

INCORPORATING MULTIPLE TEACHING TECHNIQUES INTO FOOD SAFETY
EDUCATION

by

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Abstract

According to the Centers for Disease Control and Prevention, 48% of known, single-setting foodborne illness outbreaks were caused by food consumed in restaurants. The lack of food handler training and knowledge of food safety concepts is a contributing factor to the continued occurrence of foodborne illness outbreaks. This report concerns food handler training undertaken with a goal of incorporating teaching techniques other than “stand and deliver” presentations to restaurant employees in the Kansas City, Kansas Metro area. Differing messaging concepts such as discussion, role playing, and hands-on segments were used. Training took place in classroom settings as well as commercial kitchen laboratories, including a working restaurant hot-food preparation line. Participants included restaurant owners, managers, as well as front and back of the house employees. Some had completed other food safety training in the past, while others had no formal food safety training. The food safety knowledge of the participants was determined in a pre-test administered just before the training session started, with the average score being 63%. The sessions began with a slide presentation and discussion of current best practices in safe food handling, followed by two hours of kitchen lab time, in which the participants rotated through several demonstration and practice stations. Areas of emphasis during the hands-on sessions were hand washing, cooling and reheating of food, proper thermometer use, and sanitizer use. Special focus was given to mimicking a hot food preparation line where employees had to handle potentially hazardous foods such as raw hamburger, and then work with ready-to-eat foods in the same area. The participants finished the training with a multiple-choice test (a score of 75% was required for recognition of the training), followed by a discussion of the test questions. The average score after training was 76%. At all times participants were encouraged to ask questions that would address specific challenges in their respective restaurants. Participants were given a post-training course evaluation to gauge acceptance of the training. Results showed strong appreciation and preference for the hands-on segments and the inclusion of industry experts as presenters. Overall, post-test scores increased by 13.6% compared to the pre-test scores. The improvement of test scores was significant ($P < 0.0001$) indicating that the training was successful in training restaurant managers, owners, and employees about food safety practices.

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Dedication

This report, and the work it represents is dedicated to my wife, Sarah who has supported me through the craziness of going back to school, moving across the country, becoming immersed in the culture of purple and finally reaching this point of completion. You are my foundation, without you this would not have been possible. You are my partner in all things, and you are loved.

Chapter 1 - Introduction

The Food Safety Challenge

Americans are spending more money on more meals eaten away from home. Restaurants served over 60 billion meals in the United States (US) in 2011 (O'Reilly 2012). Close to 50% of the American food budget is spent on meals outside the home (Creel and others 2008). CDC estimates that each year roughly 1 in 6 Americans (or 48 million people) get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases (CDC 2011). As half of foodborne illness outbreaks are attributed to restaurants (CDC 2006; Jones and Angulo 2006), foodborne illness is a substantial challenge to both the physical health of the dining populous and the economic health of the restaurant industry.

Time constraints on consumers, less cooking at home, greater urbanization, more demand for ready-to-eat (RTE) food/meals, all mean that more hands are involved in the production of meals (Acikel and others 2008). This includes an increase in at-risk dining populations such as small children and older adults. Trepka (2010) reported that the highest incidence rates for salmonellosis, shigellosis, and campylobacteriosis were among children less than 5 years of age. Also, pregnant women and infants are two of the groups most at risk for complications from foodborne illness. A greater burden has been placed on food handlers and facilities to follow best practices in food preparation and handling. Many of the prepared foods, by their nature, are potentially hazardous (PHF), including preparations containing cut leafy greens, cut fruit, animal proteins cooked and held or cooked and chilled, and cooked starchy foods such as rice, pasta and potatoes (CDC 2012; Brown and others 2012). Batz (2011) in studying pathogen/food pairings, found complex, non-meat, multi-ingredient foods prepared outside the home to be responsible for 70-80 percent of outbreaks associated with certain pathogens. Complex foods are more likely to have mistakes made during preparation, especially relating to cross-contamination, poor hygiene, and time-temperature abuse.

In their food safety training materials, the Kansas Department of Agriculture lists ten common pathogens that cause foodborne illness (Table 1). Most have low infectious doses and are commonly spread through poor personal hygiene, especially hand washing. The small infectious dose and ease of transmission contribute to the difficulty in controlling the spread of illness caused by these pathogens.

Table 1.1–Ten common food service related pathogens^a (KDA 2011 modified).

Causative Pathogen	Infectious Dose	Common Symptoms	Foods Involved/Source
<i>Bacillus cereus</i>	10 ⁵ -10 ¹¹ organism/100 g ¹	Nausea, vomiting cramping, diarrhea	Rice and rice dishes, vegetables, sauces
<i>Campylobacter jejuni</i>	Variable, may be < 500 organisms ¹	Cramping, fever, diarrhea, nausea, headache, vomiting	Unpasteurized dairy, poultry and meats, infected food handler
<i>Clostridium perfringens</i>	10 ⁶ -10 ¹⁰ vegetative cells ¹	Abdominal cramping, diarrhea, nausea	Meats, poultry, gravy, beans, stews, foods cooked slowly
<i>Shiga toxin-Producing E. coli</i>	10-10 ⁸ , may be as low as 10 organisms for <i>E. coli</i> O157:H7 ¹	Diarrhea-often bloody, severe cramping, nausea, vomiting, fever	Raw and undercooked ground meats (esp. ground beef)
<i>Hepatitis A</i>	Unknown ²	Mild or no symptoms, then sudden onset of fever, general discomfort, fatigue, headache, nausea, loss of appetite, vomiting, abdominal pain, and jaundice after several days	Water, ice, shellfish, salads, cold cuts, sandwiches, fruits, fruit juices, milk, milk products, vegetables, any food that will not receive a further heat treatment
<i>Listeria monocytogenes</i>	Varies with human host, may be low in high risk populations ²	Nausea, vomiting, fever, chills, headache, meningitis, miscarriages	Unpasteurized dairy, cheese, vegetables, seafood, poultry
<i>Norwalk-like</i>	< 100 particles [*]	Cramping, diarrhea, nausea, vomiting, headache, fever	Raw fruit, raw vegetables, prepared salads, raw shellfish
<i>Staphylococcus aureus</i> (Staph)	>10 ⁶ /ml for toxin production; <1 microgram of toxin will cause intoxication ²	Onset abrupt and often severe, nausea, vomiting, cramping, sometimes diarrhea	Ready-to-eat foods, i.e. sandwiches, salads, ham and other meats, potato salads, custards, warmed-over foods; often from infected food handlers-cuts, throat, nose and acne
<i>Salmonella</i>	Variable. As few as 15-20 cells in the high risk population ²	Abdominal cramping, headache, nausea, diarrhea, fever, sometimes vomiting	Undercooked or raw meats, poultry and shell eggs, poultry and egg salads, egg custards and sauces, protein foods, pets and infected handlers
<i>Shigella</i>	10-200 organisms ²	Diarrhea-often bloody. Cramping, fever, nausea, sometimes vomiting	Ready-to-eat foods associated with bare-hand contact Source: human feces, flies

a (1 Schmidt 2011; 2 CDC 2012)

Foodborne illness has proven to this point to be almost impossible to eradicate. Overall data from 2012 showed a lack of recent progress in reducing foodborne infections and highlight the need for improved prevention (FoodNet 2012). Even when health inspection scores are consistently high, food produced in restaurants has a pathogen load. Yeager (2012), sampled

food from restaurants with good scores paired with restaurants with low scores on health inspections. Over 37% of all food sampled tested positive for the pathogen *Staphylococcus aureus*, with no statistical difference between the two groups of restaurants.

Proper chilling and reheating of foods is an area of concern for food service establishments as the time spent the food preparation practices has a direct bearing on the growth of bacteria in foods. Data from Kansas shows improper cooling to be in the top three most cited critical violations during health inspections (Saathoff 2011). An EHS-Net study showed a lack of knowledge concerning cooling regulations and methods (Brown and others 2012). Food that stays in the temperature danger zone (TDZ) of 40°F (5°C) to 140°F (60°C) over four hours has an increased chance of bacteria populations reaching unsafe levels. Best practices and Food Code regulations (U. S. Food Code 2013; KS Food Code 2013) dictate that potentially hazardous foods left in the TDZ for four hours or more be discarded. The Food Code also states that the proper time frame for cooling foods is 140°F (60°C) to 70°F (21°C) within 2 hours, and within a total of 6 hours from 140°F (60°C) to 40°F (5°C) or less.

The purpose of this report is to describe the development of a food safety training course that incorporated multiple learning styles with a large experiential learning component. The author is a chef and culinary educator who has extensive experience in training culinary students and food service employees. The author was responsible for developing and implementing the experiential learning or hands-on component that included hot line simulation (to enforce proper handling of PHF and RTE foods), proper techniques for cooling various foods, cleaning versus sanitizing, and proper thermometer use, including calibration.

Chapter 2 - Literature Review

Lack of Food Safety Knowledge

“Based on the RISKS inherent to the FOOD operation, during inspections and upon request the PERSON IN CHARGE shall demonstrate to the REGULATORY AUTHORITY knowledge of foodborne disease prevention, application of the HAZARD ANALYSIS and CRITICAL CONTROL POINT principles, and the requirements of this Code” (KDA 2013). According to the Kansas Food Code, section 2-1-2.11, the restaurant manager on duty must have sound knowledge of food safety principles, including Hazard Analysis and Critical Control Point applications.

As reported in Food Safety News (2006), CDC released study findings highlighting the lack of food safety knowledge and follow through by restaurant managers and employees. Observations ranged from employees wiping hands on clothes and aprons in 40% of restaurants to 62% of workers not washing hands between working with raw ground beef and RTE foods and cooked ground beef products. In the same study, 31% of responding restaurant managers stated there were no managers in those restaurants certified in food safety. In another study by Carpenter (2013), almost 20% of respondents reported working while experiencing vomiting or diarrhea in the last year, again showing a lack of knowledge concerning the transmission of foodborne illness.

Multiple studies have shown both a lack of proper final cooking temperatures for Potentially Hazardous Foods (PHF), and a lack of proper thermometer use in restaurants. In a survey study of over 300 restaurant managers across the U.S., only 46% reported that their employees used the FDA-recommended method for taking temperatures of cooked chicken with a thermometer (Brown and others 2013). Other methods reported for checking the doneness of chicken included by feel, appearance, use of a timer, and experience/skill. Also, only 43.3% of respondents knew the correct temperature to safely cook chicken to (165°F, 73.9°C). Ground beef cookery and safe handling was the subject of an eight state study based on survey and observational data (Bogard and others 2013). Only 17% of independent restaurant managers reported using a thermometer to check the doneness of hamburgers, and 34% of chain restaurant managers did so. Eighty four percent of independent restaurant managers reported using appearance or texture to check for doneness.

A survey of food handlers in Oregon showed a distinct lack of understanding of cooking temperatures, how foodborne illness is spread, proper hand washing techniques, and other food safety basics (DeBees and others 2009). The problem is not relegated to the US. The Food Safety Authority of Ireland has identified similar factors contributing to foodborne illness: infected food handlers, poor temperature control, cross contamination, inadequate heating and HACCP concepts (Bolton and others 2008). In a survey of Irish Head Chefs, the researchers found 20% did not use a thermometer to check temperatures, over 20% did not sanitize their work stations, and only 57% used a thermometer to check the doneness of poultry or pork. These same chefs had little idea of the laws and agencies overseeing food service safety.

Similar results were obtained in a study of fast-food workers in Jordan (Osaili and others 2013). The workers showed a fair overall understanding of food safety concepts, but almost all had glaring deficiencies in specific areas such as proper thermometer use, cooking temperatures for PHF, and personal hygiene. Hygiene, especially centered on hand washing, was noticeably lacking with school food handlers in Malaysia (Tan and others 2013). In the Malaysian study on personal hygiene practices and knowledge, 88% of the study subjects could not describe proper hand washing procedures, including hand drying. All of these respondents had passed a food hygiene training course, and 44% had 1-5 years of food service experience. After noting the poor hygiene conditions and lack of food safety knowledge on Italian merchant ships, refresher food handler training of crewmen on board was shown to be effective in decreasing the pathogen load on equipment and in storage areas, both refrigerated and dry (Capunzo and others 2005).

If training can be accomplished, the effects can last years. A 15-year study in British Columbia showed that even after that length of time, trained personnel performed better in knowledge testing than their untrained co-workers (McIntyre and others 2012). While the trained workers scored higher on the knowledge test, the linear drop in scores over time shows the need for periodic refresher training to reinforce and expand food safety knowledge.

Barriers

There are many barriers to achieving successful food safety training. Food service work offers many people an entry into the work force, especially those without advanced education. The food service industry also functions as a safety net for those displaced from other areas of the workforce. A major barrier is the high turnover rate among workers in the food service

industry (Grindy 2014). In 2013, the turnover rate for the restaurant and accommodations sector was 62.6 percent. The make-up of the hospitality workforce drives this turnover, as student and seasonal workers account for a large percentage of the turnover. These employees may lack training, not stay long enough to become fully trained and may not be emotionally invested in training they feel they will not need later in life. If there is training for these workers, quite often it is “on the job” training such as job shadowing. A study concerning knowledge of receiving of leafy greens showed this to be an ineffective way to insure proper practices were employed (Coleman and others 2013). The messaging is inconsistent in these situations, as each “trainer” emphasizes the aspects of the job they feel is most important, not necessarily the aspects that lead to best food handling practices. This type of training can also lead to the reinforcement of bad habits and procedures if the trainer is not fully trained themselves.

Language is another hurdle in the broad dissemination of food safety information among restaurant workers. The restaurant and hospitality industry often functions as an economic entry point for non-English speaking immigrants. This contributes to the challenge of training and enforcing food safety training (Neal and others 2011). Language challenges can be hidden by those who may speak English well but not read or write fluently. This can have a negative impact on test taking and limits the options for messaging. Along with the language barriers, there are quite often cultural norms that have to be modified or exchanged for food safety concepts to take root. There is a pervasive culture of “that’s the way we’ve always done it” or “that’s how we do it in my country” that can be very hard to penetrate with food safety messaging.

Barriers abound within the food service establishment itself. Time constraint was the most often cited reason for not implementing proper food safety practices according to a study involving 20 focus groups of restaurant workers and managers (Howells and others 2008). Table 2.1 lists the barriers most often cited during the focus group sessions. Inadequate training and lack of knowledge was also highly ranked as a barrier to performing best food safety practices. Any training regimen for food handler food safety needs to take the issue of time into consideration, as the hospitality industry runs on a tight schedule with small profit margins. This situation quite often prevents the establishments from having adequate staffing to cover a group of employees taking a training course. Interestingly, the focus group respondents listed “Forgetting/having to remember” as a barrier, indicating that proper signage and other prompts in the work environment would be helpful in increasing the adherence to food safety practices.

Table 2.1–Perceptions of barriers for implementing three food safety practices by restaurant employees as identified through focus groups (Howells and others 2008, modified).

Barrier	Number of Groups Identifying Each Barrier					
	Cleaning and Sanitizing		Handwashing		Thermometer Use	
	Group A ^a	Group B ^b	Group A ^a	Group B ^b	Group A ^a	Group B ^b
Time constraints	10	18	10	14	9	7
Inadequate training/knowledge	8	10	1	8	6	13
Forgetting/having to remember	2	6	4	2	1	
Lack of adequate resources	6	4	4	13		
Management and employees don't care	8	13				2
Managers not monitoring		5	3	1	4	3
Competing tasks	3	7	6	7	2	
Inconvenient/hassle/easier not to do	4	4	1	3	3	2
No incentive/no desire to do it		15				

^aGroup A: Series of 10 focus groups with 34 employees whose job involved food production from local restaurants.

^bGroup B: Series of 20 focus groups with 125 employees whose job involved food production from restaurants within a 300-mile radius of the research university.

Different types of food service operations have their own challenges. Off-premise catering companies and their employees face the challenges of having to not only prepare the food, but also transport it and serve it off-site, quite often in less than ideal conditions (Ghezzi and Ayoun 2013). In a catering situation, any of the employees may be called upon to do any task from setting tables to serving food to preparing some of the food. Without the separation of people by task, there is a greater risk of missed procedures and lapses in personal hygiene and food safety practices.

Other hurdles most often mentioned included inadequate training/knowledge, forgetting/having to remember (lack of prompting signage), lack of resources, and uncaring management and employees. Sometimes the uncaring management can give different information or instructions than those from inspectors or other managers (Robertson and others 2013). When this happens, employees quickly revert to the path of least resistance, which generally means proper procedures are dropped. Concerning the lack of resources, many establishments meet regulatory standards for facility compliance, but surveys show limited correct use of those facilities (Bolton and others 2008), which bolsters the position of time constraints and lack of training as important barriers to address.

Educating the Food Service Worker

Most food handler training regimens consist of a classroom PowerPoint presentation followed immediately by a multiple-choice test. Examples are the National Restaurant Association ServSafe training, municipal food handler trainings, and many State programs. Passing rate is usually 75% (MARC 2012). There is very little discussion, and interaction by participants, situational role-play, or hands-on lessons are not used. PowerPoint presentations are geared to visual and auditory learners. A survey of on-line options shows programs ranging from \$10.00 to over \$40.00, with some guaranteeing a passing grade and a certificate. These claim to be interactive, but the extent of activity is relegated to point and click multiple-choice questions.

When developing education materials, certain attributes are desired, no matter the audience. These include 1) engaging while maintaining the seriousness of the topic, 2) utilization of techniques that provide for individuals with varied learning styles, 3) flexibility for application in populations with varying skill levels and time commitments, 4) cost effectiveness, 5) relevant and sustainable materials, and 6) widely applicable (Shearer and others 2012).

Each person learns in different ways and has a preference for a specific learning style or a combination of several learning styles. Finding ways to reach as many of the different learners as possible increases the chances of the information connecting with the participant. Trainers need to be competent, not just in technical skills and knowledge, but also in the ability to recognize and teach to the different learning styles they encounter (Kelly and Markovska 2012).

McLawhon and Cutright (2011) listed the following learning styles:

- Visual (spatial): Prefer pictures, images and spatial understanding.
- Aural (auditory-musical): Prefer using sound and music.
- Verbal (linguistic): Prefer using words, both in speech and writing.
- Physical (kinesthetic): Prefer using the body, hands, and sense of touch.
- Logical (mathematical): Prefer using logic, reasoning, and systems.
- Social (interpersonal): Prefer to learn in groups or with other people.
- Solitary (intrapersonal): Prefer to work alone and use self-study.

Incorporating as many learning styles into teaching situations increases the opportunity to connect with students from multiple backgrounds and experiences. In work with automotive technology students, Threton (2011) found instructors tended to stereotype students into learning styles without or in spite of observations that showed diverse learning populations. This

happens in many food handler food safety-training situations. Many training regimens attempt to force all trainees to assimilate the information in the same manner that of the stand and deliver PowerPoint presentation. Several teaching techniques can span several of the learning styles, when used well and can provide effective training sessions.

Storytelling is a teaching device that can deliver information in ways that reach multiple learning styles. Storytelling provides context, builds relationships, and a sense of involvement in the classes or trainings (Lordly 2007). The ability to get the trainees involved in the content is especially challenging and important in short sessions. The instructor needs to build engagement quickly when the class meets once for four hours. In his work, Chapman (2011) developed food safety infosheets that included several concepts in learning to increase buy-in on the part of the audience. Working an aspect of surprise into the message, basing the message on a story, and creating a dialogue with peer groups were all objectives of the infosheets. Chapman also tried to put the food safety information into a context that was recognizable and relevant to food service workers. While the infosheets may seem on the surface to be aimed at the verbal and visual learners, by bringing in the storytelling and surprise/shock images, conversations are started that build on the message and help learners to remember and help disseminate the information.

While it is easy to bring the outlandish or shocking image or phrase into the communication, one needs to temper the urge to have the messenger eclipse the message. According to Fischhoff and Downs (1997), the hallmarks of good communication are as follows: match the audience's technical knowledge level, clarify terms often, be organized, tell the audience what you'll be covering in a logical manner, avoid ambiguous quantifiers, and don't distract from the message.

Experiential learning is a term that can include several of the learning style listed above (Threeton and others 2011) but is most closely associated with physical or kinesthetic learning. In its most common iteration, it is called 'hands-on' learning, and can include each of the learning styles. Many technical schools, including culinary schools use experiential learning for a large part of their programs. The ability to practice concepts presented in classroom settings helps cement the knowledge and techniques. Many culinary schools, including The Culinary Institute of America, Johnson and Wales University and New England Culinary Institute, employ the experiential learning model. This model allows instructors to further develop curriculum that includes hands-on segments in almost all teaching situations. By incorporating sanitation

practices and knowledge into daily routine, the curriculum helps develop a culture of food safety among the student body. As at all culinary schools and many high school culinary programs, the students also could not graduate unless they passed the ServSafe (NRAEF) Manager program.

One of the strengths of incorporating multiple learning/teaching styles into training regimens is the increased opportunity for feedback in various forms. Feedback can be broken into three time related categories: before the task, during the task (concurrent) and after completion (immediate and delayed) of the task (Maxfield 2013). In experiential learning situations, augmenting the activity with concurrent feedback helps to create proper habits and muscle memory. Providing feedback immediately after allows the instructor to reinforce proper procedures and correct behaviors where needed.

Summary

The challenge of training food service workers in food safety is multifaceted. Creating messages that speak to a diverse population with differing levels of education is just one hurdle. Seamlessly incorporating multiple learning styles, removing barriers to participation as well as learning are also important for achieving successful training results. Because of the physical nature of the work, incorporating experiential learning into the training sessions is also an important goal.

Chapter 3 - Development of Food Safety Training with the Incorporation of Hands-on Components

Introduction

Americans are spending more money on more meals eaten away from home. Restaurants served over 60 billion meals in the United States (US) in 2011 (O'Reilly 2012). CDC estimates that each year roughly 1 in 6 Americans (or 48 million people) get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases (CDC 2011). Half of foodborne illness outbreaks are attributed to restaurants (CDC 2006; Jones and Angulo 2006). Many of outbreaks associated with restaurants and food service can be attributed to inadequate training of employees in regards to food safety practices.

One of the barriers most often cited to increased training in food safety matters is the lack of time employees are allowed away from their jobs, as staffing levels are kept at a minimum (Howells and others 2008; Carpenter and others 2013). Managers also experienced time constraints, limiting their ability to produce their own training materials.

In response to the perceived need for food safety training in the State of Kansas, and Johnson County in particular, a working group was formed to expand upon the Kansas Department of Agriculture's (KDA) "Focus on Food Safety" (KDA 2012), program. The group members included representatives from the food industry (Sysco of KC, food distributors), chemical and sanitation equipment manufacturer representatives (Ecolab Inc.), State and County government and Kansas State University, Olathe (KSUO). The targeted audience for the training consisted of owners, managers food handlers and food distributor sales staff from the Johnson County restaurant and hospitality industry.

The first meeting of the group consisted of discussions of observed problems and challenges of food safety training that the participants had experienced. An exploration of available training opportunities was also a part of the opening discussions. As the challenge took shape, (a lack of cost effective, consistent training opportunities that spoke to the broad range of food service workers, and reducing the high number of critical violations noted by the KDA inspectors), the group focused on developing training materials complimentary to the existing KDA "Focus on Food Safety" program. The supplemental materials focused on additional messaging styles and building in a large experiential learning component. The group also

realized that the supplemental materials could not add significant time involvement from the participants.

The group was charged with designing training sessions to take no more than four hours, or a half-day shift and the developers encouraged restaurants to make use of scheduled days of closure to increase attendance and lessen the impact on the staffing needs during hours of operation. Training sessions were held in the facilities at KSUO that house assorted kitchens and conference rooms for presentations, discussions, and testing. The training used two of the kitchen spaces: the restaurant hot line for creating a mock service atmosphere, and an institutional kitchen that was set-up for the experiential hands-on stations.

The overall goal was to create a training session that incorporated the best of the KDA presentation with the addition of materials and techniques that addressed the needs of non-traditional learners. The idea was to create a training regimen that gave solid factual content, highlighting current best practices, and emphasizing that food safety is achieved by paying constant attention to basic and fundamental concepts as food service employees go about their daily tasks. A secondary objective was to modify information from The Focus on Food Safety program 29-page booklet that uses a mix of visual images and concise messaging to augment a three-hour PowerPoint and demonstration presentation. Approaches to modifying the PowerPoint presentation were using attention grabbing images, humor, shock, and strong factual information, with stories and discussion to increase the impact of the delivery (Appendix C). New materials included a mix of illustrations, pictures and stories in an attempt to present the food safety message in as many different ways as possible. An interactive learning environment was encouraged in an attempt to engage participants in discussions, creating an open exchange of ideas, and an atmosphere in which questions were welcomed.

Materials and Methods

Training

As the KDA was a partner and had already developed training materials, it was decided their program, Focus on Food Safety, would be used as the basis for the modified training. The KDA provided their pamphlet and PowerPoint presentation. The KDA approach was to emphasize the four basic tenants of safe food handling: clean and sanitize; chill as quickly as possible; cook to proper temperature; and prevent contamination of ready to eat foods (RTE) by

potentially hazardous ones. The booklet is 29 pages long and is based on the Kansas and FDA food codes (KDA agriculture.ks.gov/ 2012). A set of supplementary slides was developed that used more humor, shock value and associative images in an attempt to spur conversation and build visual links to the factual information. Style of messaging was varied in an attempt to present the material in as many ways as possible in the short training time. Images were chosen to match text that would help to convey the message of the text. The text was kept to short, content intense phrases that spoke to the core messages of the training session. Employees of K-State Olathe volunteered to be test subjects for the slide presentation during the development stage to give the author feed back on the materials.

Participants pre-registered through the Department of Continuing Education (DCE) at Kansas State University and paid a \$20.00 fee that covered the cost of materials. On the day of the scheduled training, participants checked in and verified their identity. The session started with introductions and a summary of what the training would entail. A 24 question multiple-choice pre-test was given at this point, with the individuals asked to answer the questions to the best of their ability. The tests were collected and graded later. A presentation was then given via the PowerPoint slide show developed by the trainers. Participants were provided writing materials for taking notes, as well as a printed copy of the slides to follow along if they chose to do so. At the close of the PowerPoint presentation, the trainees had an opportunity to ask more questions and to take a 15 minute break before starting the next phase of the training. The experiential learning portion of the training sessions was based on the observations, training and experience of the Food Programs Manager at KSUO. His experience as a food service professional and chef span over 30 years, including 11 years as a culinary arts instructor at New England Culinary Institute. The activities were designed to reinforce the content of the presentation and give an opportunity to clarify any points that may have raised questions. The hands-on section of training consisted of four stations that the participants rotated through after the discussion session. Hands-on segments included hot line simulation (to enforce proper handling of PHF and RTE foods), proper techniques for cooling various foods, cleaning versus sanitizing, and proper thermometer use, including calibration. Participants spent approximately 20 minutes at each station before rotating to the next activity. Hair nets, aprons, and gloves where provided. Proper kitchen attire, including the removal of jewelry, loose clothing was enforced.

Hands-on Stations

Hand washing

Hand washing is often performed in a perfunctory, haphazard way, with many areas of the hands being missed in the scrubbing step (Tan and others 2013; Ghezzi and Ayoun 2013). There is also a lack of knowledge concerning when to wash hands when working with food. The training emphasized hand washing should take place anytime the worker leaves the task at hand, including to change gloves, use the restroom, touch face, handle trash or trash receptacles, eat, drink, or do anything else that might bring contamination to the food. The hand washing station (Figure 3.1) emphasized proper technique with the use of fluorescing lotion (Glitterbug, Brevis Corp. Salt Lake City UT) and an ultraviolet (UV) light box (Glitterbug Hand Show) or flashlight (Blacklight Master) (Table 3.1). Hot and cold potable water from hands-free foot pedal operated hand sinks, with soap dispenser were used.

During the presentation session, the participants were instructed in the accepted way of washing hands, that is; moisten hands with warm water, apply hand soap and scrub hands together, using a nail brush if necessary, for 20 seconds, and then rinse under the warm running water. Best practices (FDA Food Code 2012) dictate drying hands with single use paper towel. At the hand-washing station, participants were asked to apply a fluorescing lotion to their hands. They were then instructed to wash their hands as they have been shown to do during the presentation. When subjects were finished, their hands were illuminated with a UV flashlight or UV light box.

Hand wash sinks were pedal operated; hands free models (Advance Tabco 7-PS-71, T&S Brass B-0525, T&S Brass B0504-LKS), and paper towels were used from hands free dispensers (San Jamer). Nailbrushes (Sysco) were available for participants to use if they chose. Under UV light, the disclosing lotion fluoresced in the places that the subjects did not wash well. Participants were instructed to re-wash, paying close attention to the areas that were under-washed in the first washing.

Figure 3.1–Hand washing station.



Table 3.1–Supplies for hand washing station.

Hand wash sink	Nail brush
Hand soap/dispenser	Fluorescing lotion
Paper towel/dispenser	Blacklight box or flashlight

Chilling and Reheating of Foods

The emphasis at this station was on cooling foods quickly and efficiently. The proper use of ice baths, and cooling wands was demonstrated, and the participants participated in “mini” experiments following and comparing the decrease in temperature of liquid foods using different techniques and different containers. The containers used highlighted the differences in cooling ability between materials (metal versus plastic) and shape, (large versus small, deep versus shallow) (Figure 3.2 and Table 3.2). These experiments, while very quick and rudimentary, allowed the participants to see firsthand how the proper methods and materials can affect the time used to cool foods.

Attention was given to reheating foods by focusing on the use of proper heating equipment, vessel or pan, and the use of a thermometer to correctly check for reheat temperature.

The proper final temperature of reheated foods, (165°F, 74°C) (U.S. Food Code 2013), was reiterated multiple times.

Figure 3.2 Cooling station

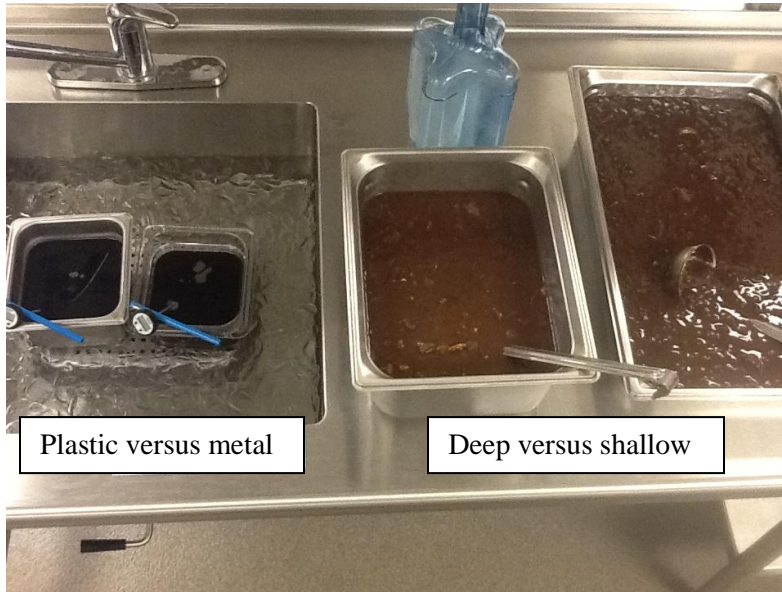


Table 3.2–Materials for cooling station.

	Cooling wands	Sanitizer bucket	Shallow stainless steel pans
	2 gal hot liquid food	Hot pads	Deep stainless steel pans
	2 Thermometers	Towels	2 Chef spoons
	Ice	Stove or oven for heating food	Cooling racks
	Large sink or tub	1 qt. stainless steel containers	1 qt. plastic containers

Thermometer Use

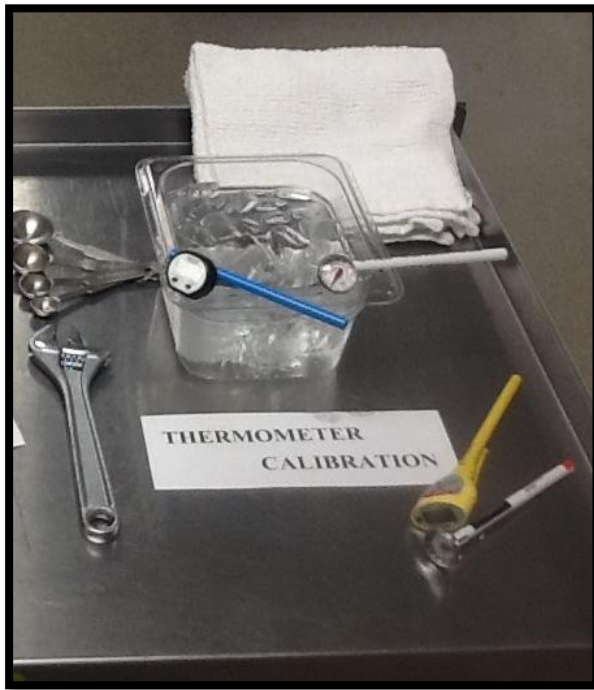
For this training, the station was set up to show the differences between bi-metal dial thermometers and digital thermometers, with an emphasis on tip-sensitive style digital thermometers. Examples of each were available for examination and demonstration. The instructor demonstrated the correct calibration method for bi-metal thermometers, using the ice bath method (Table 3.3 and Figure 3.3). Included at the station was the proper way to clean and sanitize the thermometer stems using alcohol swabs after cleaning (Table 3.3 and Figure 3.3). After a discussion and demonstration concerning the proper use of each style of thermometer, each participant calibrated a bi-metal thermometer.

The instructor at this station also demonstrated the difference between general cleaning (free of visible material) and sanitizing (reducing microbial load to safe levels). Proper use of equipment, latest code accepted practices, and proper concentrations of sanitizers were shown and the participants practiced making sanitizing solutions.

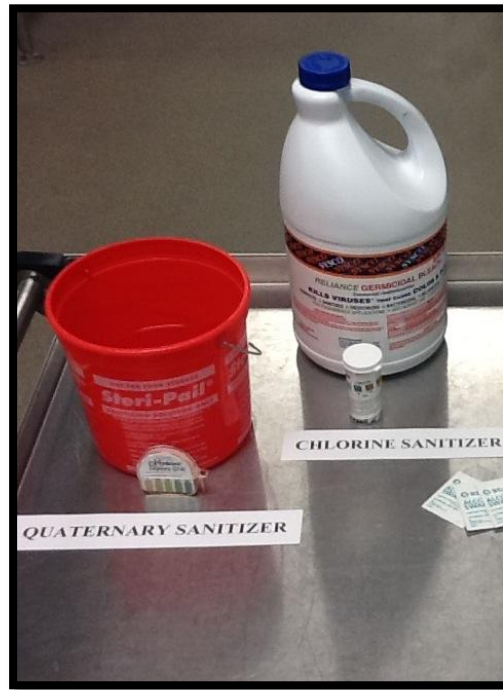
Table 3.3—Materials for sanitizing and thermometer calibration.

	Quaternary (Quat) Sanitizer		Sanitizer-buckets		Triple sink
	Chlorine bleach		Cleaning buckets		Sink 1- detergent
	Chlorine test strips		Measuring spoons		Sink 2- hot rinse
	Quat test strips		Detergent		Sink 3- sanitizer
	Spray bottles		Wrench or pliers		Towels
	Dial thermometer		Digital thermometer		Alcohol swabs

Figure 3.3–Sanitation and thermometer stations.



Thermometer calibration equipment



Sanitizer comparison materials

Hot Line Simulation

As a culminating activity, the participants assumed station assignments, in pairs, on a restaurant hot line and proceeded to prepare a hamburger with bun and garnish, plated with a cold, RTE potato salad (Table 3.4 and Figures 3.4 and 3.5). The participants were asked to demonstrate proper thermometer use, sanitation practices, proper procedures for handling PHF and RTE foods in the process of cooking and plating a meal. The participant was provided a pre-formed, 5 oz. burger patty, bun, a prepared cold potato salad, and a pickle spear. The patties were held in the refrigerated base (Continental, Bensalem PA DL2G-SS) on which the griddle, (Imperial, Corona CA ITG-36) is resting. The pickles and prepared salad were kept in cold wells of a prep station refrigerator (Continental SW48-18M-FB). Buns were kept at room temperature. Buns, patty, and pickles were Sysco (Houston TX) products. Thermometers, alcohol swipes, a bucket of Quaternary Sanitizer, (Ecolab #146), and allergen free gloves (Sysco) were also provided. The participants were instructed to cook and plate a hamburger, garnishing the plate

with a pickle and a serving of prepared salad. Instructors observed the cooking process, and provided comments and direction as needed. Participants were critiqued on their ability to organize the procedures, maintain a sanitary workstation, proper thermometer use and proper use of cooking utensils. Working together and practicing good communication skills was also encouraged.

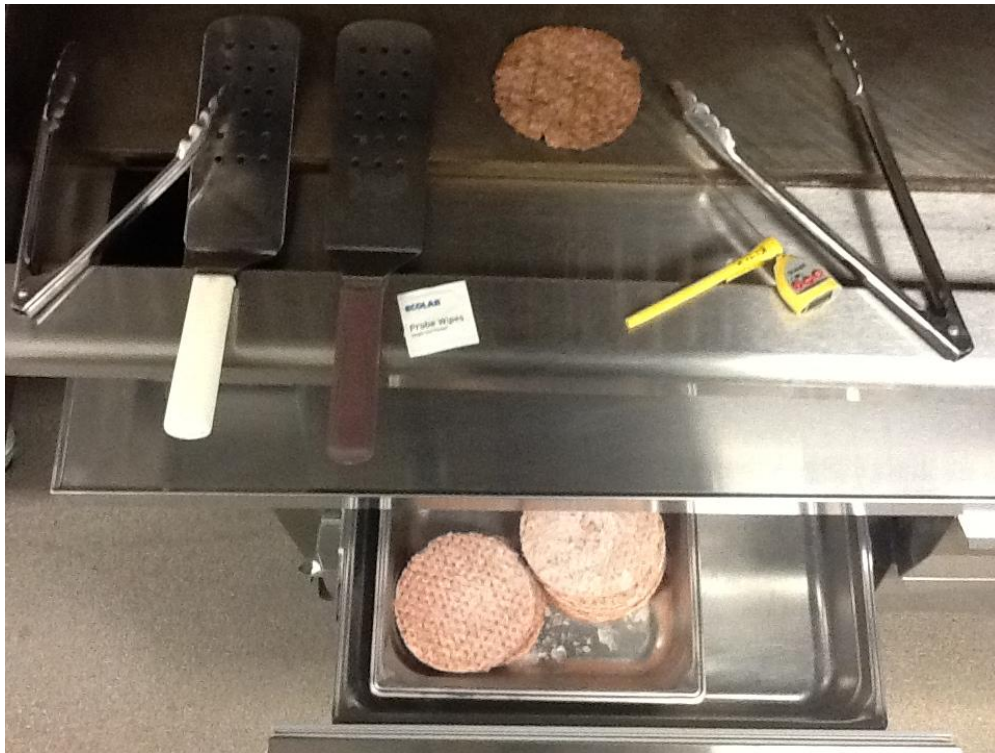
Table 3.4–Materials for cooking to proper temperature.

	Burger patties		Grill spatula(s)		Cooking equipment
	Potato salad		Tongs		Serving utensils
	Thermometers		Plates		Pickle spears
	Buns		Gloves		Sanitizer bucket

Figure 3.4–Plate set up and potato salad.



Figure 3.5–Proper cooking temperature station, griddle.



Results and Discussion

People (including adults) learn in a variety of ways. Many can do very well in traditional classroom settings, as judged by their ability to reiterate knowledge through written tests. Almost all people can benefit from experiential learning, and the hospitality industry is ideal for both the use of experiential training and those whose learning styles match up with hands-on training. The author approached this training development project with a marked bias in favor of incorporating multiple learning styles into the existing Focus on Food Safety training regimen. His successful experiences with the concept, especially the incorporation of hands-on or experiential pieces created a high level of expected success. The course evaluations showed a preference among the participants for those hands-on segments, and many called for more time with those activities. Test scores showed a marked improvement after completing the training session.

In an effort to continuously update and improve the training sessions, the group of trainers met after each session to share observations and ideas for future sessions. The

observations from the hand washing station were the most consistent, with a majority of the participants needing additional verbal instruction to achieve “clean” hands. The participants also rated this as one of the more helpful stations. The trainers spoke often of trying to elicit feedback from the participants so as to judge their level of understanding. One of the best strategies that the trainers evoked to circumvent this was to get the trainees to relate relevant incidents from their own experiences. These post-training discussions were very helpful in altering course materials and organization to make the sessions run smoother and increase the participation from the trainees. From these discussions, the streamlining the materials to concentrate on the essential message had the greatest impact on the future sessions.

An evaluation of how the test answers changed from the pre-test to post-test showed some interesting results. Of the 24 questions on the test (Appendix A), 12 were directly linked to the hands-on activities created for the training sessions. Three of the four questions that showed the greatest increase in score were questions linked to time and temperature issues. The trainees showed a marked increase in their knowledge of the temperature danger zone, cooling rates for cooked foods and proper temperatures for cooked foods.

While this training style is different from most of the programs available, the author did want to do a cursory comparison a more traditional and common training method employed by the municipal and county government agencies that make up the Mid-America Regional Council (MARC). MARC is an organization that attempts to create unified policies and practices throughout the Kansas City Metro area. The Environmental Health Food Handler Subcommittee represents those agencies tasked with food establishment inspections and food handler food safety training. These entities use a group lecture/presentation format for their training, as it is the least costly and time consuming. The training sessions last approximately 3 hours. An eight question pre-test is given to assess the participant’s base knowledge before the session starts. Upon completion of the course, and after a review and question and answer session, a 25 question multiple-choice exam is given. A score of 75% is required to become certified as a food handler.

At KSUO, four training sessions were held, with a total of 41 attendees. Cohorts ranged in size from four to 19. Participants showed an overall increase in food safety knowledge after completing the training session. All participants completed a 24 question pre-test (Appendix A) before training started, and then were tested again (24 questions) upon completion of the session.

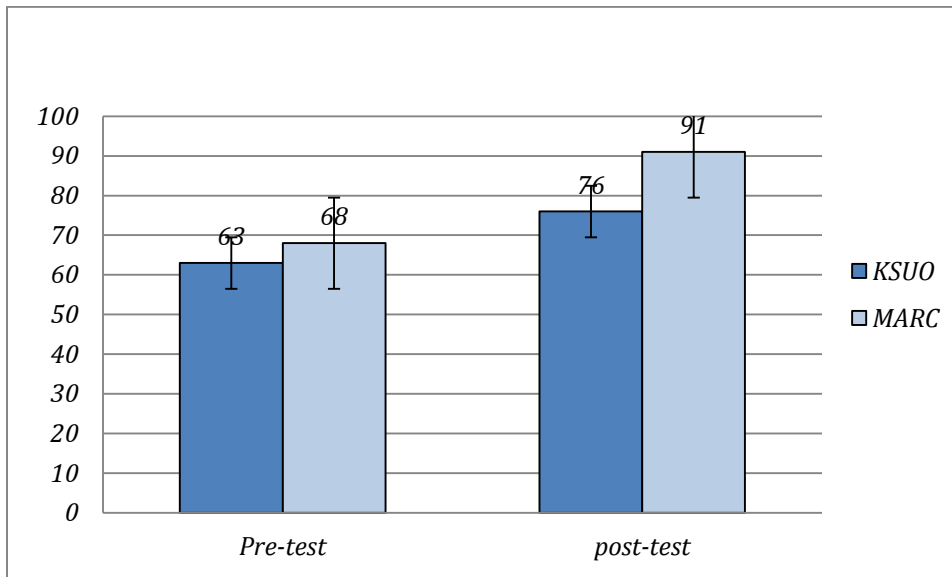
The average score on the pre-test was 63%, and the average score on the post-test was 76%, for an increase of 21%. The MARC data shows pre-test scores averaging 68% and post training scores averaging 91% for a 34% increase.

Table 3.5–Average scores before and after training.

	Pre-test	post-test	% increase
KSUO ¹	63	76	21
MARC ²	68	91	34

1. Kansas State University Olathe
2. Mid-America Regional Council

Figure 3.6 Test score comparison



KSUO=Kansas State University Olathe
MARC=Mid-America Regional Council

A statistical analysis of the test data was performed using Microsoft Excel software. A paired T-test confirmed that the increase in test scores after training was significant.

Table 3.6–Statistical summary part 1.

Variable	Observ.	Minimum	Maximum	Mean	Std. deviation
Before	41	38.0	87.5	62.6	11.3
After	41	46.0	96.0	76.2	11.2

Table 3.7–Statistical summary part 2.

Difference	-13.6
t (Observed value)	-5.474
t (Critical value)	1.990
DF	80
p-value (Two-tailed)	< 0.0001
alpha	0.05

Evaluations for the KSUO training sessions were very positive, with 94% of participants rating the trainings Excellent or Very Good. Responses to the free-write “key value/benefit of the training” emphasized increased information on food cooking temperatures, handwashing, and sanitation in general. Some of the comments follow: “...and the hand washing station was great.” “Educated me more about what needs to be done in a kitchen. How an operation should be run from a cleanliness standpoint.” “ I like getting the hands-on experience- helps me to remember it better.”

While the testimonials are nice, they only give anecdotal evidence of learning. To bring the Focus on Food Safety training results up to the level desired, a long look at each element is needed. Re-examining the presentation and how the hands-on segments match up with the information given, looking at the messaging to see if its getting the desired information across, and looking at the organization of the trainings are all areas that demand attention. There may also have been language barriers as we did not have separate trainings for non- English speakers, although all of the participants professed an ability to speak and comprehend English.

Chapter 4 - Implications and Conclusions

Test result comparison from the KSUO training sessions shows clear improvement after participating in the training session. The test results and the evaluation data show enough promise to keep working on the training program with the goal to keep improving the test outcomes and overall knowledge of the participants.

While the test question evaluation showed that some of the station activities might have made a difference in the retention of some of the concepts, other questions from the data showed some challenges for the trainers. Some of the areas that need more attention include what foods fall into the potentially hazardous category and why they do so. Developing some training pieces that address the moisture and nutrient content of various foods may help with the questions around potentially hazardous foods. The question evaluation also showed that the presentation portion of the training can be revisited to increase its effectiveness. Most of the questions that were linked to the PowerPoint session showed little increase in the number of correct answers between the pre, and post-tests.

The developing group did not make accommodations for language barriers. The registration process did not bring literacy or language issues into the open, and this is an area that bares further scrutiny. Insuring that the training message is not hampered by a participant's difficulty with English needs to be worked into all food handler training sessions. Possibilities for dealing with this issue include having translators knowledgeable in food safety are on hand during training. Working with community leaders to translate test materials into the languages of the non-English speaking participants is also a good step. The biggest challenge may be in getting the participants to admit that they are not fluent in English, or that they may need help.

The development group did not create a follow up component to the training. This would be a very informative step, showing just how much of the information from the training sessions was retained and put to use.

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Appendix A - Food Handler Test

1. **Which of the following is considered a Potentially Hazardous food?**
 - A. Baked Potatoes
 - B. Saltines
 - C. Bananas
 - D. Whole Head Romaine Lettuce

2. **Which of the following can cause food to become unsafe?**
 - A. Time-temperature abuse
 - B. Cross-contamination
 - C. Poor personal hygiene
 - D. All of the above

3. **Which of the following could lead to the contamination of food?**
 - A. Storing cleaning chemicals near food in the dry-storage area.
 - B. Putting garbage in plastic waste containers.
 - C. Using color coded cutting boards.
 - D. Washing dirty pans in three-compartment sink.

4. **To work with food, a food handler with a hand wound must**
 - A. Bandage the wound and wear a single-use glove.
 - B. Bandage the wound and limit contact with food.
 - C. Wash hands and bandage the wound.
 - D. Apply ointment and a bandage.

5. **What is the temperature danger zone?**
 - A. 35°F - 145°F
 - B. 45°F - 150°F
 - C. 41°F - 135°F
 - D. 70° F - 125°F

6. **Which food item is being stored improperly?**
 - A. Sliced pineapple stored below raw steaks.
 - B. Butter stored above raw salmon.
 - C. Raw ground pork stored above raw ground poultry.
 - D. Raw poultry stored below a raw pork roast.

7. **Which of the following food items is being thawed improperly?**
 - A. Whole chicken in a refrigerator.
 - B. Frozen fish under running, potable water at a temperature of 70°F or lower.
 - C. Frozen turkey on a prep table at room temperature.
 - D. Frozen hamburger patties on a grill while they are being cooked.

- 8. A chef is cooking red snapper fillets. What is the required minimum internal cooking temperature for the fish?**
- A. 125°F for fifteen seconds
 - B. 145°F for fifteen seconds
 - C. 155°F for fifteen seconds
 - D. 165°F for fifteen seconds
- 9. Before use, a thermometer must be**
- A. New and clean.
 - B. Clean and dry.
 - C. Sanitized and dry.
 - D. Washed, rinsed, and sanitized.
- 10. When reheating leftover chili for hot-holding, it should be reheated to:**
- A. 135°F for fifteen seconds within two hours
 - B. 145°F for fifteen seconds within two hours
 - C. 155°F for fifteen seconds within two hours
 - D. 165°F for fifteen seconds within two hours
- 11. A food handler puts a thermometer into a pot of soup that is being held hot. The reading is 139° F. Can the food handler serve the soup?**
- A. No, it is still too cold.
 - B. No, the temperature is too high.
 - C. Yes, the temperature is within the correct range.
 - D. Yes, but only after it cools.
- 12. What hazard is associated with mixing new food with food already on display?**
- A. Cross-contamination
 - B. Poor personal hygiene
 - C. Time-temperature abuse
 - D. None of the above
- 13. How long can refrigerated food that is prepped on-site be stored in a cooler?**
- A. 9 days
 - B. 3 days
 - C. 7 days
 - D. 5 days
- 14. Surfaces that touch food must be**
- A. rinsed only.
 - B. cleaned only.
 - C. cleaned and rinsed.
 - D. cleaned and sanitized.

15. **Ready-to-eat food that was prepped by a food handler must have a label that includes the name of the _____ and the _____**
- A. Food handler; current date
 - B. food; use by date
 - C. food handler; use by date
 - D. food; current date
16. **Cooked food must be cooled from 135°F to 70°F within two hours and from 70°F to 41°F or lower in an additional _____ hour(s).**
- A. one
 - B. two
 - C. three
 - D. four
17. **Food handlers should wash their hands before and after**
- A. Taking out garbage.
 - B. Touching clothing or aprons
 - C. Handling raw meat, poultry or seafood.
 - D. Using chemicals that might affect food safety.
18. **Cut melons should be stored at what internal temperature?**
- A. 41° or lower
 - B. 45° or lower
 - C. 51° or lower
 - D. 55° or lower
19. **Potentially hazardous food cooked in a microwave must be heated to**
- A. 135°F
 - B. 145°F
 - C. 155°F
 - D. 165°F
20. **All ready-to-eat PHF food that will be stored for longer than _____ hours must be labeled.**
- A. 12
 - B. 24
 - C. 36
 - D. 48
21. **A stockpot of soup that needs to cool should be placed**
- A. In the walk-in freezer.
 - B. In the walk-in cooler.
 - C. In an ice-water bath.
 - D. On a food prep table.

- 22. Which of the following items has not been stored properly?**
- A. Tableware stored six inches off the floor
 - B. Glasses stored upside down
 - C. Flatware stored with the handles down
 - D. Utensils covered for protection
- 23. A cook uses a cleaning towel to wipe up spills on the counter. When the cook is not using the towel, where should it be stored?**
- A. On the counter
 - B. In sanitizer solution
 - C. In the cook's apron pocket
 - D. In the back pocket of the cook's work pants
- 24. What should a dish washer do to make sure a sanitizer will work well?**
- A. Use extra hot water.
 - B. Add twice the amount of sanitizer.
 - C. Leave items in the sanitizer for twice as long.
 - D. Get a test kit and make sure the sanitizer is the right strength.

Appendix B - Course Evaluation

Training Course Evaluation Form					
Instructor:	Excellent	Very Good	Good	Fair	Poor
1. Knowledge of subject matter					
2. Presentation skills / delivery					
3. Well prepared and organized					
4. Answered questions carefully and completely					
5. Made the course material interesting					
Course Content:	Excellent	Very Good	Good	Fair	Poor
1. Expectations met					
2. Hands on exercises					
3. Use of class time					
4. Overall quality of course materials					
5. Flow / structure of information					
6. Overall class rating					
7. Would you recommend this course to your coworkers?		Yes		No	
8. What was the key value/benefit to you by attending this training?					
9. What recommendations would you make, if any, to improve the training session?					
Thank you for taking the time to complete this evaluation.					

Appendix C - Images From Focus on Food Safety

Focus on Food Safety

Food Safety Risk Factors

- Source
- improper cooking
- Improper Holding
- Cross contamination
- Poor personal hygiene
- Environmental contamination



Page 32

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Focus on Food Safety

DEATH BY:

- DIARRHEA
- KIDNEY FAILURE
- HEART FAILURE
- SPONTANEOUS MISCARRIAGE

**E. COLI
SALMONELLA
LISTERIA
BOTULINUM
AND OTHER COMMON PATHOGENS**



Page 33

KANSAS STATE UNIVERSITY | Olathe

Focus on Food Safety

The greatest contaminant:



Page 34

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Focus on Food Safety

How do you know it's hot?

- Touch?
- Steaming?
- Time?



Use a clean sanitized, calibrated thermometer

Page 10

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Focus on Food Safety

Your hygiene is as important as anything else in keeping food safe.

Most pathogens are easily spread by contact, especially unwashed hands

No-No's in the kitchen:

- Eating and drinking in food production areas
- Use of common towels and aprons
- Bare hand contact with RTE foods
- Open cuts and burns
- Dangling jewelry
- Nail polish
- Uncontrolled hair



Page 11

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Focus on Food Safety

Pest control

They may be cute, but they spread contaminants and pathogens



- Keep facilities clean
- Control openings to facility
- Use preventive extermination

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