

To the Graduate Council:

I am submitting herewith a dissertation written by Thomas F. Gaddis entitled "Evaluating the Effectiveness of Two Instructional Techniques for Teaching Food Safety Principles to Food Service Employees". I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

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EVALUATING THE EFFECTIVENESS OF TWO INSTRUCTIONAL TECHNIQUES
FOR TEACHING FOOD SAFETY PRINCIPLES TO FOOD SERVICE EMPLOYEES

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Thomas F. Gaddis

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DEDICATION

This dissertation is dedicated to my mother,

Verna I. Gaddis, who could not

withstand her battle with cancer

long enough to witness this dream.

I shall always remember and cherish

this magnificent parent who

unconditionally loved and believed in me

when I did not believe in myself.

Without her undeniable faith,

this accomplishment would

never have come to fruition.

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ABSTRACT

In this study two techniques for teaching food safety principles to food service employees were evaluated. The typical lecture format was compared to a computer interactive training format in terms of knowledge gained and retained as well any changes in participants' attitudes toward computer usage in their work environment. The results indicated that both methods of training provided significant gains in the amount of food safety knowledge the participant acquired throughout the process. It was determined that the computer interactive training method had some inherent advantages that could not be matched by the lecture format. These advantages included consistency, ease of operation, flexibility of scheduling, training time conservation, ability to reuse, and cost effectiveness. The computer interactive training format further was found to be acceptable by a wide demographic variety of food service employees. This study indicated that a one time use of a computer interactive training program did not effect the attitudes that employees currently held concerning the use of computers in their work environment.

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CHAPTER I

INTRODUCTION

The integrity and safety of the world's food chain has been an ever increasing topic of importance. With numerous outbreaks of food poisoning, such as the 1993 E. coli 0157:H7 outbreak on the West coast, the public's scrutinous eyes have been focused on food's origins and how it is handled. A 1994 survey on consumer's opinions of food safety revealed bacterial food poisoning and pesticide residue were of primary concern (Buzby, 1994). The food service industry also has witnessed an increasing concern for food safety. This has been substantiated by the increased amount of litigation occurring (Van Warner, 1994), and the increase in specialized liability insurance (Porchetta, 1994).

As an industry, the Jack in the Box E. coli 0157:H7 misfortunes of 1993 appeared to serve as a wake up call to the food service industry. According to a 1994 American Dietetic Association survey (Allen, 1994), one out of seven restaurant patrons felt more vulnerable to food borne illness and food poisoning than they did prior to the widely publicized Jack in the Box outbreak.

One of the most recognized solutions for maintaining the integrity of the current food supply has been through the use of Hazard Analysis Critical Control Point (HACCP). Many food service operators have identified HACCP as the methodology that public health departments will utilize as an inspection instrument in the future. While it is currently a voluntary procedure, many food service visionaries have been preparing for its certain arrival (Lorenzini, 1995).

HACCP was developed by Pillsbury in 1959 for NASA. Unlike traditional health inspection formats that rate an establishment on attributes of their physical facility, HACCP procedures were designed to evaluate the facility on how employees follow food safety procedures through the entire process for the production of food. Specifically, HACCP procedures call for the charting of the flow of food through receiving, storage, preparation, holding prior to cooking, cooking, holding after cooking, reheating, and service (Lorenzini, 1995).

The federal government also has taken an accelerated interest in the prevention of food borne illness. The mere fact that they have increased the number of meat inspectors and required safe-handling labels on raw meat is indicative of this response to public concern (Anonymous, 1994). Local governments also have shown increased concerns about food borne illnesses. For instance, the City of Philadelphia has implemented regulations that require all establishments to have a person certified in food safety on the premises at all times. This plan gave the local health department the power to certify food handlers who must undertake approximately 16 hours of training (Kapner, 1994). Some states that currently have similar plans include Florida, Wisconsin, New Jersey, and Connecticut (Kapner, 1994).

The need for food safety education is apparent. As more risks have been identified, there is a need for more education for the food service industry and for the general public (Griffith, et. al 1994). One obvious question concerning HACCP has been how to implement its use in an efficient cost effective method that also has time utility and produces tangible results. Naturally, health departments will continue to

bring current inspectors up to par for the purpose of grading facilities, but will the operators and their employees do the same? How will operators implement and teach HACCP procedures to their employees? One unique answer for this question is the use of interactive computer training. Research in other learning areas has indicated that interactive learning was more effective than the standard lecture for topics such as statistics, chemistry, and mammography (Dorn, 1993, Good, 1992, VanVuren, 1992). Business and industry have found that interactive learning is often more economical than lecture training for teaching specialized skills (Moad, 1994). Examples of this include training of customer service personnel in public utilities (Bretz, 1994), teaching interviewing skills at employment services (Holzberg, 1994), training hospitality front office personnel (Anonymous, 1994 c), and health care case study training (Gappmayer, 1994). As more people become introduced to computers at an increasingly younger age, it would appear that the lecture method of teaching is becoming outdated (Lewis, 1992).

While the advent of computer interactive training has been beneficial for many types of jobs, one has to question if it is beneficial for the food service industry? Is computer interactive training beneficial for the different types of operations within the food service industry? Can computer training be beneficial to the different types of service workers within the food service industry? These questions were the basis for this research.

The information obtained from this research had multiple benefits to several constituencies. This research compared the effectiveness of two techniques for

training HACCP-related food safety information. For the restaurant operators and owners that participated in this study, this research introduced another means to implement and teach the HACCP process to their employees. In turn, this helped the participating employees learn food safety principles for their premises and built consumer confidence concerning food safety. For consumers, successful dissemination of the applicable information helped insure that the integrity of the food supply in these public eateries was at an acceptable food safety level. From a governmental frame of reference, this research helped identify methods that the public sector also can utilize to teach new industry environmental health standards to their own inspectors so they can continually enforce the assurance of a safe food supply in public dining arenas.

The experimental portion of this research was designed to determine which method of delivery was most effective in teaching food service employees initially and for retaining the knowledge. The benefits of performing this research included illustrating how some of the components of the HACCP system work and how it helps ensure food service operations perform at a food safety level that is acceptable to the public, the government and the operators.

CHAPTER II

REVIEW OF LITERATURE

Food Safety Concerns

Concern for the state of the world's food supply is a topic of ever-growing discussion. As the public becomes increasingly aware of the causes of food borne illnesses, the number of reported cases also increases. Scientists at the U.S. Centers for Disease Control and Prevention estimated that between 10,000 and 20,000 illnesses, and between 200 and 500 deaths occur each year due to *E. coli* 0157:H7 infection (Anonymous, 1994 c). The federal government estimates that there are between 6 million and 33 million cases of food borne illness each year (Farkas, 1996). The government further estimates more than 10,000 food borne illness-related deaths occur annually (Farkas, 1996).

Consumers surveyed by the National Restaurant Association indicated three primary concerns about food. The areas of concern included fats and cholesterol in the diet, bacterial food poisoning, and pesticide residue (Busby, 1994). Similarly, Allen (1994) reported that according to the American Dietetic Association, one person in seven feels more vulnerable to food borne illness since the *E. coli* 0157:H7 incident of 1993 from infected Jack in the Box hamburgers.

A national telephone survey asked respondents questions to determine their knowledge about food safety facts and practices (Altekruse, 1996). The results indicated that more than one third of the respondents reported poor food safety knowledge and

habits, and with male respondents scoring lower than females.

While a majority of the reported cases of food borne illness have been traced to hazardous foods, there are numerous other factors that are currently surfacing as potential food safety concerns. Many food borne illness incidents have been traced to factors such as employee hygiene, sanitation of the facility, and a general lack of knowledge concerning which areas are hazardous, and which are not. This was the case when Wendy's Incorporated was handed an advisory from the U. S. Centers for Disease Control and Prevention that indicated the ice tea product served was a perishable product and had been found to be a cause of food borne illness (Quillen, 1996 a). Wendy's swiftly reacted by pulling iced tea from their menu. The management of Wendy's had no idea that tea was a perishable item and had not instructed their employees to treat it as such (Anonymous, 1996 a).

It is easy to remember the name of a restaurant that has caused a food borne illness outbreak (Zuber, 1996). Unfortunately, the rest of the industry often makes food borne illness and food safety training a priority after the tragic news about the incidents involve the actions of the competition (Bertagnoli, 1996 b).

The trend of increased incidents of food borne illness is not just present in the United States, but also is an international problem. In the United Kingdom, food poisoning cases continue to climb in frequency even though resources expended for prevention have grown (North, 1994). Similarly, the Mexican government has enacted legislation to establish standards for food safety. The push for this act came directly from a joint effort of the Ministries of Tourism and Health (Barker, 1996). Several Latin

American countries such as Venezuela are implementing food safety and health education programs for vendors and consumers (Arambulo, 1996).

Expense and Liability of Food Borne Illness

The costs associated with food poisoning are staggering. While the loss of revenue for a business can be severe from the negative publicity associated with a food borne illness, it can be minute in comparison to the costs of insurance, legal fees, and compensatory damages often associated with law suits involving pain and suffering. These costs can be extreme, but they pale in comparison to costs associated with a death due to food borne illness (Anonymous, 1995 a). Foodmaker, the parent company of Jack in the Box, had to sell its highly successful Chi Chi's chain to maintain financial liquidity after the 1993 outbreak of E. coli 0157:H7 (Allen, R. E., 1994). Three years after the E. coli 0157:H7 outbreak, Jack in the Box has become a crusader for higher standards throughout the entire food service industry (Bertagnoli, 1996 a). The example Foodmaker is setting includes a greatly increased training budget that dwarfs past efforts. How long this expense will take to reap rewards toward a better reputation remains to be seen (Bertagnoli, 1996 a).

The issue of fault has grown so much since the Jack in the Box debacle that scientific research has focused on ways to prove cause and blame for food borne illnesses, while other businesses have found new areas of opportunity (Gorham, 1989). E. I. Dupont has developed a device called Roboprinter that can extract the DNA out of insect cultures and compare it to a stored memory to determine matches (Anonymous, 1995 b).

In today's litigious society, it is likely that this technique will become a basis for proof in litigation stemming from food poisoning cases (Bryan, 1996). This type of proof will be expensive for individuals to pursue for illness suits, but will prove vital in wrongful death cases as it will enable the courts to determine cause even if the villainous organism does not produce its toxin until after it is eaten (Greenhalgh, 1994).

Insurance companies have recognized this new concern and now offer liability insurance for organizations who utilize food service operators in their special events. The Tournament of Roses organization is one client that carries special insurance to cover itself should an outbreak of food borne illness occur during events (Porchetta, 1994). While the legalities concerning risk and responsibility have been aimed at business, it is vital to remember that owners and consumers have responsibility to help prevent food poisoning (Van Warner, 1994).

Need for Food Safety Education

In spite of public concerns, food borne illnesses are on the rise and education is needed to prevent them (Griffith, 1994, Lynn, 1996). Only through continuing education and public and private efforts will individual's habits be changed so that systems to prevent food borne illnesses actually work. The topic of educating the industry and the public are of prime concern to professional organizations and members of industry (Anonymous, 1994 a). Several industry leaders, such as John Farquharson, have opted to leave their executive duties to be involved in food safety education on a full-time basis (Romeo, 1996).

Professional organizations, such as the National Restaurant Association, have taken the E. coli 0157:H7 tragedy on the West coast and used it to launch continuing education programs for the control and prevention of food borne illness (Martin, 1995, Anonymous, 1996 b, Walkup, 1994). These efforts have presently certified over 500,000 food service managers in the ServeSafe program (Lorenzini, 1996). The ServeSafe training emphasizes personal hygiene, food borne microbiology, food handling and preparation, and sanitation (Barrett, 1996, Sykes, 1996). Similarly, members of the processing industry have called for the need to use a documented system of quality assurance to ensure that the sacred trust between themselves and their customer's health remains intact (Mead, 1994, Schaffner, 1991).

HACCP System

One of the most discussed systems of managing food borne illness is Hazard Analysis Critical Control Point, commonly known as HACCP (Bryan, 1988). HACCP was developed by Pillsbury in 1959 for NASA's space program (Sanson, 1996 b). It is a system that provides a structured method for food service operators to combat food borne illness as prescribed in the 1993 Food Code's Food Safety Recommendations (Lorenzini, 1995 b).

HACCP is actually a process established to identify and control three types of contaminants (Beasley, 1995). These include microbial contaminants, chemical contaminants, and physical contaminants (Carrera, 1996). HACCP consists of a series of steps that identify and evaluate hazards, review employee cleanliness, hygiene, and

health practices, and evaluate food purchasing and storage, food preparation, and food serving (Lorenzini, 1995 a). This is important because unlike other food safety training, it focuses on preventive controls rather than post-problem reactions (Sanson, 1996 a).

The significance of the HACCP system lies with its relationship to the safety of the food chain. Fred Shank of the Center for Food Safety and Applied Nutrition for the Food and Drug Administration has been quoted as saying food safety is generally sound (Christine, 1994). However, Shank warned that changes in processing methods and the globalization of the food supply pose potential problems for the future of food safety. Again, the demand for a food safety system is continuing to grow.

Although HACCP was first introduced in 1959 as a project for NASA, several differing interpretations will be needed for different members of the food industry. For instance, grocery retailers, food processors, and restaurants will all have differing HACCP systems, but each will have elements that are remarkably similar (Stevenson, 1993).

While the need for different interpretations of HACCP exists, there are seven steps that every HACCP system requires. Step one is to identify hazards and assess their severity and risks. Step two involves determining critical control points in food preparation. Step three requires that critical control limits be established for every critical control point. Step four is monitoring of critical control points and recording data for each. Step five is to take corrective action each time a critical control limit is exceeded. Step six promotes reliability because it includes establishing effective record keeping systems to document the HACCP system. Step seven builds validity because it requires

the establishment of procedures to verify that the HACCP system is working (Norback, 1993).

While the aforementioned steps are critical to every HACCP system, members of the seafood industry have recommended two additional steps to help implement a HACCP system. The seafood industry stated that to introduce a successful HACCP system, there must be a team approach taken by all members of the company and the development of flow charts for each product to ensure that no areas of potential danger are missed (Anonymous, 1994 e).

Mandatory Enforcement

Until recently, there were no official requirements for businesses to utilize a HACCP system. For several years Congress failed to enact any seafood safety legislation (Otto, 1997). This occurred primarily due to lobbying from some members of the industry and forced the FDA to affect change administratively (Anonymous, 1994 e). In 1994 U.S. Secretary of Health and Human Services, Donna Shalala, announced that the FDA would require the seafood industry to base its food safety procedures on a HACCP system. The seafood processing plants now are inspected to ensure compliance with the established controls. The industry has supported the system, because it is designed to eliminate the causes of food borne illnesses for which their businesses could be held responsible (VanWarner, 1994). The acceptance by this segment of the industry is not surprising as the National Fisheries Institute always has been a proponent of mandatory inspections and the notion that a properly executed HACCP system gives the seafood

industry deserved credibility for its efforts in food safety (Lewis, 1995, Allen, R. L., 1994).

One significant aspect of the FDA's move to require seafood producers to write HACCP plans is that it sets a precedent for federal monitoring of food adulteration. Over 5000 seafood processing plants will be affected by this move, yet it appears that the industry welcomes it (Williams, 1994). This action is legally justified by the Food, Drug, and Cosmetic Act so any company that does not submit a HACCP plan could have its food declared adulterated (Kushner, 1994). Already, many members of the meat and poultry industry are developing HACCP plans that have an emphasis on temperature measuring technological advances for their processing plants (Hodges, 1996).

One debate concerning the mandatory enforcement of HACCP procedures lies with the question of who will enforce its use? The food safety or public health system is different in different localities. Some states have county programs that are exceptional in their knowledge and level of expectations (Moore, 1990). Other states question the effectiveness of their state wide programs concerning food safety (Kneller, 1990). Other constituencies, including operators and patrons, prefer a federal approach to compliance in order to have a widely accepted set of standards (Allen, R. E, 1994).

With this momentum, there is little doubt that HACCP is about to arrive in the food service industry. Already, the system is being hailed by professional organizations. The Institute of Food Technologists has proclaimed HACCP to be a winning proposition for the food industry, because it avoids risk rather than detecting it after the fact (Newsome, 1994). HACCP also has been the primary topic of tele-conferences produced

and administered by the National Association of College and University Food Service at East Lansing, Michigan. Currently, the FDA and USDA are soliciting opinions from industry concerning the extent of implementation, accessibility of records to the public, and avenues for consumer complaints (O'Donnell, 1994). It appears that HACCP is going to materialize throughout all facets of the food industry.

Resistance to HACCP

Although there has been much positive press concerning HACCP, there are some natural concerns. The Grocery Manufacturers of America are fighting the implementation of HACCP stating that it is an imposition of additional food safety regulation. The Grocery Manufacturers contend that the previous safeguards are sufficient to ensure a safe food supply (Ostroff, 1994). Other factions argue that the forced incorporation of HACCP plans will prove to be too costly for small businesses (DeLuca, 1996). Legally, this small business hardship could prove to be a deterrent to the growth of HACCP if it can be proven that HACCP is cost prohibitive and detrimental to small businesses (Kushner, 1994).

Members of the processing industry have similar opinions. The American Meat Association (AMA) has filed suit to ban the USDA from testing meat for E. Coli 0157:H7. The AMA rationale is that their meats and facilities already are inspected at their expense by the USDA (Kramer, 1996). They contend that the addition of another agency to be accountable to will mislead customers concerning safety of their products and increase operating costs which will be passed on to the public (Anonymous, 1995 c).

Another form of resistance to HACCP will come from the restaurant industry. Many small operators will claim the expense to be too great to undertake (McLaughlin, 1994). Others will wait for the larger chains to develop programs that can be duplicated or transformed. The worst case will be those who will ignore the probable enforcement of HACCP procedures until they have an outbreak (Quillen, 1996 b).

HACCP In Restaurants

Most of the applications for HACCP currently are tied to the food processing area of the food industry. However, it is expected that retail suppliers including restaurants and groceries will be forced to comply with a HACCP system (Dowdell, 1995). HACCP is being considered as the restaurant inspection program of the future, because it deals with production procedures rather than facility cleanliness (Lorenzini, 1995 c). Most food processors envision HACCP as a positive step for the improvement of safety in the food chain. Food processors also feel that restaurants should be held responsible for the same form of inspection, since its purpose is intended for the same goal (Lewis, 1995).

It appears that the restaurant industry is making plans for the positive initiation of HACCP procedures as indicated by the growing amount of educational programs being promoted by professional organizations such as the National Restaurant Association and the American Hotel & Motel Association. The first known restaurant to be certified in compliance was the Atlanta Fish Market at Atlanta, Georgia (Sanson, 1995). The restaurant enrolled six members in a two-day conference held by the U.S. Department of Commerce. The cost for participation was \$295 per person. Six members were selected

because a HACCP certified operation must have a member on duty who has passed the certification course. After the members had passed the course, the restaurant was inspected for a period of two days versus the hour typically utilized for a conventional health inspection.

Upon passing this inspection, the restaurant was upgraded to a level 4 approval. This level calls for an inspection every two weeks until the establishment has been passed two times in succession. At this point the restaurant became a level 3. From this level, the establishment was inspected every month until it passed two in a row. After this accomplishment, the Atlanta Fish Market was raised to level 2. The inspections then came at a rate of every other month. Once the restaurant passed two inspections in succession, the rating was raised to level 1. The level 1 restaurant gets inspected every six months. It was important to note that each of these inspections cost the Atlanta Fish Market \$500 each. The management company that operates the Atlanta Fish Market felt it was important to be on the cutting edge of this methodology so they could keep their reputation with customers intact. In fact, the restaurant used the certification as a marketing ploy by advertising the "safest seafood in America" (Sanson, 1995). In similar fashion, Ryan's Family Steak Houses and Hooter's of America have already proceeded to adopt HACCP procedures and incorporate the needed changes into their facility designs (Sanson, 1996 a).

HACCP Effectiveness Research

The overall acceptance of HACCP procedures has not come without the burden of

proof. Although specific test information resulting from HACCP's creation for NASA is still classified, there has been other reported research utilizing HACCP procedures that validates its worth. At the University of Manitoba, Powell (1994) introduced and utilized HACCP procedures in a poultry processing plant. These results indicated decreased bacteria in the emulsion chiller procedure every time there was an increase in the monitoring procedure (Powell, 1994). At the University of Alberta, HACCP procedures were used in the processing of ground beef. Again, there was a decrease in bacteria count once the critical control points related to employee hygiene, time/temperature relations, equipment sanitation, and packaging procedure were monitored effectively (Zagrosch-Miller, 1991).

Look (1993) of the University of Oregon, examined food service manager awareness and perception of risk and evaluated a HACCP-based program of food tampering hazard reduction. The initial phase of the study examined awareness and descriptive information concerning the managers and their facilities. The second step evaluated a workbook developed with a pre- and post-test for experimental and control groups. Look found that while more noncommercial food managers had college education, there was no significant relationship between education and food tampering concern. Managers with self service items showed a greater concern for food tampering than did those with no self service. Look found that with increased awareness via the use of the work book, managers demonstrated greater concern and greater ability to identify critical hazards while those in the control group did not.

Food Safety Training

Look's research emphasized another issue of great importance in the pursuit of a safer food supply. This issue revolved around food safety training. Recently, the city of Philadelphia established the requirement that every food establishment have a person certified in food safety on the premises at all times of operation. The city went a step further by establishing that the city's Department of Public Health be empowered to certify food handlers, conduct inspections, and give fines for violations (Kapner, 1994). Similar programs have been established in Florida, New Jersey, Washington State, and Connecticut. The state of Missouri has gone so far as to proclaim a food safety and sanitation day (Rousseau, 1996).

Publishers, such as Restaurants and Institutions, are trying to contribute in their own way by offering published generic training articles to enhance the importance and ease the implementation of food safety training (Berne, 1995). Food safety training is vital to the restaurant industry throughout the world and also is needed in non-restaurant settings abroad. While the British government issued regulations concerning food safety in 1994, neither how the training should occur nor how it should be evaluated were stated (Smith, 1994).

Although there is a lack of documented evidence of improvements in food safety practices that can be linked directly to education or training, it is reasonable to argue that the training of this nature in the class room is inferior to that taught on or near the employees job area (Rennie, 1994). The typical food safety and HACCP training format includes lecture, videos, employee handbooks, and leadership materials. These

products are used because they are relatively inexpensive and familiar to all (Anderson, 1994). It is important to note that these materials provide little or no involvement by the employee during the learning process. This fact leads to the idea of teaching food safety and HACCP procedures through the use of interactive learning.

Public Acceptance of Computer-Based Learning

The acceptance and popularity of computers and computer-assisted training indicates that the public currently is ready to accept and enthusiastically enrich their learning habits through the use of computers. A recent Gallup survey indicated that 25% of American households have computers (Belsie, 1992). The survey also stated that 78% of parents who own or plan to buy a computer think it will enhance their children's school performance. The public clearly recognizes the computer as a catalyst between the information and the student, which thereby generates learning (Lewis, 1992). High tech teaching is becoming increasingly common. Even the Christian Science Monitor openly recognizes that high tech attracts the human interest (Belsie, 1992). Teachers often argue that the teaching usefulness accomplished via interactive learning is rote type learning (Bulkely, 1992). It should be noted that several areas of teaching base it successes on rote learning.

Interactive Learning

Interactive learning could prove highly successful for the training of HACCP procedures. John Carney of Carney Interactive stated, "interactive learning is a body of

knowledge coupled with computer hardware and software that emphasizes the interaction between the individual and the learning device" (Benjamin, 1995). The computer-based method is both logistically advantageous and superior for teaching. Because there are increasingly fewer large companies that have the human resources to solve all the training needs they might desire, the use of shared interactive training can be paramount to success in training demands (Mapes, 1996).

Logistically, a portable system can be taken to remote sites and can be implemented during lull periods (Gerencser, 1996). This allows employees to be on the job site so they could handle problems that might occur. The cost of the training is very low once the program is established, because the trainer can go to the trainee rather than the reverse (Fisher, 1993). The Fannie Mae organization has utilized computer-based training economically for some of its training requirements (Moad, 1994). The cost associated with CD ROM and the price of video interaction have decreased to the point that many associations are utilizing this method (O'Conner, 1995). The quality of instruction remains consistent since there are very few variables to account for, such as trainer turnover.

Interactive training also has some learning advantages. These include the fact that it is self-paced, provides immediate feedback, is more effective with low achievers, and can be modified to provide for remedial instruction based on the learners' needs (Fisher, 1993). The fact that most CD ROM interfaces are extremely user-friendly contributes to the high degree of user acceptance it currently enjoys (Holzberg, 1994).

There are several instances where interactive training has been utilized. The city

of Los Angeles uses computer-based learning to train their customer telephone service personnel, because it is the most effective method in terms of cost and results (Bretz, 1994). The American Hospital Association has used interactive training successfully for presentations of case studies and debate purposes (Gappmeyer, 1994). Nearly every pilot with a major airline is trained with the aid of an interactive flight simulator. This is done to save expense and avoid potential danger and loss of life. Both appear to be good reasons to utilize interactive learning for other topics (Phillips, 1996).

In the hospitality industry, numerous hotels have utilized interactive training both for their in-house training purposes and a means to build sales by offering the interactive training service as a part of the conference package. Being a leader in cutting edge technology has proven to be the difference in commanding conference sales and observing them (Anonymous, 1994 c). In Canada, Ault Foods LTD has converted their entire customer service applications to an interactive system. While extensive training was required to adapt "food" people to the new system, the results indicated a successful venture (Peverett, 1994).

Research Concerning Interactive Learning

There have been numerous instances where interactive learning has been used in business and education. Whether or not interactive learning is really an improved teaching method or a fad is one question that arises. The findings of the following studies are indicative of the perceived learning improvement believed to be associated with interactive learning.

Kelly (1993) conducted dissertation research concerning the effect of interactive learning with nontraditional students. Kelly compared interactive learning to other learning methods. Although the results were statistically inconclusive, the grades and the student self-ratings concerning learning were positively affected by student involvement levels.

Foss (1995) performed a study at the University of Georgia using an interactive computer program to illustrate cholesterol metabolism to nutrition students. The results of this study clearly indicated that students taught via the computer interactive program had significantly higher knowledge of the subject matter than did those who learned from conventional teaching methods.

At the University of West Virginia, Roberts (1993) utilized an interactive computer-assisted system to teach conceptual predictive technology concepts. The results of this study indicated significantly higher post test results occurred within the interactive group than within the control group. The apparent success of these studies utilizing computer interactive learning indicate the teaching methodology is an improvement to other traditional methods.

Summary

Public concern for the safety of the food supply has never been greater than the present. The development and implementation of HACCP systems could affect the safety of the food supply positively and alleviate much public concern. The food service industry is preparing itself for the arrival of mandatory HACCP requirements. Teaching

the HACCP methods to restaurant managers could be enhanced by the use of an interactive computer-based learning system. The public has become more accepting of interactive computer-based learning and there is significant proof that interactive learning works better for certain subjects than does conventional teaching methods. The obvious question is whether or not computer-assisted interactive learning is a more effective means to train HACCP procedures, and is it applicable to all facets of the restaurant industry.

Objectives of the Research

The purpose of this study was to examine and determine effective methods of training HACCP procedures to food service employees.

The researcher followed the following steps:

1. developed a scripted lecture format to train HACCP procedures to food service employees;
2. performed both lecture training and computer interactive training on selected participants for the purpose of knowledge improvement analysis;
3. comparatively analyzed the knowledge gained using lecture training versus interactive computer training in terms of both initial knowledge gained and knowledge retained;
4. utilized a computer attitude survey to determine if computer attitude factors affected the knowledge gained for the food service participants;
5. determined if significant differences existed between school food service employees and quick serve restaurant employees concerning the HACCP knowledge gained and retained;

6. determined if computer attitudes were significantly different for the food service personnel tested in terms of their type of food service establishment; and
7. determined if demographic factors had an effect on knowledge gained and retained and on computer attitude scores.

CHAPTER III

METHODS

Definition of Terms

The following definitions will clarify understanding of this research study:

HACCP: Hazard Analysis Critical Control Point, the process developed for NASA in the 1950's to 1) analyze food items from their natural state throughout their evolution of preparatory steps to consumption to ensure that all critical areas are monitored and 2) to ensure that food safety practices and precautions are not omitted.

Interactive Training: training that, by design, requires the participant to interact to facilitate the lesson process.

Food Safety: the practice of preventing contamination of the food supply by implementing preventative measures.

Development of the Computer Interactive Training Software

The development of the computer interactive training software was a complex endeavor. The initial development of the computer interactive training software began with the University of Florida working in cooperation with the Florida Restaurant Association and with funding from the USDA. The University of Florida staff members were assisted in the development of the script by two professors from the University of Tennessee. This was done to ensure that the standards set forth in the training were

applicable in other states as well as Florida. Information utilized in the training software development was chosen so that it would coincide with nationally recognized codes and procedures.

The initial goal of the computer interactive training software was to develop a means to teach HACCP procedures. However, it was soon recognized that the immediate need in the industry was for food safety procedures. Just as an infant must learn to walk prior to running, so too must restaurant employees learn food safety basics which are components of HACCP. Once this knowledge is gained, the food service facility can move to the next step in operating a full-fledged HACCP system. The importance of regular record keeping was stressed throughout the training information so that it could be utilized as a stepping stone for future, in-depth HACCP training.

Once the script and the interactive software were developed, the end product was choreographed and assembled into a CD ROM format. The assembled computer interactive training software consisted of 10 separate sections each dealing with different topics concerning food safety. The complete software program required approximately 45 minutes to complete. The sections, as visualized in Appendix 1, were formatted such that one was automatically followed by another until all were covered by the participant. The program also allowed an individual section to be revisited when there was a desire or need for further training on a specific area. This option could be initiated by the clicking of the mouse cursor on the individual section.

All separate sections included numerous digitized still photographs included for the purpose of visual interaction with the verbal lesson. Many of the pictures illustrated

changes that visually demonstrated the verbal facts of the lessons. For instance, the growth of bacteria on the skin was illustrated by an empty petri dish followed by a contaminated petri dish that showed colony growths resulting after time had expired.

Each section also had interactive exercises or test questions that showed a picture and asked multiple choice questions concerning the previously explained lesson. The participant had to answer the question by clicking the mouse cursor on the correct answer. If the answer given was incorrect, the computer emitted a buzzing sound indicating the error; otherwise the computer made a soft bell sound and proceeded in the program. If the participant's first choice was incorrect, the individual was given a second chance to answer the question. If it was answered incorrectly a second time, the computer automatically buzzed, and simultaneously highlighted and verbally announced the correct answer and the reasoning for it.

Interactive segments of the software were found in specified sections of the program. For example, the storage section emphasized the order that refrigerated goods should be stored on shelves. When the verbal section was finished, an interactive exercise appeared rather than a multiple choice question. In this case, the participant was directed into the walk-in cooler and shown a pallet of food items. The participant was asked to click on and drag the items and place them on the appropriate storage shelf positions. This interaction visually simulated the physical placement of the food items.

The completed computer interactive training software in its CD Rom version required the equivalent of a DOS based micro-computer system equipped with no less than a 486 microprocessor and Microsoft's Windows software fitted with Quicktime to

insure a clock speed sufficient enough to move the graphics within the HACCP software. Upon its completion, the CD disk was shipped to the University of Tennessee at Knoxville to be tested in actual restaurant settings.

Development of the Lecture Format

The lecture format was developed directly from the information contained on the computer interactive training software. Much time and effort was exerted searching food safety codes for the purpose of verifying that the information used in the computer interactive software was in compliance with the local standards where the comparison data were to be collected. Any variances from the local codes were reviewed against the most current National Restaurant Association educational information. Any discrepancies identified were noted and the specific information was omitted from the test questionnaire instrument. Extreme care was taken for the purpose of disseminating consistent information, therefore the information that was on the computer interactive training software program was incorporated exactly into the lecture script.

The lecture format included the use of a 26 page workbook given to each of the participants in the survey (Appendix 2). The information in the workbook was developed to coordinate exactly with the computer interactive training software in terms of information and order of format. It was important in this step to ensure that the verbal information clearly coincided with the computer interactive training software. This precaution was taken to ensure a reliable comparison. The workbook used several of the same still pictures visualized in the interactive software version of the information.

A verbal explanation of the pertinent material was given in a scripted lecture format, while the participants followed along in their workbook. The script was developed to ensure the lecture was reliably delivered for all the lectures given. The lectures also included specific examples from the participant's work environment.

Development of the Survey/Test Instrument

To compare the two teaching methods sufficiently, a survey questionnaire was developed that included a set of 25 multiple choice questions and specific demographic questions (Appendix 3). The multiple choice questions were developed from information identified in the lecture script. The questions were further evaluated by a group of food safety experts consisting of four professors and two food service operators. This was done to ensure face validity.

The questionnaire was pilot tested with a group of college students and a group of college food service employees. Each question was analyzed to see if a high percentage of individuals either missed the question or answered it correctly. The questions that were identified as either too easy or difficult, or not clearly explained in the lecture information, were eliminated and replaced with other questions. Similarly, during the pilot testing the participants were asked on a separate sheet to identify any questions they had difficulty understanding and any comments they had concerning the format and layout of the instrument. After the initial changes were made, the pilot testing procedure was repeated. Again adjustments were made to questions identified as too difficult or too easy. A third pilot test and subsequent adjustments were performed with college students

and college food service employees before a final survey instrument was completed and printed for data collection.

Computer Attitude Survey

In addition to the food safety questionnaire, a separate instrument was utilized to determine if the participant attitudes concerning computers changed after the training involving the interactive software was implemented. The computer attitude measurement instrument was developed by Gressard and Loyd (1984) and has been successfully tested for accuracy, reliability, and validity (Appendix 4). Essentially, the attitude scale consisted of a Likert style instrument that used thirty statements to measure three components that make up computer attitudes. The scale utilized four points ranging from strongly agree to strongly disagree.

The three components tested were computer anxiety, computer liking, and computer confidence. Each component was represented by 10 statements. The item responses were coded such that a higher score indicated a lower degree of anxiety and a higher degree of confidence and liking. Each individual component had the possibility of a score ranging between 10 to 40. Once the three component scores were determined, they were added together for each individual for the purpose of a total computer attitude score. The total score could range between 30 to 120 points. The higher the total score, the more positive the attitude was towards learning about or using computers.

Sample

To acquire sufficient data concerning the effectiveness of the differing teaching methods, different types of food service operations and employees with different demographic characteristics were used. This step allowed for a diverse group of participants as based on their age and food service experience to be examined. The initial set of participants for data collection were employees of a local quick serve restaurant chain. The quick serve restaurants chosen for this study had the following characteristics: limited menu, a relatively small amount of food service equipment, a small back of the house area, few service and production employees, and lengthy hours of operation. Full support was given by the owners of the company. This proved vital as a sense of importance was demonstrated at every unit visited. The criteria set forth for a unit to be selected for participation was that the unit have at least six to eight employees that could be available for a limited time for as many as three consecutive weeks. Because these units were small in staff numbers, the six to eight participants ensured a good mix of all employee job descriptions from each unit.

All stores were chosen randomly from the company's list of qualifying stores. Two stores were selected to be control units in the experimental design. The survey instruments for these stores were coded to represent the non-treatment control units. In similar fashion, two stores were chosen to be lecture units and two stores were chosen to be computer interactive units. The survey instruments for these units were coded to represent lecture scores and computer interactive training scores, respectively. After the restaurant sample was determined, the participants numbered 43 individuals.

The second set of participants represented institutional food service in the form of

school food service. School food service was selected based on its characteristics that differ from the quick serve operation. These characteristics include: an expanded menu, large amount of food service equipment, large facility capacity, numerous production and service personnel, and limited hours of operation. This choice offered a very different type of participant than did the quick serve restaurants.

For the research concerning school food service employees, a sample of three schools each from two different counties were selected and utilized for each of the three treatments. Employees from one school from each county served as control groups. Employees at one school from each county were randomly chosen as lecture group participants and participants from one school in each county were chosen to receive the computer interactive training treatment.

The criteria for the chosen participation of a school included that the school have its own operating kitchen versus a satellite operation, a total of six to eight employees, and operating hours for the semester that were typical of the average school year. Six to eight of the same people from each school participated in the process from beginning to end. The participants from the school food service sector amounted to 41 employees.

Intervention and Data Collection

To collect the data needed to compare the effectiveness of the instructional methods, a three-step process was followed. The first step in this process included a pre-test examination for all participants and completion of the computer attitude survey. This was the initial step where the participants were introduced to the researcher, who offered a brief

explanation of the purpose of the experiment and a confirmation concerning their anonymity throughout the process.

The second step involved implementation of the intervention treatments, which immediately was followed by a post-test examination and a second computer anxiety survey. This step occurred approximately seven days after the initial pre-test was given to each group. The purpose of this step was to collect data to see if there was any knowledge gained immediately after the treatment was given, and if there was any change in their attitudes about computers.

The control groups received no intervention during the second step. These groups received only a second knowledge exam and a second computer anxiety survey. This group received the post-test to determine if there was any knowledge gained by virtue of the fact they realized they had some food safety knowledge deficiencies and sought out the information on their own.

The lecture groups received a 35-minute lecture that included the previously described information booklet for the participants to follow with the speaker's explanations. Each lecture was given by the same speaker and was video taped to be analyzed for consistency. It was important to note that the lectures were given in each unit in an area where the participants would normally be trained. This allowed the lecturer to point out meaningful examples to the individuals. Approximately 10 minutes were given at the end of the lecture for the individual to review the information booklet prior to the beginning of the post-test exam and their second computer attitude survey. This brief study period allowed the treatment times to be equal.

Each participant of the computer interactive training group was given a 45-minute session with the software on a DOS based lap-top computer. Every participant in this group received brief training concerning the use of the computer and its peripherals, such as the external speakers and the external mouse. This introduction to the computer training lasted slightly less than one minute. The computer session also was performed in the work areas of the specific units. This was done to ensure consistency between treatments. When the participants were finished with the session on the computer, the individuals were given their post-test exam and second computer anxiety survey.

The third step was performed to determine if any knowledge gained was retained one week after the treatment. Only the computer interactive training group and the lecture group received the third step which required them to take a third knowledge exam one week after the treatment session. This exam was termed the retention test.

Data Analysis

The Statistical Analysis System was used for all analyses (SAS, 1987). A probability level of 0.05 was used for all tests of significance. Once the data were collected from the sample groups, it was entered into the computer system. The data sets were printed on hard copy and double checked against the test documents for accuracy.

Once the data were determined to be entered correctly, frequencies and means were determined for all variables. Individual test questions were assessed by means and frequencies to determine if the teaching methods were deficient concerning a specific subject matter.

The separate data sets for quick serve restaurant participants and school food service participants were sorted by intervention method, such as control group, lecture group, and interactive group. Group means and frequencies were determined for descriptive analysis. Knowledge gained or lost from pre-test to post-test, post-test to retention test, and pre-test to retention test were determined for each group. Similarly, the computer attitude factors were grouped by intervention methods to evaluate the anxiety, liking, confidence, and total attitude changes from pre-test to post-test.

The univariate procedure was utilized to perform paired t-tests to determine if knowledge gains and anxiety differences were significantly different from zero for the individual participants. Analysis of variance was utilized to evaluate if knowledge and anxiety differences existed between participants within the differing intervention method groups with respect to the type of food service operation. For example, the question of whether or not there were significant differences in the posttest knowledge gained by the lecture group as compared to the computer interactive group and the control group, from either school food service participants or quick serve food service participants, was one answer sought through this procedure. Similar questions concerning the differences between pre-test knowledge, post-test knowledge, and retention test knowledge, with respect to the intervention training methods within either type of food service establishments were examined by use of this procedure. Further analyses concerning differences between the three computer anxiety factors and their totals as separated by intervention training method and food service establishment type also were investigated.

Once this information was determined, Spearman's correlation coefficient was

utilized to determine if significant relationships existed between knowledge and anxiety differences among demographic factors such as age and work experience. After this procedure was performed on the data for quick serve restaurants and school food service participants as inclusive groups, it was again performed within the groups broken down into subsets determined by the intervention treatments in an effort to determine if any of the correlations existed or changed when the data were separated by treatment type.

CHAPTER IV.

RESULTS AND DISCUSSION

Quick Serve Restaurant Participants

The sample studied from quick serve restaurants included participants from 6 different units of a privately-held company based in the East Tennessee area. Four of these units were company-owned, while two units were franchise-operated. The total sample consisted of 43 individuals. Because the participating company had a small labor per sales dollar ratio, this figure represented a majority of the individuals employed at each unit. Each participating unit began the data collection process with six to eight participants. Every unit, with the exception of one, had every participant complete the program that started the process during the first step. The information from the one participant at that unit was deleted from the data set.

The majority (58.5%) of the quick serve restaurant employees were under 21 years of age (Table 1). The remainder of the sample were all under 50 years of age with 21.1% being between the ages of 21 to 30 years and 13.2% between the ages of 31 to 40 years. Most of the employees in the quick serve restaurants were teenagers who are getting their first taste of employment and the food service industry.

The sample primarily consisted of female participants (69.3%) versus male participants (30.7%), all of which had little food service experience (Table 1). Over 95% had less than 10 years experience, while 71.1% had worked in food service for less than three years (Table 1). This ratio is typical of the quick serve restaurant segment of

Table 1. Demographic characteristics of quick serve restaurant participants (n=43).

Characteristics	Percentage of respondents	Frequency ^a
<u>Age (years)</u>		
under 21	58.5	25
21-30	21.1	9
31-40	13.2	6
41-50	7.0	3
51-60	0.0	0
over 60	0.0	0
<u>Gender</u>		
Male	30.7	13
Female	69.3	26
<u>Food service experience (years)</u>		
Less than 1	46.5	20
1 to 3	24.6	10
3 to 5	12.3	5
5 to 10	12.3	6
10 to 20	4.4	2
Greater than 20	0.0	0
<u>Job type</u>		
Management/Supervision	38.6	17
Food service worker	61.4	26

^a Totals within characteristics may not equal 43 due to incomplete questionnaire responses

the food service industry. Because of the long and normal late night and weekend operating hours, very often the employees have no previous work experience and are getting their first job experience.

In spite of the apparent lack of experience, a large percentage of participants (38.6%) stated they were in a supervisory role within their assigned job duties (Table 1). This statistic is common within the quick serve restaurant industry because of the severe shortage of qualified labor. This labor shortage and the subsequent shortened time frame prior to one becoming involved in supervision can account for the poor level of food safety knowledge typically identified with this sector of the industry (Altekruse, 1996).

When a company has a strong need for people who can lead others, the opportunity normally arises very quickly for those who demonstrate this ability regardless of their age or experience. The fact remains that quick serve restaurants, by definition, must produce and serve food in a short time span which requires a very structured environment where standards are paramount to success. Following these standards can spell success for most quick serve establishments. However, too much emphasis on the financial standards in lieu of concentration on food safety standards can lead to food borne illnesses in restaurants that are deemed successful in other terms (Bertagnoli, 1996 a).

In general, the quick serve dining establishments appeared to have an emphasis on food safety training that was provided from the home office. This was typified by the numerous generic signs and posters that were found throughout the production areas of the units. Typically, this information can be provided by a professional organization such as the National Restaurant Association (Martin, 1995). Concern for food safety was

further demonstrated by the strong coordination of the training efforts performed for this study. Every unit manager fully cooperated and scheduled participation for the members of their crews. This was a welcomed event as it illustrated genuine concern about food safety on management's part (Lewis, 1995).

After a brief meeting to explain the terms of employee participation, a food safety knowledge test and a computer attitude survey were administered at each unit one week prior to any intervention treatment. These test results became the base data for this study and were termed as pre-test data. One week after the pre-test was given, computer interactive training, lecture training, or no training was administered to the units designated to receive one type of intervention treatment. Immediately following these intervention treatments, a second food safety knowledge exam and a second computer attitude survey was administered. This exam was termed post-test. For the units that received either computer interactive training or lecture training, a third food safety exam was given one week after the intervention treatment. This exam was known as the retention test.

There were no significant differences in the pre-test scores for any units receiving either the computer interactive training, lecture training, or no training (Table 2). The results indicated the participants entered the training process with approximately 49% of the food safety knowledge that would later be disseminated to the groups receiving the computer and lecture treatments (Table 2). These results indicated that all participants started with the same knowledge level as all the other groups. This fact was important to ensure that the three groups were alike in their food safety

Table 2. Percentage correct and improvements among the knowledge tests for quick serve restaurant participants in the control, lecture, and computer interactive trained stores (n=43).

Knowledge Test	Control	Lecture	Computer/ Interactive
Pre-test, %	48.00 ^d	50.28 ^d	49.68 ^d
Post-test, %	51.70	71.12	65.40
Intervention improvement, %	3.70 ^d	20.84 ^e	15.72 ^f
Retention test, %	na	68.80	65.40
Retention/treatment improvement ^b , %	na	-2.32 ^d	0.00 ^e
Retention/initial improvement ^c , %	na	18.52 ^d	15.72 ^e

^a Intervention improvement = post-test scores minus pre-test scores.

^b Retention/treatment improvement = retention test scores minus post-test scores.

^c Retention/initial improvement = retention test scores minus pre-test scores.

^{def} Means within rows followed by different superscripts differ at $p < 0.05$.

knowledge.

After the groups received their appropriate intervention treatments, the post-test results indicated that every group improved albeit in differing amounts (Table 2). The control groups improved their average score by approximately 4%. This amounted to getting one more question correct on average than had been attained during the pre-test. This result was difficult to explain, but it is reasonable to assume that the participants in the control group were all able to correctly answer one more question on the post-test than they had on the pre-test. Whether the one extra correct answer was a guess or a function of the participant's self-interest could not be determined.

The lecture group improved their post-test scores by approximately 21% in comparison to their pre-test scores (Table 2). These results may be attributed to the extensive food service experience of the lecturer. The lecturer had over 15 years of food service management experience and had trained in excess of 1,500 employees during this tenure. In conjunction with the trainer's record of accomplishment and the lecture methods utilized, these results were not surprising. Specifically, the trainer assembled and utilized a workbook that implemented the same still photographs as those found in the computer interactive program. The workbook proved to be an important addition to the lecture format. As Look's (1993) research also confirmed, the awareness of the workbook appeared to have the participants place greater emphasis on learning successfully. The same could be held true for the participants receiving the lecture treatment in this study.

To further aid the learning process, the lecture site used in all cases was the

production area of the units where demonstrative examples from the participant's own environment easily were visualized. By choosing this site where the participants visualized examples in familiar surroundings, an interactive action was added to the lecture method that helped provide immediate visual feedback to the participant which has been proven to be highly effective for low achievers that tend to be abundant in the food service industry (Fisher, 1993). This addition also offered a close comparison between instructional methods as it ensured all components were relatively equal.

The individuals that received the computer interactive training also scored significantly higher on the post-test exam than did the participants from the control group, but lower than those from the lecture group. These individuals improved their average score by 15.7% over their pre-test scores (Table 2). Although this improvement was not as great as that of the individuals that received the lecture, it was significant in terms of food safety knowledge gained. This improvement in knowledge may be important for future prevention of food borne illness which can devastate communities and businesses (Farkas, 1996).

The results from the retention test given one week after the intervention treatments were administered to the lecture and computer interactive participants, indicated that both groups retained knowledge that had been learned previously. When the pre-test was compared to the retention test, the results indicated that individuals who received lecture or computer interactive training improved their knowledge 18.5 and 15.7% respectively. When comparing the post-test results to the retention test, the participants receiving computer interactive training retained all the knowledge they had

gained while the participants receiving lecture training lost 2.3% of their knowledge gained (Table 2). Whether this loss of gained knowledge was a trend could not be determined from this study. It was important to note that both training methods were effective from the standpoint of food safety knowledge gained. However, the quick serve restaurant participants appeared to have both gained and retained more food safety knowledge by the lecture training.

These results were important due to the fact that retention of the food safety knowledge is paramount in judging the effectiveness of the training methods. It is logical to assume that knowledge remembered is more likely to be applied in the work place than knowledge one has to be reminded of repeatedly. Combating a general lack of knowledge and reinforcing new information concerning where hazardous food safety areas exist is paramount to reducing food borne illness outbreaks (Quillen, 1996 a). Subject matter such as personal hygiene, food borne contamination, food handling, and sanitation are forgotten easily or ignored and are leading causes of food borne illness (Sykes, 1996).

The data were analyzed to determine if there were any correlations among demographic variables and knowledge gained or retained. There was little to report for the quick serve restaurant participant group as a whole. Specifically, there were no significant correlations between age and food service experience with knowledge improvements of the whole group (Table 3).

When the data were examined by treatment groups for correlations among demographic variables and knowledge gained or retained, some relationships were identified (Table 4). For those participants that received lecture training, there was a

Table 3. Correlation coefficients among knowledge test score^a improvements and quick serve restaurant participant demographic variables.

Demographic variable	Intervention ^b improvement	Retention ^c /treatment improvement	Retention ^d /initial improvement
Age	-0.12	-0.14	-0.04
Food service experience	-0.08	0.09	-0.01

^a Knowledge tests were based on 25 questions.

^b Intervention improvement = post-test knowledge score minus pre-test knowledge score.

^c Retention/treatment improvement = retention test score minus post-test score.

^d Retention/initial improvement = retention test score minus pre-test knowledge score.

Table 4. Correlation coefficients among knowledge test score^a improvements and demographic variables for quick serve restaurant participants who had lecture training.

Demographic variable	Intervention ^b improvement	Retention ^c /initial improvement	Retention ^d /treatment improvement
Age	-0.34 ^e	-0.61 ^e	-0.07
Food service experience	-0.35 ^e	-0.35 ^e	0.19

^a Knowledge tests were based on 25 questions.

^b Intervention improvement = post-test knowledge score minus pre-test score.

^c Retention/initial improvement = retention test score minus pre-test score.

^d Retention/treatment improvement = retention test score minus post-test score.

^e Correlations significant at $p < 0.05$.

negative correlation between age and intervention improvement (post-test minus pre-test) and between retention/initial improvement (retention test minus pre-test). In both cases, the correlation indicated that as age increased, the knowledge gain with reference to intervention improvement and retention/initial improvement decreased. This finding was significant because it showed that as age increased, for those participants that had lecture training, less knowledge was gained. As one hears increasingly more lectures about a specific topic, it becomes easier to divert attention to other subject matter than the topic of discussion. It stands to reason that as one gets older, the lecture method becomes increasingly easier to ignore because lecture opportunities increase with age. It is important to note that the participants in this sample group were very young in comparison to other food service employees. The older participants, although they were under 30, probably were indicative of a person that did not have the necessary skills to find other employment. If they lacked those skills, it stands to reason that they also may lack the skills to retain knowledge.

Similarly, the correlation of food service experience with intervention improvement and retention/initial improvement was negative, which implied that as experience increased, knowledge gain improvement from pre-test to post-test, and from pre-test to retention decreased (Table 4). From this result, it was deduced that the more experience a food service employee had, the less effective lecture training was. These results may indicate that more non-conventional training methods are needed for the more experienced worker.

The correlations for those participants receiving computer interactive training

differed from those receiving lecture training (Table 5). The relationship between age and retention/treatment improvement (retention test minus post-test) was positively correlated. This relationship indicated that as age increased, so too did knowledge gained from treatment to retention. This finding was very important because it was opposite of that found for the lecture trained participants. Concerning the relationships among food service experience and knowledge improvement, there were two significant findings (Table 5). As food service experience increased, so too did retention/initial improvement and retention/treatment improvement. Again this result was opposite of the results of the lecture trained participants. It was important that the computer trained participants had a significantly positive correlation between knowledge gained with reference to experience and age. This result is important as it illustrated that the computer interactive training was an effective training method for food service employees as their age and experience increased.

The computer attitude survey was taken by participants in conjunction with the pre-test and post-test knowledge examinations. The attitude factors consisted of computer anxiety, computer confidence, computer liking, and a total score that represented the summation of the three attitude factors. This final score could range from 30 to 120 points. The higher the point total, the more positive the computer attitude was perceived to be. Essentially, there were no significant differences among any of the attitude factors for the pre-test survey or the post-test survey (Table 6). The anxiety factor averaged approximately 33 points for all intervention groups. The confidence factor and the liking factor averaged approximately 29 points and 31 points respectively

Table 5. Correlation coefficients among knowledge test score^a improvements and demographic variables for quick serve restaurant participants who had computer interactive training.

Demographic variable	Intervention ^b improvement	Retention ^c /initial improvement	Retention ^d /treatment improvement
Age	-0.09	0.29	0.34 ^e
Food service experience	0.02	0.37 ^e	0.33 ^e

^a Knowledge tests were based on 25 questions.

^b Intervention improvement = post-test knowledge score minus pre-test score.

^c Retention/initial improvement = retention test score minus pre-test score.

^d Retention/treatment improvement = retention test score minus post-test score.

^e Correlations significant at $p < 0.05$.

Table 6. Quick serve restaurant participant's mean scores for computer attitude factors (n=43).

	Control	Lecture	Computer/Interactive
Pre-Test			
Anxiety ^a	34.33	32.14	34.42
Confidence ^b	30.53	28.28	29.14
Liking ^c	32.13	29.57	32.14
Total Attitude ^d	97.00 ^f	89.28 ^f	95.71 ^f
Post-Test			
Anxiety	34.93	32.21	33.78
Confidence	30.26	28.78	29.92
Liking	32.00	28.71	31.57
Total Attitude	97.20 ^f	89.00 ^f	94.35 ^f
Improvement ^e			
Anxiety	0.60 ^f	0.07 ^f	-0.64 ^f
Confidence	-0.27 ^f	0.50 ^f	0.78 ^f
Liking	-0.13 ^f	-0.86 ^f	-0.57 ^f
Total Attitude	0.20 ^f	-0.28 ^f	-1.36 ^f

^{abc} Figures represent mean values for computer attitude components. Scale ranged from 10 to 40 with higher score representing lower anxiety levels, higher levels of computer liking, and computer confidence, respectively.

^d Total Attitude = anxiety + confidence + liking. Scale ranged from 30 to 120 representing an overall computer attitude.

^e Improvement represents post-test minus pre-test.

^{fg} Means within rows followed by different letters differ at $p < 0.05$.

for the different treatment participants. The total attitude factor averaged approximately 93 points. In relation to the scale of 40 to 120 possible points, these results are important. Because the average attitude score was near 93, this indicated that the quick serve restaurant participants had a very positive attitude for the use of computers. This finding was important as it established the acceptance of the computers as not only imminent, but welcomed by the next generations (Belsie, 1992).

When the effect of intervention treatment on computer attitude was examined, the results showed that the quick serve restaurant participants had no significant changes in intervention treatments (Table 6). At first, these results appeared disappointing, however, one must consider that the cash register systems utilized by most quick serve establishments are a computer by definition and are certain to affect computer attitudes. Because the majority of quick serve restaurant employees get the opportunity to use the register system, they have had more computer exposure than most more traditional food service employees.

This thought is further validated by distinguishing that quick serve restaurant participants are from a younger generation than most other food service establishment types. This younger generation has had much more exposure to computers through the application of videogames, computer learning in schools, as well as a computer in their own home. In fact, it has been estimated that over 25% of American households have computers (Belsie, 1992). Therefore these personnel have had sufficient time to establish a computer attitude that would not likely be altered by the one time use of an interactive program. This result came as no surprise, because younger participants have had

computer interaction more frequently than have older participants. They have been given the blessing of their parents and other role models to pursue the use of computers at early stages of their life as indicated by 25% of households reporting the existence of a computer in the home and the fact that 78% of the public views the computer as a catalyst between students and knowledge (Belsie, 1992, Lewis, 1992).

The question of the relationship of the computer interactive training intervention treatment on computer attitudes were examined. When the correlations among the demographic variables of quick serve restaurant participants who received computer interactive training with the computer attitude improvement factors was examined, there were no significant relationships to report (Table 7). This lack of a significant finding indicated that for these younger food service workers, the demographic variables and the intervention of the computer interactive treatment had no relationship to their attitude about computers. It may have been presumptuous to think that one interactive treatment might have altered the deep rooted attitudes that already existed in the participants.

School Food Service Participants

The sample studied from school food service restaurants consisted of participants from 6 different schools from two nearby counties. There were three secondary schools and three primary schools included in the mix. The total sample consisted of 41 participants. This figure represented over 50 percent of the employees working within the school's food service operations and all participants were full time employees.

Table 7. Correlation coefficients among computer attitude factor^a improvement and demographic variables from quick serve restaurant participants who received computer interactive training.

<u>Demographic variable</u>	<u>Anxiety^b improvement</u>	<u>Confidence^c improvement</u>	<u>Liking^d improvement</u>	<u>Total^e improvement</u>
Age	0.11	-0.30	-0.18	-0.29
Food service experience	0.19	-0.30	-0.20	-0.22

^a Computer attitude factors consist of mean survey scores for computer anxiety, computer confidence, computer liking, and the total of all three factors.

^b Anxiety improvement = post-test anxiety score minus pre-test anxiety score.

^c Confidence improvement = post-test confidence score minus pre-test confidence score.

^d Liking improvement = post-test liking score minus pre-test liking score.

^e Total improvement = post-test total score minus pre-test total score.

The majority of the individual participants (63.4%) were over 40 years of age with 36.6% over the age of 50 (Table 8). It was of interest to note that there were no participants under 21 years and only one between the ages of 21 to 30 years. This result was anticipated because school food service has been favored by employees of the food service industry as they get older due to the increase in the quality of life at work that is associated with institutional food service. Unlike the quick serve segment of the industry that has operating hours that include weekends and late nights, the school food segment operates primarily during the lunch meal on a weekday basis.

The sample consisted of 97.6% female employees. There was only one male participant in the group which typified the population for this particular food establishment type (Table 8). This ratio was not unusual because one of the primary benefits of working in school food service is the fact that the operating hours both begin and end during the school day when a mother's children are in school. That fact makes this career choice very attractive to members of the female population who have school age children.

The level of food service experience found with this sample was considerably higher than that of quick serve participants. Specifically, 41.4% of the participants had over 10 years of food service experience (Table 8). On the other end of the spectrum, 29.3% of the participants had 3 or less years of food service experience (Table 8). These results are typical for school food service because once a person is hired, a majority of them tend to stay until the end of their career primarily due to the better quality of life associated with this segment of the industry. The need for new people, who have less

Table 8. Demographic characteristics of school food service participants (n=41).

<u>Characteristics</u>	<u>Percentage of respondents</u>	<u>Frequency^a</u>
<u>Age (years)</u>		
under 21	0.0	0
21-30	2.4	1
31-40	34.1	14
41-50	26.8	11
51-60	22.0	9
over 60	14.6	6
<u>Gender</u>		
Male	2.4	1
Female	97.6	40
<u>Food service experience (years)</u>		
Less than 1	4.9	2
1 to 3	24.4	10
3 to 5	9.8	4
5 to 10	19.5	8
10 to 20	26.8	11
Greater than 20	14.6	6
<u>Job type</u>		
Management/Supervision	26.8	11
Food service worker	73.2	30

a Totals within characteristics may not equal 43 due to incomplete questionnaire responses.

experience is not necessary as often as within other segments of the industry. Therefore, there will be experience gaps created primarily by the simultaneous retirement of a few members of the crew.

In comparison to the quick serve restaurant participants, only 26.8% of the school food service participants stated that their job duties required them to supervise the work of others (Table 8). This percentage was high artificially because the participants from some of the secondary units are occasionally sent to supervise the dining service at a satellite unit such as a nearby day care operation or a small primary school. By removing this occasional supervisory experience the percentage of supervisors to food service employees dramatically drops to 14.6%.

In comparison to the quick serve restaurant units, the school food service units had a similar emphasis on food safety training. It was important to note that every manager demonstrated a sincere respect for the topic and welcomed the opportunity not only to train or retrain their employees, but also to participate themselves. This attitude was indicative of other food service entities, such as the Atlanta Fish Market, that have positively pursued learning HACCP procedures (Sanson, 1995).

The dedication exhibited by the managers demonstrated a "lead by example" attitude that opened the minds of the participating employees to the importance of their involvement. Like the quick serve restaurants, the school food service establishments were inundated with posters and signs illustrating proper food handling procedures and public health concerns. Much like the quick serve restaurants, these materials had been provided by local health departments, and national trade organizations (Walkup,

1994). It was apparent that the food safety emphasis identified had originated from the central offices and the associated food service directors.

The intervention data collection procedure was implemented with the school food service participants. The results from the pre-test scores indicated similar results for school food service participants compared to the quick serve restaurant participants concerning their initial food safety knowledge (Table 9). There were no significant differences in the pre-test scores for any of the participants that received either computer interactive training, lecture training, or no training. This was important as it established that all groups of school food service participants in this study started with similar knowledge. On the average, the school food service participants answered approximately 55.6% of the food safety questions correctly. This amount was approximately 6% higher than the quick serve participants. This result came as no surprise as the school food service employees were more mature and had obviously established food service as a long term career choice versus a first time occupation.

Once the groups had received their intended intervention treatments one week after their pre-test exam, the post-test was administered. The post-test results indicated that all participants improved their average scores, except for the control group whose average score decreased by 2.7%. Although this is not a significant decrease, it can be explained by the same reasons as the quick serve restaurant control group. Essentially, this difference amounted to the value of one question answered incorrectly. This could have occurred due to a person guessing differently between two similar answers on the exam.

Table 9. Percentage correct and improvements among the knowledge tests for school food service participants in the control, lecture, and computer interactive trained stores (n=41).

Knowledge Test	Control	Lecture	Computer/ Interactive
Pre-test, %	56.52 ^d	55.12 ^d	55.33 ^d
Post-test, %	53.84	73.44	70.66
Intervention improvement ^a , %	-2.68 ^d	18.32 ^c	15.33 ^c
Retention test, %	na	71.12	72.00
Retention/treatment improvement ^b , %	na	-2.32 ^d	1.34 ^d
Retention/initial improvement ^c , %	na	16.00 ^d	16.67 ^d

^a Intervention improvement = post-test scores minus pre-test scores.

^b Retention/treatment improvement = retention test scores minus post-test scores.

^c Retention/initial improvement = retention test scores minus pre-test scores.

^{de} Means within rows followed by different superscripts differ at $p < 0.05$.

The lecture group participants improved their average post-test scores by 18.32%. This difference was similar to the quick serve participants that received lecture training and improved their post-test scores by 20.84%. The similarity in this result can be accounted for by the fact that the lectures continued to be effective consistently. All lectures were video taped and reviewed for consistency. As was the case with the quick serve participants, the lecturer did an admirable job delivering the information to the school food service participants. These lectures were given in the participant's production areas, which allowed the lecturer to demonstrate specific pieces of information found in the workbook and the interactive software. The use of the combination of this material with the selected location served to form an interactive learning environment in a rudimentary form (Benjamin, 1995).

The participants that received computer interactive training scored significantly higher on the post-test exam than did the participants receiving no training (Table 9). This result paralleled the findings of Kelly (1993) with regard to the improvement of knowledge gained by use of interactive learning with non-traditional students. The individuals that received computer interactive training did not differ significantly in their intervention improvement from the participants that received the lecture treatment. This was an important finding as it established that lecture and computer interactive training software were equally effective as teaching methods with respect to initial knowledge gain for this group of food service workers. Regardless of the method used, similar results could be expected for school food service participants for immediate knowledge gain.

The results from the retention test given one week after the intervention treatments were administered to the lecture and computer interactive participants indicated that both groups retained knowledge that had been previously learned. When the pre-test was compared to the retention test, the results indicated the individuals who received lecture or computer interactive training improved their knowledge 16.0 and 16.7%, respectively. This result should be recognized as a very significant increase in food safety knowledge, which could be vital to the establishment of higher food safety standards for any employee willing to participate in the computer interactive training. Increases of this magnitude will often be the difference in a food borne illness versus a safe operation (Lorenzini, 1996). As Quillen (1996) pointed out, removing ignorance of potential hazardous areas are key to preventing food borne illness.

When comparing the post-test results to the retention test, the participants receiving computer interactive training retained all the knowledge previously gained. In addition, there were no significant differences between the participants that received the lecture or computer training which indicated that the computer interactive training method and the lecture training method were statistically equal. This finding was important as it verified that both methods of training achieved very positive results in both food safety knowledge gained and retained.

The data were analyzed to determine if there were any correlations among demographic variables and knowledge gained or retained for the school food service group as a whole. Only food service experience exhibited a significant relationship with intervention improvement (Table 10). This relationship indicated that as food service

Table 10. Correlation coefficients among knowledge test score^a improvements and school food service participant demographic variables.

Demographic variable	Intervention ^b improvement	Retention ^c /treatment improvement	Retention ^d /initial improvement
Age	0.18	0.06	-0.09
Food service experience	0.23 ^e	0.01	0.19

^a Knowledge tests were based on 25 questions.

^b Intervention improvement = post-test knowledge score minus pre-test knowledge score.

^c Retention/treatment improvement = retention test score minus post-test score.

^d Retention/initial improvement = retention test score minus pre-test knowledge score.

^e Correlation significant at $p < 0.05$.

experience increased, intervention improvement also increased. This result could be because as food service experience increases, the individuals realize that the jobs they currently are performing are apt to be their career choice for a lengthy period. Therefore, the individuals put forth more effort to learn than others who may still harbor strong hopes of another career choice.

This correlation also may signify that when experience reaches a certain level, the learners are experienced enough with real life experiences to influence their perceptions of the importance of the study matter. For instance, perhaps one or more of the experienced employees had suffered with food borne illness or at least know somebody who had been ill. This experience would likely cause the participant to pay more attention to the food safety material being presented.

The data were examined by treatment groups for correlations among demographic variables and knowledge gained or retained (Table 11) . Analysis indicated a significant positive correlation between food service experience and retention/treatment improvement for the school food service participants that received lecture training. This relationship indicated that as food service experience increased, knowledge retained from the lecture increased as well. This could be attributed to the possibility that personnel with longer tenure tend to take training sessions more seriously than do less tenured employees. It must be emphasized these participants had a much wider range of years of experience than did the previously mentioned quick serve workers. Therefore, personnel with longer job experience make greater efforts to remember information that has been given to them in a lecture training format.

Table 11. Correlation coefficients among knowledge test score^a improvements and demographic variables for school food service participants who had lecture training.

Demographic variable	Intervention ^b improvement	Retention ^c /initial improvement	Retention ^d /treatment improvement
Age	-0.10	-0.02	0.09
Food Service experience	-0.06	0.10	0.44 ^e

^a Knowledge tests were based on 25 questions.

^b Intervention improvement = post-test knowledge score minus pre-test score.

^c Retention/initial improvement = retention test score minus pre-test score.

^d Retention/treatment improvement = retention test score minus post-test score.

^e Correlations significant at $p < 0.05$.

Significant correlations for school food service participants who received computer interactive training were identified from the analysis illustrated in Table 12. There was a significant correlation between age and retention/treatment improvement. In this case the relation indicated that as age increased, knowledge retained after computer training increased. This result was identical to that found with the quick serve participants. Therefore, as a person got older, his or her retained knowledge increased for the computer interactive trained group. This was very significant because it established that older participants demonstrated effective knowledge retention after the computer interactive training. This result was important as it demonstrated the same results as Kelly's (1993) survey with respect to knowledge improvements and non-traditional type students.

Significant correlations also were found to exist between food service experience and intervention and retention/initial improvement for school food service participants who received computer interactive training. In both cases the correlation was positive. This indicated that as food service experience increased, so too did intervention improvement and retention/initial improvement. Therefore, as a person grew in food service experience, their knowledge gained and retained after computer interactive training increased. These findings were very important as it illustrated positive relationships that were not true of the participants trained by lecture methods with regard to knowledge gain and retention. This illustrated a positive reason for the use of computer interactive software for training food safety procedures to school food service workers.

The data acquired from the school food service participants concerning computer

Table 12. Correlation coefficients among knowledge test score^a improvements and demographic variables for school food service participants who had computer interactive training.

<u>Demographic variable</u>	<u>Intervention^b improvement</u>	<u>Retention^c /initial improvement</u>	<u>Retention^d /treatment improvement</u>
Age	-0.07	0.05	0.35 ^e
Food Service experience	0.46 ^e	0.57 ^e	-0.13

^a Knowledge tests were based on 25 questions.

^b Intervention improvement = post-test knowledge score minus pre-test score.

^c Retention/initial improvement = retention test score minus pre-test score.

^d Retention/treatment improvement = retention test score minus post-test score.

^e Correlations significant at $p < 0.05$.

attitudes were similar and different to that identified within the quick serve restaurant groups. While pre-test and post-test treatment values did not vary greatly, there were some significant comparisons identified from this data (Table 13). Initially, the control and the computer interactive training groups had very similar values for all three computer attitude factors and the total attitude value. However, the lecture group had significantly lower values for the total score (68.28) compared with the control (83.13) and computer trained groups (85.67). It was important to note that the average total computer attitude scores for the school food service group were approximately 79 points, whereas the same average for the quick serve restaurant participants was approximately 94 points. This comparison indicated that the school food service participants had a much poorer attitude about the use of computers than did the quick serve restaurant participants. This discrepancy was probably due to the fact that the school food service participants were typically older and would not have grown up with the technological advances at their fingertips that the younger quick serve participants had. This point appears relevant as the older school food service participants had never heard of a computer as long as forty years ago. By comparison, at least 25% of today's younger generation has grown up with computers in their home (Belsie, 1992).

The attitude difference trend continued after the treatments were administered (Table 13). Again, the lecture group had a significantly lower total attitude rating (69.92) after the treatments than did either the control (78.86) or the computer interactive training group (86.25). The computer attitude factors for the control group decreased after one week of time. The reasons for this change cannot reasonably be assumed. When the

Table 13. School food service participant's mean scores for computer attitude factors (n=41).

	Control	Lecture	Computer/Interactive
	Pre-Test		
Anxiety ^a	29.46	23.57	29.75
Confidence ^b	24.06	21.07	25.00
Liking ^c	29.60	23.64	30.92
Total Attitude ^d	83.13 ^f	68.28 ^g	85.67 ^f
	Post-Test		
Anxiety	27.86	24.21	30.25
Confidence	23.40	22.00	26.33
Liking	27.60	23.71	29.67
Total Attitude	78.86 ^f	69.92 ^g	86.25 ^f
	Improvement ^e		
Anxiety	-1.60 ^f	0.64 ^g	0.50 ^{fg}
Confidence	-0.66 ^f	0.93 ^f	1.33 ^f
Liking	-2.00 ^f	0.07 ^f	-1.25 ^f
Total Attitude	-4.27 ^f	1.64 ^g	0.58 ^{fg}

^{abc} Figures represent mean values for computer attitude components. Scale ranged from 10 to 40 with higher score representing lower anxiety levels and higher levels of computer liking and computer confidence, respectively.

^d Total = anxiety + confidence + liking. Scale ranged from 30 to 120 representing an overall computer attitude.

^e Improvement represents post-test minus pre-test.

^{fg} Means within rows followed by different letters differ at $p < 0.05$.

attitude improvement differences are examined, it was easily identified that total attitude improvement was significantly different for control group participants and lecture group participants, but neither were significantly different than the improvements found in the computer interactive group (Table 13). Therefore, it was determined that the attitudes that participants held about the use of computers did not change significantly from the effect of intervention treatment. It could not be stated that training via computer interactive software either improved or diminished the overall computer attitude these specific participants had. This further indicated that the attitude one builds concerning the use of computers does not change from a one time usage of interactive software.

Analyses were performed to identify significant correlations among school food service demographic factors and computer attitude factors for those participants receiving computer interactive training (Table 14). Negative correlations were determined to exist between age and anxiety improvement, liking improvement, and total attitude improvement. In each case, as age increased, improvement decreased. This was explained by the concept that as people get older, the more anxiety and discomfort towards new ideas they develop. This information was important to discover because it indicated that a trainer might have to do extra coaching to coax older potential trainees into willingly using the process. However, even though the group did not have good attitudes about the use of the computer, they did have significant gains in food safety knowledge.

This analysis further identified a correlation between food service experience and computer attitude factor improvements. Specifically, it was determined that

Table 14. Correlation coefficients among computer attitude factor^a improvement and demographic variables from school food service participants who received computer interactive training.

Demographic variable	Anxiety ^b improvement	Confidence ^c improvement	Liking ^d improvement	Total ^e improvement
Age	- 0.42 ^f	0.12	- 0.53 ^f	-0.50 ^f
Food service experience	- 0.05	-0.36 ^f	0.32	0.08

^a Computer attitude factors consist of mean survey scores for computer anxiety, computer confidence, computer liking, and the total of all three factors.

^b Anxiety improvement = post-test anxiety score minus pre-test anxiety score.

^c Confidence improvement = post-test confidence score minus pre-test confidence score.

^d Liking improvement = post-test liking score minus pre-test liking score.

^e Total improvement = post-test total score minus pre-test total score.

^f Correlation significant at $p < 0.05$.

as food service experience increased, computer confidence decreased (Table 14).

This relation could have been because after a person has been on a job for an extended period of time, the idea of new concepts such as using computers becomes less appealing.

This information was important to uncover because it implied that positive coaching might be required to get more experienced employees to attempt computer training.

Comparison Among Quick Serve Restaurants and School Food Operation Participants

A comparison of the pertinent results from both types of food service operations revealed one of the most important aspects of this research. An examination of knowledge test improvement for participants from both school food service and quick serve restaurants that received computer interactive training revealed some close similarity (Table 15). Both the quick serve and the school food service employees improved their knowledge from initial to post-test by over 15%. This figure amounted to a substantial gain in food safety knowledge for these employees and their facilities. This gain in food safety knowledge is one vital element needed to combat food borne illness (Busby, 1996). Even more important was the fact that the knowledge retained was 100% or better. This implied that the people who received the computer interactive training not only improved their knowledge by 15% the same day they took the intervention treatment, but also remembered all of the material one week later. This finding was of great importance because knowledge that is remembered is more likely to be put to use in the work place (Quillen 1996 a).

Table 15. Knowledge test score percentage improvements among quick serve restaurant participants and school food service participants who received computer interactive training treatment (n=84).

Knowledge Test	Quick serve participants	School food service participants
Intervention improvement ^a , %	15.72 ^d	15.33 ^d
Retention/treatment improvement ^b , %	0.00 ^d	1.34 ^d
Retention/initial improvement ^c , %	15.72 ^d	16.67 ^d

^a Intervention improvement = post-test scores minus pre-test scores.

^b Retention/treatment improvement = retention test scores minus post-test scores.

^c Retention/initial improvement = retention test scores minus pre-test scores.

^d Means within rows followed by different superscripts differ at $p < 0.05$.

The results from those participants who received lecture training also were similar to each other in terms of either quick serve restaurant or school food service employees (Table 16). The quick serve restaurant and the school food service employees improved their food safety knowledge after the lecture by 20.8 and 18.3% respectively. However, there was a 2.3% loss of knowledge after just one week. While this figure when compared with initial knowledge gained was statistically significant for the quick serve restaurant participants, it was not for the school food service participants. However, there was no difference in retention between the quick serve and school food service participants.

It could not be said from this research whether this trend would continue. Considering that even if knowledge gained and retained were equal for both groups of workers, the fact remains that lecture training requires a specialized person to perform the training duties. These people are not usually readily available. However, the interactive computer requires only someone to do a brief set-up and quick explanation of the hardware for the few remaining employees who have no computer experience. The interactive software can be in use in multiple places at one time while a lecturer can only be at one location.

When comparing the improvement of computer attitude factors for both types of establishments that received computer interactive training, there were no significant differences (Table 17). Therefore, the attitudes of the participants that received computer interactive training got no better, or no worse after their session with the computer software. This indicated that one session of this type of computer interactive training did not affect attitudes that have been established over a long period of time.

Table 16. Knowledge test score percentage improvements among quick serve restaurant participants and school food service participants who received lecture treatment (n=84).

Knowledge Test	Quick serve participants	School food service participants
Intervention improvement ^a , %	20.84 ^d	18.32 ^d
Retention/treatment improvement ^b , %	-2.32 ^d	-2.32 ^d
Retention/initial improvement ^c , %	18.52 ^d	16.00 ^d

^a Intervention improvement = post-test scores minus pre-test scores.

^b Retention/treatment improvement = retention test scores minus post-test scores.

^c Retention/initial improvement = retention test scores minus pre-test scores.

^d Means within rows followed by different superscripts differ at $p < 0.05$.

Table 17. Mean scores for computer attitude factors^a improvement for quick serve restaurant and school food service participants who received computer interactive training.

Variable	Quick service participants (n=14)	School food service participants (n=12)
Computer anxiety improvement ^b	-0.65 ^f	0.50 ^f
Computer confidence improvement ^c	0.79 ^f	1.33 ^f
Computer liking improvement ^d	-0.57 ^f	-1.25 ^f
Total computer attitude improvement ^e	-1.36 ^f	0.58 ^f

^a Figures represent mean values for computer attitude components. Scale ranged from 1 to 40 with higher score representing lower anxiety levels, and higher scores representing higher levels of computer liking and computer confidence. Total attitude figures represent the combined mean value of computer anxiety, confidence, and liking. Scale ranged from 1 to 120, representing an overall computer attitude.

^{b,c,d,e} Figures represent post-test scores minus pre-test scores for the respective variable.

^{f,g} Means in rows followed by different letters differ at $p < 0.05$.

CHAPTER V

SUMMARY

The integrity of the world's food supply has become a topic of increasing importance. Consumers increasingly are voicing their opinions about topics such as restaurant sanitation, pesticide residue, and bacterial food poisoning (Buzby, 1994). The recent E. coli 0157:H7 outbreaks on the west coast of the United States have served as a wake up call to the food service industry. The misfortunes that Jack in the Box has had after an E. coli 0157:H7 outbreak, which resulted in the deaths of young children, have sent a clear message to the food service industry. The public is more aware of, and feels more vulnerable to, food borne illness and food poisoning than ever before (Allen, 1994).

As an industry known for tight budgets and small profit margins, the fear of food borne illness has created a problem that all operators will have to solve in the near future. That problem is how to acquire safe establishments without going out of business from excessive training costs. This problem is widely recognized by the food service industry and has been a topic of great deliberation for some time. One of the most recognized solutions for maintaining the integrity of the food supply has been through the use of Hazard Analysis Critical Control Point (HACCP). Numerous food operators have recognized HACCP as the methodology that public health departments will utilize in the future (Lorenzini, 1995). Although HACCP is not a mandatory system for food service operators, it is very likely that it will become so in the near future (Lorenzini, 1995).

The obvious question concerning the HACCP solution to the food safety problem is how to implement its use in an efficient, cost effective method that also produces tangible results. For this solution to be effective, all food service employees within an establishment must be trained about HACCP procedures and the role they play as individuals concerned with the prevention of food borne illness. To be able to accomplish this feat effectively and economically would be a proactive solution to preventing an outbreak of food borne illness.

One solution to train HACCP procedures to food service employees is the use of computer interactive training. Research performed in other areas has indicated that interactive learning was more effective than the standard lecture for topics involving subject matter of a technical nature (VanVuren, 1992, Dorn, 1993). It already has been proven that this training method is effective and economical for other business training purposes (Gappmeyer, 1994). By comparison, the common lecture method of training requires numerous experts to teach multiple classes. For this reason, the lecture method of training is under severe scrutiny and is on the verge of becoming outdated (Lewis, 1992).

The purpose of this research was to compare the effectiveness of two HACCP-oriented instructional training methods for teaching food safety information in the food service industry. The two instructional methods included the typical lecture method and a computer interactive training method. As an additional point of interest, the participants attitude about the use of computers in their work area was evaluated before and after the computer intervention.

The information presented in the computer interactive software consisted of 10 modules that offered basic food safety knowledge. The information included the importance of food safety, personal hygiene, hand washing, receiving, storage, thawing of foods, cross contamination, cooking and hot holding, cooling, and sanitation. The importance of record keeping was stressed throughout the entire process. Although the software was narrated, there were interactive portions where the participants were asked to answer specific questions or perform tasks related to the previous learning module.

To evaluate the effectiveness of both instructional types, a survey questionnaire was developed and utilized to establish a base knowledge score, a post-treatment knowledge score, and a retained knowledge score. The questionnaire consisted of 25 multiple choice questions and specific demographic questions. The multiple choice questions were developed from specific information in the lecture script.

The data acquired from the aforementioned process were evaluated by means of statistical analysis. Specifically, the two types of food service employees were found to be different in terms of age, experience, and other demographic factors. It was determined that the quick serve participants were considerably younger and less experienced than their school food service counterparts. This provided some interesting insights as the data were compared by both instructional methods utilized and the type of food service operation the participant worked at.

After the base knowledge was established for all groups by means of the pre-test survey, initial knowledge levels were found to be higher for the school food service employees than for the quick serve employees. This was attributed to the larger amount

of food service experience that belonged to school food participants.

The improvement in knowledge gained was determined after the intervention treatment. The pre-test scores were subtracted from the post-test scores to arrive at a figure recognized as knowledge gained from intervention treatment. Specifically, this knowledge gain for the participants that received lecture training was 20.84% and 18.32% for quick serve restaurant and school food service participants, respectively. For the participants that received computer interactive training the knowledge gain was 15.72% and 15.33% for the quick serve and school food service participants, respectively. This amounted to a substantial increase in food safety knowledge for these individuals and the companies they represented. The fact that the lecture treatment gave slightly better initial score results could be accounted for by the fact the lecturer was an accomplished trainer in the food service industry combined with the fact that the lecture was administered in the employees production facilities which in itself provided an interactive feature not present in most class room lectures.

The retention in knowledge gained was measured by subtracting the retention test scores from the immediate post-test scores. This figure provided an indicator for a longer term effectiveness of the teaching methods. For both the quick serve and school food service participant results, the computer interactive training demonstrated no loss of knowledge gained. By comparison, both of the participant groups that received the lecture training lost 2.32% of the knowledge they had gained from the intervention treatment. From this research it could not be determined if this was the start of a trend or a one time anomaly. It should be pointed out that although there was a loss during the

retention measure, the overall total food safety knowledge retained one week later by utilization of either the lecture or the computer interactive training was significantly greater than the amount of knowledge the participants began the study with. This was a very important finding because the effectiveness of a training method must account for the long term use of the information it disseminates. After all, knowledge remembered can be put to use, whereas knowledge forgotten is never put into action.

The examination of the computer attitude survey indicated that the younger, more technologically exposed quick serve restaurant participants had a better beginning attitude concerning the use of computers in the work place than the school food service participants. Once the initial attitude survey results were compared to the post intervention treatment surveys, it was determined that the one time use of computer interactive training was not sufficient enough to alter the attitudes a person has about computers. It was important to note that the knowledge gained by both participant groups that received computer interactive training was not only a significant amount, but also a relatively equal amount. Therefore, apparently one's attitude about computers does not affect his or her ability to learn from them.

The importance of the results of this study lie within its determination to choose which of two instructional training methods are best suited to train food service employees about HACCP-oriented food safety procedures. The results indicated that the lecture method yielded better results for the initial gain and retention of food safety knowledge with respect to the quick serve restaurant participants. Both methods proved to be equally effective with the school food service employees in terms of knowledge

gained and retained.

It is important to note some very significant differences in the two methods that are not results oriented, but still apply to the determination of the better training method. If the lecture training method is selected, there must be either multiple trainers, or limited training. A trainer can only be in one place at one time. This limits the amount of people that effectively can be trained by this method. If there are multiple trainers performing the duty, then questions of performance and consistency must arise. Every trainer, regardless of how great he or she is at their job, occasionally is going to have a poor performance. When this occurs, there is no doubt that whomever was participating in the training got less information than other groups who viewed the trainer on a good day. To further complicate this thought, it is very unlikely that a company could ever have trainers of equal talent. Therefore, the recipients of the training message may have gotten their information from the good trainer or the poor trainer. In this case, consistency is sacrificed.

If there is only one trainer, then it is very difficult to schedule training sessions that can be performed in a short enough time frame to be effective in solving the problems they are designed to accommodate. If big groups of employees are taken from their jobs, then service and production suffer, which leads to decreased profits in an already difficult industry. Even though the employees may get the intended message, it may cost the company several thousand dollars in wages and sales to accomplish this feat. Another problem with the lecture training comes from the fact that it is difficult if not impossible to repeat the lecture message exactly. The human factor causes

inconsistencies in the message that can be detrimental to the training process.

By comparison, the computer always is consistent. Once it is turned on, it is more consistent than any other training method. Multiple computers not only can be purchased and sent to numerous locations, but also can be specified to be exactly the same. Furthermore, the computer interactive training is performed on a one on one basis and allows for the participant to return to any section of the training that might be unclear. This would not be a typical situation for lecture training sessions. This is very important because it allows personnel to be trained in slow business periods so the training does not interfere with the daily business of the facility. It also is very easy to give repeat training performances every time they are needed when the training is done on a computer and the message is stored on a compact disc at the facility. Essentially, this instructional method allows every unit to have a food safety expert on staff by means of computer.

In conclusion, this research was performed to determine which of two training methods was superior for the purposes of training food service employees about food safety procedures. The statistical results indicated that the methods were equal in terms of knowledge gained and retained for school food service workers. Both methods yielded large percentage increases in food safety knowledge gained, which is the primary purpose of training. However, from the perspective of an accomplished trainer, it appeared that the computer interactive training method was much more effective in terms of its consistency, convenience, ease of application, and ease of repetition. This study also determined that attitude about computers does not significantly affect the system's ability to train effectively. Based upon the applicability, it was clear to the researcher that the

computer interactive instructional method was superior to the standard lecture training method for the purpose of training food service employees about HACCP related food safety procedures.

Limitations

One of the potential limitations in this study lies in the propensity to judge the success of a methodology to be true over a longer period of time than this cross sectional research included. Although it was determined that interactive training was as effective as lecture training for school food service workers, as based upon both results and practicality, it is incorrect to assume that this evidence will stand the test of time. Further studies of this type will be needed to offer time tested results that lend themselves to trend analysis. A second limitation of this research would be to assume the improvement results found for quick serve restaurants and school food service establishments would extrapolate to other types of food service operations such as family style or theme restaurants. Until participants from these segments are included in the analyses, it cannot be assumed that these statistical results would apply to their participant's level of knowledge improvement. However, the positive factors concerning application of the computer interactive training method would extrapolate to other industry segments.

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APPENDICES

APPENDIX 1

The Ten Segments of the Computer Interactive Software

The Ten Segments of the Computer Interactive Software.

Step	Description	Length in Minutes
1.	Employee Hygiene	8.2
2.	Receiving Foods	4.5
3.	Food Storage	6.5
4.	Thawing Foods	4.2
5.	Cross Contamination	3.5
6.	Record Keeping	2.0
7.	Food Safe Cooking	3.5
8.	Hot Holding Foods	4.6
9.	Rapid Cooling	3.0
10.	Food Service Sanitation	5.0

APPENDIX 2.
Lecture Training Book

THE IMPORTANCE OF FOOD SAFETY

Food service employees have a sacred trust with the public. The public believes that you are serving food to them in a sanitary environment. Fail to honor that trust, and the customer will hold both you and your employer accountable.

FACTS ABOUT FOOD BORNE ILLNESS

Food borne illness may cause upset stomach, diarrhea, vomiting, cramps, or death.

Food borne illness may cause mild to serious disease in your customers.

A food borne illness can bring financial losses to your food service operation.

Food service employees can prevent food borne illness by following good food safety practices.

IMPORTANT TERMS

Contamination - process of polluting, tainting, or spoiling.

Bacteria - very small organisms that can be harmful to man because of their poisoning chemical effect.

Germ - small living substances that are capable of growing into an organism or one of its parts.

Contagious - can be transferred by contact, whether by touch or by air.

FOOD BORNE ILLNESS

Food borne illness is caused by the contamination of food.

THE WAYS FOODS BECOME CONTAMINATED

- * Inadequate cooling or cold holding.
- * Time and temperature abuse when preparing foods too many hours before serving.
- * Inadequate hot holding.
- * Poor personal hygiene of food service workers.
- * Inadequate re-heating.
- * Inadequate cleaning and sanitizing of equipment.
- * Incorrect use of leftovers.
- * Cross contamination.
- * Inadequate cooking for temperatures.

HOW BACTERIA SPREAD IN THE KITCHEN

- * Unwashed hands or contaminated rubber gloves.
- * Sick employees.
- * Employees with open cuts or scrapes.
- * Employees who touch their face or mouth with their hands.
- * Employees who don't wash their hands after using the restroom.
- * Unwashed cutting boards, utensils, and preparation areas.
- * Improperly stored foods.
- * Raw foods that drip into other food items.
- * Refilling used food containers for buffet lines and cold stations.
- * Unwashed kitchen equipment.

EMPLOYEE HYGIENE



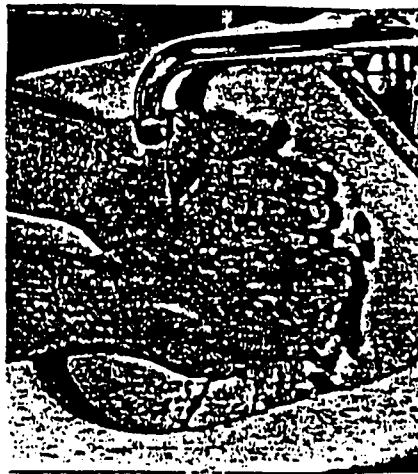
Food safety begins at home and should be followed throughout the work day. Personal hygiene is important for food safety because even a healthy person can have thousands of germs in their hair, nose, and on their skin. Something as simple as a sore throat, or other symptoms of the common cold, can be signs of infection and a potential threat to food safety.

Diseases such as hepatitis are **most** contagious before their symptoms appear. If you feel sick, you should call your manager to find whether to come to work or not.

Normal grooming rituals such as picking, rubbing, and scratching open sores, ears, nose, or face, can lead to food contamination. You are responsible for your customer's food safety. The job you save may be your own.

EMPLOYEE HYGIENE AT HOME

There are several rules of personal hygiene that should be common knowledge for all food service employees. They should be practiced at home for the food services worker's well being, and that of the public they serve. These rules include:



Skin, hair, and fingernails can support the growth of thousands of germs that are invisible to the naked eye. Therefore, everyday before you come to work, you should take a bath or shower with soap, scrub your fingernails with a soapy nail brush, wash your hair, and brush your teeth. This is very important because the normal skin temperature provides an ideal environment for bacteria to multiply.

Washing your hair on a daily basis removes dirt, loose hair, and dandruff from the scalp.

Fingernails should be kept clean and have no polish on them.

Open sores, cuts, and abrasions should be treated with an antiseptic and then covered with a sanitary bandage.

Jewelry can be a hiding and gathering place for dirt and bacteria while it is on your body. Jewelry should not be worn to work.

How you dress is representative of your personal cleanliness as well as the cleanliness of where you work. Wear clean clothes so that your public image is satisfying to your customers.



If you are sick, stay at home. A single sneeze can spread thousands of germs in an instant. Symptoms such as diarrhea, cramps, or fever are indicative of contagious infections. If you are in doubt about coming to work, call your supervisor to find out whether or not to stay at home.

EMPLOYEE HYGIENE AT WORK

The general rules of personal hygiene should be followed at work in a food service establishment. These include:

Hair should always be restrained in the manner directed by management. This should be done before reporting to work.

A clean, unsoiled uniform must be worn to work.

Jewelry should not be worn during work.

Any cuts, scrapes or abrasions should be cleaned with an antiseptic and covered with a fresh, sanitary bandage.

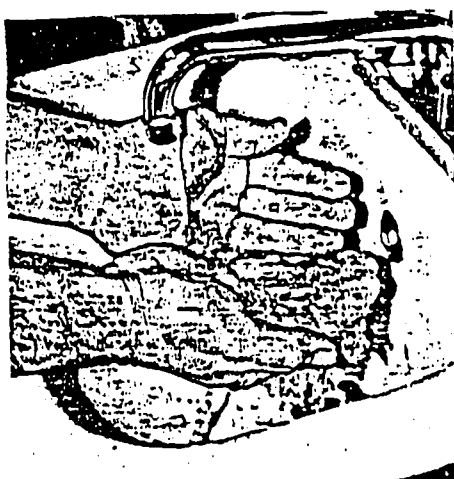
There should not be any eating, drinking (other than water), or smoking in a food production area. If food tasting is part of your job, use a different, clean, and sanitized bowl and utensil each time you taste a product. Never put a utensil in a food container after you have put it in your mouth.

Smoking or use of any tobacco product is never allowed in the food production area.

Many oral habits should be refrained from while at work. These include: eating, gum chewing, chewing toothpicks, chewing tobacco or snuff, nail biting, and spitting.

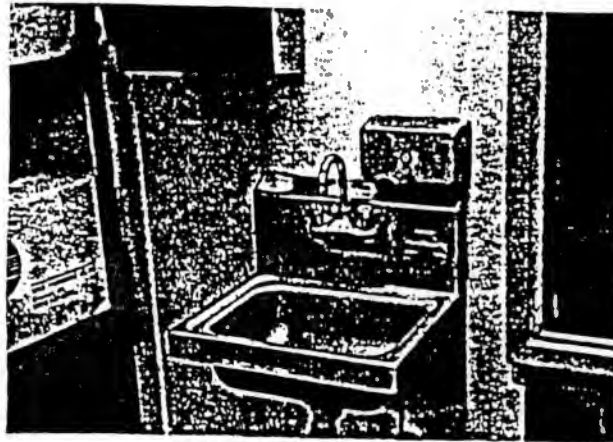
Hand washing rules and procedures should be followed without fail. You should wash your hands after:

using the telephone,
using the restroom,
handling money,
touching soiled linens,
handling raw foods,
touching fresh produce,
handling poultry products,
touching dirty dishes, utensils, or equipment.



The proper hand washing steps are:

1. Use soap and warm water.
2. Scrub hands and exposed portions or arms by vigorously washing all surfaces including the backs of your hands, wrists, between fingers, and forearms.
3. Use a nail brush to clean beneath and around your fingernails thoroughly.
4. Rinse thoroughly with warm water.
5. Lather your hands and wash them again to remove any micro-organisms remaining after the first washing.
6. Dry your hands under a warm air dryer or use a disposable paper towel.
7. Use a paper towel to turn the faucets off if your hand sink does not have foot pedals for this.



- Tell your manager if your hand sink does not have proper supplies to follow the hand washing steps.
- Never wash your hands in a production sink.

RECEIVING FOODS

The receiving function is the first time you take possession of the food you serve, and it is the point where your food safety responsibility begins. The rules of receiving are simple yet often overlooked.



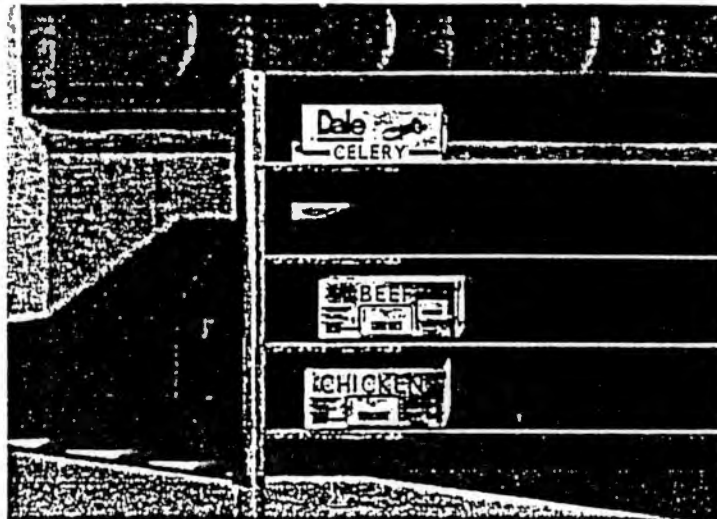
All food products are required to be purchased from an approved supplier.

Deliveries should arrive in refrigerated, clean trucks. The merchandise should be shipped according to the rules of storage.

All food products should be inspected upon delivery.

The receiving area should be clean and free of trash and debris.

All packages accepted must be undamaged, intact, and free of spoilage.



All refrigerated or frozen product should have the temperature checked with a calibrated thermometer prior to its acceptance.

Pocket thermometers can be calibrated by turning the retaining nut under the face to 32 degrees F while the stem is inserted in a glass of ice water.

Refrigerated foods such as meats and seafood should be received at 40 degrees F or lower.

Frozen foods should be received at 0 degrees F or less.

Foods containing high levels of natural juices such as meats and poultry must be free of any tears or leaking fluids.

Food products should be free of any foul or offensive odors.

Perishable foods must be moved immediately into refrigerated storage units.

All packages should be dated and labeled upon receipt.

FOOD STORAGE

It is critical to food safety that areas where food items are stored are designed for the type of products to be kept there. It is equally important that the rules for storing foods are followed by employees.



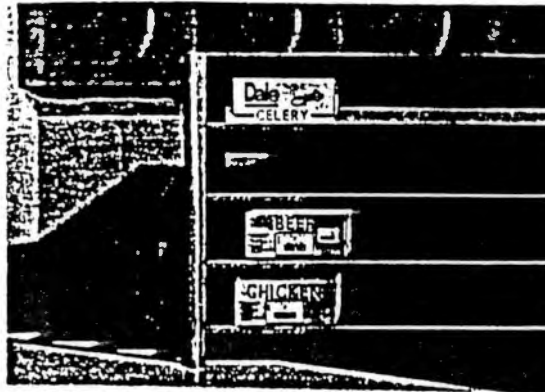
Storage areas should be kept clean and orderly and free of debris and offensive odors.

Trash and garbage containers should be kept clean and free of rodent infestation. When emptied, they should be washed inside and out.

To ensure foods do not stay in storage for too long, the FIFO storage method should be utilized.

Every food item in storage should be dated and labeled when it is received.

Stored foods that have already been prepared should be kept under refrigeration, in a clear, sanitized, and covered container that is clearly labeled with the time and date the product was prepared.



The position of food products in storage is also important in controlling food borne illness.

- Hazardous foods should always be stored beneath non-hazardous foods.
- Cooked foods should be stored above everything.
- Never store cleaning supplies near food products.
- Non-food supplies should be stored separately from food.
- Toxic materials such as pesticides should be stored in well-marked cabinets away from food.
- Bulk food should be stored in separate covered containers.
- No food containers should be exposed to unprotected sewer or water pipes.

Nearly all food service establishments have coolers and freezers to keep their products from spoiling. The low temperatures found there reduce disease-causing bacteria's ability to grow and multiply thus preventing the contamination of nearby food products.

Coolers should be kept free of objectionable odors and should have their thermostats set to maintain a temperature of 40 degrees F.

Freezers should be clean and orderly and have their thermostats set to maintain a temperature of 0 degrees F.

Even though most coolers and freezers have a thermometer mounted on the outside, it is important to regularly take temperatures from within the coolers.

The temperatures of these should be written in a log book for tracking of any equipment failure.

In general, red meat, poultry, and seafood should be stored frozen, thawed before use, and then cooked immediately.

Meats, poultry, and fish should be stored at a temperature of 40 degrees F or less.

The position in which food is stored also is important:

- * Food products should be stored at least 6 inches off the floor, and should never be placed directly on storage shelving without being wrapped and sealed.
- * Boxes should be stacked such that insect and rodent infestation is prohibited.
- * Food should be kept in tightly sealed and covered containers.
- * When food is received, it should be labeled with a time and date denoting when it arrived. It then should be placed behind or under older packs of the same food so that the oldest gets used first.
- * Chemicals should be stored completely away from food products because they can spill and contaminate foods, as well as contaminate them with fumes.
- * In general, hazardous foods should not be stored near non-hazardous foods. If this must occur, the hazardous foods must go on the bottom to insure their juices cannot drip into other foods.
- * If hazardous foods must be stored above one another, they should be stored by order of cooking temperature.
- * Dairy products should be stored separately from foods with strong odors.

THAWING FOODS



Thawing food is the first step in preparing frozen foods. Thawing large food items can take several hours or even days if done properly.

There are three thawing methods:

1. Thawing under refrigeration,
2. Thawing under running water, and
3. Thawing while cooking in a microwave oven.



To thaw in a refrigerator, you must use a refrigerator that is 45 degrees F or lower.

To thaw under running water, place food under running water with a temperature of 70 degrees F.

To thaw while cooking in a microwave oven, be certain to thaw food to its proper temperature and then transfer it to other cooking units to finish. You also can finish cooking an item in the microwave oven.

Thawing pre-cooked frozen foods requires special care. Be sure to follow the processor's instructions completely.

All thawing foods should be maintained at temperatures below 40 degrees F or above 140 degrees F.

CROSS CONTAMINATION

Cross contamination is a transfer of bacteria to food by other foods or non-food sources.

Human hands, equipment, or utensils, are all vehicles that can transfer bacteria from one food to another.

Cross contamination can occur when a food handler touches a prepared food after touching a raw food.

Raw foods will contaminate any surface it touches. Therefore work surfaces must be sanitized before contacting prepared food.

Clean clothing, equipment, and utensils that contact raw food must be sanitized before contacting prepared food.

Cross contamination is most frequent at multiple use work stations. Therefore the following guidelines must be followed:

- Raw and prepared foods must be kept in separate containers
- Each multipurpose work station should have its own container of sanitizing solution and an accompanying wiping cloth.

Cutting boards are a common source of cross contamination. Cutting boards should be:

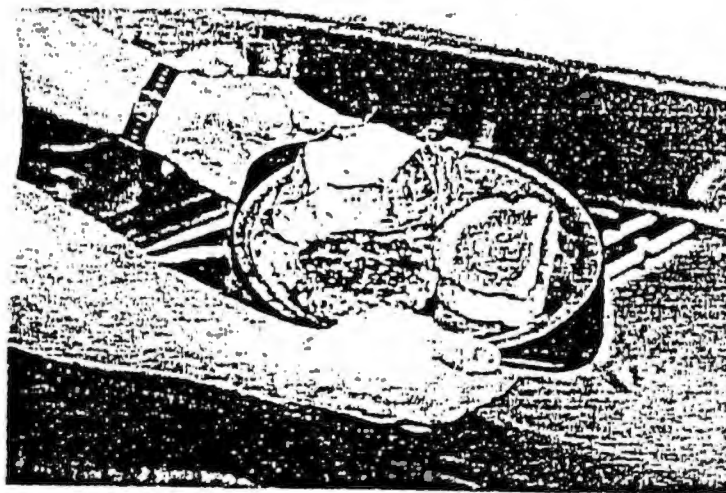
- Separated according to food type: raw or cooked
- Washed and sanitized after each use.

Cross contamination also occurs frequently with the multiple use of utensils and equipment. To prevent cross contamination with equipment:

- Equipment, utensils, and preparation sinks must be washed and sanitized after each use.
- Food handlers must use tongs or disposable gloves when serving food.
- Tongs, spoons, and other serving utensils must be stored with their handles above the top of the food containers on the cold station or display.
- Dispensers should be used to serve condiments or single serve packets.

How food is held also affects cross contamination. Some rules to avoid cross contamination:

- Never reuse food which has been served or held hot for over four hours on display.
- Maintain foods at their proper temperature and provide shields or display cases when food is on display.



RECORD KEEPING

Record keeping is one of the most effective means to document anything that has occurred during the course of a business day. Food service establishments should keep records just like any other business.

Keeping daily records that indicate dates, times, and temperatures are crucial for identifying problematic areas concerning food borne illnesses. It is vital to keep accurate records for these areas.

A daily tracking sheet such as the one shown below can be very useful for tracking temperatures of specific items.

Day Tracker

Date _____

Product	ITEM	1	2	3	4	5	6	7	8
Beef									
Poultry									
Fork									
Fish									
Shellfish									
Cold Food									
Misc.									
Cool Temp.	Refrigerator	Fry	Grill	Steamer	Sauté	Broast	Boil	Misc.	
Shift 1									
Shift 2									
Shift 3									
Delivery	Temp.								
Product	Item								
Beef									
Poultry									
Fork									
Fish									
Shellfish									
Dairy									
Misc.									

Reviewed by: _____

Date: _____

Temperatures of refrigerated goods should be tracked and recorded every shift.

Temperatures of all refrigeration units should be assessed and recorded once every shift.

Temperatures of food when they are delivered should be tracked and recorded.



FOOD SAFE COOKING

The cooking process can be a cause of food borne illness. It also can be one of the most reliable methods for control of food borne illness.

Cooking raises the temperature of food to a point where bacteria that was introduced from mishandling or improper storage can no longer survive.

It is critical that foods be cooked and served at the proper temperatures for heat to be an effective method to kill bacteria. Some of the most common internal cooking temperatures required by law are:

- * Poultry 165 degrees F
- * Pork 150 degrees F
- * Rare roast beef 130 degrees F
- * Ground beef 155 degrees F
- * Reheated foods 165 degrees F

Most other foods should be heated to 165 degrees F to insure that bacteria will be destroyed.

Never use hot holding equipment to heat food.

Internal temperatures of food should be sampled on a regular basis and logged in a time and temperature log book.

A well-kept log book can be a valuable tool to track the efficiency of your food safety system.

HOT HOLDING FOODS

Hot holding is a major cause of food borne illness.

To insure food safety, hot holding equipment must maintain foods at 140 degrees F or higher.

Hot holding equipment must be designed to protect food from employees or customers and to maintain proper food temperatures.

To check a piece of hot holding equipment for temperature, do not rely on its external thermometer. Instead place your pocket thermometer inside the unit for 5 minutes.

Once you are assured that the holding equipment is working, you should follow these rules to ensure that proper holding is achieved:

- All food transferred to hot holding equipment must be cooked to 140 degrees F or higher.
- All reheated food must be heated to 165 degrees F or higher.
- The entire portion of a hot held food must reach a minimum temperature of 140 degrees F.
- Hot holding equipment **must not** be used to heat or reheat food.
- **Never** add old food to new food.

RAPID COOLING FOODS

Improper cooling is the major cause of food borne illness. Proper cooling of hot foods is very time consuming and requires a great deal of a food handler's attention.

Cooling equipment needs for individual food service establishments will depend on their volume and menu.

The steps for the simplest rapid cooling method for hot food is:

1. Separate the food into small quantities in shallow pans not deeper than 4 inches.
2. Place the shallow pans in an ice bath, a sink, or large container filled with enough ice so that there is three times the amount of ice as food.
3. Stir the food once every fifteen minutes, and check its internal temperature each time.
4. Once the internal temperature of the food has reached 45 degrees F, cover the pan and place it in a refrigeration unit.

You also may use a cooler instead of an ice bath. The steps for this method are:

1. Separate the food into small quantities in shallow pans not deeper than 4 inches.
2. Place the shallow pans on the top shelf in the cooling unit.
3. Stir the food every fifteen minutes, and check its internal temperature each time.
4. Once the internal temperature of the food reaches 45 degrees F, cover the pan and label it with its name and the current date.

The steps to chilling hot liquids rapidly are:

1. Pour the liquid to a depth of up to 2 inches in a shallow aluminum or stainless steel pan.
2. Place the pan in an ice bath. The amount of ice should be at least three times the volume of the hot liquid.
3. Be certain the ice surrounds all sides of the pans.
4. Once the hot liquid reaches 70 degrees F, cover the pan and place it into a refrigerated unit.

FOOD SERVICE SANITATION

It is vital for a food service operation to be clean and sanitary. Just because an establishment appears clean, it may not be sanitary. Traditional methods of cleaning insure the removal of visible contaminants on food contact surfaces but offer little protection against the presence of bacteria.

SANITATION LAW:

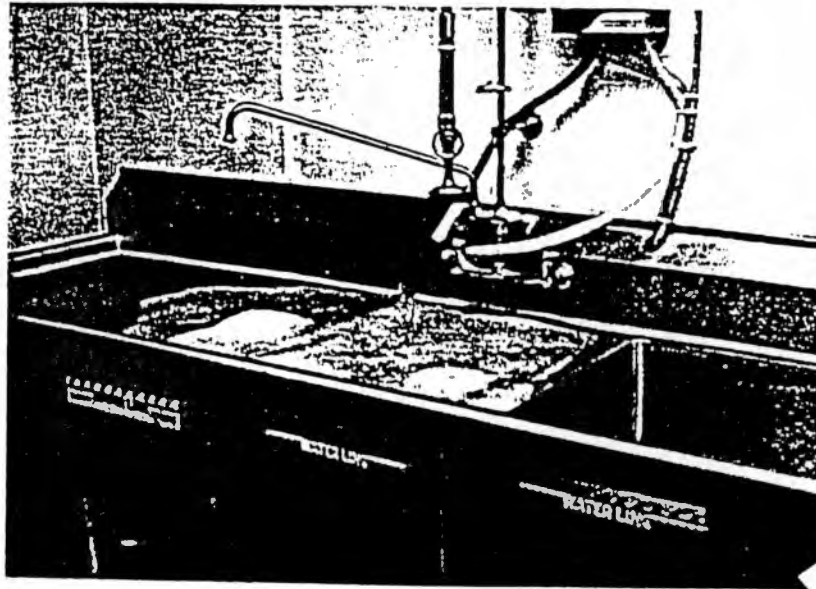
Every time a piece of equipment or service ware is used, it is assumed to be contaminated until it receives proper treatment to insure the removal of any bacteria that could be present. All utensils, serving ware, and cooking equipment should be cleaned, then sanitized in an approved manner. **CLEANED, then SANITIZED.**

Cleanliness is critical if you want your operation to be profitable and inviting for return customers. However, visual cleanliness does not insure safe food. The difference between cleaning and sanitizing is that a clean object can be free of visible soil, but a sanitized object is free of harmful bacteria.

A cleaning program that lists times and areas to be done daily, weekly, and monthly will help insure that an operation remains in sanitary condition. Learning to clean as you go also will help you develop a higher level of efficiency and cleanliness.

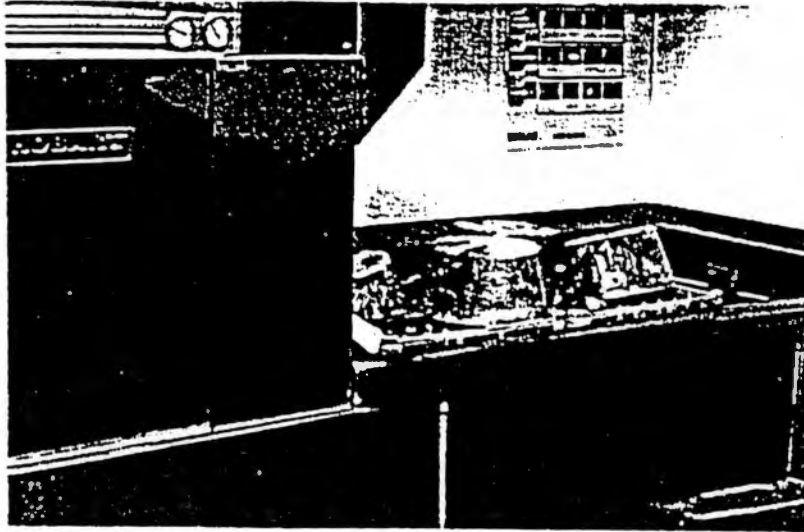
Cleaning requires the use of hot water and an approved detergent to loosen and remove all soils from equipment and serving ware. Detergents for the food service industry are usually chemicals specified for unique applications. Common soaps usually are used for hand washing while synthetic detergents are used to clean food contact surfaces.

DO NOT CONFUSE THE TWO! Anytime you use a detergent on food service equipment, be sure to rinse it thoroughly. Detergent residue that remains on a piece of equipment can render the applied sanitizer ineffective.



RULES FOR MANUAL WASHING IN A 3 COMPARTMENT SINK

1. Use the first basin for washing. The temperature of the wash solution should be maintained between 110 degrees F and 120 degrees F. When the solution becomes cloudy, it should be replaced.
2. Use the second compartment for rinsing. The water in this basin should always be clear and hot. If it becomes cloudy, drain the basin and refill it with fresh, hot rinse water.
3. The third basin is used for the sanitation process. If you are using hot water as the means for sanitizing, you should submerge the utensils and serving ware in 170 degree F water for 30 seconds. If you are using a chemical sanitizer, you should fill the third basin with water and chemical as prescribed by the manufacturer.



RULES FOR MECHANICAL WASHING

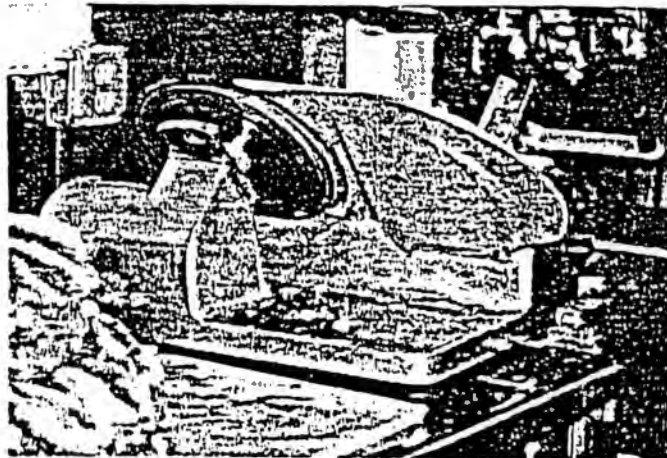
1. Scrape off and remove any excess foods on the service ware and utensils.
2. Sort the utensils and equipment to have like objects go through at the same time.
3. Run the wash cycle with the appropriate detergent at a minimum temperature of 145 degrees F.
4. Run the final rinse temperature at a minimum temperature of 180 degrees F. Check the accuracy of all gauges and thermometers on a mechanical machine regularly, as these parts can wear out and lose their calibration.

THE THREE MOST COMMON SANITIZERS FOR FOOD PREP SURFACES

1. Chlorine mixed in concentrations of 1 teaspoon per 1 gallon of water.
2. Iodine mixed in concentrations of 1 ounce per five gallons of water.
3. Quaternary Ammonia mixed in various concentrations according to the manufacturer's recommendations.

OTHER SANITIZERS

There are other sanitizers used in a food service establishment. Many of these are designed for specific uses such as sanitizing floors and garbage cans. These sanitizers should not be used on food prep surfaces because they can be toxic if consumed.



TO SANITIZE STATIONARY EQUIPMENT AND FOOD PREPARATION AREAS

1. Unplug all equipment and remove guards.
2. Clean and sanitize all moving parts of kitchen equipment by hand.
3. Rinse and sanitize all surfaces with a solution of double strength sanitizer.
4. Reassemble equipment while it is still unplugged.
5. All equipment should be air dried.

APPENDIX 3.

Food Safety Information Test

FOOD SAFETY INFORMATION TEST

Please answer all of the following questions by circling the answer that you feel is correct. All of the exam results will be kept confidential and used only to develop better food safety training methods for the future.

1. A food service employee should wash their hands....
 - A. Before they go to the restroom
 - B. With sanitizer and hot water
 - C. In hot running water with an approved soap
 - D. Before they go on break
2. Which of the following is a food safety rule of personal hygiene?
 - A. Hands can have open cuts or wounds.
 - B. Clear fingernail polish is all right.
 - C. It is all right to chew a toothpick while working.
 - D. You should wear no jewelry while you work
3. Which of the following rules is not true?
 - A. You cannot eat while working
 - B. You cannot chew gum while working
 - C. You cannot smoke a cigarette while working
 - D. You cannot drink water while working
4. Meat to be served in a restaurant cannot be purchased from...
 - A. A salesman selling government inspected meat
 - B. The farmer down the road
 - C. A slaughter house
 - D. A grocery store
5. Any meat to be received must...
 - A. Be delivered in a clean truck
 - B. Be below 40 degrees F.
 - C. Arrive in a refrigerated truck
 - D. All of the above
6. Raw vegetables should be...
 - A. Stored below cooked products
 - B. Stored below fresh meat
 - C. Stored above hazardous foods
 - D. Stored with cleaning chemicals

7. The food safety danger zone is...

- A. Between 45 degrees F and 140 degrees F
- B. Under 45 degrees F and over 140 degrees F
- C. Between 40 degrees F and 140 degrees F
- D. Over 45 degrees F and under 145 degrees F

8. All food products must be stored at least ____ above the ground

- A. 6 inches
- B. 8 inches
- C. 9 inches
- D. 12 inches

9. According to food safety principles, a freezer unit's temperature should be ____

- A. At 0 degrees F
- B. At 20 degrees F
- C. At 32 degrees F
- D. None of the above.

Use the following story to answer questions 10 - 12.

You just received one case of lettuce, one case of fresh chicken, one case of bagels, one case of grease cutter, and one case of pre-made lasagna. All of these items are to be used on the same day. You only have one empty rack with three shelves on it.

10. Which item would go on the bottom shelf?

- A. The bagels
- B. The chicken
- C. The lettuce
- D. The lasagna

11. Which item could go on the top shelf?

- A. The bagels
- B. The chicken
- C. The lettuce
- D. The grease cutter

12. Which item could not go on any of the shelves?

- A. The bagels
- B. The chicken
- C. The grease cutter
- D. The lasagna

13. Thermostats for refrigerated storage spaces should be set to keep the unit's temperature at

- A. 38 degrees F
- B. 40 degrees F
- C. 42 degrees F
- D. 45 degrees F

14. Which of the following is considered to be good food surface sanitizer?
- A. Iodine
 - B. Quaternary Ammonia
 - C. Chlorine
 - D. All of the above
15. Why is it important to rinse a food service utensil after it has been washed with a detergent?
- A. It is not important
 - B. To remove the soap residue so the sanitizer can work
 - C. To make its surface shiny again
 - D. To get a good grade from the health department.
16. Pork should be cooked to at least what internal temperature?
- A. 140 degrees F
 - B. 150 degrees F
 - C. 160 degrees F
 - D. 165 degrees F
17. _____ is the leading cause of food borne illness
- A. Hot holding for too long
 - B. Improper cooling
 - C. Under cooking
 - D. Poor personal hygiene
18. A package of frozen turkey is being delivered to you. You notice that the box is badly crushed on one side. You should _____
- A. Open the box and inspect the product and accept it if it appears all right.
 - B. Accept the package because it is frozen and couldn't be damaged.
 - C. Refuse the package and reorder the product.
 - D. Refuse the product unless the delivery driver says you can have it free.
19. Hot foods that have fallen below 140 degrees F can
- A. be heated to 165 degrees F and served once again
 - B. be heated to 165 degrees F and used repeatedly
 - C. be frozen to kill any bacteria in them
 - D. washed, rinsed, sanitized, and re-heated to 160 degrees F. and served once again
20. Which of the following are true about cooling food?
- A. Cooling is the major cause of foodborne illness
 - B. Leave containers of cooling food uncovered until they reach 45 degrees F, then cover them
 - C. Hot foods should be placed in shallow pans and stirred every fifteen minutes in a cooling source
 - D. Freeze hot foods as soon as they are leftover

21. When calibrating a Fahrenheit thermometer in a glass of ice water, you should set the temperature at
- A. 0 degrees F.
 - B. 27 degrees F.
 - C. 32 degrees F.
 - D. 40 degrees F.
22. The rinse cycle in a mechanical dishwashing machine should be?
- A. 140 degrees F.
 - B. 165 degrees F.
 - C. 180 degrees F.
 - D. 220 degrees F.
23. Keeping food service records are important because:
- A. They keep secretaries employed
 - B. They prevent food borne illness
 - C. They prove that proper procedures were followed
 - D. All the above
24. Which of the following items should be included in food safety records?
- A. Food product prices
 - B. Temperatures of refrigeration units
 - C. Daily sales figures
 - D. Time cards
25. A cook has been told by her manager to prepare pork chops. She has cooked some pork chops on the chargrill for three minutes on each side. The internal temperature of the pork chops is 145 degrees F. The cook should....
- A. Serve the chops as medium rare
 - B. Cook the chops until they reach 150 degrees F
 - C. Cook the chops until they reach 165 degrees F
 - D. Put the chops in a hot holding box until they reach proper temperature

APPENDIX 4.

Computer Attitude Survey

COMPUTER ATTITUDE SCALE

Please place an "x" in the space that best describes how you feel about the statements below. Place the "x" under the column for "Strongly Agree", "Slightly Agree", "Slightly Disagree" or "Strongly Disagree".

Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
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[illegible]

- I do not like talking to others about computers.
I will do as little work with computers as possible.
I think working with computers would be enjoyable and stimulating.
Figuring out computer problems does not appeal to me.
I am no good with computers.
Computers make me feel uncomfortable.
Generally, I would feel all right about trying a new problem on the computer.
I would like working with computers.
I have a lot of self-confidence when it comes to working with computers.
It would not bother me at all to take computer courses.
Computers do not scare me at all.
Working with a computer would make me nervous.
I do not feel threatened when others talk about computers.
I don't think I would do advanced computer work.
If a problem were left unsolved in a computer class, I would think about it afterward.
The challenge of solving problems with computers does not appeal to me.
Once I start to work with the computer, I find it hard to stop.
I don't think I could handle a computer course.
I think using a computer would be very hard for me.
I am sure I could learn a computer language.
I am sure I could do work with computers.
I get a sinking feeling when I think of trying to use a computer.
I am not the type to do well with computers.
I would feel at ease in a computer class.
I would feel comfortable working with a computer.
When there is a problem with a program running that I cannot immediately solve, I will stick with it until I have an answer.
I don't understand how some people can spend so much time working with computers and seem to enjoy it.
I feel aggressive and hostile against computers.
Computers make me feel uneasy and confused.

VITA

Thomas F. Gaddis was born in Paducah, Kentucky on October 17, 1959. He attended schools in the Loudon County and Knox County, Tennessee public school system as well as The Webb School of Knoxville. He graduated from the School of Business at the University of Tennessee at Knoxville in 1982 and immediately went to work for the Burroughs Corporation. He later rekindled a life long interest in the food service industry and went to work for Cracker Barrel Old Country Stores, Inc. After a few years of industry application, he returned to the University of Tennessee to attain a Masters degree in Hotel and Restaurant Administration. He achieved this goals while concurrently managing within the University's Dining Service division. Upon completion of his Masters degree in 1993, he began work on his Ph.D. in Human Ecology which was attained in August 1997.

After completion of the degree of Doctor of Philosophy in Human Ecology, he started a Hospitality/Tourism program at Pellissippi State Technical Community College and became a Regional Coordinator of the Tennessee Hospitality Educators Association.