©Journal of Agricultural Education
Volume 54, Number 1, pp. 18 – 30
DOI: 10.5032/jae.2013.01018

Evaluating the Effectiveness of Traditional Training Methods in Non-Traditional Training Programs for Adult Learners through a Pre-test/Post-test Comparison of Food Safety Knowledge

Caleb D. Dodd
Scott Burris
Steve Fraze
David Doerfert
Abigail McCulloch
Texas Tech University

The incorporation of hot and cold food bars into grocery stores in an effort to capture a portion of the home meal replacement industry is presenting new challenges for retail food establishments. To ensure retail success and customer safety, employees need to be educated in food safety practices. Traditional methods of training are not meeting the needs of the retail food industry. Although many food safety training programs exist, few meet the educational needs of hot and cold food bar employees. In an effort to determine the effectiveness of traditional training methods for employees, a quasi-experimental study was performed. Data was collected from three separate chains within the retail food industry from six geographical locations. The pre-post assessment study utilized an interventional training and included collecting questionnaires from 300 employees. Findings of the study described characteristics of employees within each chain individually and collectively. Food safety knowledge was assessed by comparing pre-training and post-training assessments for managerial and non-managerial employees. The most important finding for this study was determining the change in essential food safety knowledge of employees after traditional food safety training was conducted for managerial employees within the treatment stores and comparing that change to the change that occurred in the control groups.

Keywords: Non-traditional training; food safety; training effectiveness; adult training.

The retail food industry is rapidly changing with new trends and practices emerging constantly (Bolton, Shankar, & Montoya, 2010). Throughout the past decade, Home Meal Replacement (HMR) has developed into a leading trend in the food service and grocery industries (Quested, Cook, Gorris, & Cole, 2010). Foodservice operations are competing with grocery stores for the traditional food market (Friddle, Mangaraj, & Kinsey, 2001). With the HMR trend taking over the industry, grocery stores are striving to maintain their traditional hold on the food market by developing ready-to-eat hot and cold self-service food bars (Binkley & Ghiselli, 2005).

With the addition of new products, kitchens, and procedures comes additional food safety concerns (Friddle et al., 2001). These concerns lead to a need to incorporate food safety training for the new procedures. In order to provide safe food, employees need to know how to properly prepare and maintain food for hot and cold food bars and be trained to properly use kitchen tools and equipment (McCulloch, 2009). This new market opportunity presents a need for training to ensure proper food safety practices in the hot and cold food bars within the grocery store industry.

An organized approach is necessary to identify and fulfill training needs. In 2006, organizations spent $129.6 billion dollars on training to

prepare employees for conducting their tasks. With such a sizable investment, organizations must prioritize and focus training resources where they will be most effective (Moskowitz, 2008). One way of providing this focus is through the utilization of a needs assessment. A needs assessment is the process of identifying needs, prioritizing them, making needs-based decisions, allocating resources, and implementing actions in organizations to resolve problems underlying important needs (Altschuld & Kumar, 2010). Moskowitz (2008) found that the most efficient way to collect data for a training needs assessment is through surveys. However, employee behavior can also be observed in the working environment to provide usable data for the assessment. In addition, tests can be administered to employees to assess job knowledge (Moskowitz, 2008).

There are many methods for conducting a needs assessment. In 1984, Witkin developed a process model that contained three phases and emphasized three levels of need (Altschuld & Kumar, 2010). Since then, Altschuld and Kumar (2010) have revised the model.

Phase I of the needs assessment model consists of becoming organized and focusing on potential areas of concern. This includes exploring literature and research to determine what is already available and its level of success as it relates to the specified focus of each employer. Phase I is a critical building block of a needs assessment as it leads to a wealth of information about the areas of concern. The purpose of this phase is to take advantage of existing data (Altschuld & Kumar, 2010). Previous literature of training strategies and programs within the grocery industry was researched to complete Phase I of the needs assessment.

Phase II deals with gathering new information based on what has not been discovered in Phase I. Phase II involves determining initial needs, prioritizing these needs, and analyzing their possible solution strategies. Phase II often requires an extensive investment of time, personnel, and resources for the collection of new data (Altschuld & Kumar, 2010). A pretest/post-test study was conducted to create a wealth of new data to complete Phase II of the needs assessment.

Designing and implementing solutions for high-priority needs and evaluating the results of the needs assessment process constitute Phase III. Evaluation of the process generally is not done but should be completed as part of organizational development and change (Altschuld & Kumar, 2010). Recommendations were made for future training programs to complete Phase III of the needs assessment.

Despite the success, there have been many challenges for grocery stores that serve HMRs, including time, labor, and food safety risks. The intricate food structure, employee turnover, and food pathogens are hampering the safety efforts that supermarkets utilize in the United States (Binkley & Ghiselli, 2005). Even if perfect production and distribution practices are followed, consumers may not follow safe-handling procedures (Reyes, 2002). This knowledge combined with the fact that many grocery stores are adding kitchens and unfamiliar equipment and processes to their businesses forces grocery stores to be more focused on food safety practices and train their employees to handle food safely (Binkley & Ghiselli, 2005).

Effective food safety plans and well-trained staff can help prevent an unwanted outbreak of foodborne illness. As the complexity of the food distribution and retailing system increases, the need for more stringent food safety controls and training increases as well. Food safety training and certification are a crucial part of any food safety plan (Drummer, 1998). Implementing an effective food safety training program for employees, applying a sanitation program, and designing a crisis plan in the case of a foodborne illness outbreak are evident needs in the HMR market (Binkley & Ghiselli, 2005).

There are many barriers to implementing effective food safety training for employees. A small staff base, employee turnover, lack of time, cost, a lack of suitable courses, and inflexibility of courses were reported as the most common barriers when attempting to provide effective training for supermarket employees (Worsfold, 2005). Some researchers suggest that food safety training is effective, but others find no improvement in food safety practices after training employees (York et al., 2009).

Worsfold (2005) found that effective training did not appear to be on the agenda of priori-

ties for many food managers. Some managers in the study viewed training as an operating expense and did not realize the benefits. Due to low cost and convenience, on-the-job training was the most common type of training within the food service industry (Worsfold, 2005). This type of training can produce negative results including poorly trained employees who use dangerous or ineffective methods to produce food products (Worsfold, 2005).

Purpose and Objectives

The purpose of this study was to determine the effectiveness of commonly used training methods within a non-traditional learning program. Food safety is a major concern that is continually faced by grocery stores and other food providers (Binkley & Ghiselli, 2005). Food workers' improper preparation procedures are the most prominent cause of foodborne illness outbreaks (Foodborne Illness, 2010). Effective training is needed to allow for grocery store employees to prepare and serve food in a manner that is safe and foodborne illness free.

This study is directly related to the fourth (Examine appropriate non-formal educational delivery systems) and fifth (Identify and use evaluation systems to assess program impact) research priority areas of Agricultural Education in Domestic and International Settings: Extension and Outreach of the National Research Agenda for Agricultural Education and Communication. In order to successfully complete this study, objectives were determined to identify the effectiveness of traditional training methods within stores by transferring knowledge from managerial employees to non-managerial employees. This needs assessment was guided by two research objectives:

1. Describe characteristics of managerial and non-managerial individuals employed within the hot and cold self-service food bars of grocery stores.
2. Assess the change in food safety knowledge of stores between pre-assessment and post-assessment.

Methods and Procedures

The research design for this study was quasi-experimental. This type of experiment lacks random assignment but can yield useful knowledge if it is carefully designed (Gall, Gall, & Borg, 2007). The study contained an education intervention. Initial assessment was pre-test, followed by a traditional food safety training program, then followed by a post-test assessment. The effectiveness of the training program and the transfer of information from managerial employees to non-managerial employees were determined through differences in the pre-training questionnaires and post-training questionnaires.

With the intention of developing a computer-based training program for hot and cold self-service food bars in the grocery store industry, the United States Department of Agriculture (USDA) funded a research grant through the International Center for Food Industry Excellence (ICFIE). Three grocery chain retail food providers agreed to participate in the collaborative project. The chains span six geographical regions within five states. In order to properly assess the effectiveness of food safety training it was determined that both managerial and non-managerial employees should be included in the study. The target population included employees that worked in the hot and cold self-serve food bar department of grocery stores. The sampling technique used for this study was non-probabilistic purposive.

The grocery chains agreed to allow one managerial employee and two non-managerial employees to complete a written questionnaire. Following the initial data collection period, managerial employees from randomly selected stores participated in an interventional food safety training program presented in a traditional classroom method. The stores not selected were identified as a control group, while the stores participating in the training were identified as the treatment group. The interventional food safety training the managerial employees received was presented by professionals using certification curriculum. Post-training data was collected no less than 30 days later, this period of time gave managerial employees time to transfer new knowledge to non-managerial em-

ployees within the stores. Post-training data included the same questionnaire, again targeting one managerial employee and two non-managerial employees. After the collection of the data, analysis was performed to identify what effects the training had on the stores' food safety knowledge collectively.

The accessible sample for the needs assessment consisted of 44 stores from three grocery chains in five states who offered hot and cold self-service food bars for customers. The 44 stores were represented by 300 questionnaires. Fifty-six managerial employees and 113 non-managerial employees participated in the pre-assessment of food safety knowledge, whereas 43 managerial employees and 88 non-managerial employees participated in the post-training questionnaire. The sampling technique was non-probabilistic. Results of this study cannot be generalized to a larger population due to the fact that the sample was purposively selected by the chains upper management. However, the sampling technique does allow for adequate needs assessment to be performed.

The instrument used for this study was a Food Safety Questionnaire developed for a pre-assessment to develop a food safety training program (McCulloch, 2009). The questionnaire consisted of five sections. The questionnaire was developed in both English and Spanish. As reported by McCulloch, the content and validity of the instrument used for this study was established by a panel of experts. McCulloch reported the Kuder-Richardson 20 coefficient was 0.51. This is relatively low, but acceptable value for the Kuder-Richardson (Nunnally, 1967).

Two different modes were used for collecting data from employees. An online instrument was initially developed for the delivery of the questionnaire; a paper booklet was then designed to accommodate individuals without access to internet connections. The collection of pre-test and post-test data spanned 15 months. The study was designed to offset data collection between chains to reduce the number of personnel used data collection. Data from each chain was collected within a 200-day period.

Data was entered and analyzed using the Statistical Package for Social Sciences (SPSS) 16.0 computer program for Microsoft Windows. Microsoft Excel 2007 was used for calculating scores. Descriptive data for objective one was reported using frequencies, percentages, means, and standard deviations. In analyzing data for objective two, 16 questions from section two of the questionnaire were used to determine food safety knowledge scores. Each participant received a percentage score representing the number of questions the individual answered correctly out of the 16 possible. Objective two assessed the change between pre-training food safety knowledge and post-training food safety knowledge of employees.

Findings

Managerial employees' data were analyzed separately from non-managerial employee data as statistical comparison between the two groups were not suitable. The findings are presented by each chain individually and from all stores cumulatively. Table 1 provides a summary of the number of participants by chain for each phase of data collection.

Table 1
Summary of Number of Participants by Employment Type, Location, and Administration

Participants (*N*)	Chain I	Chain II	Chain III	Cumulative
Stores				
Control Group	9	7	8	24
Treatment Group	6	8	6	20
Total	15	15	14	44
Managerial Employees				
Pre-Training Control	8	9	12	29
Post-Training Control	9	12	6	27
Pre-Training Treatment	8	10	9	27
Post-Training Treatment	5	9	2	16
Total	30	40	29	99
Non-managerial Employees				
Pre-Training Control	23	16	18	57
Post-Training Control	20	17	11	48
Pre-Training Treatment	23	16	17	56
Post-Training Treatment	11	18	11	40
Total	77	67	57	201

Objective one sought to describe the employees participating in the study. This section described the demographic characteristics of the participants along with their retail food experience and experiences in food safety training. The average age of the participants and their average number of years in the retail food industry are presented in Table 2. The mean age of managerial employees in the study was 39 (*SD*=9.2) while non-managerial employees' average age was slightly younger (*M*=38) with a higher level of variance (*SD*=13.8). The average number of years in the industry for managerial employees was 10 years (*SD*=7.0). The average for non-managerial employees in the retail food industry was six years (*SD*=6.2).

Table 2
Participants' Ages and Years of Experience

	Chain I		Chain II		Chain III		Grand Mean	
Characteristic	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Managerial Employees								
Age	41	10.6	40	8.9	36	7.7	39	9.2
Years in Industry	8	8.4	11	7.2	10	4.4	10	7.0
Non-managerial Employees								
Age	39	16.4	36	12.7	40	10.8	38	13.8
Years in Industry	5	6.1	6	6.7	7	5.4	6	6.2

Gender, current positions held, and levels of education for the managerial employees are reported in the Table 3. Just over half the managerial employees were female (*n*=50). Fifty-five percent (*n*=55) of managerial employees in the study reported being their stores' department manager. The level of education of the managerial employees varied from 21.2% of participants (*n*=21) reporting having some high school to 11.1% of participants (*n*=11) having earned a bachelor's degree. Almost half of the managerial employees reported either a high school diploma or some high school being their highest level of education.

Table 3
Managerial Employees' Gender, Position, and Education Level

	Chain I		Chain II		Chain III		Cumulative	
Characteristic	*f*	%	*f*	%	*f*	%	*f*	%
Gender								
Female	14	46.7	26	65.0	10	34.5	50	50.5
Male	13	43.3	14	35.0	18	62.1	45	45.5
Undisclosed	3	10.0	0	0.0	1	3.4	4	4.0
Position								
Department Manager	19	63.3	22	55.0	14	48.3	55	55.6
Department Head	2	6.7	4	10.0	5	17.2	11	11.1
Co-Manager	3	10.0	2	5.0	2	6.9	7	7.1
Other title	6	20.0	12	30.0	8	27.6	26	26.2
Education								
Some High School	10	33.3	9	22.5	2	6.9	21	21.2
High School Diploma	5	16.7	12	30.0	8	27.7	25	25.3
Some Culinary/Tech	6	20.0	3	7.5	4	13.8	13	13.1
Graduate Culinary/Tech	2	6.7	4	10.0	1	3.4	7	7.1
Associate's Degree	5	16.6	6	15.0	11	37.9	22	22.2
Bachelor's Degree	2	6.7	6	15.0	3	10.3	11	11.1

The same information provided for managerial employees in Table 3 was provided for non-managerial employees in the study in Table 4. Unlike the managerial employees, who were relatively even in the female-to-male ratio, females accounted for 68.1% (*n*=137) of all the non-managerial employees participating in the study. Although 21.4% (*n*=43) of the non-managerial employees reported holding positions with titles, the vast majority, 78.6% (*n*=158) reported being an hourly employee or some other title. The level of education did fluctuate from percentages reported by managerial employees. However, the most frequent responses remained the same with 65 (32.3%) of the non-managerial employees reporting a high school diploma as the highest level of education and some high school accounting for 28.9% (*n*=58).

Table 4
Non-managerial Employees' Gender, Position, and Education Level

	Chain I		Chain II		Chain III		Cumulative	
Characteristic	*f*	%	*f*	%	*f*	%	*f*	%
Gender								
Female	52	67.5	46	68.7	39	68.4	137	68.1
Male	20	26.0	20	29.9	17	29.8	57	28.4
Undisclosed	5	6.5	1	1.5	1	1.8	7	3.5
Position								
Shift Leader	3	3.9	12	17.9	7	12.3	22	10.9
Department Head	2	2.6	0	0.0	2	3.5	4	2.0
Assistant Head	5	6.5	8	11.9	4	7.0	17	8.5
Hourly Employee	61	79.2	44	65.7	29	50.9	134	66.7
Other title	6	7.8	3	4.5	15	26.3	24	11.9
Education								
Some High School	27	35.0	18	26.9	13	22.8	58	28.9
High School Diploma	23	29.9	26	38.8	16	28.1	65	32.3
Some Culinary/Tech	15	19.5	10	14.9	9	15.8	34	16.9
Graduate Culinary/Tech	3	3.9	3	4.5	2	3.5	8	4.0
Associate's Degree	5	6.5	7	10.4	9	15.8	21	10.4
Bachelor's Degree	4	5.2	3	4.5	8	14.0	15	7.5

Methods of training received and time spent training for managerial employees are displayed in Table 5. When responding to methods of training received, participants were encouraged to answer all that applied to their individual experience.

Table 5
Managerial Employees' Experience with Food Safety Training

	Chain I		Chain II		Chain III		Cumulative	
Characteristic	*f*	%	*f*	%	*f*	%	*f*	%
Method of Training								
Classroom	17	56.8	39	97.5	26	89.7	82	82.8
On-the-job	20	66.7	15	37.5	10	34.5	45	45.5
Textbook	8	26.7	11	27.5	17	58.6	36	36.4
Video	9	30.0	15	37.5	11	37.9	35	35.4
Computer-based	24	80.0	2	5.0	3	10.3	36	29.3
Company-web	10	33.3	0	0.0	3	10.3	13	13.1
Internet	6	20.0	0	0.0	1	3.4	7	7.1
Time Spent Training								
More than 3 days	12	40.0	4	10.0	2	6.9	18	18.2
2 – 3 days	7	23.3	24	60.0	21	72.4	52	52.5
1 day	3	10.0	2	5.0	4	13.8	9	9.1
6 – 12 hours	3	10.0	6	15.0	1	3.4	10	10.1
Less than 5 hours	5	16.7	4	10.0	1	3.4	10	10.1

Classroom training, accounting for 82.8% (n=82), was the most common method reported by managerial employees. It was also the most frequent response in two of the three chains. Eighty percent of managerial employees (n=24) in Chain I reported computer-based training to be most prominent. Only two managerial employees (5.0%) in Chain II and three managerial employees (10.3%) in Chain III re-

ported utilizing computer-based training. Although city and state certification appeared to be the most popular training certification with 48.8% (*n*=49), it was less than half of the most frequent response in two of the three chains. Fifty-two managerial employees (52.5%) reported spending between two and three days in food safety training. Two to three days training was also the majority in Chain II and Chain III; however, 40% (*n*=12) of managerial employees in Chain I reported spending more than three days in food safety training. Methods of training and time spent training for non-managerial employees are described in Table 6.

Table 6
Non-managerial Employees' Experience with Food Safety Training

	Chain I		Chain II		Chain III		Cumulative	
Characteristic	*F*	%	*f*	%	*f*	%	*f*	%
Method of Training								
Classroom	13	16.9	51	76.1	40	70.2	104	51.7
On-the-job	53	68.8	44	65.7	38	66.7	135	67.2
Textbook	15	19.5	11	16.4	31	54.4	57	28.4
Video	34	44.2	25	37.3	31	54.4	90	44.8
Computer-based	46	59.7	1	1.5	12	21.1	59	29.4
Company-web	13	16.9	1	1.5	11	19.3	25	12.4
Internet	3	3.9	2	3.0	3	5.7	8	4.0
Time Spent Training								
More than 3 days	12	15.6	7	10.4	7	12.3	26	12.9
2 – 3 days	11	14.3	22	32.8	24	42.1	57	28.4
1 day	14	18.2	11	16.4	9	15.8	34	16.9
6 – 12 hours	2	2.6	7	10.4	8	14.0	17	8.5
Less than 5 hours	38	49.3	20	30.0	9	15.8	67	33.3

Unlike the responses given by the managerial employees, the method of training most frequently used, as reported by non-managerial employees, was on-the-job training by 67.2% (*n*=135). Chain II and Chain III aligned more closely to the numbers reported by managerial employees. The most frequent method of training for these chains was classroom training by 76.1% (*n*=51) for Chain II and 70.2% (*n*=40) for Chain III. At 59.7% (*n*=46), more than half of Chain I non-managerial employees reported participating in computer-based training. Like managerial employees from Chain II and Chain III, only one non-managerial employee from Chain II (1.5%) and 12 non-managerial employees from Chain III (21.1%) reported using computer-based training. The amount of time spent training also differed from responses given by managerial employees. The most frequent response given by non-managerial employees was less than five hours with 33.3% (*n*=67). Two to three days was the second most frequent overall and the most frequent in Chain II with 32.8% (*n*=22) and Chain III with 42.1% (*n*=24).

Objective two assessed the change in food safety knowledge of employees from the pre-assessment to the post-assessment. Food safety knowledge was assessed through 16 multiple choice items developed specifically to test the essential knowledge of employees within the hot and cold self-service food bar sectors of grocery stores. Each participant was given a score based on the percentage of items they answered correctly out of the 16 questions. Scores were averaged among the control groups and treatment groups for both pre-training and post-training assessments for each chain individually and cumulatively. Changes in scores were calculated for each category of participants.

The difference in percentage scores were used for comparing and identifying changes between pre-training and post-training performance. There are many different levels of pre-training food safety knowledge scores reported in this section. Knowledge scores that are high in the pre-training assessment do not leave as large of a window for improvement to occur. Identifying the changes in scores allowed

researchers to compare and contrast but should not be the only way of measuring effectiveness.

The food safety knowledge scores for managerial employees are reported in Table 7. The scores are reported as an average of the percentage of correct answers of all the managerial employees in each category identified in the study. The difference in the pre-training and post-training scores represents the change in food safety knowledge that occurred over time between the collections of the data. The control group received no additional treatment between the assessments of knowledge, whereas managerial employees in the treatment group participated in interventional training for food safety.

Table 7
Change in Food Safety Knowledge Scores for Managerial Employees

Knowledge	Chain I		Chain II		Chain III		Cumulative	
	C	T	C	T	C	T	C	T
Pre-Training	68.8	68.0	81.3	83.8	65.6	70.9	71.3	74.8
Post-Training	70.8	75.0	79.2	81.3	77.1	81.3	75.9	79.3
Difference in Scores	2.0	7.0	(2.1)	(2.5)	11.5	10.4	4.6	4.5

Note. C=Control Group, T=Treatment Group

Cumulatively, the control group had lower pre-training (71.3%) and post-training (75.9%) scores than the treatment group (74.8%, 79.3%). However, the difference in the amount of change that occurred over time between both groups was one-tenth of a percent. Chain I's pre-training scores were extremely close (68.8%, 68.0%), but a 7.0% increase occurred in the treatment group as opposed to the 2.0% increase that was seen in the control group between the pre-training and post-training assessments of knowledge. Chain II had the highest scores by far on the assessment prior to training with the control group scoring 81.3% and the treatment group scoring 83.8%. Chain II also had a negative change in knowledge with both groups dropping in their average scores by 2.1% (control) and 2.5% (treatment). Although Chain II had a decrease in scores, the percentage of correct answers on the post-training assessment remained the top scores represented in the data (79.2%, 81.3%). Chain III's control group started with the lowest score of 65.6%, but had the largest change of 11.0%. Chain III's treatment group also had an increase in knowledge from 70.9% (pre-training) to 81.3% (post-training) for a change of 10.4%.

The food safety knowledge scores for non-managerial employees are reported in Table 8. The difference in the pre-training and post-training scores represents the change in food safety knowledge that occurred over time between the collections of the data. The managerial employees in the control group received no additional treatment between the assessments of knowledge; whereas, the managerial employees in the treatment group participated in interventional food safety training. Non-managerial employees received no additional training.

Table 8
Change in Food Safety Knowledge Scores for Non-managerial Employees

Knowledge	Chain I		Chain II		Chain III		Cumulative	
	C	T	C	T	C	T	C	T
Pre-Training	62.8	59.0	75.0	71.5	63.5	58.8	67.2	62.5
Post-Training	67.8	66.5	68.0	65.3	61.4	60.1	66.4	64.2
Difference in Scores	5.0	7.5	(7.0)	(6.2)	(2.1)	1.3	(0.8)	1.7

Note. C=Control Group, T=Treatment Group

The average knowledge scores for non-managerial employees were lower than the scores reported for managerial employees across the board. Cumulatively, the non-managerial employees pre-training scores were 67.2% for the control group and 62.5% for the treatment group. A slight decrease of 0.8% was scored on the post-training score in the control group with a slight increase of 1.7% occurring in the treatment group. Chain I was only 0.2% away from having the lowest scores on the pre-training assessment and only 0.2% away from having the highest scores on the post-training assessment. Chain I had the greatest amount of change for both the control group (5.0%) and the treatment group (7.5%). Chain II had the highest scores on the pre-training assessment (75.0%, 71.5%) but, like the managerial employees, also showed the greatest decrease in knowledge scores (7.0%, 6.2%). Even with the decrease in knowledge scores, the non-managerial employees in Chain II had some of the highest scores recorded in the post-training assessment. Chain III's non-managerial employees showed the least amount of change from pre-training to post-training assessments. The control group's score decreased 2.1% while the treatment group's score increased by 1.3%.

A comparison of food safety knowledge percentage scores between managerial and non-managerial employees was conducted to assess the difference in food safety knowledge between the two groups. The pre-training and post-training food safety knowledge percentage scores are displayed in Table 9.

Table 9
Difference in Food Safety Knowledge Scores for Different Types of Employees

Knowledge	Chain I		Chain II		Chain III		Grand Mean	
	C	T	C	T	C	T	C	T
Pre-Training								
Managerial	68.8	68.0	81.3	83.8	65.6	70.9	71.3	74.8
Non-managerial	62.8	59.0	75.0	71.5	63.5	58.8	67.2	62.5
Difference	6.0	9.0	6.3	12.3	2.1	12.1	4.1	12.3
Post-Training								
Managerial	70.8	75.0	79.2	81.3	77.1	81.3	75.9	79.3
Non-managerial	67.8	66.5	68.0	65.3	61.4	60.1	66.4	64.2
Difference	3.0	8.5	11.2	16.0	15.7	21.2	9.5	15.1

Note. C=Control Group, T=Treatment Group

The average scores for managerial employees in every chain was consistently higher that the non-managerial employees' scores. In the pre-training, Chain II had the highest scores for both managerial and non-managerial employees, but also had the largest difference in scores with 6.3% in the control group and 12.3% in the treatment group. The difference in food safety knowledge scores was consistently larger in the treatment groups for the pre-training assessment. The difference of food safety knowledge scores between the managerial and non-managerial employees grew larger in every group except Chain I's control group from the pre-training to the post-training. The gap of knowledge grew the largest in Chain III. The control group had a 2.1% difference in the pre-training and a 15.7% difference in the post-training while the treatment group went from a 12.1% difference in the pre-training to a 21.2% difference in the post-training. The overall increase in the difference in food safety knowledge scores between the managerial and non-managerial employees was 5.4% (control) and 2.8% (treatment).

Conclusions, Implications and Recommendations

The employees in this study reported a similar average age. This is most likely due to the high population of high school students mixed with the growing number of baby boomers reaching retirement age and taking part-time employment in the retail food service industry to supplement retirement funds. Managerial employees had almost twice as many years of experience in the industry than did non-managerial employees. This represents two important aspects. First, time in the industry is an important factor for promotion and career success within the industry. Second, non-managerial employees who stay in the industry for an extended period of time are likely to move into management positions. Because non-managerial employees are the ones who move into the management positions, training should be focused on all employees, not only managerial employees.

Most managerial employees in the study held positions with titles and reported a variety of educational levels from some who had only attended some high school to others who had earned bachelor degrees. The majority of non-managerial employees were on hourly employment with over 60% reporting either a high school diploma or some high school. There is a large intellectual range of participants targeted for food safety training. This finding is consistent with findings from McCulloch (2009).Over half of all the employees who participated in the study reported their highest level of education to be a high school diploma or some high school. Based on this finding, food safety training should target a junior high reading level.

Trends for methods of training and time spent training between managerial and non-managerial employees showed some similarities. Employees are accustomed to classroom and on-the-job training between two and three days. This supports findings by Kramer and Scott (2004), Worsfold (2005), and York et al., (2009). Based on results of food safety knowledge scores and number of non-managerial employees who only reported receiving on the job training, researchers can conclude that the current methods of training are not meeting the needs of the hot and cold self-service food bars, therefore, a more effective method for training employees in the retail food industry is needed.

Food safety knowledge scores prior to the interventional training were compared to the food safety knowledge scores following the training to assess the effects the interventional training had on employees' food safety knowledge. The average food safety knowledge scores for employees in the post-training assessment for the treatment groups were lower than one might expect on an assessment of essential knowledge. This finding was consistent with the results of other food safety studies conducted by Hertzman and Barrash (2007) within other regions of the retail food industry. Managerial employees' scores resulted in a 79% average, and carried into a 64% average for their non-managerial employees. The method of transferring knowledge to employees does not sufficiently educate participants in food safety knowledge that is necessary to ensuring food safety for hot and cold self-serve food bar sectors of grocery stores.

The average scores for the three chains cumulatively did not exhibit a large variance between the control group and the treatment group from pre-training to post-training. Managerial employees' difference was less than a tenth of a point and non-managerial employees' resulted in a difference of two and a half percentage points. Overall, the control groups showed a similar change in food safety knowledge as the treatment groups in the study. The traditional method of food safety training did not appear to effectively meet the educational needs of employees in the hot and cold food bars.

In addition, following the training the difference in food safety knowledge between managerial and non-managerial employees grew larger. Managerial employees were the only ones to receive the interventional training with expectations of taking the information back to the non-managerial employees. Information from the interventional training did not appear to have been distributed from the managerial employees to the non-managerial employees in an effective manner. Traditional methods of "training the trainer," expecting information to filter down, does not meet the educational needs within the

hot and cold self-service food bar to ensure safe food for consumers.

Food safety knowledge within the grocery store industry is not at an appropriate level to meet the needs of food safety standards. McCulloch (2009) recommended that the most common methods of training, classroom and on-the-job training, be utilized to build these scores. Researchers in this study do not see these methods meeting the need and recommend that a more effective style of training be explored to promote the retention of understanding of the concepts and importance of food safety in hot and cold food self-service food bars of grocery stores.

Palvia and Palvia (2007) found that all methods of computer-based instruction led to an improvement in the skills of the participants. Macaulay and Pantazi (2006) discovered that students who used computer-based training scored significantly higher than those who used traditional methods. Van Gerven, Paas, and Tabbers (2006) found that computer-based training plays an important role in optimizing the level of cognitive load an individual is capable of processing. Based on findings of this study, computer-based curriculum will be a new method for more than half of participants.

This study identified a flaw in the traditional method of training employees in the hot and cold food bars utilizing food safety training developed for grocery stores as a whole. The study also found that managerial employees' food safety knowledge is not effectively distributed to their non-managerial employees. All employees who work in any aspect of the hot and cold self-service food bars within the grocery stores should be required to participate in additional food safety training that focuses specifically on issues relating to hot and cold food bar food safety.

References

Altschuld, J. W., & Kumar, D. D. (2010). *Needs Assessment: An Overview.* Thousand Oaks, CA: SAGE Publications.

Binkley, M., & Ghiselli, R. (2005). Food safety issues and training methods for ready-to-eat foods in the grocery industry. *Journal of Environmental Health, 68* (3), 27-31.

Bolton, R. N., Shankar, V., & Montoya, D. Y. (2010). Recent Trends and Emerging Practices in Retailer Pricing. In M. Krafft, & M. K. Mantrala, *Retailing in the 21st Century: Current and Future Trends* (pp. 301-318). New York: Springer .

Drummer, J. (1998, September). Food safety in a grocery environment. *Supermarket Journal*.

Foodborne Illness. (2010). Retrieved April 7, 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm#howmanycases

Friddle, C. G., Mangaraj, S., & Kinsey, J. D. (2001). *The Food Service Industry: Trends and Changing Structure in the New Millennium.* St. Paul, MN: The Retail Food Industry Center.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational Research, An Introduction (8th Edition)*. Boston, MA: Pearson Education, Inc.

Hertzman, J., & Barrash, D. (2007). An assessment of food safety knowledge and practices of catering employees. *British Food Journal, 109* (7), 562-576.

Kramer, J., & Scott, W. G. (2004). Food safety knowledge and practices in ready-to-eat food establishments. . *International Journal of Environmental Health Research, 14* (5), 343-350.

Macaulay, M., & Pantazi, I. (2006). Material difficulty and the effectiveness of multimedia in learning. *International Journal of Instructional Media, 33* (2), 187-195.

McCulloch, A. (2009). *A preassessment for developing a food safety training program for self service food bars in grocery stores* (Unpublished masters thesis). Texas Tech University, Lubbock, TX.

Moskowitz, M. (2008). *A Practical Guide to Training and Development.* San Francisco, CA: Pfeiffer.

Nunnally, J. C. (1967). *Psychometric theory.* New York: McGraw-Hill Book Company, Inc.

Palvia, S. C., & Palvia, P. C. (2007). The effectiveness of using computers for software training: An exploratory study. *Journal of Information Systems Education, 18* (4), 479-489.

Quested, T. E., Cook, P. E., Gorris, L. G., & Cole, M. B. (2010). Trends in technology, trade, and consumption likely to impact on microbial food safety. *International Journal of Food Microbiology*, 29-42.

Reyes, S. (2002). New analysis: Demand for convenient foods continues to rise. *Brandweek, 443* (42), p. 8.

Van Gerven, P. W., Paas, F., & Tabbers, H. K. (2006). Cognitive aging and computer-based intructional design: Where do we go from here? *Educaitonal Psychology Review, 18,* 141-157.

Worsfold, D. (2005). A survey of food safety training in small food manufacturers. *International Journal of Environmental Health Research, 15* (4), 281-288.

York, V. K., Brannon, L. A., Shanklin, C. W., Roberts, K. R., Howells, A. D., & Barrett, E. B. (2009). Foodservice employees benefit from interventions targeting barriers to food safety. *Jouranal of the American Dietetic Association, 109,* 1576-1581.

CALEB D. DODD was an Agricultural Education Graduate Student in the Department of Agricultural Education and Communications at Texas Tech University, Box 42131, Lubbock, TX 79404-2131, caleb-dodd@hotmail.com.

SCOTT BURRIS, Ph.D. is an Associate Professor of Agricultural Education in the Department of Agricultural Education and Communications at Texas Tech University, Box 42131, Lubbock, TX 79404-2131, scott.burris@ttu.edu.

STEVE FRAZE, Ph.D. is the Chair of the Department of Agricultural Education and Communications at Texas Tech University, Box 42131, Lubbock, TX 79404-2131, steve.fraze@ttu.edu.

DAVID DOERFERT, Ph.D. is a Professor for Agricultural Education and the Graduate Studies Coordinator in the Department of Agricultural Education and Communications at Texas Tech University, Box 42131, Lubbock, TX 79404-2131, david.doerfert@ttu.edu.

ABIGAIL MCCULLOCH was an Agricultural Education Graduate Student in the Department of Agricultural Education and Communications at Texas Tech University; she is currently an Agriculture Educator and Advisor at Cleburne High School, 1501 North Harland Drive, Cleburne, TX, 76033, abigail.mcculloch@cleburne.k12.tx.us.

This project was supported by the International Center for Food Industry Excellence through a research grant from the United States Department of Agriculture. Award # 2008-1690 -CSREES USDA