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## **A Comparison of Participant Gains in Attitude and Behavior After Experiencing a Food Safety Curriculum in Traditional and Computer Delivered Environments**

Jennifer Knowles Schilling

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A comparison of participant gains in attitude and behavior after experiencing a food  
safety curriculum in traditional and computer delivered environments

By

Jennifer Knowles Schilling

A Dissertation  
Submitted to the Faculty of  
Mississippi State University  
in Partial Fulfillment of the Requirements  
for the Degree of Doctorate of Philosophy  
in Agricultural Science  
in the College of Agriculture and Life Sciences

Mississippi State, Mississippi

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A comparison of participant gains in attitude and behavior after experiencing a food  
safety curriculum in traditional and computer delivered environments

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Child care providers in Mississippi are required by the Mississippi Health Department to obtain food manager's training and certification. The TummySafe<sup>®</sup> program satisfies this requirement and is offered in a self-paced computer delivered version and a traditional classroom version. This research explores participant changes in attitude and self-reported behaviors in the two methods of curriculum delivery as well as the correlation of knowledge change with attitude and self-reported behavior change. A quasi-experimental, pre-test/post-test design was used. Attitude change was not significantly different in the two methods. Traditional participants reported a higher change in self-reported behaviors than computer delivered participants. Both attitude and self-reported behavior change were positively correlated with knowledge gain.

Key words: attitude, behavior change, food safety, knowledge gain.

## DEDICATION

As I think about the number of people that have inspired me to work for this goal, I am humbled by the support I have received. Wes Schilling, thank you for all the support you have given me in the last five years. The countless nights watching the kids, the weekend hours distracting them while I worked and the additional pick-ups and drop offs just begin to start the list in the ways you have supported me. Thank you! You are the love of my life and I am blessed to have you as a life partner.

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## CHAPTER I

### INTRODUCTION

Foodborne illnesses are a major public health concern. The Centers for Disease Control and Prevention (CDC) reported in 2011(a) that one in six Americans, or about 48 million people, get sick with a foodborne illness each year. Frenzen, Drake and Angulo (2005) reported a societal cost of \$7 million due to one case of *Echerichia Coli* O157 in the United States. The United States Department of Agriculture (USDA) reported a cost of approximately \$2.3 billion per year for foodborne illness in children under 10 years old (Buzby, 2001). As many as 11.2 million children ages zero to five years old attend some type of child-care arrangement and 23.8% attend organized child care at least once a week (National Child Care Information Center, 2010). In 2012, the National Association of Child Care Resource and Referral Agencies reported that 15,060,140 children under six years of age in the United States potentially need child care and 158,047 of those children reside in Mississippi. This grouping of children creates an excellent opportunity for illness prevention.

In 2011(b), the CDC reported in *Morbidity and Mortality Weekly* that foodborne illness can be prevented and the incidence of illness due to several pathogens has significantly reduced since surveillance started in 1996. One method that prevents foodborne illness in children is the training of food handlers, including cooks and staff at child care centers. The Mississippi Department of Health requires that Food Service

Managers receive food safety training in order to obtain a Child Care License and requires recertification every five years (Mississippi Department of Health, 2013). As child care and its licensure regulations advance in sophistication, child care directors are faced with juggling the demands of providing for the children in their care, obtaining staff training, and finding the funds for the necessary training. As child care centers work to meet the demands of licensure training with an ever-in-flux employee base, the demand for effective, on-location training is a continual need.

In light of this need, educational institutions have made great advances in the use of technology to provide training opportunities. These vary from courses delivered via the Internet, to computer software, to curriculum delivered by public television stations, and correspondence courses (Brewer, 2004; Kudryavtsev, Krasny, Ferenz, & Babcock, 2007). The initial emergence of curricula delivered with advanced technology in the college area waned as students reported that the in-person aspects of college life and the intrinsic experiences of college life warranted the traditional college experience. While the ebb and flow of these curricula has been well documented (Wales, 2003), the need for effective, efficient work force training in the child care industry has continued.

The Mississippi State University Extension Service (MSU-ES) is uniquely suited to address these training needs. The presence of an Extension office in each of Mississippi's 82 counties and the well-trained and available staff offered by MSU-ES makes it the perfect educational agency to reach the training needs of the child care providers. In light of this potential, the USDA funded a cooperative project between MSU-ES and the Center for Advanced Vehicular Systems (CAVS). The project was entitled *Food Safety Certification Program for Child Care Facilities using traditional*

*and technologically advanced, self-paced delivery methods.* This program produced a Food Safety curriculum named TummySafe<sup>®</sup>. During the project, this curriculum was developed and implemented through traditional and computer delivery methods. The two delivery methods of TummySafe<sup>®</sup> were first pilot tested on November 23, 2004. This particular pilot examined the attitudes of the adult participants in the traditional classroom setting and the individual, self-paced version as they completed one of the TummySafe<sup>®</sup> modules. For the period of April 2005 to June 2006, the complete six-module TummySafe<sup>®</sup> curriculum was offered at no charge state-wide. Certifications were given for scores over 80% on the certification exam and data were collected on participant's attitude towards and self-reported behaviors in food safety.

### **Statement of the Problem**

Will adult learners, receiving a one-time workforce training in food safety, report a more positive attitude and self-report an increase in food safety behaviors after a self-paced, computer-delivered curriculum than an instructor-led, traditional, classroom-based curriculum? In addition, does increased knowledge of food safety lead to improvement in self-reported attitude and a self-reported increase in food safety behaviors?

### **Hypothesis One**

Adult learners receiving a one-time workforce food safety training will report a more positive attitude in food safety concepts after a self-paced, computer-delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

### **Hypothesis Two**

Adult learners receiving a one-time workforce food safety training will report a larger increase in self-reported food safety behaviors after a self-paced, computer delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

### **Hypothesis Three**

Knowledge gain in the area of food safety is correlated to improvement in attitude of adult learners completing a one-time food safety training.

### **Hypothesis Four**

Knowledge gain in the area of food safety is correlated to increased self reported food safety behaviors in adult learners receiving a one-time food safety training.

### **Operational Definition of Terms**

1. Adult learners. Participants in a short-term curriculum for a one time certification or credentialing, not students working toward a degree or in a long term course of study. (Ota, DiCarlo, Burts, Laird, & Gioe, 2006)
2. Traditional classroom curriculum. A setting in which the curriculum is delivered live and face-to-face by an instructor and students observe as a group and participate within a classroom (Fishel & Ferrell, 2009). In this study, the curriculum was delivered via the Insite<sup>©</sup> software on which TummySafe<sup>©</sup> is built. An MSU faculty member or Extension Area Agent led the class through the software pausing to allow the TummySafe<sup>©</sup> audio to play. Questions within TummySafe<sup>©</sup> were answered by either a volunteer student or by a voting method,



where the instructor clicked the answer that the majority of the students selected by raising their hands. TummySafe<sup>®</sup> required repetition of that portion of the curriculum until correct answers were given; then and only then, the curriculum continued to new material. The instructor was available to answer individual questions as they arose.

3. Self-paced curriculum. Training delivered individually to each student via interactive computer based training (Fishel & Ferrell, 2009). Each student controlled their individual progress through the curriculum and was required to individually interact with the curriculum on a computer. As in the traditional version, as each student answered questions in the curriculum, incorrect answers resulted in being sent back through the information again. Once correct answers were given, the student was allowed to progress to new information. All TummySafe<sup>®</sup> audio was used. Participants completed the material on their own computers, at their own pace. They were permitted to login and logout as they deemed necessary and to complete the full curriculum as many times as they wished.
4. Attitude. How participants feel about the curriculum they are using based on their knowledge, experience with the curriculum, their internal resistance to change and resulting answers to several survey questions (Culbertson, 1968). In this study, these attributes are measured and estimated based on participants' responses to several questions. These questions were developed to specifically examine attitude and were evaluated for content validity by multiple researchers in Agriculture Information Sciences and Educational Psychology.

5. Behavior: Self-reported perceptions of the participants' actions in various settings and topics.

### **Assumptions**

1. Child care providers use TummySafe<sup>®</sup> to reach their licensure and training requirements.

### **Limitations**

1. Participants may or may not have chosen the method of delivery they used, ie. a director of a child care center would choose the method for the cook's training. Participants were not randomly assigned to treatment options in the full curriculum study.
2. The use of interactive, computer based learning was a novel experience for the participants.
3. All behavior data were self-reported. Lew, Alwis and Schmidt (2010) found self-reported attributes to be only mildly correlated to peer assessments of students' actual learning. In-depth observation of the participants in a time-series study was not possible due to time, travel and other barriers.

## CHAPTER II

### LITERATURE REVIEW

#### **Demographic of the Child Care Provider**

The National Child Care Information and Technical Assistance Center (NCCIC) reported in March 2009(a) that approximately 1.2 million individuals are providing child care in a formal setting to children under five years old in the United States. These settings include child care centers and family child care homes. Another 1.1 million individuals are paid neighbors, friends or relatives of children that they care for. In total, 2.3 million people in the United States are paid to care for and educate children under five years old. The National Association of Child Care Resource and Referral Agencies (NACCRRA) reported in 2012 that there are 158,047 children under six years old that need child care in Mississippi. The Mississippi average yearly cost of that child care is \$4,591 for an infant and \$3,911 for a four year old child, or about 7-16% of the median married couple's income for an infant's child care. The national cost for child care ranges for an infant from \$4,560 to \$15,895 and \$4,056 to \$11,678 for a four year old child, which is 7-16% of the median married couple's annual income.

The NACCRRA (2009b) reported that, across the United States, there are 576,680 child care workers, excluding self-employed providers. The average wage for a child care provider in a child care center was \$9.46 per hour. A slightly higher wage of \$12.40 per hour was reported for preschool teachers. Ninety seven percent of child care

providers in child care centers are women and 20% of child care center teachers have a high school diploma or less. In addition, 43% of teaching assistants in the child care field also report they have a high school diploma or less. In 2012, the NACCRRA reported that, in Mississippi, there are 1,717 child care centers and 5,130 child care providers. These providers have an average income of \$18,070, which is lower than the national average of \$21,320 for a child care provider.

### **Regulations and Training in the Child Care Industry**

Training is an issue in child care. In six states, child care providers are not required to take even an orientation class before entering the classroom. Fukkink and Lont (2007), in a meta-analysis, found significant evidence of the positive impact of training of the child care provider. The NACCRRA (2009a) reported that they have training centers in each state and 99.33% of populated zip codes in Mississippi. In these centers, they reported the training of 650,000 child care providers across the United States. In Mississippi in 2000, the NACCRRA, reported that their eight offices held 406 training sessions, with an average of 31 child care providers attending each training, for a total of 12,586 participants trained. For the period of 2011, they reported 628 trainings with an average of 20 participants trained at each training (NACCRRA, 2012).

Each state in the United States has regulations regarding child care centers and each state has provisions for unannounced annual visits to the food preparation areas (Scarr, 1998). In Mississippi, licensed child care centers are required to complete a variety of trainings each year to maintain licensure (Mississippi Department of Health, 2009). Each center is required to have one employee maintain current Food Manager's Certification. Indeed, child care providers have demonstrated an interest in health and

safety workshops (Murphy, 1995). Even so, Pollard, Lewis and Miller (1999) found that nearly one-fifth of the 330 meal preparers in child care centers in Australia had no cooking or food service training. Even those child care providers who received training may no longer work at the child care center. Vandell and Wolfe (2000) reported that Whitebook, Sakai and Howes in 1997 found a 51% turnover rate for teachers, a 34% turnover rate for teacher-directors and a 36% turnover rate for directors in child care centers in the United States. This turnover rate creates a constant supply of employees who need training.

Barriers to this education are multifaceted and varied. A common barrier to obtaining continuing education or certification is that child care workers are low wage earners (Ackerman, 2006). Other barriers are lack of time and or difficulty in transportation to the trainings (Rusby, 2002). Another potential barrier is lack of personal motivation and felt need to obtain food safety training, as the vast majority of consumers consider the food they eat to be very safe and show little concern for the safety of their food (Brewer & Rojas, 2008). Regardless of the barriers to this continuing education, Enke, Briley, Curtis, Greninger and Staskel (2007) have shown that continual food safety training is essential to providing a safe environment for preschool children.

### **The Use of Non-face-to-face Instruction in Work Force Training**

One method that can be used to overcome barriers associated with continuing education is the use of technology driven instruction. State Extension programs have accepted the challenge of providing this continuing education through the use of advanced technology. One such example is described by Fishel and Ferrell (2009) in which Certified and Licensed Pesticide Applicators utilize an on-line system to recertify.

This technology driven instruction has taken many forms which include but are not limited to curriculum delivered by public television stations, internet delivered curricula, correspondence courses, and computer programs (Brewer, 2004; Kudryavtsev, Krasny, Ferenz, and Babcock, 2007). Success has been demonstrated through the use of internet based instruction in the training of youth leaders and coaches in Texas equine programs (Cavinder, Antilley, Gibbs, and Briers, 2009), despite extensive multi-county areas and a large population.

While the use of technology driven instruction has had its challenges and challengers, the use of this instruction has been well suited for continuing education situations (Fishel & Ferrell, 2009). Thomas (2007) reports that the Greenville Technical College in South Carolina provides a “virtual campus” model for effective long-distance testing of over 1,000 students monthly in both traditional and electronic based testing.

Cavinder et al. (2009) reported the successful use of web-based instruction to overcome geographical barriers to adult education in Texas. The authors reported that the participants had a positive affect towards their perceived educational value of the web based training. The authors stressed the use of in-person workshops and online training to provide training to the public and youth programs. Fox, Hebert, Martin, and Bairnsfather (2009) reported that among 4-H volunteers, the preferred training delivery mode was electronic communication (30.3%) and group trainings (40.5%). They went on to report that 26.3% of participants preferred a computer based CD. The authors noted that the volunteers sampled for this study were at a group training for the survey and suggested future work to survey participants in each of the delivery methods to determine if they consistently select the method they are attending.

Fishel and Ferrel (2009) reported that Florida's Certified and Licensed Pesticide Applicator training online system was just as effective as the face-to-face instruction methods available. Participants reported choosing this method to recertify as a way to decrease their time away from work. Participants also reported being comfortable with this type of instruction and indicated that they would use this type of instruction again. The authors also reported that this sort of online training is an excellent way for Extension Educators to increase their time efficiency while decreasing their costs.

### **Factors in the Attitude of the Learner**

Attitude was described by Culbertson in 1968 as involving at least three things:

1. An attitude object as "defined by the attitude holder"
2. "A set of beliefs" about the object
3. "A tendency to behave towards the object so as to keep or get rid of it."

Culbertson identified several factors and dimensions within the sphere of attitude. These include but are not limited to how intensely a person feels towards the attitude object, the irreversibility of the commitment toward the attitude, the knowledge level of the attitude, and a person's resistance to change. All these complex factors influence a person's attitude or preference and are termed affect.

Ormrod in *Human Learning* (2008) defined affect as "the feelings, emotions, and general moods that a learner brings to bear on a task" (p. 474). Education has long focused on the learners' cognitive gains. Mok (2006) brought to light students' affective and social gains developed as a result of educational experiences. Affect has many facets and includes a large number of variables. Olson, Vernon, Aitken, and Jang (2001) looked at 30 unique variables of affect and stated that these variables can be environmental,

hereditary, or learned. Common variables reported on are feeling happy, calm or tired (Linnebrink-Garcia, Rogat, & Koskey, 2011), self reported perceptions of like/dislike (Stryuven, Dochy, & Janssens, 2008), enthusiasm (Salanova, Llorens, & Schaufeli, 2010) and self measurements of academic self concept (Marjoribanks, 2006). These examples were a small sampling of the variety and types of the many facets of affect.

### **Methods Used to Determine Affect**

Just as affect has many facets, so have the methods used to determine affect. Self assessment instruments such as mail-out surveys (Rakap & Kaczmarek, 2010), self report surveys (Meyer, McClure, Walkey, Weir, & McKenzi, 2009), Likert type researcher developed questionnaires (Hahne, Benndorf, Frey & Herzig, 2005; Jung & Reid, 2009; Fischer, Kubitzki, Guter & Frey, 2007; and Boekaerts & Minnaert, 2006), focus groups (Swan, & O'Donnell, 2009) and standardized instruments (Dorman & Fraser, 2009; Moneta & Kekkonen, 2007; Chan & Moore, 2006; & Edwards, Edwards, Shaver, & Oaks, 2009) are all common methods that have been used to determine participant affect.

### **Self-Assessments**

Self-assessments are a common research tool used to determine affect. Lew, Alwis and Schmidt (2010) examined the accuracy of self-assessments. In their report of two studies, the researchers compared the self-assessments of 3,588 first-year students with assessments from tutors and peers taken during the same semester. The students completed 80 self assessments of their learning process over the semester. The researchers found that the self-assessment scores were only weakly to moderately correlated to peer and tutor assessments of their learning. The authors also reported an



ability effect where higher achieving students were able to better assess their own learning than lower achieving students. The accuracy of these self-assessments over time did not improve despite the researchers repeating the self-assessment over four time periods. This study highlighted the need for objective assessment of students learning rather than relying on student perception in self-assessment.

### **Affect's Impact on Learning**

There is significant evidence of the impact of affect on learning. Meyer et al. (2009) conducted a study that shows the impact of affect on success. In this study of 3,568 high school students in 20 schools in New Zealand, the authors found that motivation and success, facets of affect, were directly correlated. Those students who reported themselves to be the most motivated were the most successful on the New Zealand National Certificate of Educational Achievement. The authors also found that though boys' academic success wanes in the late teenage years as compared with girls, they had a small group of high achieving students that had the highest motivation orientations. Salanova et al. (2011) also found a spiral of gain in efficacy as time passed due to engagement and positive affect (enthusiasm). In this longitudinal study of 100 college students, the authors determined that as positive affect improved, specifically enthusiasm improved, students were more likely to engage and thus more likely to succeed. Just as high affect produced, albeit through complex mechanisms, success; Jung and Reid (2009) reported a strong correlation between low ability and low attitude in their study. The authors studied 714 science students aged 12 and 14 in typical South Korean schools. This correlation between low attitude and low ability was related to the low achievers using a less effective means of storing what they are learning. The low

achievers self reported that they were rote memorizing the science materials rather than trying to understand the material like the higher attitude/higher achieving students reported doing.

Both Salanova et al. (2011) and Jung and Reid (2009) agreed with findings previously reported by Chan and Moore (2006). In this longitudinal study of children in Australia, the authors determined that maladaptive attitudinal beliefs created a cycle of poor academic achievement through failure to use strategic learning and learned self helplessness. The opposite was also seen that students with positive (or adaptive) attitudinal beliefs tended to cycle in more and more successful outcomes, and were more likely to use strategic learning. The authors also point out that increased beliefs in personal control could help a student leave the maladaptive attitudinal cycle and find a more adaptive cycle leading to success. While attitudinal beliefs influenced success or failure, success or failure also influenced attitude (Figure One).

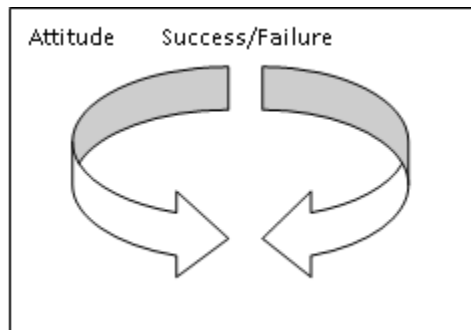


Figure 1 Illustration of attitude and impact on success or failure

In contrast, Sizemore and Lewandowski (2009) showed that knowledge gain and attitude improvement were independent of each other. In this study, the researchers used

pre/post tests to determine that students in a research and statistics class demonstrated an increase in knowledge but not a decrease in poor attitude and perception of utility. The authors pointed out that these findings are different than the anecdotal reports of many instructors and suggest that more one-on-one interaction in their situation would enhance students affect towards the material. Indeed, a similar idea was also discussed by Forbes-Riley, Rotaru, and Litman (2008) in computer instruction. Affect included computer instruction consistently outperformed models that excluded affect. Mirici (2010) found that attitude was improved as students were more prepared for instruction. Prestudy handouts were used in foreign language study; as students found themselves more prepared for class, they were more motivated, active and thus interacted more in class. This improvement in activity and in-class interaction resulted in attitude improvement toward the subject matter. These studies suggested that individual interactions are key to knowledge and affective gain in instruction.

While some change in affect has been demonstrated, the stable nature of affect has also been reported. Lipp, Mallan, Libera, and Tan (2010) reviewed affective learning in two experiments using verbal instructions. Participants exhibited affective learning as expressed through a pleasantness rating of 1-9 on Likert type scale. This affective learning showed extinction and reversal as the authors expected it would based on their previous work. The affective learning was not regulated though by verbal instruction. The authors theorize that affective learning is more “conservative and more affected by past events” (p. 208) than expectancy learning so less apt to change. This is a similar behavior as reported by Edwards et al. (2009). Edwards et al. (2009) examined the “Expectations-Affect-Behavior Hypothesis” (p. 374) using 135 undergraduate students

ranging in age from 18 to 40. The authors reviewed the students' expectations and their behavior and learning outcomes collected through a questionnaire. The research found that students' affect mediated their learning outcomes in groups that expected to do well but not in students that had a negative affect towards the material. Those students that expected to do well did tend to do well, but not the opposite. Learning outcomes for students with negative affect were the same as the students with positive affect. Affect was not as flexible to the learning curriculum as the learning and behavior outcomes indicated.

This stability of affect is also reported by Tractenberg, Chaterji, and Haramati (2007). These researchers looked at affect in terms of attitude and how strongly a participant was comfortable with the material they were being instructed on. After 22 hours of contact, some participants did report a shift in their attitude towards elements of the instruction. The majority of the participants showed no shift in attitude. The lack of attitude shift is thought to be the consequence of the highly motivated students and their self selection of the course in the experiment and no thought was given the steady nature of attitude.

A 23-year longitudinal study of change in affect by Charles, Reynolds, and Gatz (2001) found that, in general, affect was stable over time. The authors used the Bradburn Affect Balance Scale and found very little change in affect over time, with only older adults having shown a slight decrease in positive affect and a slight increase in negative affect over time. The authors suggested that at least some portion of affect is related to intrinsic personality traits such as extraversion. This agreed with the findings of Tractenburg et al. (2007) and Edwards et al. (2009) but brought to light an important

issue. It is imperative that researchers determine subjects affect toward the object of the research not just their general affect.

Dorman and Fraser (2009) reported a different finding about the attitude facet of affect. These authors reviewed ten elements of classrooms in Australian high schools and the affect outcomes of these classrooms. They found that while environment and academic efficacy were positively linked, a student's good attitude toward a computer would not necessarily translate to a good attitude about a particular subject. Indeed students made a distinction between computer use and subjects studied on a computer. Attitudes toward these elements of a classroom are best addressed individually as the students seem to view them individually. If a student was predisposed to a negative affect towards a subject, for example, history, then they would dislike history presented on a computer. It is best to address the issue of the negative affect towards history rather than try to overcome the affect with the addition of the layer of the computer delivered curricula.

Fisher et al. (2007) also found that affect change was dependent upon the population. These authors reported on three experiments on risk-taking behavior, cognitions and affect in young adults, aged 16 to 46 years old, before and after playing street racing games. They found that only men ( $n = 198$ ) experience an increased affect for risk taking after playing the games. These participants were susceptible to a change in affect because of their unique traits for the subject matter. The 92 women in the experiments did not experience a change in affect and were reportedly not as susceptible to change in affect.

While a change in attitude is difficult to predict, the student's attitude was a good predictor of their success in academic situations. Struyven et al. (2008) demonstrated that students "(dis)like" of various educational settings explained up to 30% of the variance in their model for learning and performance. Struyven et al. (2008) used the Course Experience Questionnaire to evaluate the course experience of 578 students in a child development course. The course was administered in five groups. One group received a lecture-based environment with assessment by a multiple-choice exam. The other four groups received a student activating environment and received one of four unique assessments. The four assessments were 1) portfolio, 2) peer assessment, 3) case-based assessment, and 4) multiple-choice exam. The researchers reported that the students' affect for the teaching methods correlated to the learning environment, but the students' affect for the learning environment did not correlate to the assessment. For example, a student who would "like" their student activating learning would then "like" the learning environment but may or may not like their portfolio assessment. Students' perception of their learning was multifaceted and complex.

O'Muircheartaigh and Hickey (2008) used a student questionnaire to determine that students' anxiety, a facet of affect that impacts learning, did not result in lower scores on their performance tests. While later immersion students did show higher anxiety and were determined to have greater mastery over the Irish language, their overall performance scores were the same as students with early immersion and lower anxiety levels. Their anxiety levels did not impact their overall performance. This research contradicted many studies that demonstrated anxiety to be a facet of affect that did tend to inhibit learning outcomes in students. Blanchette and Richards (2010) discussed

anxiety and its impact on four elements of higher level cognition. These elements were interpretation, reasoning, judgment, and decision making. Anxiety was characterized by the authors as incidental or integral. Incidental affect was mood manipulation produced independent of the cognitive task, such as a sad video or music before a task. Integral affect was when the cognitive task at hand produces the affect. These distinctions aid in attempting to understand the impact of affect on participants in a particular situation. For example, in the O'Muicheartaigh and Hickey (2008) study, the anxiety was not generated by the cognitive material (the study of Irish) but the full immersion into an Irish-only speaking school. Thus the affect was an incidental affect which may explain why the students tested the same on their standardized performance tests regardless of their self-reported anxiety levels.

Blanchette and Richards (2010) discussion of various types of anxiety may also shed light on Dorman and Fraser's (2009) study comparing technology rich classrooms and traditional classrooms. The student's anxiety with the subjects hindered their performance, not the use of computers themselves to study the material. The students may have had an integral anxiety to the material not an incidental anxiety due to the use of technology in the teaching environment.

Hahne et al. (2005) saw a similar impact of affect but in a nearly opposite direction. Third-year medical students took a computer based mandatory course in pharmacology rather than a traditional lecture course. Students in both learning methods completed pre- and post-tests and scored similarly on learning outcomes. While the learning outcomes were the same across methods, the students in the computer based course demonstrated a worsening attitude towards the course. The authors made no

mention of a novel effect here where the initial high attitude scores could simply be the result of taking the novel course. In the definitions given by Blanchette and Richards (2010), the students had an initial incidental affect to the novel method and that heightened affect simply waned as the course progressed. Moneta and Kekkonen-Moneta (2007) did consider and allow for a novel affect though they reported an increase in negative effect for the computer delivered instruction over time. Moneta and Kekkonen-Moneta (2007) included two studies in their report of two separate computer courses. They attributed the increased negative affect in the second course from the first course as a possible novel effect. The students in the second course did know about the first course so the second course was no longer novel.

### **Affect's Influence on Learning Environments and Learning Outcomes**

Moneta and Kekkonen-Moneta (2007), Broady, Chan and Caputi (2010), Swan and O'Donnell (2009) and Hahne et al. (2005), all discussed affect in computer and/or traditional instruction. Moneta and Kekkonen-Moneta (2007) made several arguments about lecture based and computer delivered instruction. They suggested that the interactive nature of the computer delivered instruction encouraged more intrinsic engagement than the immediacy of lectures. The authors considered their computer delivered curricula to be highly engaging. Hahne et al. (2005) reported an increase in negative affect and students reported their computer delivered instruction to be average or below average. These findings suggested that the quality of the instruction has an impact on affect of the students regardless of the delivery method. Swan and O'Donnell (2009) reported a student's comment about the increased impact of the virtual laboratories in their study over the actual laboratories. The authors suggested that the consistent nature



of the videos in the laboratories to be an advantage to the students. The videos show the organism under study predictably to each student. The students in the actual laboratories had to find the organism under a microscope and there was an assumption made that the organism was acting normally and was normally formed. The students in this study chose the virtual laboratories and scored higher on the exams than students who did not choose the virtual laboratories. The act of choosing the virtual labs may be an indicator of motivation but the virtual laboratory students self report low motivation. Surveys were not collected on students that did not choose the virtual laboratories so a comparison was not possible.

Meyer et al. (2009) discussed several implications of motivation and academic achievement. They reported that Asian students were found to have higher motivation as a whole and that some regional ethnic groups in New Zealand had lower motivation which agreed with nationally reported data. The authors suggested that motivation has cultural and societal roots unique to specific demographics. These suggestions aligned with Chan and Moore's (2006) suggestions to improve attitudinal beliefs and the cycle of attitude to success and failure. Though Chan and Moore (2006) did not discuss ethnicity, they did stress individual interactions to improve attitudinal beliefs and suggested teacher training to include these elements in their daily teaching strategies.

Broady, Chan and Caputi (2010) reviewed the literature on computer acceptance amongst older and younger adults and found that attitudes toward computer use are markedly similar. These findings were in contrast with The Center for Aging and Work's (2007) report that employers reported their older employees to be reluctant to try new technologies. Broady et al. (2010) clearly advocated letting "myths" die and treating all

learners, regardless of age, with the same respect and consideration in the learning environment. Individual strategies focused on improving motivation in specific target groups may be the most effective at improving educational outcomes.

Boekaerts and Minnaert (2006) also found that self-reported satisfaction with learning conditions and topic interest coincide with student's own level of competency. These authors reviewed 95 second-year undergraduate students' affect toward topic interest, situational interest and individual interest in group learning situations. It is important to note that 78 of the 95 participants were women and they were studying sub-disciplines in the School of Education. The authors report findings that interest and motivation function similarly in education, clearly related to competency, but are not the same concept entirely.

Other factors influencing the adult learner are multifaceted. Ota et al. (2006) summarized Malcolm Knowles in the 1970s when he first used the term "andragogy." Andragogy is defined by Merriam and Brockett (2007) as "the art and science of helping adults learn". There are six factors within andragogy. These are quoted from Ota et al. (2006) as 1) The need to know, 2) The learner's self concept, 3) The role of the learner's experiences, 4) Readiness to learn, 5) Orientation to learning, and 6) Motivation. Ota et al. (2006) offered several methods to include these six goals including educational games, role play and problem-based learning. It was concluded that learning experiences that were developed and presented with these theories in mind and practice, resulted in enhanced comprehension and application in the adult learner. While Donovan (2009) pointed out several criticisms of andragogy, he went on to acknowledge that the theory was useful in adult learning and professional development. A key to the application of

this theory was the adult participants' voluntariness of the experience, or the willingness of the learner to participate (Donovant, 2009).

### **Learning to Create Behavior Change**

While changing affect and increasing knowledge are important goals of food safety programs, actual behavior change in the food managers is the true goal. Roberts, Barrett, Howells, Shanklin, Pilling and Brannon (2008), found that training did improve knowledge and behavior but improved knowledge did not always lead to increased behaviors. Improved food safety behaviors are the key to reducing or eliminating food borne illness outbreaks (Jenkins-McLean, Skilton & Sellers, 2004). The authors pointed out that a key strategy to preparing effective training for behavior change was determining the barriers to the food service workers performing the desired behavior. Barriers to the desired behavior were physical, such as lacking enough storage space to separate uncooked and ready-to-eat foods, or lack of knowledge, such as how to use a thermometer correctly. Once strategies were in place to remove these barriers to the desired behavior, several training methods were used to engage the workers in food safety behaviors. These methods were a variety of teaching strategies and behavior modification theories. Almost half of the 156 participants reported a preference for hands-on training, while four percent preferred that public health officials use printed materials, and five percent preferred videos as their main method of education. Jenkins-McLean, Skilton, and Sellers (2004) used a "mock" inspection to train food service employees. The authors found a 25% decrease in inspection violations after the behavior modification intervention and gave strategies for future trainings. Byrd-Bredbenner, Maurer, Wheatley, Schaffner, Bruhn, and Blalock (2007) found that though the young

adults surveyed ( $n = 4,343$ ) had adequate knowledge of basic food safety; they self-reported less than adequate behaviors key to food safety. This survey of young adults were of the age and education level typical to a classroom child care provider. The researchers also reported that women significantly knew more food safety knowledge and self-reported more food safety behaviors than men. The majority of child care providers in Mississippi are women.

### **Theoretical Framework for the Curriculum and Study**

Garrison, Anderson and Archer (2000) proposed the Community of Inquiry (CoI) model for online instruction. Since that time, significant work has been done to verify the three elements of the framework (see Figure 2) through factor analyses (Garrison, Cleveland-Innes & Fung (2004); Arbaugh (2007); and Arbaugh & Hwang (2006)). Even so, Garrison and Arbaugh (2007) encouraged the study of the framework's three elements simultaneously. The three components are Social Presence, Cognitive Presence and Teaching Presence.

Social Presence was defined as the “ability of the learners to project themselves socially and emotionally, thereby being perceived as “real people” in mediated communication” (Garrison & Arbaugh, 2007) and has three components: 1) affective expression, 2) open communication, and 3) group cohesion. Garrison and Arbaugh (2007) describe cognitive presence as the “extent to which learners are able to construct and confirm meaning through sustained reflection and discourse.” Teaching Presence is the “design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes” (Garrison & Arbaugh, 2007). Teaching presence has three components: 1) instructional

design and organization, 2) facilitating discourse, and 3) direct instruction (Anderson, Rourke, Garrison & Archer, 2001).



Figure 2 Community of Inquiry by Garrison, Anderson and Archer (2001)

In TummySafe<sup>®</sup>, the social presence was addressed via multiple interactive quizzes and activities where the participant was encouraged to respond freely to questions. Some questions were multiple choice but some questions were also free response with an automatic response that seemed like it acknowledged the response. In the traditional classroom, the presence of classmates and an instructor clearly achieved this dimension of social presence to a greater degree than the self-paced computer delivered version. While this difference does exist, Picciano (2002) found that social presence was less important when no collaborative projects were present and the learning activities were acquisitional in nature. This was the case with this TummySafe<sup>®</sup> Food Safety Curriculum as participants were there for work-force certification.

The discourse and sustained reflection required in cognitive presence was achieved in the TummySafe<sup>®</sup> curriculum via interactive quizzes, interactive activities, and case studies. When a participant in the individual, self-directed version completed a quiz and got the questions wrong, they were re-directed back through the material. This is a type of discourse. In the traditional method, the discourse and sustained reflection were typical of classroom instruction.

The teaching presence of the curriculum was similar but different in both methods. The curriculum was the same with only the physical delivery mechanism altering. The six-module layout of the curriculum was the instructional design and organization. The curriculum facilitates discourse via quizzes and interactive activities. Direct instruction was prevalent though out the curriculum in both methods of delivery with the traditional classroom method having the addition of a live instructor. The three elements of teaching presence are in both versions of the curriculum (Anderson et al., 2001.)

The theory of Planned Behavior Change (Ajzen, 2006) has begun to get some attention in the area of training in food safety. This psychologically based theory uses belief and attitude to move a person from intention to behavior. Some applications could be made of this theory to TummySafe<sup>®</sup>.

### **Knowledge Gain in TummySafe<sup>®</sup>**

Sexton, Schilling and Taylor (2009) examined the hypothesis that knowledge gain in TummySafe<sup>®</sup> would not be different amongst the traditional method and the self-paced methods of completing the curriculum. Knowles (1973) reported that adults were largely self-paced learners. Sexton et al. evaluated knowledge scores from pre-test and post-tests

of child care providers that took both the traditional classroom version of TummySafe<sup>®</sup> and the computer delivered, self-paced version of TummySafe<sup>®</sup>. The authors reported that the child care providers in the traditional method scored significantly higher than the computer delivered method when scores were adjusted with pretest scores ( $n = 1625$ ,  $F = 268.00$ ,  $p < .05$ ). The authors note that the computer delivered, self-paced participants had higher pre-test scores than the traditional participants but those scores did not carry through to higher post-test scores. It is possible that in the unsupervised environment of the computer delivered curriculum, that the participants shared pre-test answers. It is also possible that the traditional classroom method was a familiar and comfortable method for child care providers to receive training and thus they learned more. It is also important to note that traditional participants had no lag time between the training and the exam. Computer delivered participants had days, sometimes weeks, between when they finished the curriculum and their post-test. Despite significantly lower scores, the participants of the self-paced method were satisfied with the curriculum. This is in contrast to findings by Kenny's (2007) that self-paced training was effective at training adults based on significantly higher post-test scores. Despite differences in test scores, the adults in Kenny's study were also very pleased with the self-paced training method.

## CHAPTER III

### METHODS

#### **Sampling**

The participants in this study were 2,280 Mississippi child care providers. Mississippi Child Care Regulations (2012) require that one person in each licensed center complete Food Manager's training, such as TummySafe<sup>®</sup>. TummySafe<sup>®</sup> required a passing score of 80% or greater on the exam administered at the completion of the curriculum in order to gain certification. Data were collected between April 2005 and June 2006. The exam proctoring, traditional classes and distribution of the computer delivered, self-paced curriculum were coordinated through the 82 Extension offices throughout Mississippi. The final research sample was 1,985 for reasons including incomplete data, right of refusal, unanswered questions, and testing irregularities that may have compromised data.

#### **Statement of the Problem**

Will adult learners, receiving a one-time workforce training in food safety, report a more positive attitude and self-report an increase in food safety behaviors after a self-paced, computer-delivered curriculum than an instructor-led, traditional, classroom-based curriculum? In addition, does increased knowledge of food safety lead to improvement in self-reported attitude and a self-reported increase in food safety behaviors?



### **Hypothesis One**

Adult learners receiving a one-time workforce food safety training will report a more positive attitude towards a self-paced, computer-delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

### **Hypothesis Two**

Adult learners receiving a one-time workforce food safety training will report an increase in self-reported food safety behaviors after a self-paced, computer delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

### **Hypothesis Three**

Knowledge gain in the area of food safety is positively correlated to change in attitude of adult learners completing a one-time food safety training.

### **Hypothesis Four**

Knowledge gain in the area of food safety is positively correlated to increased self reported food safety behaviors in adult learners receiving a one-time food safety training.

### **Instruments**

An expert panel determined content validity and designated all questions as knowledge, affect or behavior oriented questions. The questions used are in Appendices 1 and 2. The expert panel's review was completed on June 7, 2005 and included four Mississippi State University faculty. The questions were answered with Likert type scales of 1 to 5 representing either Never (1) to Always (5) or True (1), False (2) or Don't Know (3). All questions were sorted and combined into one complete test with the

knowledge gain questions. Attitude and behavior questions did not impact certification status as only knowledge gain questions as well as additional content questions were used to determine certification status. A score of 80% or greater on only the knowledge based questions was required for certification. The certification exam had a Cronbach's alpha of .936 with 58 knowledge questions. The knowledge gain questions, (those questions with matching a question on the pre-test) had a Cronbach's alpha of .795 ( $n = 12$ ). The attitude questions ( $n = 8$ ) had a Cronbach's alpha of .521 with the removal of three questions for lack of reliability. The behavior questions ( $n = 22$ ) had a Cronbach's alpha of .538 with the removal of one question due to a coding error.

### **Research Design**

A nonequivalent control group design was used (Campbell & Stanley, 1963) (Figure Three). A threat to this quasi-experimental design is selection. There was no randomization in the study as participants (or their supervisors) chose the method of study, either traditional version or computer-delivered version.

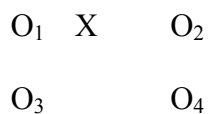


Figure 3 Study Design

Campbell and Stanley (1963) indicate that a threat to the external validity of the pre-test/post-test study design is the interaction of testing and treatment. Participants could be stimulated to pay particular attention to the material from the pre-test in the

curriculum that they thought would be on the post-test. The lack of randomization made a pre-test necessary to establish a baseline for comparing the two testing groups.

### **Data Collection Procedure**

All participants were given a pre-test and a post-test (certification) exam. Knowledge, affect and behavior questions were included in the exam. The knowledge questions alone contributed to the certification score. Participants' answers to affect and behavior questions were recorded but had no impact on certification. A Participant Information Form was collected from each participant as well (see Appendix Four).

### **Selection**

Participants chose, or had chosen for them, such as in the case of a child care director choosing the method for the center's cook, the version of curriculum they completed. Computer delivered curriculum participants installed the curriculum on their personal computers via a CD and finished the curriculum on their own time at their own pace. Through the use of a username and password process, participants did have the option of logging out and returning to the same computer at another sitting. Traditional participants attended a classroom setting and finished the curriculum under the instruction of MSU-ES's Area Agents in Nutrition and Food Safety. Participants in both methods completed a face-to-face proctored examination in the Extension offices. Extensive training and practices were put into place to verify the identity of the examinee and to verify the credibility of the testing process, such as verifying the identity of the participant with photo identification. Other procedures included, but were not limited to, proctors instructed participants to turn off their cellphones and stayed in the room with

the participants throughout the exam. Traditional participants completed a pre-test that was collected by their instructor. Computer delivered participants completed a pre-test on their computer and turned in a coded printout of their responses when they took their post-test in person.

### **Data Analysis**

Data were collected and entered into SPSS 19. An ANOVA was performed. An alpha level of .05 was established *a priori*.

### **Protection of Human Subjects**

Concern for human subjects was considered in the project design and implementation. Mississippi State University's Institutional Review Board for the Protection of Human Subjects in Research Docket # 02-265 was prepared and maintained for the duration of the project. The research was completed and the docket number closed as of September 30, 2006.

### **Treatment Description**

TummySafe<sup>®</sup> is a six module Food Safety Curriculum for child care providers in Mississippi and was used in this study. Objectives and curriculum description are given in Appendix Three. Reported here are details relevant to the treatment differences in this study. The traditional classroom participants were taught in a classroom setting by a MSU-ES instructor. Seven MSU Area Agents were the instructors in this design. The instructor allowed the curriculum to play, including all narration, and clicked from each screen to the next screen. Instructors were trained to be as consistent as possible and not to bring outside activities into the classroom. They were also trained to be as consistent

as possible between each other and between each session they taught themselves during this research period. Participants in the computer delivered group led themselves through the curriculum individually.

Quizzes throughout TummySafe<sup>®</sup> required a correct answer to allow the participant to continue. Figure Four is the screen capture from an example quiz. Figure Five is an example of a response for correct answers. Figure Six is an example of the TummySafe<sup>®</sup> response for incorrect answers.

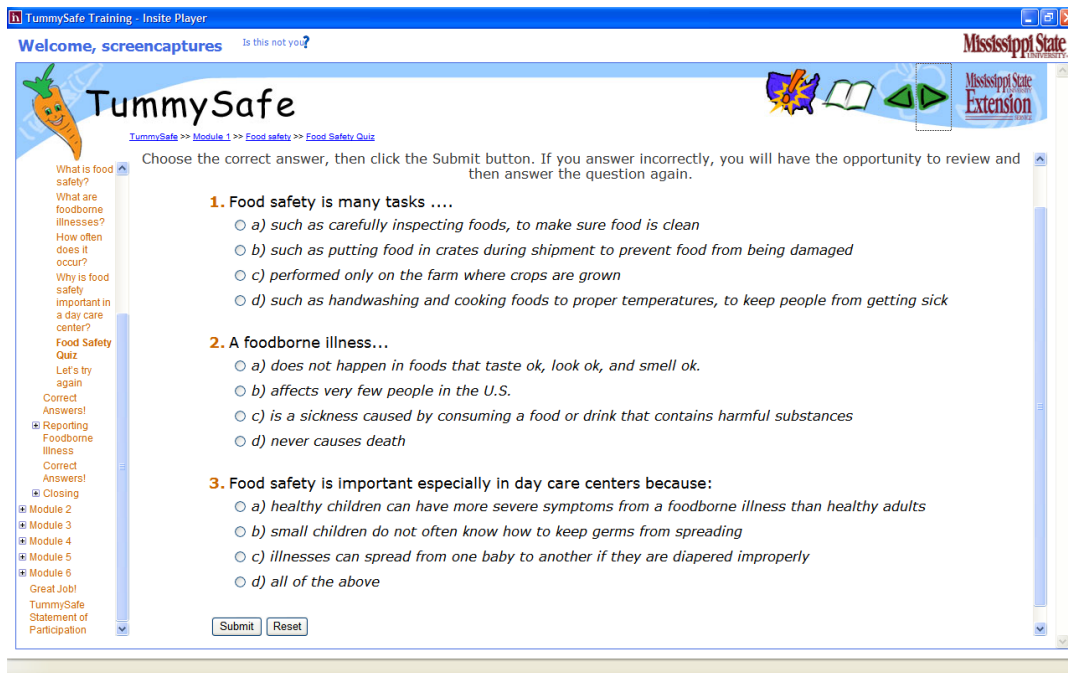


Figure 4 Module One Quiz

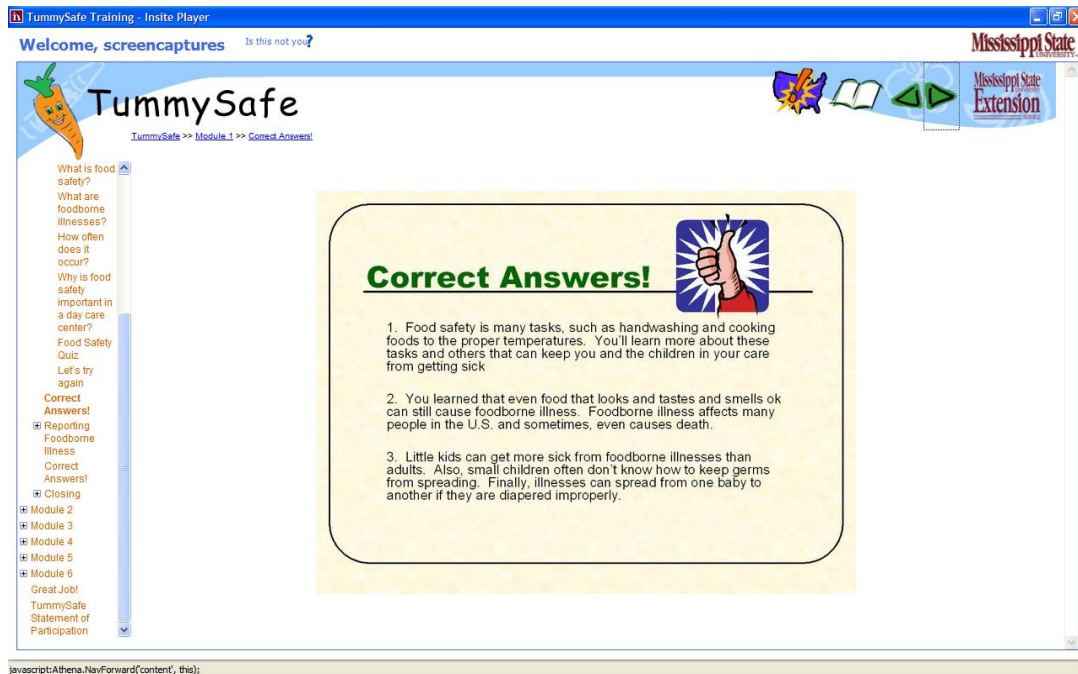


Figure 5 Quiz when participants answered correctly  
An explanation of the answers is given as reinforcement.

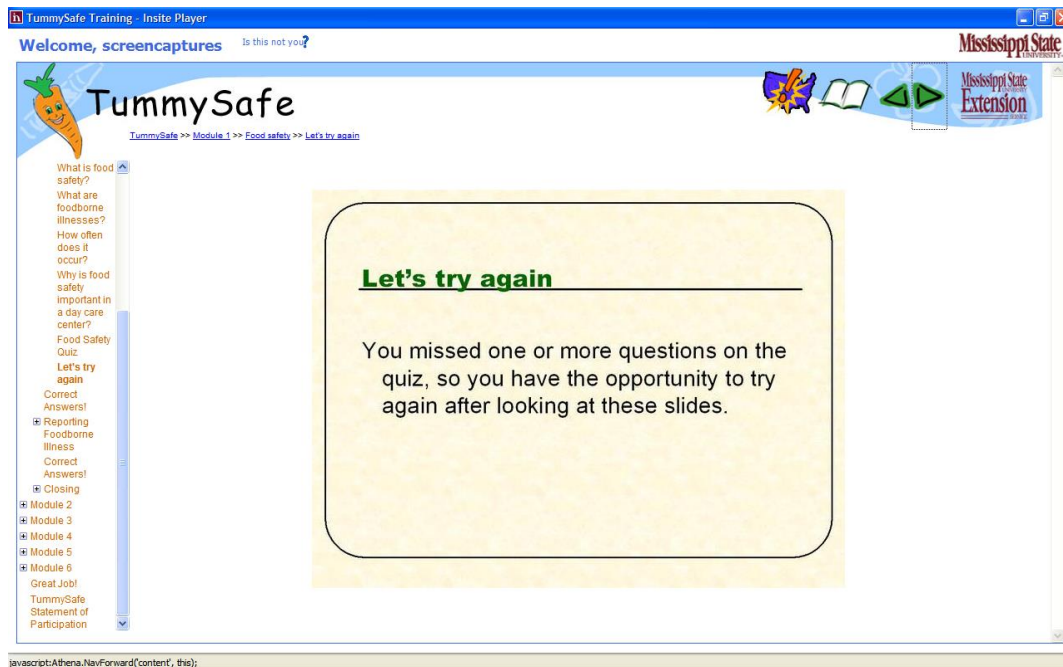


Figure 6 Quiz when the Participant answers incorrectly  
An example of the redirect participants received when they incorrectly answered quizzes.

This self-pacing of TummySafe<sup>®</sup> is a key treatment difference. Knowles (1973) noted that adults are mostly self-paced learners. The traditional classroom version was paced by a MSU-ES Instructor. The computer delivered version was paced by the child care provider on an individual basis. Lack of understanding could be addressed by the instructor in the classroom version but lack of understanding in the computer delivered version resulted in a repeat of the material. If the content repetition resulted in learning, the child care provider was able to proceed. If not, they were forced to randomly guess until they found the right answers by chance. This is a key difference in computer delivered and live curriculum.

Several activities were used to create social presence and teaching presence in the TummySafe<sup>®</sup> curriculum. Figure Seven displays an interactive activity in which participants were asked to sort groceries for safe storage. This kinetic activity provided a “real life” activity to practice the concepts being taught in this module. In the traditional treatment, the instructor would lead the class room through this activity using either a student volunteer or classroom consensus. In the individual self-paced computer delivered treatment, the participant had to interact with the curriculum independently and practice the concept they were being taught.

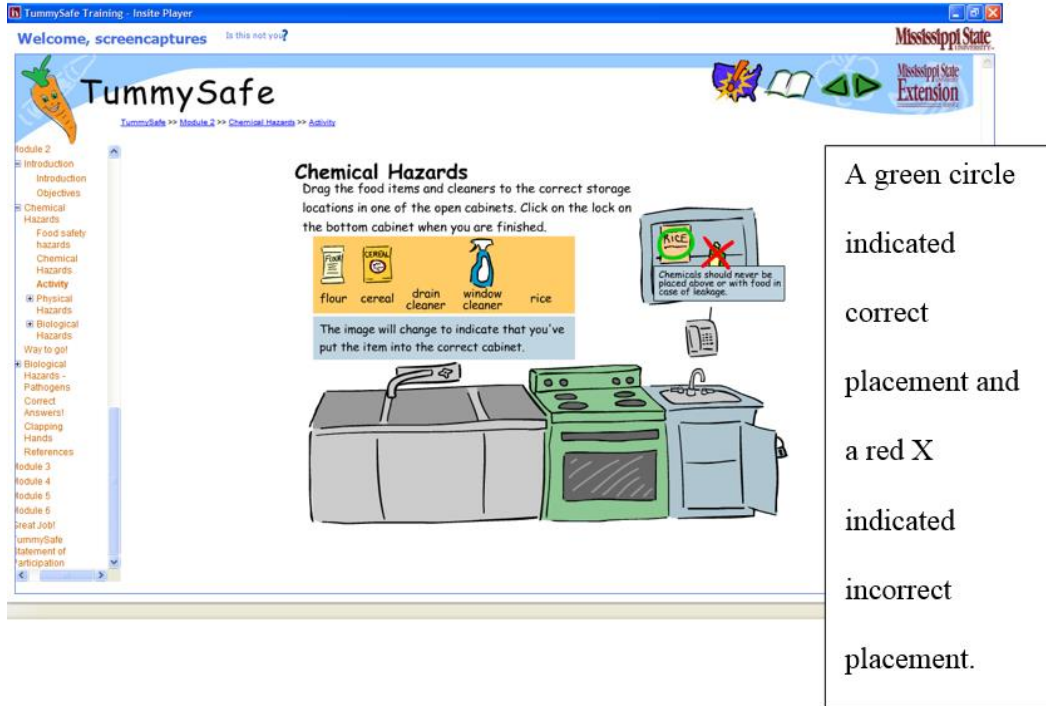


Figure 7 Chemical storage activity

Figure Eight displays an interactive activity in which participants read the information and choose one of the two answers. Feedback from the questions confirmed the participant's answer or explained why the answer was wrong. Participants could click on the can to "see" a close up image of the contaminated food.





Figure 8 Ms. Pat contamination activity

In Figure Eight, participants were presented with a scenario in which they were forced to make a decision common to a child care center.

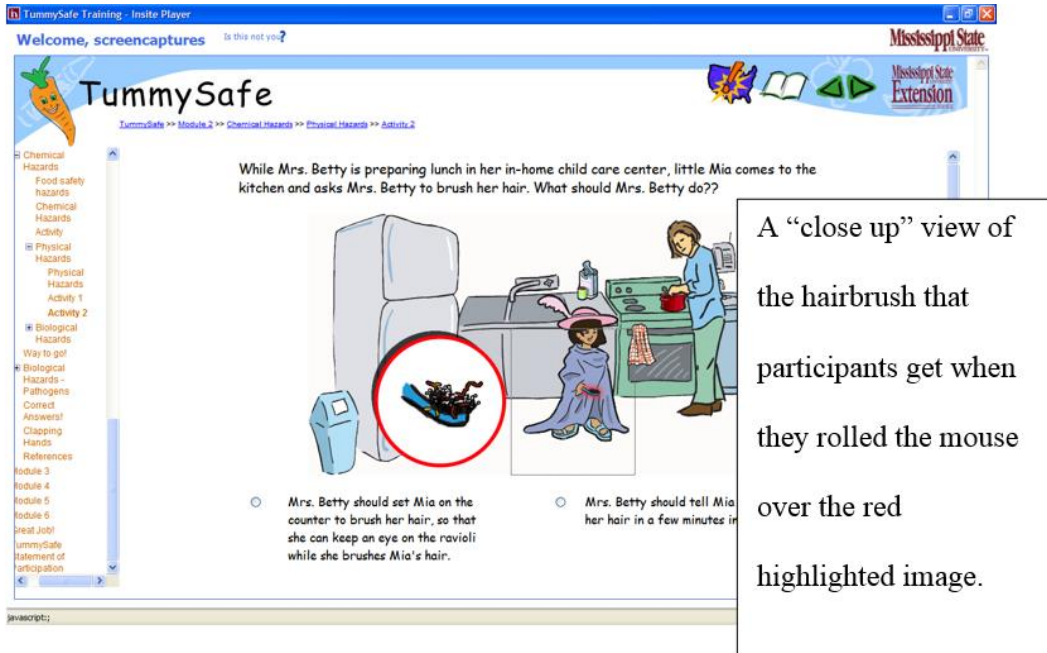


Figure 9 Ms. Pat hair brushing activity

In Figures Nine, Ten and Eleven participants followed Ms. Pat through her day. The concepts of cross contamination and the importance of hand washing were reinforced through this interactive, scaffolding activity. Ms. Pat wiped a child's nose, answered the phone, and started lunch/snack. This type of real-life application is recommended by Knowles (1973) for adult learners. Participants could use the mouse to "see" the bacteria on the various parts of the kitchen (Figure Ten) and then the classroom (Figure Eleven) that Ms. Pat had touched. This interactive activity permitted participants to experience the concept of cross contamination. Through trial and error, participants could follow the contamination through the center created by Ms. Pat's failure to wash her hands.



Figure 10 First screen.

Participants could scroll over the cutting board, towel and Ms. Pat's hands to "see" bacteria



Figure 11 Second screen.

Participants could scroll over the table, toys and infant Susie's hands to "see" bacteria

Module Two included an easily identifiable animation created for each classification of pathogen; viruses, fungi, parasites and bacteria. Module Two also discussed prevention and characteristics for each classification of pathogen and offered examples of actual pathogens within each classification (Figure 12). Each detailed explanation of a pathogen included a quiz in which participants were asked to read the information and accompanying table to answer questions. Some of these activities had a map activity to show an actual example of an outbreak as reported by the CDC. This activity offered the chance for participants to experience the realities of an outbreak and thus enhance their felt need for food safety practices and behaviors. This real-life-based experiential activity enhances learning in the adult learner (Knowles, 1973). In the traditional delivery, these questions were answered by the instructor, a volunteer participant or by consensus and the opportunity for classroom discussion is had. The computer delivered participant must individually answer these questions with no chance for peer discussion.

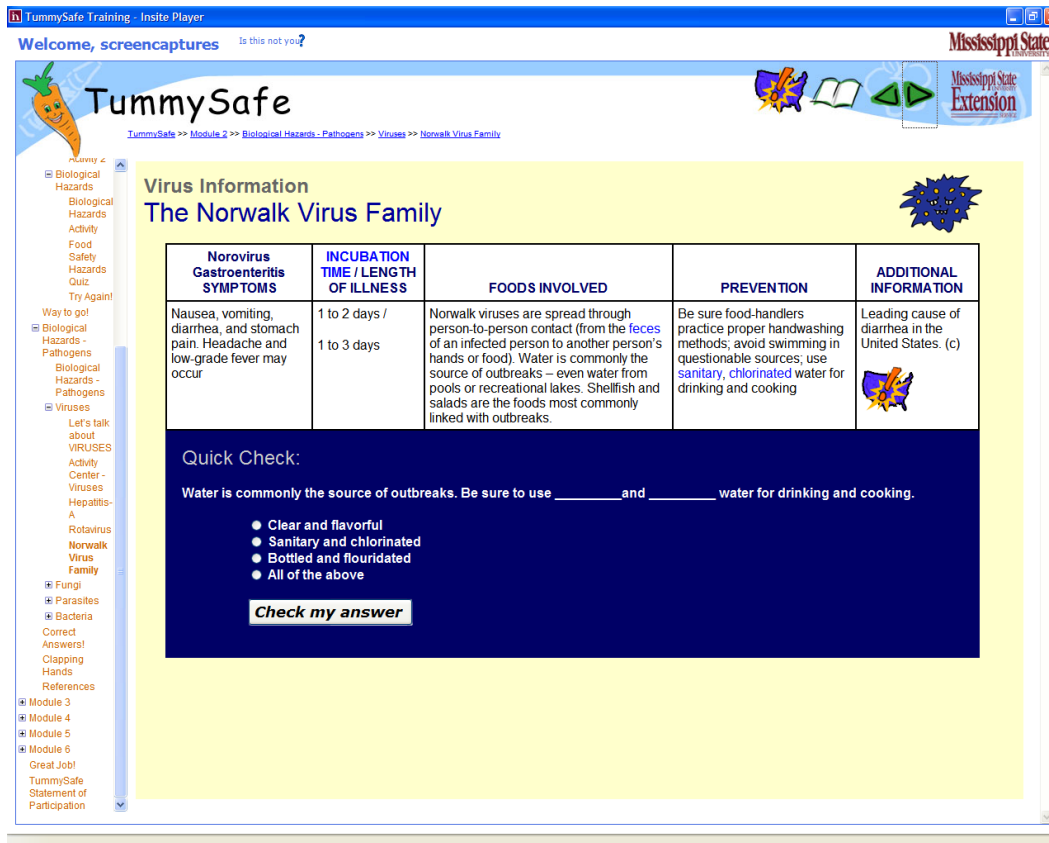


Figure 12 An example of the individual pathogen study pages

The inclusion of the “Map Activity” offered real-world examples of the concept presented (Figure 13). Participants could click on the map icon anytime it is on the screen or at any time as it is always in the upper border. Each star leads to the details of an actual outbreak as reported by the CDC in that location. This activity was led by the instructor in the traditional setting. In the computer delivered setting, the participant could, at any time, pursue this activity and review outbreaks that interested them.

Figures 14 and 15 demonstrate both the repetition of material and the kinetic nature of the curriculum. Participants were exposed to the material, given a handout on the material and asked to play a game requiring application of what they have learned.

TummySafe Training - Insite Player

Welcome, screencaptures [Is this not you?](#)

**TummySafe**

TummySafe >> Module 1 >> Map Activity >> It Can Happen Anywhere!

Mississippi State University  
Mississippi State Extension

- Intro to TummySafe
- Welcome
- How to Use
- Ready to go...
- Module 1
  - Introduction
  - Food Safety Objectives
  - Map Activity
    - It Can Happen Anywhere!**
    - Food Safety Correct Answers!
    - Reporting Foodborne Illness Correct Answers!
    - Closing
  - Module 2
  - Module 3
  - Module 4
  - Module 5
  - Module 6
  - Great Job!
  - TummySafe Statement of Participation

**It can happen ANYWHERE!!!**

A foodborne outbreak occurs when 2 or more people get sick from eating contaminated food or drink. This activity will help you learn more about actual foodborne illness outbreaks that have occurred in the United States. Click on a state to learn more about an outbreak that happened there.

javascript:Athena.NavForward('content', this);

Figure 13 Map Activity: OUTBREAK!

TummySafe Training - Insite Player

Welcome, screencaptures is this not you?



Mississippi State University  
Mississippi State Extension

# TummySafe

TummySafe >> Module 3 >> Handwashing >> Correct Method for Hand Washing

- Clapping
- Hands
- References
- Module 3
- Introduction
- Objectives
- Handwashing
  - Why is hand washing important?
  - Correct Method for Hand Washing
  - Handwashing Pictures
  - Handwashing Activity
  - Tips to Improve Hand Hygiene
  - When should I wash my hands?
  - When should the children wash their hands?
  - Handwashing Assessment
  - Please Try Again!
- Handwashing Conclusion
- Cleaning and Sanitizing
- Conclusion
- Module 4
- Module 5
- Module 6
- Get Job!
- TummySafe
- Element of Nutrition

## Correct Method for Hand Washing<sup>d</sup>

1. 110° F water (warm)
2. Apply Soap
3. Wash for 20 seconds
4. Pay special attention to nails and between fingers
5. Rinse
6. Dry hands with a paper towel, Turn off water with paper towel, Dispose of paper towel in trash can

Click on the picture above to print the hand washing steps to post by your sink.






Figure 14 Hand washing procedure

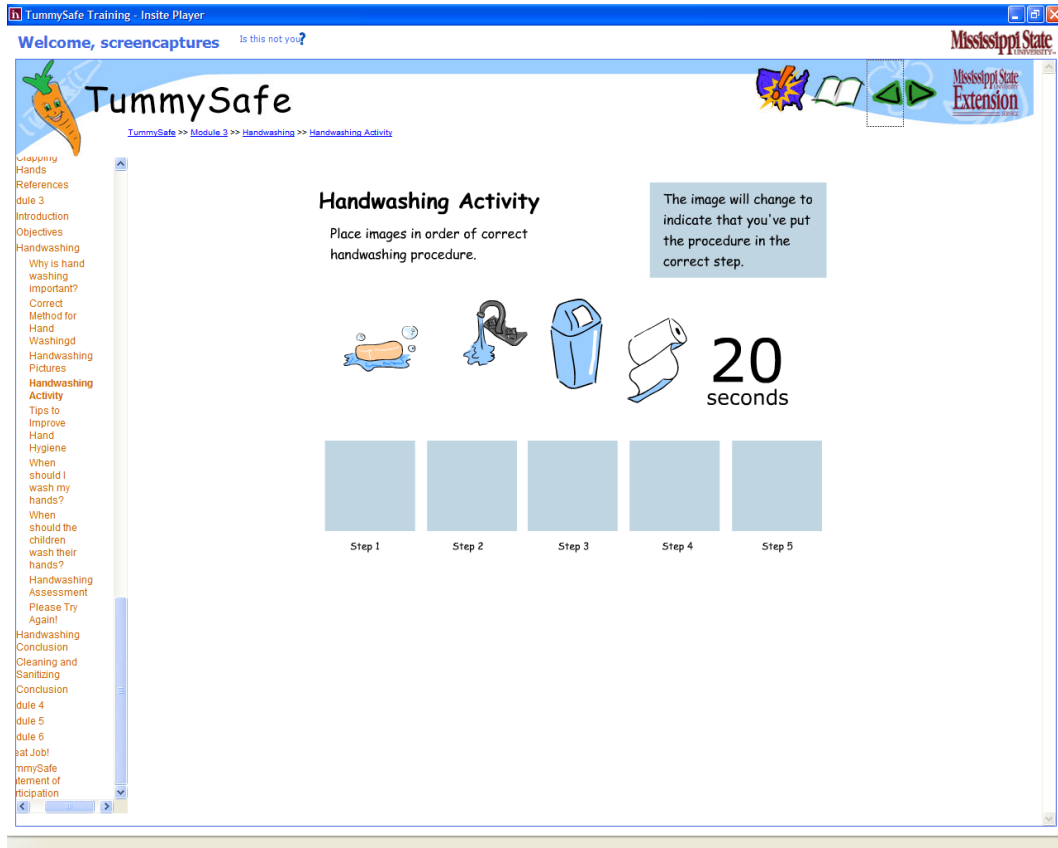


Figure 15 Hand washing activity.

Participants were asked to put the steps in the correct order



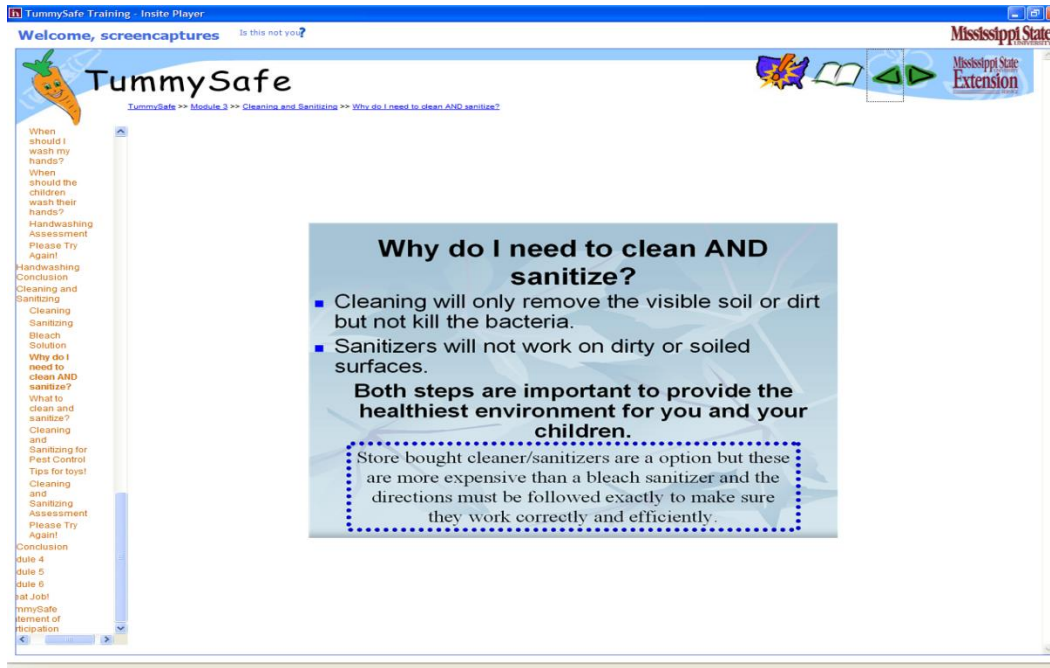


Figure 16 Cleaning and Sanitizing

In a cross contamination activity, participants were asked by the narrator to sort the foods into the grocery cart (Figures 17, 18, and 19). A correct placement opened a box that explained that the participant did a good job putting the meat far enough from the fruit to prevent cross contamination. This activity created cognitive presence as the participant had to reflect on the meaning of the presented material and construct the concepts into a correct answer on the activity.

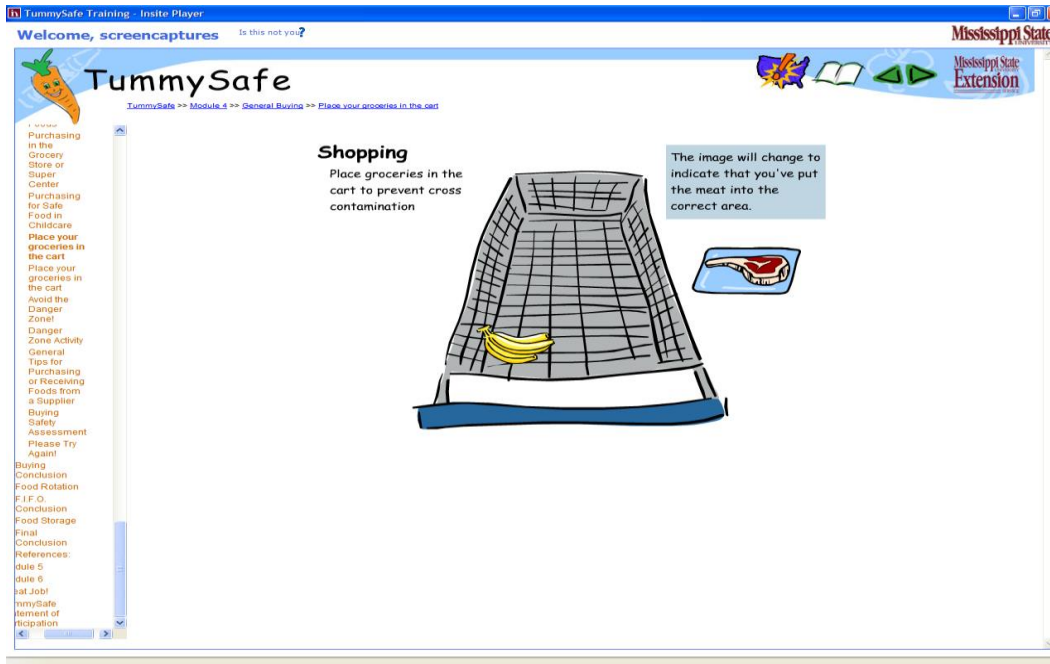


Figure 17 Cross contamination in the grocery cart



Figure 18 Correct placement prevents cross contamination and a message of positive reinforcement

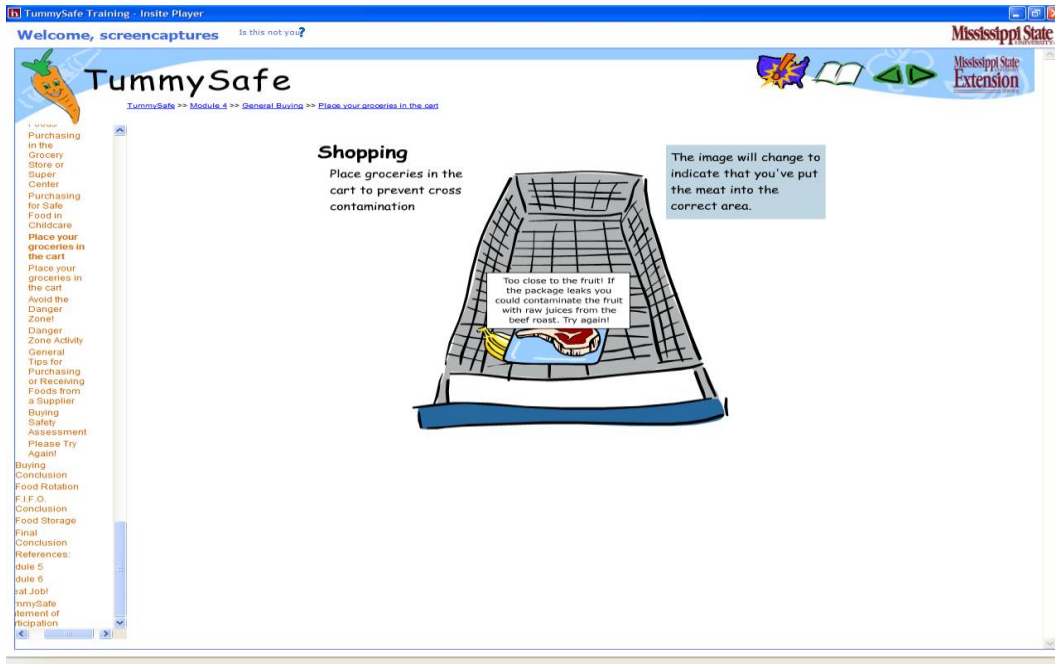


Figure 19 Incorrect placement in the grocery cart created a potential for cross contamination and an explanation is given by the curriculum

In both delivery methods, the Temperature Danger Zone is explained visually, by the narrator and in the text presented on the screen, the participants were then immediately given the opportunity to utilize the new information by completing an activity. Participants were asked to move the stars to the start and end points of the Temperature Danger Zone (Figure 20 and Figure 21). This demonstrated knowledge of the zone but also ability to use the scale on a thermometer and placed the knowledge in a context of use. This method also attempted to reach all three elements of the CoI framework and all types of learners (kinesthetic, auditory, and visual).

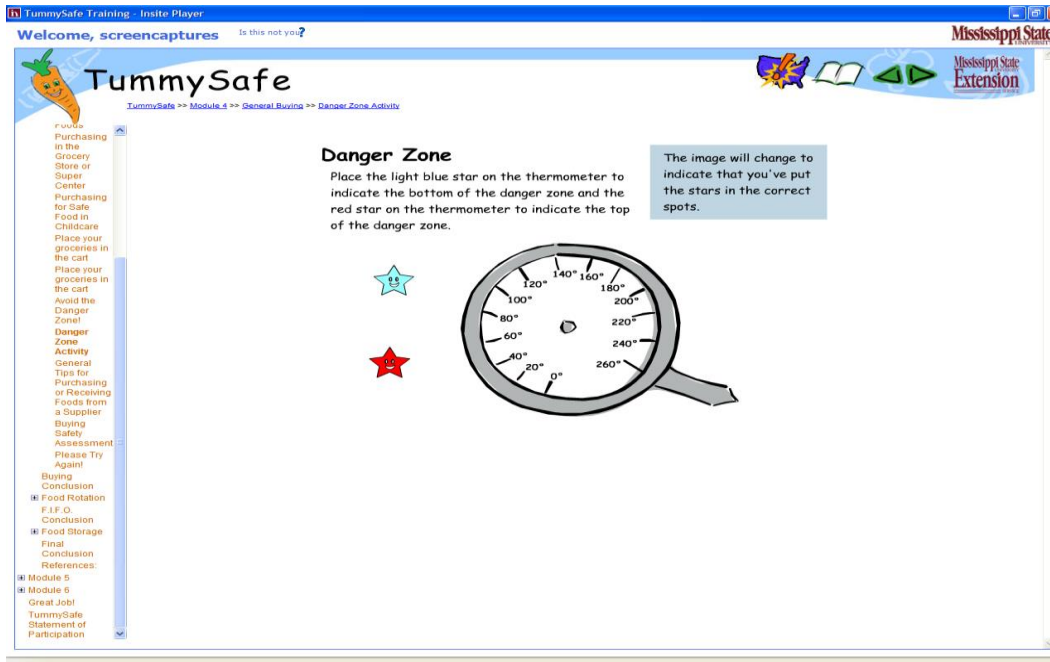


Figure 20 Activity utilizing the temperature danger zone and a thermometer

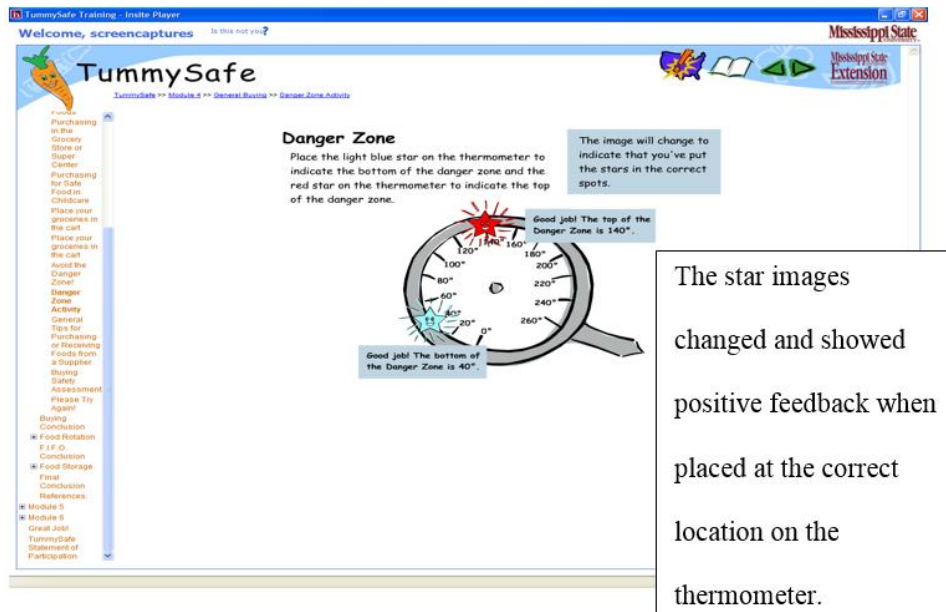


Figure 21 Activity with correct participant responses

Assessment quizzes were scattered throughout each module and would not allow the participant to continue until correct answers were chosen. In the traditional method, the instructor collected these answers and entered them. In the computer delivered method, these questions were answered individually by each participant and each participant had the consequences of their answers, either to repeat or to move on.

Module five offered the concept of cross contamination for repetition and further application to real life situations in child care centers (Figure 22 and Figure 23).

In a cross contamination activity, participants were asked to pick the fridge with the food stored properly to prevent cross contamination. This activity created social discourse and sustained reflection. Also, the structure provided teaching presence. This activity added to all three elements of the CoI framework in TummySafe<sup>®</sup> (Figure 22 and Figure 23).

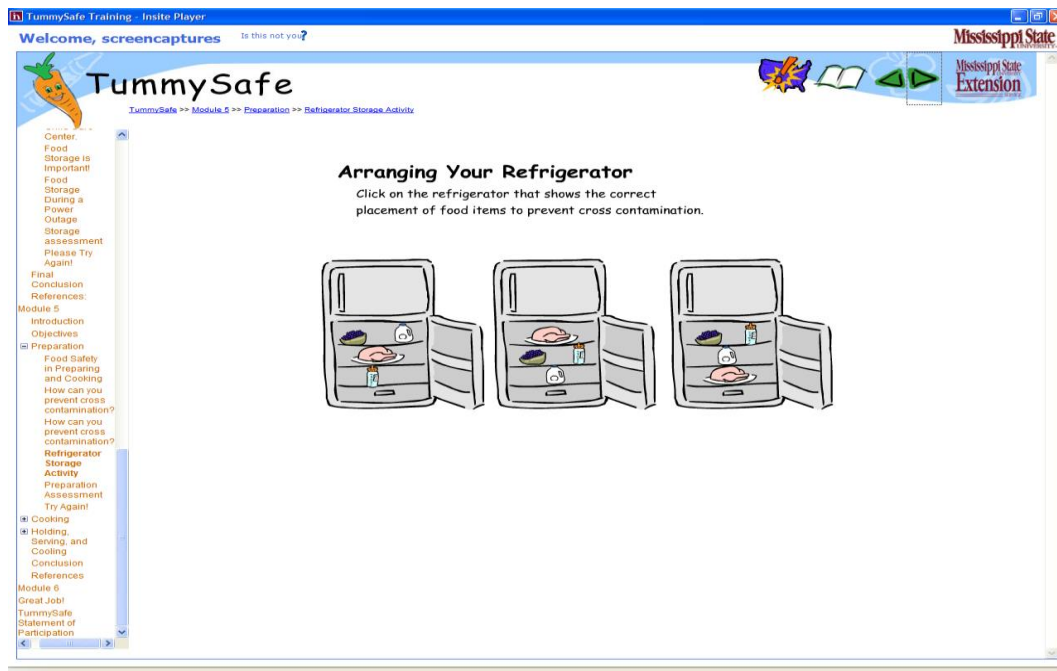


Figure 22 Cross contamination initial image

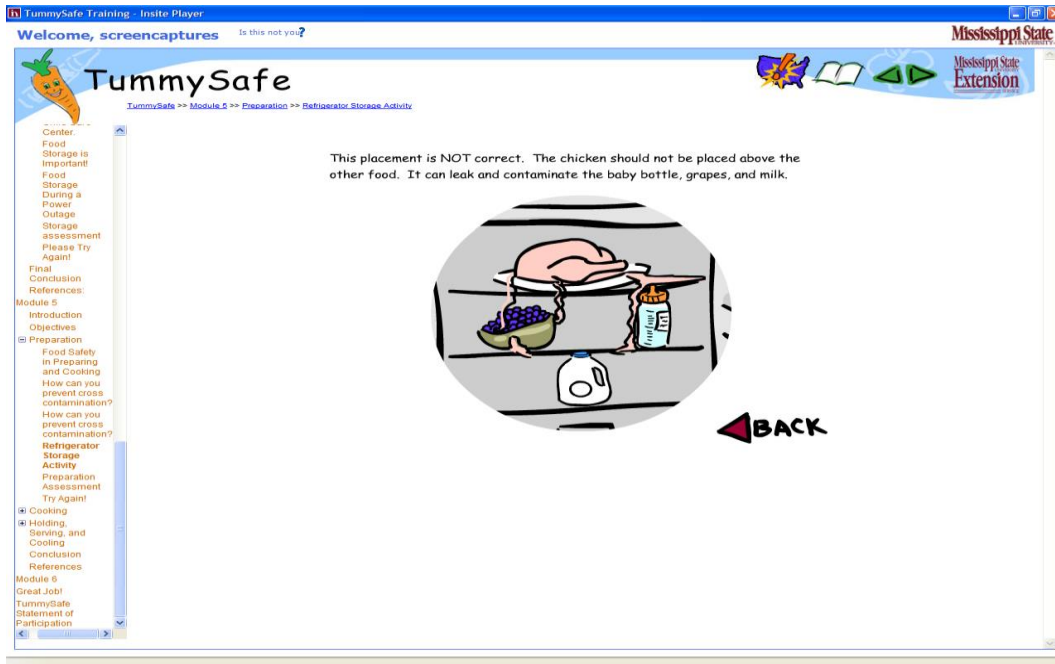


Figure 23 Incorrect answers both showed food “dripping” on grapes and a baby bottle

Module Five continued with end point temperatures and thermometers, including where to find thermometers to buy and reassurance of their inexpensive cost. The information was represented in both narrative and written forms to engage both auditory and visual learners. This narrative also created social presence and the repetition aided cognitive presence. Multiple quizzes throughout the module required correct answers to advance through the material. Both participants in the classroom and the computer delivered treatments received feedback if their answers were incorrect (Figure 26) and were made to repeat the material. The Instructor in the classroom version directed these repetitive activities. The comprehension of the participant directed the repetition in the computer

delivered method.



Figure 24 Cross Contamination Assessment

Participants were asked to scroll through a table and find the end point temperature for a chosen food (Figure 25). This put the information in a context they would use in the kitchen and provided opportunity for cognitive presence. This activity gave remedial students an opportunity to learn how to interpret a table. In the classroom method, where this activity was answered as a group, often these remedial students fail to comprehend this essential skill while the rest of the group would move on. Computer participants could also print out an End Point Temperatures chart for their kitchen. Instructor in the traditional method would give out the chart at this point. Receiving the chart was not optional in the classroom version but was optional in the computer version.

Participants were also taught where to take the end point temperature in Module Five. The “thickest part of the meat” was the temperature taking location that was

stressed by text and narration. This satisfies Health Department requirements without getting into specific locations on specific cuts of meats or birds. Participants were asked to demonstrate their knowledge in an activity where they select the correct location (Figure 26)

The screenshot shows a web-based training module titled "TummySafe" with a navigation menu on the left. The main content area displays a table titled "Safe End Point Temperatures for Foods". Above the table, there is a question: "Look at the table below and select the safe end point temperature for whole chicken:" with four radio button options: 165F, 155F, 180F, and 170F. Below the question are two buttons: "Check my answer" and "Print the table".

| Food                               | F                                   |
|------------------------------------|-------------------------------------|
| Eggs                               | Cook until yolk and whites are firm |
| Egg Dishes                         | 160                                 |
| Ground Turkey, ground chicken      | 165                                 |
| Ground beef, ground pork           | 160                                 |
| Fresh Beef                         |                                     |
| Medium Rare                        | 145                                 |
| Medium                             | 160                                 |
| Well Done                          | 170                                 |
| Whole Chicken                      | 180                                 |
| Whole Turkey                       | 180                                 |
| Poultry, breasts, roast            | 170                                 |
| Poultry, thighs, wings             | 180                                 |
| Stuffing (cooked alone or in bird) | 165                                 |
| Duck and Goose                     | 180                                 |
| Ham                                |                                     |
| Fresh (raw)                        | 160                                 |
| Pre-cooked (to reheat)             | 140                                 |
| Fresh Pork                         |                                     |

Figure 25 End Point temperature tables



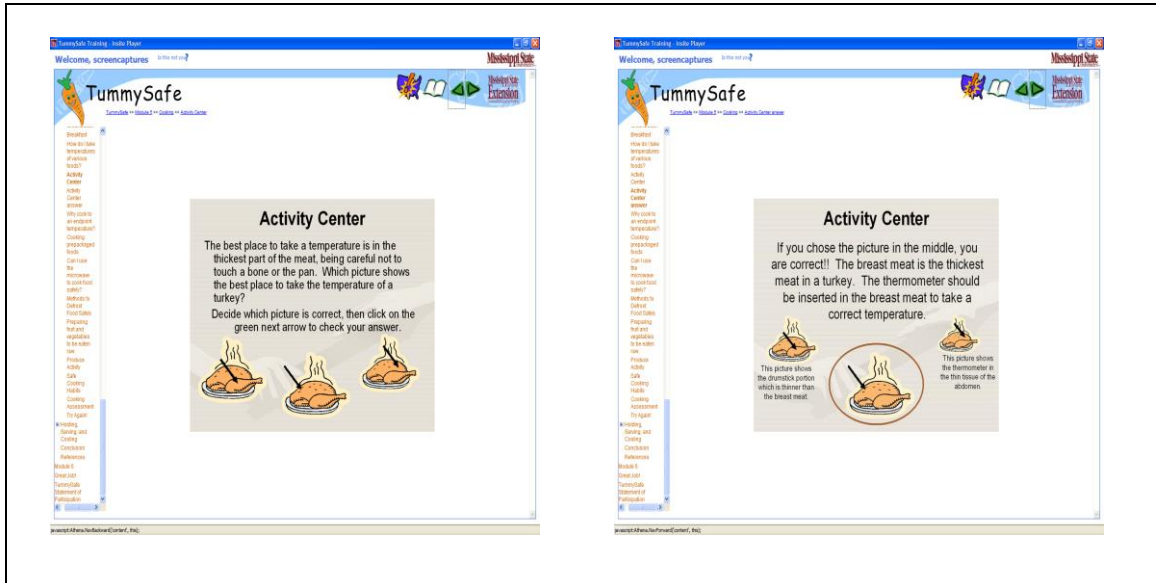


Figure 26 Before and after of thermometer location

TummySafe<sup>®</sup> concluded with positive reinforcement. Computer delivered participants could click to print a Study Guide, locate their Extension Office and print their Statement of Participation. They had to then follow up with their Extension office to schedule a proctored exam. Traditional classroom participants would be given a study guide and some time to review the material. They were then given a proctored exam. When they left the classroom, they were given their Statement of Participation.

## CHAPTER IV

### RESULTS

The TummySafe<sup>®</sup> program has been successful as a self-supporting Extension program. As of June 2013, approximately 4,600 child care providers have taken the certification exam. Numerous other participants have completed the training for the contact hours only. The research period was April 2005 to June 2006. During this time, 2,280 child care providers completed the exam but the research sample for behavior change was trimmed to 1,709 due to incomplete cases, participants opting not to participate in the research or testing irregularities in the 82 counties. The attitude change data was further trimmed to 1,742 for the same reasons.

#### **Demographics**

The demographics portion of the Participant Information Form (Appendix Five) had a five to seven percent non-response rate. A crosstabs analysis was performed on the ordinal demographic data (age, education, level of previous food safety education and tenure in child care). Significant differences were found between participants in the traditional and computer delivered groups in all demographic categories and are reported in Table 4. Gender was excluded from the analysis as these were dichotomous, nominal data. Race was included as nominal data. The participants were 97% female, and 68.3% African American and 28.6% Caucasian. The remaining 4.7 % of participants were 0.6%

Hispanic, 1.7% Native American and 0.7% classified themselves as other than the options available (see Tables 1, 2 and 3).

Table 1 Demographics of computer and traditional participants ( $n = 1,985$ )

|                     | Traditional |       | Computer |       | Total |
|---------------------|-------------|-------|----------|-------|-------|
| <b>AGE:</b>         |             |       |          |       |       |
| 19 and under        | 9           | 0.9%  | 30       | 3.1%  | 39    |
| 20-29               | 142         | 13.8% | 195      | 20.0% | 337   |
| 30-39               | 209         | 20.3% | 233      | 23.9% | 442   |
| 40-50               | 306         | 29.7% | 244      | 25.1% | 550   |
| 50-59               | 227         | 22.0% | 172      | 17.7% | 399   |
| 60 and up           | 88          | 8.5%  | 45       | 4.6%  | 133   |
| Total               | 981         |       | 919      |       | 1900  |
| <b>GENDER:</b>      |             |       |          |       |       |
| Male                | 30          | 2.9%  | 25       | 2.6%  | 55    |
| Female              | 949         | 92.1% | 901      | 92.6% | 1850  |
| Total               | 979         |       | 926      |       | 1905  |
| <b>GRADE:</b>       |             |       |          |       |       |
| 1st-8 <sup>th</sup> | 5           | 0.5%  | 7        | 0.7%  | 12    |
| Some HS             | 83          | 8.1%  | 32       | 3.3%  | 115   |
| HS diploma          | 517         | 50.2% | 437      | 44.9% | 954   |
| Associate Degree    | 217         | 21.1% | 219      | 22.5% | 436   |
| Bachelor's Degree   | 118         | 11.5% | 148      | 15.2% | 266   |
| Graduate Degree     | 33          | 3.2%  | 67       | 6.9%  | 100   |
| Total               | 973         |       | 910      |       | 1883  |
| <b>RACE:</b>        |             |       |          |       |       |
| African American    | 670         | 65.0% | 565      | 58.1% | 1235  |
| Asian American      | 2           | 0.2%  | 4        | 0.4%  | 6     |
| Caucasian           | 250         | 24.3% | 318      | 32.7% | 568   |
| Hispanic            | 8           | 0.8%  | 3        | 0.3%  | 11    |
| Native American     | 26          | 2.5%  | 8        | 0.8%  | 34    |
| Other               | 5           | 0.5%  | 8        | 0.8%  | 13    |
| Total               | 961         |       | 906      |       | 1867  |

Note: Sample size varied by question, since each was optional response by participant.

Table 2 Participants' self-reported previous food safety education ( $n = 1,985$ )

|                        | Traditional |       | Computer |       | Total |
|------------------------|-------------|-------|----------|-------|-------|
| FOOD SAFETY EDUCATION: |             |       |          |       |       |
| ServSafe®              | 245         | 23.8% | 255      | 26.2% | 500   |
| Some FS                | 323         | 31.4% | 345      | 35.5% | 668   |
| Very little FS         | 143         | 13.9% | 126      | 12.9% | 269   |
| No FS                  | 236         | 22.9% | 152      | 15.6% | 388   |
| Total                  | 947         |       | 878      |       | 1825  |

Note: Sample size varied by question, since each was optional response by participant.

Table 3 Participants' self-reported tenure in child care

|                   | Traditional |       | Computer |       | Total |
|-------------------|-------------|-------|----------|-------|-------|
| TENURE:           |             |       |          |       |       |
| Not in child care | 27          | 2.6%  | 59       | 6.1%  | 86    |
| < 6 months        | 67          | 6.5%  | 73       | 7.5%  | 140   |
| 6 - 12 months     | 45          | 4.4%  | 48       | 4.9%  | 93    |
| 1 - 3 years       | 174         | 16.9% | 189      | 19.4% | 363   |
| 4 - 10 years      | 361         | 35.0% | 265      | 27.2% | 626   |
| > 10 years        | 300         | 29.1% | 270      | 27.7% | 570   |
| Total             | 974         |       | 904      |       | 1878  |

( $n = 1,985$ )

Note: Sample size varied by question, since each was optional response by participant.

### Data Checks for Possible Extraneous Variables

Participants age, race, last grade completed, level of previous food safety

education and tenure in child care variables all showed significance by method of curriculum they received (Table 4). The participants in each method were different from each other in every category. It is theorized that the large sample size created a significant effect even though there is no practical significance to the numbers.

Table 4 Pearson’s chi square of participant demographics by method

|        |         | Pearson’s Chi Squared | Df | Eta  | Sig. |
|--------|---------|-----------------------|----|------|------|
| Age    | *Method | 46.156                | 5  | .152 | .000 |
| Race   | *Method | 28.623                | 5  | .120 | .000 |
| Grade  | *Method | 44.772                | 5  | .150 | .000 |
| FoodEd | *Method | 19.404                | 4  | .099 | .001 |
| Tenure | *Method | 31.106                | 5  | .125 | .000 |

### Creation of the “Change” Score

To create the “change” score the pre-test score was subtracted from the post-test score. This created an issue with the reliability of the score and the resultant score was always lower than the initial scores. In this case, the initial reliability was below the 0.7 threshold so another method of analysis may be better suited to this data.

### Data Checks for Assumptions and Transformation

The behavior change data were checked for normality using Shapiro-Wilk’s test of normality and the assumption was not met ( $p < .001$ ). After repeated data transformations, it was discovered that reflecting the data and cubing it brought the data most closely to normality but it still did not reach the threshold for lack of significance in

Shapiro-Wilk's test. Considering that this is a very conservative test and a very large data set ( $n = 1,709$ ), normality may not be a viable goal with Shapiro-Wilk's test. The stem and leaf plot of the transformed behavior change data show a visual representation of a normal data set (Figure 36). Descriptives statistics are given in Table 6 and Table 7.

Method= Traditional

Frequency Stem & Leaf

```
23.00  1 . 2357788999
56.00  2 . 11133333444566677888999999&
79.00  3 . 002222333555555666677888999999&
113.00 4 . 000001112222222233333344444555566666677778888999
147.00 5 . 00000000111111112222233334444444555555555666667778888889999999
185.00 6 . 0000000001111122223333444444444444444555555566667777888888889999999999999999999
119.00 7 . 00000000001111222333333333444444444555566677888999999
72.00  8 . 000001122223344445555666778899999
51.00  9 . 0112234555566666777889
31.00 10 . 0000122335567&
6.00  11 . 0&
```

Stem width: 1.00, Each leaf: 2 case(s), & denotes fractional leaves.

Method= Computer

Frequency Stem & Leaf

```
9.00  1 . 789&
29.00  2 . 123366699&
37.00  3 . 122355666789&
96.00  4 . 000000222333344445566666778889&
136.00 5 . 00001111111222223445555556666667788899999
221.00 6 . 0000000001112333334444444444444555555555666666677888899999999
125.00 7 . 000000000000233333444444455555555678899
88.00  8 . 000000223344455566666677889&
48.00  9 . 011113455667778&
34.00 10 . 02233566789
4.00  11 . 0
```

Stem width: 1.00, Each leaf: 3 case(s), & denotes fractional leaves.

Figure 27 Stem-and-leaf plots for reflected and cubed behavior change data, by method of instruction

The assumption of homogeneity of variance could also not be met for the transformed behavior change data using Levene's test for homogeneity of variance (See

Table 5). The attitude change data was corrected for homogeneity of variance by reflecting the data (Table Five). The assumption of normality could not be met for the attitude data despite multiple transformations. It is again theorized that the large data set creates a situation in which normality may not be a viable goal with Shapiro-Wilk's test.

Table 5 Test of homogeneity of variance

|  |               | Levene<br>Statistic | df2  | Sig. |
|--|---------------|---------------------|------|------|
| Cubed and reflected<br>Behavior Change | Based on Mean | 16.333              | 1707 | .000 |
| Cubed and reflected<br>Attitude Change | Based on Mean | .444                | 1741 | .505 |

## Data Analysis

### Hypothesis One

Adult learners participating in a one-time workforce food safety training will report a more positive attitude in food safety concepts after a self-paced, computer-delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

Participants in the traditional method ( $M = .170$ ,  $SD = .413$ ,  $n = 920$ ) reported a lower pre/post-test mean than participants in the computer delivered method ( $M = .177$ ,  $SD = .346$ ,  $n = 822$ ) but a significant difference was not seen ( $p = .214$ ) (See Table 6). The traditional participants had a slightly less positive attitude towards food safety concepts than computer delivered participants, but no significant difference was found (See Table 7).



Table 6 ANOVA table of adjusted self-reported attitudes

|                | SS        | df   | MS     | F     | Sig. |
|----------------|-----------|------|--------|-------|------|
| Between Groups | 39.479    | 1    | 39.479 | 1.545 | .214 |
| Within Groups  | 44457.758 | 1740 | 25.550 |       |      |
| Total          | 44497.237 | 1741 |        |       |      |

Table 7 Descriptives for attitude data

| <i>Descriptives for attitude data</i> |                                  |             | Untransformed Data |            | Reflected Data |            |
|---------------------------------------|----------------------------------|-------------|--------------------|------------|----------------|------------|
| Method                                |                                  |             | Statistic          | Std. Error | Statistic      | Std. Error |
| Traditional                           | Mean                             |             | .1704              | .01345     | 1.3574         | .16462     |
|                                       | 95% Confidence Interval for Mean | Lower Bound | .1440              |            | 1.0343         |            |
|                                       |                                  | Upper Bound | .1968              |            | 1.6805         |            |
|                                       |                                  |             |                    |            |                |            |
|                                       | 5% Trimmed Mean                  |             | .1761              |            | 1.5082         |            |
|                                       | Median                           |             | .1818              |            | 2.2000         |            |
|                                       | Variance                         |             | .171               |            | 24.931         |            |
|                                       | Std. Deviation                   |             | .41317             |            | 4.99313        |            |
|                                       | Minimum/Maximum                  |             | -1.73/2.00         |            | -11.00/11.00   |            |
|                                       | Range                            |             | 3.73               |            | 22.00          |            |
|                                       | Skewness                         |             | -.261              | .080       | -.529          | .081       |
|                                       | Kurtosis                         |             | 1.757              | .159       | .882           | .161       |
| Computer                              | Mean                             |             | .1765              | .01170     | 1.6590         | .17868     |
|                                       | 95% Confidence Interval for Mean | Lower Bound | .1536              |            | 1.3082         |            |
|                                       |                                  | Upper Bound | .1995              |            | 2.0097         |            |
|                                       |                                  |             |                    |            |                |            |
|                                       | 5% Trimmed Mean                  |             | .1833              |            | 1.8433         |            |
|                                       | Median                           |             | .1818              |            | 2.7500         |            |
|                                       | Variance                         |             | .120               |            | 26.243         |            |
|                                       | Std. Deviation                   |             | .34639             |            | 5.12283        |            |
|                                       | Minimum/Maximum                  |             | -1.55/1.64         |            | -11.00/11.00   |            |
|                                       | Range                            |             | 3.18               |            | 22.00          |            |
|                                       | Skewness                         |             | -.398              | .083       | -.692          | .085       |
|                                       | Kurtosis                         |             | 1.968              | .165       | .904           | .170       |

## Hypothesis Two

Adult learners participating in a one-time workforce food safety training will report a larger increase in self-reported food safety behaviors after a self-paced, computer delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

Table 8 Descriptive statistics of behavior

| <i>Descriptive Statistics of behavior score</i> |                        | Untransformed Data |            | Cubed and reflected Data |            |
|---|------------------------|--------------------|------------|--------------------------|------------|
|   |                        | Statistic          | Std. Error | Statistic                | Std. Error |
| Traditional                                     | Mean                   | .2027              | .00775     | 6.0839                   | .07192     |
|   | 95% CI for Lower Bound | .1875              |            | 5.9427                   |            |
|   | Mean Upper Bound       | .2179              |            | 6.2250                   |            |
|   | 5% Trimmed Mean        | .1939              |            | 6.0717                   |            |
|   | Median                 | .1698              |            | 6.1308                   |            |
|   | Variance               | .053               |            | 4.562                    |            |
|   | Std. Deviation         | .23015             |            | 2.13595                  |            |
|   | Minimum/Maximum        | -.25/.94           |            | 1.21/11.37               |            |
|   | Range                  | 1.18               |            | 10.16                    |            |
|   | Skewness               | .567               | .082       | .071                     | .082       |
|   | Kurtosis               | .063               | .164       | -.465                    | .164       |
|   | Computer               | Mean               | .1573      | .00687                   | 6.4678     |
| 95% CI for Lower Bound                          |                        | .1438              |            | 6.3364                   |            |
| Mean Upper Bound                                |                        | .1708              |            | 6.5992                   |            |
| 5% Trimmed Mean                                 |                        | .1488              |            | 6.4675                   |            |
| Median  |                        | .1304              |            | 6.5346                   |            |
| Variance  |                        | .039               |            | 3.707                    |            |
| Std. Deviation                                  |                        | .19761             |            | 1.92535                  |            |
| Minimum/Maximum                                 |                        | -.23/.81           |            | 1.69/11.03               |            |
| Range   |                        | 1.04               |            | 9.34                     |            |
| Skewness  |                        | .650               | .085       | .027                     | .085       |
| Kurtosis  |                        | .643               | .170       | -.123                    | .170       |

Descriptive statistics for behavior change are given in Table 8. The method of instruction, computer delivered or traditional face-to-face delivery, had a statistically significant impact on the participants' self-reported food safety behaviors, ( $F(1,1708) = 15.17, MSE = 4.148, p < .001$ ) (Table 9). Traditional participants ( $M = .203, SD = .23, n = 882$ ) reported a higher change in self-reported behavior than computer delivered participants ( $M = .147, SD = .20, n = 827$ ) (Table 8).

Table 9 Tests of between-subjects effects

*Tests of Between-Subjects Effects*  
 Dependent Variable: Transformed Behavior Change

| Source          | Type III            |      | Mean Square | F         | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power <sup>b</sup> |
|-----------------|---------------------|------|-------------|-----------|------|---------------------|--------------------|-----------------------------|
|                 | Sum of Squares      | df   |             |           |      |                     |                    |                             |
| Corrected Model | 62.915 <sup>a</sup> | 1    | 62.915      | 15.166    | .000 | .009                | 15.166             | .973                        |
| Intercept       | 67240.948           | 1    | 67240.948   | 16208.803 | .000 | .905                | 16208.803          | 1.000                       |
| Method          | 62.915              | 1    | 62.915      | 15.166    | .000 | .009                | 15.166             | .973                        |
| Error           | 7081.356            | 1707 | 4.148       |           |      |                     |                    |                             |
| Total           | 74322.474           | 1709 |             |           |      |                     |                    |                             |
| Corrected Total | 7144.270            | 1708 |             |           |      |                     |                    |                             |

a. R Squared = .009 (Adjusted R Squared = .008)

b. Alpha = .05

### Hypothesis Three

Knowledge gain in the area of food safety is positively correlated to change in attitude of adult learners completing a one-time food safety training.

A Pearson correlation of .251 ( $p \leq .001$ ) was found for knowledge change and attitude change (see Table 10).

#### **Hypothesis Four**

Knowledge gain in the area of food safety is positively correlated to increased self reported food safety behaviors in adult learners completing a one-time food safety training. As participants increased in their knowledge of food safety practices, they reported better attitudes towards food safety concepts.

A Pearson correlation of .254 ( $p \leq .001$ ) was found for knowledge change and behavior change (see Table 10). As participants increased their knowledge of food safety concepts, they self-reported increased practice of food safety behaviors such as hand washing and thermometer use.

Table 10 Correlation of attitude change, behavior change and knowledge change with method.

|                  |                                   | <b>Correlations</b> |                 |                |                |
|------------------|-----------------------------------|---------------------|-----------------|----------------|----------------|
|                  |                                   | Method              | KnowledgeChange | BehaviorChange | AttitudeChange |
| Method           | Pearson Correlation               | 1                   | .262**          | -.018          | .030           |
|                  | Sig. (2-tailed)                   |                     | .000            | .419           | .179           |
|                  | Sum of Squares and Cross-products | 495.995             | 2215.103        | -7.194         | 14.047         |
|                  | Covariance                        | .250                | 1.116           | -.004          | .007           |
|                  | N                                 | 1985                | 1985            | 1985           | 1985           |
| Knowledge Change | Pearson Correlation               | .262**              | 1               | .254**         | .251**         |
|                  | Sig. (2-tailed)                   | .000                |                 | .000           | .000           |
|                  | Sum of Squares and Cross-products | 2215.103            | 144551.983      | 1715.226       | 1992.696       |
|                  | Covariance                        | 1.116               | 72.859          | .865           | 1.004          |
|                  | N                                 | 1985                | 1985            | 1985           | 1985           |
| Behavior Change  | Pearson Correlation               | -.018               | .254**          | 1              | .484**         |
|                  | Sig. (2-tailed)                   | .419                | .000            |                | .000           |
|                  | Sum of Squares and Cross-products | -7.194              | 1715.226        | 316.257        | 180.165        |
|                  | Covariance                        | -.004               | .865            | .159           | .091           |
|                  | N                                 | 1985                | 1985            | 1985           | 1985           |
| Attitude Change  | Pearson Correlation               | .030                | .251**          | .484**         | 1              |
|                  | Sig. (2-tailed)                   | .179                | .000            | .000           |                |
|                  | Sum of Squares and Cross-products | 14.047              | 1992.696        | 180.165        | 437.439        |
|                  | Covariance                        | .007                | 1.004           | .091           | .220           |
|                  | N                                 | 1985                | 1985            | 1985           | 1985           |

\*\* .Correlation is significant at the 0.01 level (2-tailed).

### Further Analysis with Demographics

A comparison of means was performed with the demographic variable entered as a covariate (See Table 11). Only last grade completed had significance ( $F = 3.458$ ,  $Eta = .093$ ). A Post-Hoc analysis on Behavior Change with the participant's last grade completed as a covariate resulted in a slight difference being seen in those participants that had completed "some high school" (see Figure 28). A smaller change was seen in the participants with some high school; this change was only .12-.25 smaller than the other groups. It is theorized that the large sample size created a significant effect even though there was no practical significance to the numbers.

Table 11 Comparison of means for behavior change by demographic

| Demographic | F     | Sig. | Eta  |
|-------------|-------|------|------|
| Age         | 1.514 | .182 | .062 |
| Gender      | 1.714 | .162 | .051 |
| Grade       | 3.458 | .044 | .093 |
| Race        | 0.902 | .479 | .048 |
| Food Ed     | 2.114 | .077 | .065 |
| Tenure      | 1.807 | .108 | .067 |

(*n* = 1,709)

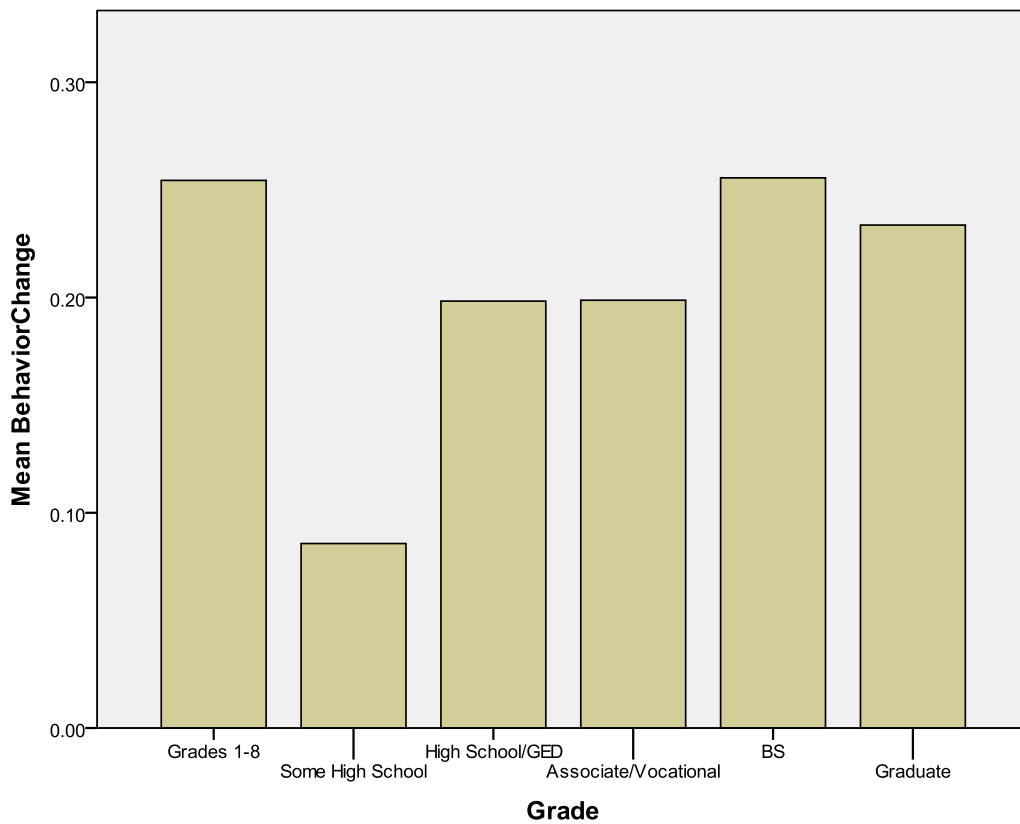


Figure 28 Behavior change by participant's reported education level

CHAPTER V  
SUMMARY, CONCLUSIONS AND IMPLICATIONS

The purpose of this chapter is to provide a summary, make conclusions and discuss implications from the study.

**Summary**

Food borne illnesses are a major public health concern. The grouping of children in child care creates an excellent opportunity for illness prevention. The Mississippi Department of Health requires that Food Service Managers receive food safety training in order to obtain a Child Care License and requires retraining every five years (Mississippi Department of Health, 2013). As child care centers work to meet the demands of licensure training with an ever-in-flux employee base, the demand for effective on-location training is a continual need.

The presence of an Extension office in each of Mississippi's 82 counties and the well-trained and available staff offered by MSU-ES make Extension well suited to reach the needs of the child care providers' training. In light of this, the USDA funded a cooperative project between MSU-ES and the CAVS. The project was entitled Food Safety Certification Program for Childcare Facilities using traditional and technologically advanced, self-paced delivery methods. This program produced a Food Safety curriculum named TummySafe<sup>®</sup>. This curriculum was developed and then implemented

through two methods. Child care providers could complete the curriculum in a traditional class room setting or computer delivered via a CD rom. A non-equivalent control group design was used (Campbell and Stanley, 1963). Data was collected in both a pre-test and post-test on participant knowledge, attitude and self-reported behaviors. This research attempted to assess the training experience and glean information on how the delivery of the curriculum impacts participant attitude and self-reported behavior.

### **Purpose**

The purpose of this study was to examine the impact of the delivery method on participant attitude and self-reported behavior after a food safety curriculum. The correlation between knowledge gain and attitude as well as between knowledge gain and self-reported behavior were also examined.

### **Null Hypotheses and Findings**

The following hypotheses were examined in this study.

#### **Hypothesis One**

Adult learners participating in a one-time workforce food safety training will report a more positive attitude towards a self-paced, computer-delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

#### *Findings*

Participants in the traditional method) reported a lower pre/post-test adjusted mean ( $M = .170$ ,  $SD = .413$ ,  $n = 882$ ) than participants in the computer delivered method ( $M = .177$ ,  $SD = .346$ ,  $n = 827$ ) but a significant difference was not seen ( $p = .179$ ) (See Table 9). The traditional participants had a slightly less positive attitude towards food



safety concepts than computer delivered participants, but no difference was found statistically.

### **Hypothesis Two**

Adult learners participating in a one-time workforce food safety training will report a larger increase in self-reported food safety behaviors after a self-paced, computer delivered curriculum than adult learners receiving an instructor-led, traditional classroom curriculum.

#### *Findings*

The method of instruction, computer delivered or traditional face-to-face delivery, did have a significant impact on the participant's self-reported food safety behaviors ( $F(1,1708) = 15.17, MSE = 4.148, p < .001$ ) (See Table 9). Traditional Participants ( $M = .203, SD = .23, n = 882$ ) reported a higher change in self-reported behavior than computer delivered participants ( $M = .147, SD = .20, n = 827$ ).

### **Hypothesis Three**

Knowledge gain in the area of food safety is positively correlated to change in attitude of adult learners completing a one-time food safety training. As participants increased in their knowledge of food safety practices, they reported better attitudes towards food safety concepts.

#### *Findings*

A Pearson correlation of .251 ( $p \geq .001$ ) was found for knowledge change and attitude change.

## **Hypothesis Four**

Knowledge gain in the area of food safety is positively correlated to increase self reported food safety behaviors in adult learners receiving a one-time food safety training. As participants increased their knowledge of food safety concepts, they increased their self-reported practice of food safety behaviors.

### *Findings*

A Pearson correlation of .254 ( $p \geq .001$ ) was found for knowledge change and behavior change.

## **Conclusions and Implications**

The method in which participants completed a food safety training course did not influence their attitude. This finding agrees with the work of Hahne et al. (2005) and Moneta and Kekkonen-Moneta (2007). The instrument used to measure attitude in this study could use further refinement to determine its ability to measure incidental or integral attitude. Also, attitude measures throughout the curriculum could evaluate for novel affect as it appeared and then waned over time in Hahne's 2005 study.

The method of instruction, traditional face-to-face or computer delivered, did have a significant impact on the participant's self-reported food safety behaviors. Traditional participants reported a higher change in self-reported behavior than the computer delivered participants. It is possible that the face-to-face instruction in the class room as well as the person to person interaction was more successful at developing felt need for the behaviors in the traditional setting. The traditional setting was a more typical learning environment than the computer delivered environment. Multiple

classrooms were used throughout the test period but all the classrooms were quiet, clean facilities. In the computer delivered environments, the facilities were truly unique to each participant. It is possible that the unique environments were also difficult environments to comprehend the material to the level required to result in behavior change.

The software did not produce a way to track the participants time spent on each item. The instructors in the classroom method did monitor the participants' comprehension and spent more time on subjects that needed more time by forcing optional activities and repeating the quizzes. This sort of active monitoring can only be done by a person in a classroom and is a key treatment difference in this study. It is theorized that a live and dynamic instructor is more adapt at progressing participants through a curriculum based on the participants' apparent comprehension, than a computer delivered self-paced version, particularly when some activities are optional.

The ability to log-in and log-out is both a benefit and a challenge. Participants can choose a time they prefer to engage with the curriculum but they also can be distracted from the curriculum when attempting to follow the material in the busy environment of a child care center. A traditional classroom has an environment controlled for maximum learning and engagement. Future work should ask participants for specifics on how they used the computer based curriculum. Perhaps timed modules would be more effective at encouraging participants to engage in a sustained way and should be considered in future upgrades and studies.

Increased food safety knowledge showed a correlation to a more positive attitude towards food safety concepts. Increased food safety knowledge also showed a positive

correlation to more self-reported food safety behaviors. This was expected and demonstrated comprehension of the knowledge despite the low correlations. Roberts et al. (2008) found that training did improve knowledge and behavior but improved knowledge did not always lead to increased behaviors. Training for the desired behavior was critical. It is important to design curricula with the desired behavior in mind, not just the increased knowledge gained.

There is significant issue with the use of self-reported data in this study which may limit usability of the findings. As Kirkpatrick and Kirkpatrick (1967) report, the best way to determine behavior is to observe the participants after the training. This sort of observation was not possible in this study. Also, Lew, Alwis and Shmidt (2010) found that self-assessments only weakly correlated to peer and tutor assessments. More work should be done to review the correlation between self-reported behavior and observed data.

The use of untested scales of attitude and behavior left this study lacking in the areas of validity and reliability. Using a valid and reliable instrument from the literature would be preferred, such as the work by Medeiros, Hillers, Chen, Bergmann, Kendall, and Schroeder (2004). These researchers developed a scale for food safety knowledge and attitude and tested the instruments for reliability and validity. The resulting instruments had 18 knowledge items and 10 attitude items. Another scale that could be adapted to measure affect is the Bradburn Affect Balance Scale (Bradburn, 1969). This scale would be difficult to adapt to the pre-test/post-test model used in this study but offers a useful way to measure affect.

With the limitations in self-reported data inherent in this study, it is suggested that

future work include behavioral observations. Child care centers are inspected annually. This inspection looks specifically at compliance with the Child Care Licensure regulations. It may be possible to use this inspection as an opportunity to observe behavior applications within the child care facilities.

The theory of Planned Behavior Change (Ajzen, 2006) has begun to get some attention in the area of training in food safety. Future research efforts could attempt to utilize this theory to produce an increase in food safety behaviors in child care facilities.

### **Recommendations for Future Research**

- Repeat the current study with a valid and reliable instrument for both attitude and behavior.
- Design a study to observe behaviors in child care centers after training and compare these findings with self-reported values.
- Explore the interplay of curriculum design and attitude change, specifically looking at the role of interactive activities in improved attitudes
- Study the knowledge gained and time spent on the various activities in TummySafe<sup>®</sup> to help refine future curricula.

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APPENDIX A  
AFFECT QUESTIONS ASKED IN PRE-TEST AND POST-TEST OF FULL  
CURRICULUM

**Affect questions asked in Pre-test and Post-test of Full Curriculum**

I feel that it is very important to wash my hands thoroughly.

I think cleaning and sanitizing are both very important.

I feel that every child care worker can make small changes that really can decrease the risk of foodborne illness in a child care center.

If I suspected a foodborne illness outbreak in my child care center, I would report it.

Only child care workers who prepare and serve food should be required to take a food safety course.

I feel that learning about food safety hazards is especially important for people that work with children.

I feel that food safety hazards happen only in places that are not regularly cleaned.

It's reasonable to wash each baby's hands before feeding him a bottle and after changing his diaper.

I feel that handwashing is more important for older children than for babies.

I feel the money saved buying dented or rusted cans is worth any risk of food borne illness.

I think it is safe to hold food at room temperature for several hours prior to serving it as long as you heat the food right before eating it.

APPENDIX B  
BEHAVIOR QUESTIONS FROM PRE-TEST AND POST-TEST OF FULL  
CURRICULUM STUDY

**Behavior Questions from Pre-test and Post-test of Full Curriculum Study**

I have looked on the websites or received information from the CDC, FDA, USDA, MSDH, or the MSU Extension Service to learn more about food safety.

I wash my hands after every diaper change.

I wash my hands before I prepare a bottle or give a bottle to a baby.

Some of the cabinets in our child care center contain both cleaners and food products.

We allow babies who are under a year of age to eat honey.

I wash my hands after sneezing or coughing.

At my child care center, employees work when they have cold symptoms.

I wash my hands after using the restroom.

I teach the children in my care about hand washing.

I have the children in my care wash their hands before eating.

I always wash and sanitize counters after cutting up meats.

At our child care center, bottles are labeled with both the baby's name and the date the bottle was prepared.

I use a food thermometer to tell if my food is safe.

I rinse fresh fruits and vegetables with cold water before I eat them.

I put leftover food immediately in to the refrigerator.

Our child care center sanitizes toys daily.

If the baby doesn't finish his bottle at the end of his feeding, I offer it to him later in the day.

At our child care center, the diaper table is cleaned and sanitized after each child's diaper is changed.

I generally clean and sanitize my kitchen counters \_\_\_\_\_ times a day.

I separate fresh meats and vegetables in my refrigerator.

I use a thermometer to determine the temperature at which my refrigerator operates.



APPENDIX C  
TUMMYSAFE<sup>®</sup> FOOD SAFETY CURRICULUM

Developed in 2004-2005 for child care providers in Mississippi, this curriculum meets the requirements of the Food Manager’s Training in the Mississippi Health Department’s Child Care Licensure Regulations. The curriculum is offered online and in traditional classroom settings in Mississippi through the Mississippi State Extension Service’s 82 county offices and Mississippi State University’s Starkville, MS Campus. Six out-of-house contact hours are rewarded for finishing the curriculum and a Certification exam is offered. Certification lasts five years before renewal is required. Following is a listing of the six modules and their objectives.

**Module One: Food Safety**

Module one is narrated by a male voice and gives the basics to start the course.

Objectives:

1. Define “food safety” and “foodborne illness”
2. Identify reasons for importance of food safety in day care centers
3. Identify organizations that help in prevention of foodborne illness
4. Identify importance of reporting foodborne illness as well as the correct procedure for reporting suspected foodborne illness.

**Module Two: Food Safety Hazards**

Module two is narrated by a male voice.

Objectives:

1. Identify food safety hazards
2. Identify ways to prevent foodborne illness from spreading.

**Module Three: Hand Washing, Cleaning and Sanitizing**

Module three is narrated by a female voice.

Objectives:

1. Emphasize the importance of hand washing
2. Explain correct hand washing technique
3. Emphasize the importance of washing the children's hands and teaching the children hand washing skills.

#### **Module Four: Purchasing and Storing for Safe Food in Child Care**

Module four is narrated by a male voice.

Objectives:

1. Review expiration dates and terms
2. Discuss First In First Out (FIFO)
3. Discuss the prevention of cross contamination in purchasing.
4. Learn, and be able to repeat back and use the Temperature Danger zone.
5. Learn the correct temperature for refrigerator operation.
6. Review food storage in general, on field trips and during power outages.

#### **Module Five: Preparing, Cooking, Holding, Cooling and Serving**

Module five is narrated by a female voice.

Objectives:

1. Define Cross contamination and identify prevention techniques
2. Demonstrate correct temperature taking skills
3. Identify end point temperatures
4. Identify correct way to determine doneness of meats (not relying on color)
5. Learn safe techniques for reheating leftover food
6. Identify proper cooling method

7. Identify temperature danger zone
8. Identify proper holding temperature

### **Module Six Infant Care**

Module six is narrated by a female voice.

Objectives:

1. Identify correct mixing, storage and feeding methods
2. Identify correct methods for sterilizing bottles
3. Identify correct storage dates for formula and baby food
4. Identify correct diapering methods
5. Identify foods that may cause choking in small children.

APPENDIX D  
PARTICIPANT INFORMATION FORM



**Demographic survey:**

Please answer the following questions. Your answers will not impact your certification or final exam and will be kept confidential.

**Please circle the answer you are choosing:**

|  |                                   |                           |                                  |                                  |                   |                       |
|--|-----------------------------------|---------------------------|----------------------------------|----------------------------------|-------------------|-----------------------|
| <b>Your age:</b>                               | 19 and under                      | 20-29                     | 30-39                            | 40-49                            | 50-59             | 60 and over           |
| <b>Gender:</b>                                 |                                   | Female                    |                                  | Male                             |                   |                       |
| <b>Last grade completed:</b>                   | Attended grades 1-8               | Some High School          | High School diploma or GED       | Associate's or Vocational Degree | Bachelor's Degree | Graduate Degree       |
| <b>Ethnicity:</b>                              | African American                  | Asian American            | Caucasian                        | Hispanic                         | Native American   | Other                 |
| <b>Food Safety Education:</b>                  | Completed ServSafe® or equivalent | Some Food Safety Training | Very little Food Safety Training | No Food Safety Training          |                   |                       |
| <b>How long have you worked in Child care?</b> | Not currently in child care       | Less than 6 months        | 6 to 12 months                   | 1 to 3 years                     | 4-10 years        | Greater than 10 years |

Do you have any suggestions or comments for the TummySafe developers?

\_\_\_\_\_

**For Extension Personnel Use Only**

Select method (Check one)

Classroom course: Location of class: \_\_\_\_\_ Date of class: \_\_\_\_\_

Agent who taught class: \_\_\_\_\_ IRB expiration date: \_\_\_\_\_

Self paced computer course

Checklist:

- \_\_\_\_\_ Completed TummySafe Participant Information form, all lines and questions answered.
- \_\_\_\_\_ Informed Consent form completed and included. Copy offered to participant.
- \_\_\_\_\_ Completed Scantron answer sheet (bubbles completely filled out, name correct)
- \_\_\_\_\_ Completed Demographic survey (included on this page)
- \_\_\_\_\_ Computer printouts from self directed computer version participants.

Signature of person administering exam: \_\_\_\_\_  
(Please sign legibly in case we need to contact you)

Date Exam was administered: \_\_\_\_\_