__Other_____
_____

Fresh Vegetables
__Lettuce/Salad Items
__Beans (Green, Pinto, etc.)
__Potatoes (Baked, Fried)
__Green (Broccoli, Spinach, etc.)
__Carrots, Squash, Sweet Potato
__Corn
__Other_____
_____

Boxed Foods
__Macaroni & Cheese
__Hamburger Helper
__Cookie/Cake Mixes
__Pancake/Biscuit Mixes
__Tuna Helper
__Other_____
_____

Fresh Fruits
__Apples/Pears
__Oranges/Grapefruit
__Melons (Any kind)
__Berries (Any kind)
__Grapes (Any kind)
__Other_____
_____

Dairy Foods and Eggs
__Milk
__Yogurt
__Cheese (String, Cheddar, etc.)
__Ice Cream
__Eggs (Fresh in the Shell)
__Other_____
_____

9. What items in the kitchen do you use?
A. Stove/Oven
B. Blender
C. Microwave
D. Knives/Cutting boards
E. Toaster/Toaster-Oven
F. Refrigerator/Freezer
G. Dishwasher/Hand-wash Dishes
H. Other(Write-in)_____

10. Do you wash your hands before your touch, cook or eat food?
A. Always
B. Sometimes
C. Never
D. I'm not sure

11. Do you wash your hands after using the bathroom?
A. Always
B. Sometimes
C. Never
D. I'm not sure

12. Do you wash your hands after touching your pets?
A. Always
B. Sometimes
C. Never
D. I'm not sure

13. Do you know why you should wash your hands?
A. Yes
B. I'm not sure
C. No

14. Do you know what food safety is?
A. Yes
B. I'm not sure
C. No

15. Do you know what "foodborne illness" or "food poisoning" means?
A. Yes
B. I'm not sure
C. No

16. Do you know what causes "foodborne illness" or "food poisoning?"
A. Yes
B. I'm not sure
C. No

17. Do you know what bacteria are?
A. Yes
B. I'm not sure
C. No

18. Do you know what "cross-contamination" means?
A. Yes
B. I'm not sure
C. No

19. Do you ever use the same surface to cut raw meat and other raw foods, which will not be cooked (vegetables, bread)?
A. Always
B. Sometimes
C. Never
D. I'm not sure

20. Do you know what an "internal cooking temperature" of food means?
A. Yes
B. I'm not sure
C. No

21. Do you know how to use a thermometer to take the internal temperature of a food product?
A. Yes
B. I'm not sure
C. No

22. Do you know the right temperature to which you need to cook foods?
A. Yes
B. I'm not sure
C. No

23. Where is raw hamburger or chicken (that is ready to be cooked) stored in your refrigerator?
A. On the bottom shelf
B. Wherever there is room
C. In the veggie or deli drawer
D. I don't know

24. Where is meat thawed in your kitchen?
A. On the counter
B. In the refrigerator
C. In the microwave
D. Cooked while still frozen
E. I don't know

25. Do you ever have cleaning supplies (dish-soap, ammonia, bleach, glass cleaner, etc.) on the counter when you cook?

A. Always
B. Sometimes
C. Never
D. I'm not sure

26. How are the dishes washed in your house?

A. Sponge/Scrubbie
B. Dishcloth
C. Scrub Brush
D. Dishwasher
E. I don't know

27. What ways do you like to learn new things?
(circle all that you like)

A. Reading
B. Hands-on-Activities
C. Teacher talking or reading to me
D. Videos

28. Do you use a computer at home?

A. Yes
B. No

29. How often do you use computers?

A. Everyday
B. Once a week
C. A few times a month
D. A few times a year
E. I don't use it

30. Do you like to use computers to learn new things?

A. Yes
B. No

31. What kind of computer games do you like? (circle all that you like)

A. Mystery games where I have to solve problems (ex. Math Blaster Mystery)
B. Interactive games that allow me to be part of the activity (ex. Sim Town)
C. Programs that present information and then asks me questions. (ex. Orgeon Trail)
D. Games that allow me to build things from scratch (ex. Opening Night)
E. Games that let me relax and I don't have to think. (ex. Tetris)
F. I don't like computer games

32. What things do you like about computer learning. (circle all that you like)

A. I can control the program (I can navigate where to go and when to stop and start)
B. I like graphics and pictures
C. I like music and sounds
D. I like animation
E. I like video
F. I like games that ask me questions

33. What kind of TV programs/channels do you like to watch?

A. Nickelodeon
B. Discovery Channel
C. Disney
D. Others (list as many as you like)

_____

_____

34. What after-school activities do you participate in?

A. 4-H (what projects)_____

_____

B. Sports (what kind)_____

_____

C. Music/Dance/Drama Lessons_____

_____

D. Clubs (what kind)_____

_____

If you need extra room to write your answers turn the paper over and label your answer with the number of the question that is being answered.

APPENDIX D

Photo Release Forms
Child and Adult

Photo Release Form
Food Safety Education CD

I (print name)_____ give consent for the use of my child's photographic image to be used in a Food Safety Education CD developed by Toni Bryant for the Kansas State University Extension Family Nutrition Program. This image may appear in printed publications, electronic media or other materials used to promote use of this education program.

Child's Name _____ Phone _____

Address _____ Date _____

Parent's Signature_____

Photo Release Consent Form
Food Safety Education CD

I (print name)_____ grant consent for my photographic image to be used in a Food Safety Education Program developed by Toni Bryant for the Kansas State University Extension Family Nutrition Program. This image may be used in printed materials, electronic media or other materials used for promotion of this educational program.

Address _____ Phone _____

Signature _____ Date _____

APPENDIX E

Copy of
"Kid Chef and the Clean Kitchen Crew" CD/ROM