ABSTRACT

SANIGA, KRISTEN NOELLE. A Case Study Of Factors Impacting Food Safety Training Effectiveness In Dairy Processing. (Under the direction of Dr. Clint Stevenson).

Internal food safety training is often performed by food production companies to fulfill requirements of regulatory agencies or private industry. There are a variety of food safety training methods, yet little research has been performed to determine which methods are most effective. There is also not a complete understanding of how food safety culture affects food safety training outcomes. The purpose of this study was to evaluate the effect of learning theories, training format, and food safety culture on changes in food safety knowledge, intentions, and compliance

Individualized and group trainings were developed using behaviorism and constructivism learning theories on four food safety topics: Introduction to Good Manufacturing Practices and Material Controls, Personal Hygiene and Communicable Diseases, Allergen Control, and Food Defense. The training programs were implemented at 66 dairy processing plants. Pre and post-training evaluations were received from 793 employees at 22 dairy plants using a validated evaluation method. Data was collected in the form of pre- and post- training supervisor audits and employee surveys. Employees surveys contained questions to evaluate the food safety culture of the corresponding processing plant and questions to measure employees' attitudes, perceived norms, personal agency, intentions, and knowledge related to the corresponding training topic.

A significant increase in knowledge was found after training for the aggregate data and the data for each training topic. When comparing the various training delivery methods, group trainings that employed direct instruction and social and situated learning theories were more effective than individual training utilizing programmed instruction at improving

employee food safety knowledge. This study did not find a change in non-compliance associated with receiving training, however that could be due to the fact that non-compliances were self-reported by the company and not recorded by a third party. Regressions also revealed that knowledge was a significant positive predictor of compliance, whereas intention was not.

An effect of food safety culture (vision, communication, commitment, leadership, training, attitude, safety, perception, and risk awareness) on change in knowledge and intention was observed, however, this was a negative relationship. This could be because a positive relationship was found between food safety culture and employee pre-training knowledge and pre-training intentions. These findings suggest that the perception of a strong food safety culture may be associated with higher food safety knowledge, intentions, and, potentially, behaviors. However, follow up studies should be performed to further explore the relationship between food safety culture and training.

A Case Study Of Factors Impacting Food Safety Training Effectiveness On Dairy Processing Employees

by
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DEDICATION

To my parents, John and Denise Saniga, and my grandparents, Ken and Karen Marks.

Thank you for teaching me the importance of education, for supporting me in all of my endeavors, and for being an example of hard work and service to others.

BIOGRAPHY

Kristen Saniga is the daughter of John and Denise Saniga. She spent her early childhood growing up on the eastern coast of Virginia with her parents and her older brother. In 2006, she moved to North Carolina with her parents where she gained an appreciation for “real” barbecue.

Growing up, Kristen spent much of her free time playing field hockey, cooking with family, and camping. In addition to learning about food science, she currently enjoys kayaking, napping in her eno hammock, cooking, and cross-stitching.

Kristen completed her Bachelors of Science in Food Science with a Minor in Microbiology at NC State University in 2016. During her undergraduate degree, she became deeply involved in the Food Science Club, the Catholic Campus Ministry, and food safety research under the direction of Dr. Clint Stevenson. Her undergraduate research sparked her passion for food safety as a way to improve the lives of others.

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CHAPTER ONE

The Current View of Food Safety Training and Food Safety Culture: A Review of Selected Literature

INTRODUCTION

Employee food safety training is performed by many companies as a requirement of either regulation or private industry. The primary goal of food safety training is to increase the food safety knowledge of employees in order to support proper food safety behaviors. Although food safety training is often a requirement, there is no guideline or standard of how training should be designed, implemented, or evaluated. Across various industries and companies, there are a wide variety of types of training programs that are used. These varieties include: bulletins, pamphlets, posters, magazines, books, oral presentations, short courses, films, PowerPoints (Schuler, 1975). More recently, a food safety survey by Campden BRI revealed that the ten most common types of food safety training performed in the food industry are (in descending order): on the job training, reading policies, onboarding training, refresher training, on-site classroom internal training, coaching, examinations, on-site classroom external training, off-site external training, and computer-based training (Emond, 2015).

In recent years, there has been a shift in the food industry and associated literature to focus on employee behaviors and how food safety behaviors can be improved. Accompanying this shift comes the question of how food safety training programs should be evaluated and how employee behaviors can be improved. Several publications have been released related to food safety training with in the food industry (Figure 1.1), but many of these papers collected data from food service or retail locations and not a manufacturing setting. This literature review was only able to find four papers that study food safety training in a manufacturing setting (Fenton et al., 2006; Hicks et al., 2004; Nieto-Montenegro et al., 2008; Worsfold, 2005).

As researchers and professionals venture to answer the question of how to improve food safety behaviors, food safety culture has become an important new focus. Food safety culture is a subset of organizational culture, similar to how safety culture is subset of organizational culture. Schein (1985) has defined culture as “the accumulated shared learning of that group as it solves its problems of external adaptation and internal integration; which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, feel, and behave in relation to those problems. This accumulated learning is a pattern of system of beliefs, values, and behavioral norms that come to be taken for granted as basic assumptions and eventually drops out of awareness.” Food safety culture has been defined as “the shared attitudes, values and beliefs, towards the food safety behaviors that are routinely demonstrated in food handling organizations (Griffith et al., 2010). Food safety culture is now considered a primary way to predict and change behavior (Yiannas, 2009). Some researchers have set up the field of research for there to be a connection made between food safety culture and food safety training (Jespersen et al, 2017; Nyarugwe et al., 2006; Griffith et al., 2017). Food safety training has even been identified as factor to consider when performing food safety culture research (Nyarugwe et al., 2016).

METHODS

A review of food safety training and food safety culture-related literature was performed using the North Carolina State University library online Summons database. Papers discussing food safety training, food safety culture, and organizational culture and training, and training effectiveness were reviewed.

RESULTS

Evaluations of Food Safety Trainings

There is a general lack of information regarding food safety training evaluations in a manufacturing environment. Nieto-Montenegro et al. observed that little research has been done on the effects of food safety training on behaviors in food manufacturing settings. This review of literature found a similar lack of studies. With the search terms "food safety" + "training", only two peer-reviewed papers were conducted in a manufacturing setting (Nieto-Montenegro et al, 2008.; Worsfold 2005). However, other papers were found that performed studies in a manufacturing setting that did not meet the search criteria (Fenton et al., 2006; Hicks et al., 2004), but there is still a lack of research done on training in manufacturing compared to training in retail, food service, or catering.

Evaluating food safety training programs is key to ensuring program effectiveness and also encouraging continuous improvement (Nieto-Montenegro et al., 2008). Nieto-Montenegro et al. (2008) stated that the evaluation of training programs is crucial because it allows the users to ensure that the training program is effective at increasing the knowledge of employees and improving behavior. If not, the evaluation should reflect any weaknesses and the training program can be adjusted as needed. In their review of other studies, Nieto-Montenegro et al. (2008) also stated that the following constructs have been considered when training programs have been evaluated: knowledge, behavior, and behavior change model constructs

Potential Training Outcomes and Factors Affecting Training Outcomes

Across industry and academia, there is strong support for the notion that an increase in employees' knowledge is one of the primary outcomes of food safety training (Nieto-Montenegro et al., 2008; Lynch et al., 2003; Worsfold, 2005). By surveying environmental health specialists, Nummer et al. (2010) found that there was a general agreement that food safety training was a key element of food safety in retail and food service. However, they discovered that there was disagreement over whether or not the training was effective because several restaurants have closed due to violations, despite receiving food safety training. Nummer et al. (2010) reported that the environmental health specialists thought there was a strong relationship between the quality of the training and its effect on behaviors. Several studies have linked training to increases in knowledge and some have even linked it to improvements in food safe behaviors. Nieto-Montenegro et al. (2008) found that training led to a significant increase in knowledge and incidence of handwashing for employees in the mushroom industry. Lynch et al. (2003) also found that restaurant managers who had received formal food safety training had higher knowledge scores than managers that had not received training and that more experienced managers tended to have higher knowledge scores than managers with less experience. Worsfold (2005) reported that surveyed food manufacturing managers stated that benefits of food safety training are to satisfy requirements, increase knowledge of staff, improve food quality and food safety, increase employee satisfaction, and improve confidence to delegate.

While it is generally agreed that effective training programs increase employee food safety knowledge (Nieto-Montenegro et al., 2008; Lynch et al., 2003; Worsfold, 2005), there are obstacles to achieving an effective training program. Worsfold (2005) reported that some of the reported challenges to effective training are small employee number, high turnover rate, the high time commitment, and lack of appropriate training courses. In the retail and food service sector, Nummer et al. (2010) found that some shortcomings of training programs are that trainers are poor communicators, do not have a full understanding of the topic being taught, and do not provide an evaluation of the training program. They also found that many of the environmental health specialists they surveyed stated that they were uncomfortable with their current food safety training program and believed that it could be improved, whether that be improving the trainer, the objective of the training, the formatting details of the training, employee motivation, and management commitment (Nummer et al., 2010). In order for training programs to be effective, Nik Husain et al. (2016) concluded that trainings should be built considering the learning process and theories, behavioral theories, and communicating information. Trainings that utilize primarily sequential verbal presentations can limit participant's learning and may fail to engage participants of varying backgrounds (Weber, 2007). Poorly designed training using traditional methods can lead to a lack of motivation, misperceptions, and lack of knowledge in participants (ISU, 2003). Learning theory-related research has created knowledge that can help design more effective training and education tools (Weber, 2007).

Gap Between Food Safety Training and Behavior

Several studies have stated that knowledge and attitudes about food safety, while important, are not the only factors that affect employee food safety behaviors (Clayton and Griffith, 2008; Mitchel et al, 2007; Neal et al., 2012). Clayton and Griffith (2008) identified that employee attitudes, subjective norms, descriptive norms, perceived behavioral control, and intention were significant predictors of hand hygiene non-compliances among food handlers in the catering industry. Mitchel et al. (2007) identify that within the food service industry, employee training programs are only slightly successful at affecting employee behaviors. They applied a Precede- Proceed model to employee behaviors, suggesting that there are many factors impacting employee food safety behaviors, including: knowledge, perceived risk, perceived control, exposure to training, work pace, worker literacy, other employee's attitudes towards food safety, incentives for proper behavior, job stress, and perceived organizational justice. The factors impacting employee food safety behaviors are categorized into three groups: predisposing factors, enabling factors, and reinforcing factors. Predisposing factors include factors that "provide the rationale or motivation for engaging" in a particular behavior, enabling factors include factors that "make it easier for motivated individuals to engage" in a particular behavior, and reinforcing factors include factors that "appear subsequent to the behavior and provide continuing reward or incentive for the behavior to continue" (Mitchel et al., 2007).

Food Safety Culture and Food Safety Training

Several studies have noted connections between food safety training and food safety culture. In their survey of environmental health specialists, Nummer et al. (2010) found that many felt that employees may understand and know the training content, but still did not display safe food behaviors because food safety is not prioritized by management and other employees. Similarly, Nieto-Montenegro et al. (2008) found that post-training supervisor enforcement helped to significantly improve hand-washing in employees in mushroom packing facilities. Food safety training has also been identified by Nyarugwe et al. (2016) as a metric to consider when evaluating food safety culture.

Measuring Food Safety Culture

As more people seek to evaluate food safety culture, several studies have proposed methods to measure food safety culture. The survey distributed by Neal et al. (2012) to food service employees identified that the most important factors to developing a food safety culture are management commitment to workers and worker food safety behavior. Ungku Fatimah et al. (2014) measured food service employee's perception of food safety culture by surveying employees to evaluate management and coworkers' support, communication, self-commitment, environmental support, work pressure, and risk judgement. Jespersen et al. (2016) developed a survey tool using a food safety culture maturity model to measure a company's position in the framework of the model. This model measures five capability areas (perceived value, people system, process thinking, technology enabled, and tools and infrastructure) and identifies which stage of maturity (doubt, react to, know of, predict, internalize) the company is in for each capability. De Boeck et al. (2015) created a survey instrument to assess food safety culture of an organization by measuring leadership, communication, commitment, resources, and risk awareness.

CONCLUSION

As the industry has become more concerned with improving employee behaviors, many researchers have studied how food safety training and food safety culture can be evaluated and improved. However, very few studies evaluating food safety training have been performed in a manufacturing setting and studies were not found that directly explore the effect of food safety culture on training outcomes. This research studies the effect of various learning theories and delivery methods on the effectiveness of food safety training. It also explores the potential relationship between food safety culture and effectiveness of food safety training.

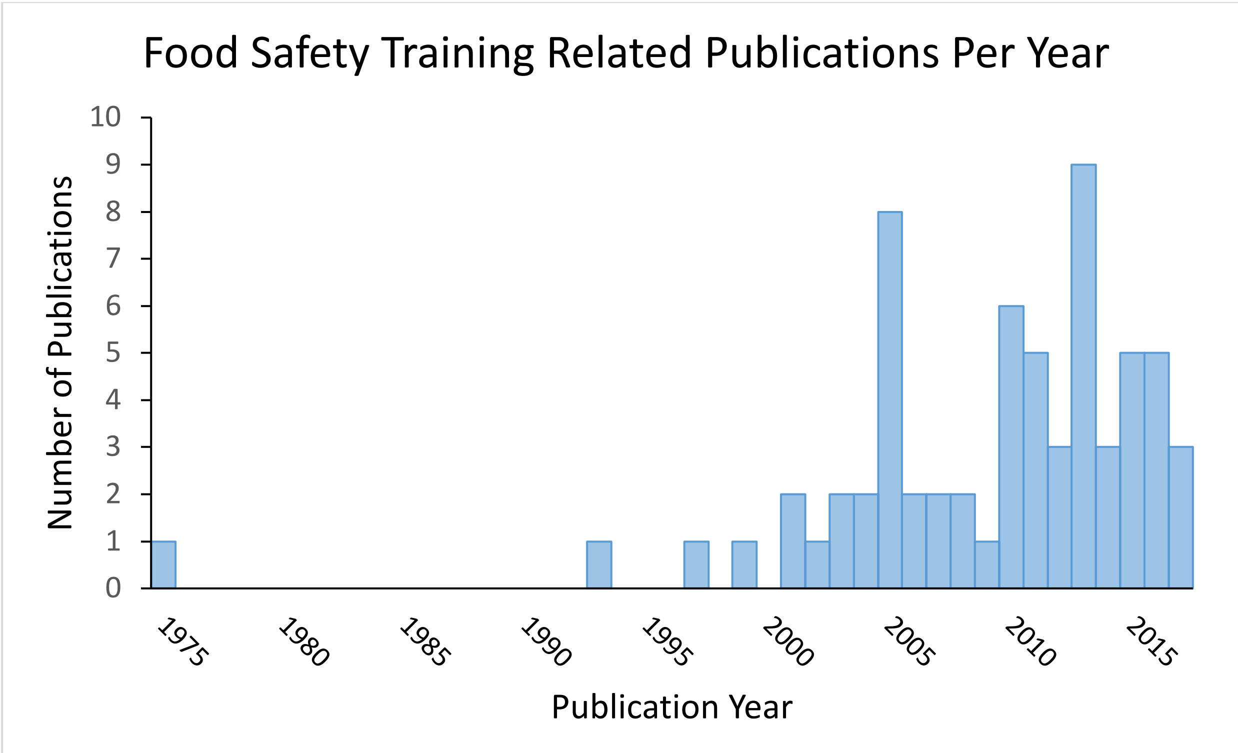

Figure 1.1- ***Peer-Reviewed Food Safety Training-Related Publications Per Year.***

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CHAPTER TWO

The Effects of Food Safety Trainings on Employee's Food Safety Knowledge, Intentions, and Behaviors: Comparing Learning Theories

INTRODUCTION

Over the past 20 years, the topic of food safety training has become more of a concern and priority of those in both academia and industry. This growing concern is evident by looking at the number of peer-reviewed food safety training-related papers published per year (Figure 2.1). Beginning in 2001, peer-reviewed papers were published with "food safety" and "training" in the title every year, with 9 papers published in 2013. This increase in attention is likely due to regulatory or audit-related requirements and increased importance being placed on food safety behaviors caused by the rise of food safety culture awareness (Griffith 2010). Companies are beginning to focus more on their employees and their competencies and attitudes (Griffith 2010; Lynch et al. 2003; Nieto-Montenegro et al. 2008, Dodd et al. 2013, Sinclair et al. 2003), as they realize that on-the-floor employees are extremely influential in the safety of the final product. Since training is one of the most traditional methods of knowledge transfer and is commonly required by regulatory or auditing agencies, many in industry and academia are asking how employee food safety training can be used more effectively in order to affect behavioral change (Nummer et al., 2010; Nieto-Montenegro, 2008; Appendix A).

The Integrated Behavior Model (IBM) (Figure 2.2) is a behavioral prediction theory that has been used to understand and predict behavior (Glanz et al., 2008). It includes behavior, attitude, subjective norm, intention, and perceived control from the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB), but also includes other constructs, such as knowledge or skills, salience of behavior, environmental constraints, and habit (Glanz et al., 2008). The IBM suggests that knowledge is just one of the predictors of behavior, along with intention, personal agency, perceived norm, and attitudes. Several studies have observed a gap between food safety knowledge and food safety behaviors in food safety research, meaning that knowledgeable employees do not always have the most food safe behaviors. (Mullan et al., 2010; Nummer et al., 2010). Ajzen et al. (2011) suggests that actual knowledge is irrelevant to behavior, while general knowledge or beliefs about a behavior are much stronger predictors of a behavior. In their study, they found that environmental knowledge did not affect energy conservation and knowledge about the risks of alcohol did not affect drinking behavior. They found a positive effect of Muslim knowledge on pro-Muslim behavior, but this was due to participants' positive attitudes towards Muslims. Thus, suggesting that training programs that also focus on improving food safety beliefs and are implemented in a supportive environment may have stronger effects on employee food safety behaviors.

This push to improve food safety training programs and employee food safety behaviors raises questions about how the effectiveness of employee training programs can be improved to promote better food safety behaviors (Nummer et al., 2010). Generally, training has been seen as something that is required by auditing agencies, but there is not a standard code of practice for how training should be implemented or even evaluated. Training methods vary from on the job training, reading company policies, classroom training with an internal training, classroom training with an external training, and computer training (Emond, 2015). In a 2015 Food Safety Training Survey, Campden BRI found that training evaluation methods in industry include assessment quizzes, recording attendance, on-the-job review, or measuring behaviors (Emond, 2015). They also found that over 30% of responding food manufacturers and processers were not "satisfied" with their current food safety training methods. Yet, the same processors reported that benefits of having effective employee training include improved food safety culture, improved product quality, and fewer consumer complaints (Emond, 2015).

This study explored the effect of three types of food safety trainings on employee attitudes, personal agency, perceived norm, intention, knowledge, and behavior. Individual e-learning modules, group e-learning modules, and group discussion-based virtual tour trainings were developed and assessed in order to compare effects of learning theories on changes in knowledge, attitudes, perceived norm, personal agency, and intentions. It was hypothesized that there would be differences in the effects of learning theories on training outcomes and that group trainings would be more effective than individual trainings. These training types were selected because these represent three of the more popular types of training performed within the food industry and the primary (Medeiros et al, 2011; Emond, 2015). These analyses emphasized the importance of training design and delivery methods, as well as highlighted the potential effect that training can have on employee knowledge, attitudes, perceived norm, personal agency, intentions, and behavior.

METHODS

Training Module and Tour Development

Three training deliveries were evaluated to test four learning theories: direct instruction (DI), programmed instruction (PI), and social and situated learning (SSL) (Table 2.1). Direct instruction, programmed instruction, and the social learning theory are principles of the behaviorism learning theory and situated learning is a principle of the constructivism learning theory (Wu et al., 2011). The behaviorism learning theory suggest that learning is created through stimulation and reinforcement from the environment. Wu et al. (2011), described direct instruction as “a general term for explicit teaching using lectures rather than exploratory models such as inquiry-based learning.” Programmed instruction involves technology that presents structured material in a sequence that allows students to progress through the material at their own speed. Social learning involves learning through observation or imitation of others. The constructivism learning theory suggests that learning is an active process. Situated learning suggests that “learning is embedded within activity, context, and culture” and is “a product of the social practices of its educational professionals” (Wu et al, 2011).

The programmed instruction training was completed by employees individually, at their own pace, on a company computer, at work (Appendix B). It was created using Articulate Storyline e-learning software (Articulate). Each module began by reviewing the learning outcomes of the module. Each chapter or “page” of the module was accompanied by voiceover narration and had buttons on the bottom of the screen to advance the user to the next page. Each page had graphics or a type of animation requiring user interaction. “Knowledge Check” questions were embedded throughout the module to ensure and measure user comprehension. If the questions were answered incorrectly, a narrated page would appear to explain why the chosen answer is incorrect and inform the user of the correct answer. After completing the module, the user’s knowledge score would appear informing them of whether or not they had passed the module.

The direct instruction trainings consisted of supervisors or managers guiding a group of employees through the same computer module used in the programmed instruction training (Appendix B). However, these trainings allow for employee-employee interaction, as well as employee-manager interaction to facilitate discussions and questions.

The social and situated learning training consisted of a virtual tour, guided by a manager or supervisor, and was performed in a group setting. This training was developed using Panotour virtual tour creation software (Panotour). 360° still-images were taken in 10 locations in a dairy processing plant using six GoPro cameras mounted in a Freedom 360 mount. The dairy processing plant processed both liquid milk and ice cream and therefore was representative of the majority of Company X's plants, whether those plants processed liquid milk, ice cream, or other dairy products. Each social and situated learning training began in the training room and had a hotspot that opened a 1-3 minute introductory video or introductory text. Each room within the tour contain hot spots, or buttons, that could be clicked to reveal informative text and images. Transitional hot spots were also present and allowed the user to progress to the next room or return to the previous room. The social and situated learning trainings were designed to be led by a facilitator, either a plant manager or supervisor, and was accompanied by a facilitator's guide that contained instructions of how to navigate the tour. The facilitator's guide also contained accompanying narration and discussion-based knowledge questions that encourage group engagement and interaction.

The PI, DI, and SSL training interventions were developed on the four following topics: Allergen Controls, Introduction to Good Manufacturing Practices and Material Controls, Personal Responsibility and Communicable Diseases, and Food Defense. Each training module was developed in partnership between an instructional designer and several subject matter experts, including three regional directors of quality, a professor of food science, and food science graduate student, to ensure that the training material was relevant, effective, and engaging.

Table 2.1: Learning Theories of Training Deliveries

	Individual Training	Group Training
Computer Module	Programmed Instruction (PI)	Direct Instruction (DI)
Virtual-Tour		Social and Situated Learning (SSL)

Instrument Development

The Integrated Behavior Model (Figure 2.2) (Glanz et al. 2008) was used as a framework for a brief questionnaire (15 minutes) (Appendix C-F). This food safety training-evaluation questionnaire (FSTEQ) measured employee attitudes, perceived norms, and personal agency, intentions, and knowledge regarding the food safety policies of the associated module using a 7-point Likert scale. The questionnaire was administered to employees immediately before and after the employees experienced training. Supervisor observation audits were also used to collect behavioral data by measuring non-compliances twice one month prior to the training being implemented and twice after the training had been completed (Appendix G-J). These observation audits recorded the level of compliance to various food safety policies that are covered in the training modules. These data were used to provide a complete picture of the effectiveness of the current training system.

Data Collection

Training programs were implemented at 66 dairy processing plants at Company X across the United States. Data was intended to be collected from all 66 dairy processing plants at Company X. Sixty-seven Quality Assurance managers and supervisors were trained via a webinar about how to implement the P.I., D.I., and S.S.L. trainings and how to proceed in the data collection process. The webinars were designed to explain the differences between the new trainings and previous trainings, differences between the types of trainings provided, and instructions on how to perform each type of training. Each plant was randomly assigned one training topic for which to perform the evaluations, in an effort reduce the extra workload assigned to each facility and the time taken during the training process.

Employees at each plant were offered a pre- and post-training survey, which they were instructed to place in a sealed "ballot box" created by Human Resources. The pre-training survey contained the FSTEQ and the post-training survey contained the FSTEQ and demographic questions. Once training at each location has been completed, the human resources manager shipped the box to researchers at NC State without breaking the seal on the box. All data collection methods and data collection tools were approved by the North Carolina State University Institutional Review Board prior to any data being collected.

Pilot Testing

The survey instrument was tested during a pilot study prior to being used to collect data. The pilot test was performed at a single processing plant. Data was collected from twenty employees using an online form of the survey. Only the Allergen Control programmed instruction training delivery was evaluated.

Populations and Sample

Since data was not able to be collected from every processing location or every employee from responding processing locations, a multiple linear regression was performed with response rate and SQF audit scores to determine if there was a difference in audit scores between plants that responded and those that didn't. If so, it could indicate that responding plants are skewing the data and are not a representative sample if those plants exhibit better food safety standards. A logistic regression was performed to determine if there was a difference between the SQF audit scores of plants that completed and returned supervisor audits and those that did not. There was not a statistically significant difference between the audit scores of plants that submitted supervisor audits and those that did not (p=0.372) (Table 2.2).

Data Analysis

All pre-training IBM construct questions were tested for reliability and validity by calculating the Cronbach's alpha scores and principal component scores. Before the analyses were run, all responses were adjusted to be measured on a negative (1) to positive (7) Likert scale.

The trainings were implemented at all 66 of Company X's dairy processing plants. Evaluations were assigned and sent to each location. One third (N=22) of all plants mailed in completed employee surveys (Table 2.2). When considering the number of workers employed at responding plants, (N=3620), the total response rate of completed surveys was 21.9% (N=793). 21.2% (N=14) of all plants responded with completed supervisor audit data (Table 2.2).

Pre- and post-training knowledge quizzes were sorted to eliminate quizzes that had over 50% completion. Scores of quizzes with 50% completion or less were eliminated to control for inaccurate data due to skipped questions, while also allowing for the possibility that some questions may be skipped due to lack of knowledge.

Using SPSS, the IBM construct data, knowledge scores, and audit data were tested for normality with a Shapiro-Wilk test, which determined that all of the data was non-parametric. As a result, all pre- and post-training comparisons of non-compliances, IBM constructs, and knowledge were made using either a Wilcoxon test or a sign test, which compare medians rather than means. Kruskal-Wallis-H tests were used to measure the effects of training type, experience, and demographics on changes in compliance and knowledge (IBM Corp).

RESULTS

Reliability and Validity

The Cronbach's alpha score for each construct for each training topic was higher than 0.7 (Table 2.3-2.6) and the PCA factor loadings were 0.420 or higher, with only one principle component per factor loading (Tables 2.7-38). Therefore, all evaluation questions are deemed to be reliable and valid (Hair et al., 2010).

Regression of Pre-Training Knowledge and Intention to Predict Non-Compliances

For the aggregate training data, the results of the multiple linear regression indicated that there was a significant collective effect of pre-training knowledge and intentions on pre-training non-compliances $F(2, 235)$-10.977, $p<0.000$, $R^2=0.078$, This model only explains 7.8% of the variance in the regression. The individual predictors were examined further and indicated that only pre-training knowledge was a significant individual predictor ($t=4.392$, $p<0.000$). The standardized coefficients Beta ($B=0.275$) indicated that higher pre-training knowledge was associated with higher pre-training non-compliances.

However, these results were not consistent for the individual training topic data. There was not a significant collective effect on pre-training knowledge and intention on pre-training non-compliance scores for the Introduction to Good Manufacturing Practices and Material Controls, Personal Responsibility and Communicable Diseases, or Food Defense training topics ($p<0.05$). This analysis was not able to be performed for the Allergen Controls training topic.

Regression of Change in Knowledge and Intention to Predict Change in Non-Compliances

There was not a significant effect of change in knowledge and intention on change in non-compliances for neither the aggregate training data nor the Introduction to Good Manufacturing Practices and Material Controls or Personal Responsibility and Communicable

Diseases training topics ($p<0.05$). This regression was not able to be performed from the Allergen Controls or Food Defense training topics.

Effect of Training on Employees' Food Safety Knowledge

There was a significant difference in pre- (Median=75.00, Mean=74.82, SD=19.68) and post-training (Median=80.06, Mean=80.06, SD=18.62) knowledge scores for aggregate training data ($p<0.000$). There was also a significant increase in knowledge for each of the individual training topics, except Allergen Controls (Figure 2.4).

There was a significant increase in knowledge from pre-training knowledge scores (Median=83.33, SD=21.308) to post-training knowledge scores (Median=91.67, SD=19.326) for all Introduction to Good Manufacturing Practices and Material Controls trainings, $p=0.001$ (Figure 2.3). There was also a significant increase in knowledge for questions on Question 4: Ingredient and Packaging Storage (pre-training Median=1.00, Mean=0.80, SD=0.398; post training Median=1.00, Mean=0.87 SD=0.332), $p=0.004$) (Figure 2.5).

There was a significant increase overall in knowledge from pre-training knowledge scores (Median=75.00 SD=14.47) to post-training knowledge scores (Median=85.00, SD=14.04) for all Personal Responsibility and Communicable Diseases trainings, $p<0.000$ (Figure 2.4). There was also a significant increase in knowledge for questions on Question 1: Symptoms of Illness (pre-training Median=1.00, M=0.87, SD=0.19; post-training Median=1.00 M=0.91, SD=0.14) , $p=0.021$), Question 4: Time to Return to Work (pre-training Median= 0.00, M=0.25, SD=0.43; post-training Median=0.00, M=0.48, SD=0.502), $p<0.000$), and Question 6: Changing Gloves and Aprons (pre-training Median= 0.00, M=0.44, SD=0.50; post-training Median=1.00 M=0.59, SD=0.49), $p=0.000$) (Figure 2.6).

There was a not a significant increase overall in knowledge from pre-training knowledge scores (Median=62.50, SD=20.96) to post-training knowledge scores (Median=69.38, SD=20.03) for Allergen Control trainings, p=0.094. However ,there was a significant increase in knowledge for questions on Question 2: % of Allergens (pre-training Median=1.00, M=0.67, SD=0.47; post-training Median=1.00, M=0.80, SD=0.40), p=0.005, Question 4: Source of Contamination (pre-training Median= 0.40, M=0.52, SD=0.35; post-training Median=0.75, M=0.62, SD=0.32), p=0.041), and Question 5: Cleaning Procedure (pre-training Median=1.00, M=0.53, SD=0.50; post-training Median= 1.00, M=0.66, SD=0.47), p=0.013) (Figure 2.7).

There was a significant increase overall in knowledge from pre-training knowledge scores (Median=73.33, SD=15.74) to post-training knowledge scores (M=75.00, SD=15.72) for Food Defense trainings, p=0.023 (Figure 2.4). There was also a significant increase in knowledge for questions on Question 2: Food Defense vs. Food Safety (pre-training Median= 0.00, M=0.39, SD=0.482; post-training Median=1.0, M=0.61, SD=0.490), p=0.013) and Question 5: Product Vulnerability (pre-training Median=0.67, M=0.62, SD=0.30; post-training Median=0.67, M=0.73, SD=0.26), p<0.000) (Figure 2.8).

Effect of Training Delivery on Employees' Food Safety Knowledge

Overall, group training had a more significant effect on employees' knowledge than individual training. For the aggregate training data, the sign tests showed a significant difference in pre- and post-training knowledge scores for employees that received the social and situated learning (pre-training Median= 75.00, Mean=73.96, SD=19.92; post-training Median=83.33, Mean=79.19, SD=18.96; p=0.001) and direct instruction trainings (pre-training Median=77.22, Mean=74.93, SD=20.06; post-training Median=85, Mean=80.99, SD=18.17; p<0.000), but not the programmed instruction training (p>0.05) (Figure 2.9). However, when performing the same analyses for each individual training topic, there was only a significant difference in pre and post-training knowledge scores for the Introduction to Good Manufacturing Practices and Material Controls direct instruction training (Tables 2.39-2.42).

Effect of Demographics on Change in Food Safety Knowledge

The aggregate data was tested to measure for differences in effects of various demographic aspects. Speaking English as a primary language, Gender, Length of time worked for the company, and Ethnicity did not have a significant effect on the change in knowledge experienced by employees ($p>0.05$).

Effect of Training on Change in Intentions

For the aggregate data, a Wilcoxon test indicated that there was a significant increase in employee intentions from (Median=7.00, Mean=6.35, SD=0.90) to (Median=7.00, Mean=6.39, SD=1.03) after receiving training ($p=0.007$). When performing this test on each training delivery, there was only a significant difference in intention for the direct instruction training from (Median= 6.50, Mean=6.26, SD=0.95) to (Median=6.75, Mean=6.35, SD=0.97) after receiving training ($p=0.023$). The direct instruction training was the only training to display significant increases in employee intentions, although significant increases were only seen for the Introduction to Good Manufacturing Practices and Material Controls and 2 training topics $p<0.05$) (Tables 2.39-2.42).

Integrated Behavior Model Confirmation- Pre-training results

For the aggregate training data, results of the multiple linear regression indicated that there was a significant collective effect of pre-training attitude, perceived norm, and personal agency on pre-training intention scores $F(3, 711)=142.951$, $p<0.000$, $R^2=0.374$. This model explains 37.4% of the variance in the data. All thee constructs were significant positive individual predictors of pre-training intention ($p<0.000$) (Figure 2.10). This regression was also significant for the Introduction to Good Manufacturing Practices and Material Controls, Personal Responsibility and Communicable Diseases, Allergen Controls, and Food Defense training topics.

Integrated Behavior Model Confirmation- Change in Pre and Post-Training Constructs

For each responding plant, post-training non-compliances were subtracted from pre-training non-compliances to determine the total change in non-compliances.

For the aggregate training data, there was not a significant regression between change in attitudes, personal agency, and perceived norm to predict change in intentions ($p<0.05$). The regression was also not significant for the Introduction to Good Manufacturing Practices and Material Controls, Personal Responsibility and Communicable Diseases, Allergen Controls, and Food Defense training topics ($p<0.05$).

Integrated Behavior Model Confirmation- Change in Training Constructs

For the aggregate data, results of the multiple linear regression explained 35.7% of the variation in the data and indicated that there was a significant collective effect of post-training attitude, perceived norm, and personal agency on post-training intention scores $F(3, 649)=121.581$, $p<0.000$, $R^2=0.357$) (Figure 2.11). The individual predictors were examined further and indicated that post-training perceived norm ($t=6.749$, $p<0.000$) and personal agency ($t=10.779$, $p<0.000$) were significant predictors of intention, but post-training attitude was not ($p<0.05$).

DISCUSSION

Effect of Food Safety Trainings on Non-Compliances

Concerning the change in non-compliances reported on the supervisor audits from before and after training, significant changes were not found in the aggregate data or for individual training topics. This gap between training and behavior is consistent with findings from other studies (Nummer et al., 2009; Clayton et al., 2002). However, Nieto-Montenegro et al. (2008) did see a reduction in rates of non-compliance for several food safety behaviors in their study. This outcome could be influenced by the lower response rate (responding plants might have a lower number of pre-training non-compliances than non-responding plants), respondent bias (reporting fewer non-compliances than actually present), or the high starting level of compliance. Each plant that completed supervisor audits did not administer the same type of training to all employees, so comparisons were not able to be made of the effect of each training on measured non-compliance. Another study should be done that administers only one type of training to the employees of a manufacturing location and collects compliance data over a longer period of time with a more detailed audit and using behavioral observations.

Knowledge and Intention as Predictors of Non-Compliance

Pre-training intention and knowledge were significant predictors of pre-training non-compliance, but this regression only explained 7.8% of the variance in the data, suggesting there are other external factors affecting employee behaviors. This contradicts findings by Azjen et al (2011), who found that knowledge was not a predictor of behavior, and by Mullan et al. (2010) and Nummer et al. (2010), who comment on the gap between food safety knowledge and behaviors. However, change in knowledge and intention were not predictors of change in compliance. This finding implies that merely increasing employee's food safety knowledge during a training intervention will not necessarily lead to an improvement in employee behaviors. This is supported by the previously discussed finding that there was not a significant change in compliance after experiencing food safety training.

Effect of Food Safety Trainings on Knowledge

There was a significant increase in knowledge for the aggregate data and each training topic. This association between a training intervention and an increase in knowledge is consistent with findings from other studies (Nieto-Montenegro et al., 2007; Nummer et al., 2009; Lynch et al., 2003) In the comparison between pre- and post-training training knowledge scores, group training was generally more effective at generating knowledge gains. The two group training options (direct instruction and social and situated learning) displayed significant increases in knowledge for the aggregate data, but the programmed instruction did not. This data slightly contradicts the results of the effects of training delivery on non-compliance, but this test had a much larger sample size and fewer impacting external variables. This data demonstrates that, overall, group training may be more beneficial than individual training.

Only the direct instruction training delivery showed a significant increase in training for one of the training topics. This is likely because the sample sizes were small for these analyses and the Wilcoxon and Sign tests have a higher chance of Type 2 error, or incorrectly retaining a false null hypothesis. The data suggests that e-module group training utilizing direct instruction was more effective than the group discussion-based virtual tour utilizing social and situated learning training. This could be due to the fact that the virtual-tour training is a new technology that plants were unfamiliar with, so it might not have been utilized to its fullest potential. Future experiments should compare trainings that are designed on the same platform with different learning theories in order to differentiate if the difference in effectiveness is due to the technological platform or the learning theory. Alternatively, the difference could be due to the fact that the direct instruction module as very structured and there was room for deviation and variation in the social and situated learning module. The data showed that the direct instruction training option was the most effective in terms of knowledge transfer. However, this training option was not designed for the study, but was created by the plant employees administering the training, so this result should be interpreted cautiously. Outside factors that might have affected the performance of the social and situated learning training option is the familiarity of the trainers and employees with the training medium. Virtual reality is still a novel concept, so it is possible that trainers were not comfortable in leading the training, despite having received training via webinar. Demographic variables such as gender, speaking English as a primary language, ethnicity, and length of time worked at the company did not have consistent notable effects on pre-training knowledge, post-training knowledge, or change in food safety knowledge.

Effect of Food Safety Trainings on Intentions

For the aggregate data, there was a significant increase in food safety intentions after training, but when comparing the three training deliveries, there was only a significant increase observed for the direct instruction training. There was also a significant change in intentions for the Introduction to Good Manufacturing Practices and Material Controls and Personal Responsibility and Communicable Diseases direct instruction training delivery and the Personal Responsibility and Communicable Diseases programmed instruction. training delivery. These data suggest that training that utilizes the direct instruction learning theory may have a significant impact at increasing employee intentions, whereas trainings that employ the programmed instruction and social and situated learning theories may not.

Integrated Behavior Model Confirmation

The multiple regressions showed that there was a significant predictive effect of pre and post-training employee attitudes, perceived norms, and personal agency on employee food safety pre- and post-training intentions for the aggregate data and for each training topic, which was expected by the IBM model (Glanz et al. 2008). There was also a significant positive effect of pre-training intention and knowledge on pre-training non-compliances for the aggregate data, but this was not consistent with the data for any of the individual training topics. The regression between change in knowledge and intention to predict change in non-compliances was also not significant or the aggregate data or any of the individual training topics. The main explanation for this is that non-compliances observed is an indirect measure of behavior, and thus does not necessarily fit into the model as the IBM is a measure to predict behavior (Glanz et al. 2008). A more accurate measurement would have been direct behavioral observations, but that was outside the scope and abilities of this project.

CONCLUSION

Significant changes in compliance were not found before and after training, but increases in knowledge were found for the aggregate data and group e-module trainings that employed the direct instruction and group, discussion-based virtual tour trainings that employed social and situated learning. The main take-away from the data is that group trainings that implemented the direct instruction and social and situated learning theories were consistently the most effective in terms of knowledge gains. This could be because the group interaction makes the training more engaging or because the training is able to be more easily customized by the supervisor to the needs of their employees. This finding provides support for an argument against individual, distant-based training, which, by design, can be less engaging and customizable. This data also demonstrates that training design can impact the effectiveness of training. Furthermore, there was a difference in the effectiveness of training based on the learning theory applied, suggesting that the intentional application of learning theories.

Because the limitations of this study, direct behavioral observations were not able to be made and this weakened the accuracy of the compliance data in certain regards. Although the supervisor audit forms were able to measure compliance to certain standards, observations in the form of video surveillance would have been a more accurate measure.

Another limitation of this study was that each manufacturing plant performed training a variety of different ways. Measuring the effect of training on compliance was difficult because data was not received from all employees at each location and it is unknown what type of training the majority of employees received. Future research should consider performing more controlled experiments to specifically measure the effect of various types of training on employee behaviors.

Table 2.2- Response Rate for Training Evaluation Surveys and Audit Forms

Training Topic	Number of plants contacted	Number of plants respond ed	Plant response rate	Estimated employees contacted	Employee surveys received	Estimated Response Rate	Supervisor audits received	Supervisor Audit response rate
Introduction to Good Manufacturing Practices and Material Controls	20	9	**45 .0%**	1742	380	**21.8**	5	**25.0%**
Personal Responsibility and Communicable Diseases	19	6	**31.6%**	791	165	**20.9**	3	**15.8%**
Allergen Control	13	3	**23.1%**	224	99	**44.2**	4	**30.8%**
Food Defense	14	4	**28.6%**	863	224	**17.3**	2	**14.3%**
Total	**66**	**22**	**33.3%**	**3620**	**793**	**21.9**	**14**	**21.2%**

Table 2.3- Introduction to Good Manufacturing Practices and Material Controls Reliability Analyses for each Integrated Behavior Model Construct

Sub-Construct	Cronbach's Alpha	Construct	Cronbach's Alpha	Construct	Cronbach's Alpha
Experiential Attitude	0.949	**Overall Attitude**	**0.875**	**Intention**	**0.926**
Instrumental Attitude	0.925				
Injunctive Norm	0.957	**Perceived Norm**	**0.960**		
Descriptive Norm	0.952				
Perceived Control	0.923	**Personal Agency**	**0.944**		
Self-Efficacy	0.898				

Table 2.4- Personal Responsibility and Communicable Diseases Reliability Analyses for each Integrated Behavior Model Construct

Sub-Construct	Cronbach's Alpha	Construct	Cronbach's Alpha	Construct	Cronbach's Alpha
Experiential Attitude	0.841	**Overall Attitude**	**0.742**	**Intention**	**0.656 /0.825***
Instrumental Attitude	0.829				
Injunctive Norm	0.883	**Perceived Norm**	**0.929**		
Descriptive Norm	0.886				
Perceived Control	0.821	**Personal Agency**	**0.849**		
Self-Efficacy	0.628 /0.796*				

*based on standardized items

Table 2.5- Allergen Control Reliability Analyses for each Integrated Behavior Model Construct

Sub-Construct	Cronbach's Alpha	Construct	Cronbach's Alpha	Construct	Cronbach's Alpha
Experiential Attitude	0.881	**Overall Attitude**	**0.861**	**Intention**	**0.976**
Instrumental Attitude	0.921				
Injunctive Norm	0.966	**Perceived Norm**	**0.971**		
Descriptive Norm	0.955				
Perceived Control	0.925	**Personal Agency**	**0.944**		
Self-Efficacy	0.887				

Table 2.6- Food Defense Reliability Analyses for each Integrated Behavior Model Construct

Sub-Construct	Cronbach's Alpha	Construct	Cronbach's Alpha	Construct	Cronbach's Alpha
Experiential Attitude	0.873	**Overall Attitude**	0.840	**Intention**	0.887
Instrumental Attitude	0.881				
Injunctive Norm	0.971	**Perceived Norm**	0.970		
Descriptive Norm	0.964				
Perceived Control	0.913	**Personal Agency**	0.927		
Self-Efficacy	0.830				

Table 2.7- Introduction to Good Manufacturing Practices and Material Controls Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from very gratifying (1) to very ungratifying (7).

EXPERIENTIAL ATTITUDE	
Question: Please rank how gratifying you find the following tasks.	**Factor Loading Comp 1**
Using the correct color of buckets and brushes to prevent contamination.	0.922
Keeping my workplace clean during my shift.	0.906
Making sure than cleaning compounds are properly labeled and stored separately from raw materials.	0.949
Making sure that materials and ingredients are properly labeled, stored, and sealed.	0.948

Table 2.8- Introduction to Good Manufacturing Practices and Material Controls Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Extremely unlikely (1) to Extremely likely (7).

INSTRUMENTAL ATTITUDE	
Question: Please rank how likely you find the following statements.	Factor Loading Comp 1
Using the correct color of buckets and brushes supports the safety of the product.	0.895
Keeping my workplace clean throughout my shift supports the safety of the product	0.891
Making sure that cleaning compounds are properly labeled and stored separately from raw materials supports the safety of the product.	0.945
Making sure that materials and ingredients are properly labeled, stored, and sealed supports the safety of the product.	0.894

Table 2.9- Introduction to Good Manufacturing Practices and Material Controls Injunctive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7). PCAs were run separately for each group: Supervisor, Company, Consumers, Auditors.

	Supervisor	Company	Consumers	Auditors
Question: _______ want me to	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1
Use the correct color of buckets and brushes.	0.896	0.904	0.895	0.923
Keep my workplace clean during my shift.	0.929	0.943	0.965	0.975
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	0.961	0.967	0.972	0.978
Make sure that materials and ingredients are properly labeled, stored, and sealed.	0.949	0.944	0.971	0.981

Table 2.10- Introduction to Good Manufacturing Practices and Material Controls Descriptive Norm (Employee) principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

Question: My fellow employee….	Factor Loading Comp 1
Uses the correct color of bucket and brushes.	0.928
Keeps the workplace clean during their shift.	0.893
Makes sure that cleaning compounds are properly labeled and stored separately from raw materials.	0.961
Makes sure that materials and ingredients are properly labeled, stored, and sealed.	0.963

Table 2.11 Introduction to Good Manufacturing Practices and Material Controls Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from “not under my control” (1) to “under my control” (7). PCAs for Safety and Occasion were run separately.

	Safety
Question: Rank how much control you have over the safety of our products by…	Factor Loading Comp 1
Using the correct color of buckets and brushes.	0.847
Keeping my workplace clean during my shift.	0.733
Making sure that cleaning compounds are properly labeled and stored separately from raw materials.	0.916
Making sure that materials and ingredients are properly labeled, stored, and sealed.	0.896

Table 2.12- Introduction to Good Manufacturing Practices and Material Controls Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from “not under my control” (1) to “under my control” (7). PCAs for Safety and Occasion were run separately.

	Occasion
Question: At every possible occasion, I am able to…	Factor Loading Comp 1
Using the correct color of buckets and brushes.	0.819
Keeping my workplace clean during my shift.	0.755
Making sure that cleaning compounds are properly labeled and stored separately from raw materials.	0.911
Making sure that materials and ingredients are properly labeled, stored, and sealed.	0.903

Table 2.13- Introduction to Good Manufacturing Practices and Material Controls Self Efficacy principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from "I could not" (1) to "certain I could" (7).

Question: I have the ability to…	Factor Loading Comp 1
Use the correct color of buckets and brushes.	0.854
Keep my workplace clean during my shift.	0.846
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	0.891
Make sure that materials and ingredients are properly labeled, stored, and sealed.	0.918

Table 2.14- Introduction to Good Manufacturing Practices and Material Controls Intention principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

Question: I will…	Factor Loading Comp 1
Use the correct color of buckets and brushes.	0.888
Keep my workplace clean during my shift.	0.895
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	0.945
Make sure that materials and ingredients are properly labeled, stored, and sealed.	0.903

Table 2.15- Personal Responsibility and Communicable Diseases Experiential Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from very gratifying (1) to very ungratifying (7).

EXPERIENTIAL ATTITUDE	
Question: Please rank how gratifying you find the following tasks.	Factor Loading Comp 1
Properly washing my hands when necessary.	0.869
Correctly wearing gloves, hair nets, and beard nets.	0.937
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP area.	0.881
Not coming into work when I am sick.	0.655

Table 2.16- Personal Responsibility and Communicable Diseases Instrumental Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from extremely unlikely (1) to extremely likely (7).

INSTRUMENTAL ATTITUDE	
Question: Please rank how likely you find the following statements.	Factor Loading Comp 1
Properly washing my hands when necessary supports the safety of the product.	0.863
Correctly wearing gloves, hair nets, and beard nets supports the safety of the product	0.875
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas supports the safety of the product.	0.914
Not coming into work when I am sick supports the safety of the product.	0.658

Table 2.17- Personal Responsibility and Communicable Diseases Injunctive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7). PCAs were run separately for each group: Supervisor, Company, Consumers, Auditors.

	Supervisor	Company	Consumer	Auditor
Question: My ___ wants me to	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1
Properly wash my hands when necessary.	0.902	0.873	0.926	0.981
Correctly wear gloves, hair nets, and beard nets.	0.938	0.933	0.967	0.975
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	0.900	0.892	0.919	0.966
Not come into work when I am sick.	0.608	0.506	0.863	0.696

Table 2.18- Personal Responsibility and Communicable Diseases Descriptive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7). PCAs were run separately for each group: Supervisor, Company, Consumers, Auditors.

	Supervisor	Plant Manager	Employee
Question: My ____:	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1
Properly washes their hands when necessary.	0.865	0.909	0.913
Correctly wears gloves, hair nets, and beard nets.	0.939	0.893	0.940
Does not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	0.899	0.849	0.927
Does not come into work when they are sick.	0.381	0.399	0.719

Table 2.19- Personal Responsibility and Communicable Diseases Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Not under my control (1) to Under my control (7).

	Safety
Question: Rank how much control you have over the safety of our product by:	Factor Loading Comp 1
Properly washing my hands when necessary.	0.891
Correctly wearing gloves, hair nets, and beard nets.	0.916
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas.	0.925
Not coming into work when I am sick.	0.593

Table 2.20- Personal Responsibility and Communicable Diseases Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Not under my control (1) to Under my control (7).

	Occasion
Question: At every possible occasion, I am able to:	Factor Loading Comp 1
Properly wash my hands when necessary.	0.863
Correctly wear gloves, hair nets, and beard nets.	0.929
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	0.933
Not come into work when I am sick.	0.313

Table 2.21- Personal Responsibility and Communicable Diseases Self-Efficacy principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from I could not (1) to certain I could agree (7).

Question: I have the ability to:	Factor Loading Comp 1
Properly wash my hands when necessary.	0.815
Correctly wear gloves, hair nets, and beard nets.	0.917
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	0.869
Not come into work when I am sick.	0.532

Table 2.22- Personal Responsibility and Communicable Diseases Intention principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

Question: I will:	Factor Loading Comp 1
Properly wash my hands when necessary.	0.930
Correctly wear gloves, hair nets, and beard nets.	0.932
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	0.919
Not come into work when I am sick.	0.420

Table 2.23- Allergen Controls Experiential Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from very gratifying (1) to very ungratifying (7).

EXPERIENTIAL ATTITUDE	
Question: Please rank how gratifying you find the following tasks.	Factor Loading Comp 1
Properly stacking and storing raw materials to prevent allergen cross-contact.	0.730
Making sure the correct label and packaging is on the product to prevent allergen cross-contact.	0.919
Properly cleaning machines and equipment to prevent allergen cross-contact.	0.885
Following the production schedule to prevent allergen cross-contact.	0.933

Table 2.24- Allergen Controls Instrumental Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from extremely unlikely (1) to extremely likely (7).

ISNTRUMENTAL ATTITUDE	
Question: Please rank how likely you find the following statements.	Factor Loading Comp 1
Properly stacking and storing raw materials supports the safety of the product.	0.950
Making sure the correct label packaging is on the product supports the safety of the product.	0.928
Properly cleaning machines and equipment supports the safety of the product.	0.922
Following the production schedule supports the safety of the product.	0.816

Table 2.25- Allergen Controls Injunctive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

	Supervisor	Company	Consumer	Auditor
Question: My ___ wants me to…	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1
Properly stack and store raw materials to prevent allergen cross-contact.	0.941	0.976	0.983	0.963
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	0.930	0.993	0.993	0.987
Properly clean machines and equipment to prevent allergen cross-contact.	0.949	0.977	0.987	0.975
Follow the production schedule to prevent allergen cross-contact.	0.929	0.942	0.986	0.960

Table 2.26- Allergen Controls Descriptive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

Question: My fellow employee:	Factor Loading Comp 1
Properly stacks and stores raw materials to prevent allergen cross contact.	0.961
Makes sure the correct label and packaging it on the product to prevent allergen cross-contact.	0.941
Properly cleans machines and equipment to prevent allergen cross-contact.	0.933
Follows the production schedule to prevent allergen cross-contact.	0.919

Table 2.27- Allergen Controls Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

	Safety
Question: Rank how much control you have over whether someone has an allergic reaction to our product by:	Factor Loading Comp 1
Properly stacking and storing raw materials to prevent allergen cross-contact.	0.759
Making sure the correct label and packaging is on the product to prevent allergen cross-contact.	0.808
Properly cleaning machines and equipment to prevent allergen cross-contact.	0.816
Following the production schedule to prevent allergen cross-contact.	0.907

Table 2.28- Allergen Controls Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

	Occasion
Question: At every possible occasion, I am able to:	Factor Loading Comp 1
Properly stacking and storing raw materials to prevent allergen cross-contact.	0.888
Making sure the correct label and packaging is on the product to prevent allergen cross-contact.	0.866
Properly cleaning machines and equipment to prevent allergen cross-contact.	0.774
Following the production schedule to prevent allergen cross-contact.	0.924

Table 2.29- Allergen Controls Self Efficacy principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from I could not (1) to Certain I could (7).

Question: I have the ability to:	Factor Loading Comp 1
Properly stack and storing raw materials to prevent allergen cross-contact.	0.801
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	0.918
Properly clean machines and equipment to prevent allergen cross-contact.	0.824
Follow the production schedule to prevent allergen cross-contact.	0.922

Table 2.30- Allergen Controls Intention principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

Question: I will:	Factor Loading Comp 1
Properly stack and store raw materials to prevent allergen cross-contact.	0.983
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	0.988
Properly clean machines and equipment to prevent allergen cross-contact.	0.965
Follow the production schedule to prevent allergen cross-contact.	0.929

Table 2.31-Food Defense Experiential Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Very gratifying (1) to Very ungratifying (7).

EXPERIENTIAL ATTITUDE	
Question: Please rank how gratifying you find the following tasks.	Factor Loading Comp 1
Making sure that doors to the facility are secured.	0.831
Reporting unusual activities or visitors to supervisors.	0.852
Properly documenting product and lot numbers throughout the process.	0.826
Making sure that incoming and outgoing trucks and trailers are sealed.	0.894

Table 2.31- Food Defense Instrumental Attitude principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Extremely unlikely (1) to Extremely likely (7).

INSTRUMENTAL ATTITUDE	
Question: Please rank how likely you find the following statements.	Factor Loading Comp 1
Making sure that doors to the plant are secured supports the safety of the product.	0.865
Reporting unusual activities or visitors to supervisors supports the safety of the product.	0.895
Documenting product and lot numbers supports the safety of the product.	0.870
Making sure that incoming and outgoing trucks and trailers are sealed supports the safety of the product.	0.804

Table 2.33- Food Defense Injunctive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

	Supervisor	Company	Consumer	Auditor
Question: My ___ wants me to…	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1	Factor Loading Comp 1
Ensure that doors to the facility are properly secured.	0.910	0.951	0.982	0.932
Report unusual activities or visitors to supervisors.	0.951	0.962	0.992	0.991
Properly document product and lot numbers throughout the process.	0.943	0.944	0.989	0.975
Ensure that incoming and outgoing trucks and trailers are properly sealed.	0.902	0.912	0.982	0.989

Table 2.34- Food Defense Descriptive Norm principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

	Supervisor	Fellow employee
Question: My ___ …	Factor Loading Comp 1	Factor Loading Comp 1
Ensures that doors to the facility are properly secured.	0.978	0.923
Reports unusual activities or visitors.	0.968	0.935
Properly documents product and lot numbers throughout the process.	0.966	0.925
Ensures that incoming and outgoing trucks and trailers are properly sealed.	0.917	0.928

Table 2.35- Food Defense Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Not under my control (1) to Under my control (7).

	Safety
Question: Rank how much control you have over the safety of our product by:	Factor Loading Comp 1
Ensuring that doors to the facility are properly secured.	0.810
Reporting unusual activities or visitors to supervisors.	0.852
Properly documenting product and lot numbers throughout the process.	0.830
Ensuring that incoming and outgoing trucks and trailers are properly sealed.	0.782

Table 2.36 Food Defense Perceived Control principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from Not under my control (1) to Under my control (7).

	Occasion
Question: At every possible occasion, I am able to:	Factor Loading Comp 1
Ensure that doors to the facility are properly secured.	0.891
Report unusual activities or visitors to supervisors.	0.896
Properly document product and lot numbers throughout the process.	0.861
Ensure that incoming and outgoing trucks and trailers are properly sealed.	0.839

Table 2.37 Food Defense Self Efficacy principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from I could not (1) to Certain I could (7).

Question: I have the ability to:	Factor Loading Comp 1
Ensure that doors to the facility are properly secured.	0.865
Report unusual activities or visitors to supervisors.	0.730
Properly document product and lot numbers throughout the process.	0.827
Ensure that incoming and outgoing trucks and trailers are properly sealed.	0.851

Table 2.38 Food Defense Intention principle component analysis (PCA) factor loadings. Each question was measured with a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

Question: I will:	Factor Loading Comp 1
Ensure that doors to the facility are properly secured.	0.949
Report unusual activities or visitors to supervisors.	0.942
Properly document product and lot numbers throughout the process.	0.882
Ensure that incoming and outgoing trucks and trailers are properly sealed.	0.748

Table 2.39- Wilcoxon and Sign Test Results of Integrated Behavior Model Constructs for Introduction to Good Manufacturing Practices and Material Controls Training Model

Construct	Training Learning Theory	Timing	Mean	N	Mean Difference (Post-Pre)	Significance (2-tailed) Wilcoxon	Significance (2-tailed) Sign test
Experiential Attitude	PI	Pre	5.6292	20	-0.1292	0.653	
		Post	5.5900	20			
	SSL	Pre	5.7891	98	0.1335		
		Post	5.9226	98			0.034
	DI	Pre	5.7846	130	0.2833		
		Post	6.0679	130			0.013
Instrumental Attitude	PI	Pre	6.2500	22	0.2955		0.006
		Post	6.5455	22			
	SSL	Pre	6.3309	102	-0.0760		0.112
		Post	6.2549	102			
	DI	Pre	6.0460	134	-0.0721		
		Post	5.9739	134			0.171
Overall Attitude	PI	Pre	5.9458	20	0.0792		0.267
		Post	6.0250	20			
	SSL	Pre	6.0782	98	-0.0021		0.154
		Post	6.0761	98			
	DI	Pre	5.9154	131	0.1126		0.003
		Post	6.0280	131			

Table 2.39 continued

Injunctive Norm-Supervisor	PI	Pre	5.8636	22	0.8371		0.006
		Post	6.7008	22			
	SSL	Pre	6.1607	97	0.2423		0.004
		Post	6.4029	97			
	DI	Pre	6.0599	128	0.0768		0.126
		Post	6.1367	128			
Injunctive Norm-Company	PI	Pre	5.9881	21	0.5952		0.070
		Post	6.5833	21			
	SSL	Pre	6.3359	99	0.2155		0.026
		Post	6.5513	99			
	DI	Pre	6.1757	129	0.2410		0.000
		Post	6.4167	129			
Injunctive Norm-Consumer	PI	Pre	6.1310	21	0.2024		0.508
		Post	6.3333	21			
	SSL	Pre	6.1868	95	0.1842		0.003
		Post	6.3711	95			
	DI	Pre	6.0968	130	0.1378		0.064
		Post	6.2346	130			
Injunctive Norm-Auditors	PI	Pre	6.6023	22	0.1477		0.219
		Post	6.7500	22			
	SSL	Pre	6.5740	98	0.0612		1.000
		Post	6.6352	98			
	DI	Pre	6.2852	128	0.1211		0.136
		Post	6.4063	128			

Table 2.39 continued

Overall Injunctive Norm	PI	Pre	6.4510	20	0.4962	0.001	
		Post	6.7260	20			
	SSL	Pre	6.3117	101	0.1831		0.000
		Post	6.4948	101			
	DI	Pre	6.1500	129	0.1457		0.019
		Post	6.2956	129			
Descriptive Norm-Employee	PI	Pre	5.3295	22	0.1705	0.458	
		Post	5.5000	22			
	SSL	Pre	5.5916	101	0.1238		0.306
		Post	5.7153	101			
	DI	Pre	5.4602	134	-0.0106	0.979	
		Post	5.4496	134			
Perceived Norm	PI	Pre	5.7188	22	0.3333	0.048	
		Post	6.0521	22			
	SSL	Pre	5.9516	101	0.1460		0.006
		Post	6.0977	101			
	DI	Pre	5.8142	131	0.0636		0.132
		Post	5.8778	131			
Perceived Control-Safety	PI	Pre	6.5833	21	-0.4246		0.109
		Post	6.1587	21			
	SSL	Pre	6.0944	98	0.2449		0.067
		Post	6.3393	98			
	DI	Pre	5.7691	131	0.2131		0.054
		Post	5.9822	131			

Table 2.39 continued

Perceived Control-Occasion	PI	Pre	6.3864	22	-0.0341		1.000
		Post	6.3523	22			
	SSL	Pre	6.2474	97	0.0730		0.626
		Post	6.3204	97			
	DI	Pre	5.7867	127	0.3176		0.005
		Post	6.1043	127			
Overall Perceived Control	PI	Pre	6.4702	21	-0.1825		1.000
		Post	6.2877	21			
	SSL	Pre	6.1696	98	0.1637		0.093
		Post	6.3333	98			
	DI	Pre	5.7545	129	0.2762		0.004
		Post	6.0307	129			
Self-Efficacy	PI	Pre	6.5568	22	-0.3295		0.070
		Post	6.2273	22			
	SSL	Pre	6.4773	99	0.0387		0.361
		Post	6.5160	99			
	DI	Pre	5.9135	132	0.3567		0.006
		Post	6.2702	132			
Personal Agency	PI	Pre	6.5268	21	-0.2401	0.401	
		Post	6.2867	21			
	SSL	Pre	6.3035	97	0.1192		0.071
		Post	6.4227	97			
	DI	Pre	5.8405	128	0.3234		0.000
		Post	6.1639	128			

Table 2.39 continued

Intention	PI	Pre	6.6023	22	0.1856		0.125
		Post	6.7879	22			
	SSL	Pre	6.5145	98	0.0281		0.742
		Post	6.5425	98			
	DI	Pre	6.1648	132	0.1414		0.028
		Post	6.3062	132			
Knowledge Question 1-Material Storage	PI	Pre	0.9123	19	-0.0175		0.500
		Post	0.8947	19			
	SSL	Pre	0.8582	87	0.0345		1.000
		Post	0.8927	87			
	DI	Pre	0.8051	118	0.0452		0.134
		Post	0.8503	118			
Knowledge Question 2-GMP Activities	PI	Pre	1.0000	19	-0.0530	0.317	
		Post	0.9500	19			
	SSL	Pre	0.8100	86	0.0230		0.754
		Post	0.8400	86			
	DI	Pre	0.8500	117	0.0430		0.227
		Post	0.8900	117			
Knowledge Question 3-Bucket and Brush Colors	PI	Pre	0.8500	20	0.0500	0.317	
		Post	0.9000	20			
	SSL	Pre	0.7600	94	-0.0320		
		Post	0.7200	94			0.607
	DI	Pre	0.8100	113	0.0440		0.180
		Post	0.8500	113			

Table 2.39 continued

Knowledge Question 4- Ingredient and Packaging Storage	PI	Pre	0.9500	21	-0.0950		0.500
		Post	0.8600	21			
	SSL	Pre	0.7700	97	0.1440		0.001
		Post	0.9200	97			
	DI	Pre	0.8000	125	0.0800		0.031
		Post	0.8800	125			
Knowledge Question 5- Chemical Storage	PI	Pre	1.00a	20	-	1.000	
		Post	1.00a	20			
	SSL	Pre	0.9900	97	-0.0310		
		Post	0.9600	97			0.375
	DI	Pre	0.9700	130	0.0230		0.375
		Post	0.9900	130			
Knowledge Question 6- Container Re-Use	PI	Pre	0.8500	20	-0.2000		0.125
		Post	0.6500	20			
	SSL	Pre	0.7900	97	0.0620		0.210
		Post	0.8600	97			
	DI	Pre	0.7700	124	0.0560		0.167
		Post	0.8200	124			
Total Knowledge Score	PI	Pre	90.2778	20	-4.4444		0.109
		Post	85.8333	20			
	SSL	Pre	79.5351	98	4.5351		0.053
		Post	84.0703	98			
	DI	Pre	78.3376	129	7.6658		0.000
		Post	86.0034	129			

Table 2.40- Wilcoxon and Sign Test Results of Integrated Behavior Model Constructs for Personal Responsibility and Communicable Diseases Training Model

Construct	Training Topic	Timing	Mean	N	Mean Difference (Post-Pre)	Significance (2-tailed) Wilcoxon	Significance (2-tailed) Sign test
Experiential Attitude	PI	Pre	5.7143	14	-0.1429		1.000
		Post	5.5714	14			
	SSL	Pre	5.5093	27	-1.1296		1.000
		Post	4.3796	27			
	DI	Pre	5.6580	67	-0.2214		0.047
		Post	5.4366	67			
Instrumental Attitude	PI	Pre	5.8036	14	0.3036	0.437	
		Post	6.1071	14			
	SSL	Pre	6.4074	27	0.2037		0.774
		Post	6.6111	27			
	DI	Pre	6.4743	68	-0.0919	0.767	
		Post	6.3824	68			
Overall Attitude	PI	Pre	5.7589	14	0.0804		0.754
		Post	5.8393	14			
	SSL	Pre	5.9630	27	-0.4537		1.000
		Post	5.5093	27			
	DI	Pre	6.0622	67	-0.1573	0.753	
		Post	5.9049	67			

Table 2.40 continued

Injunctive Norm-Supervisor	PI	Pre	5.5357	14	0.4821		0.039
		Post	6.0179	14			
	SSL	Pre	5.9423	26	0.3846		0.031
		Post	6.3269	26			
	DI	Pre	5.8968	67	0.1667		0.025
		Post	6.0634	67			
Injunctive Norm-Company	PI	Pre	6.0714	14	0.2321		0.289
		Post	6.3036	14			
	SSL	Pre	6.2596	26	0.2885		0.118
		Post	6.5481	26			
	DI	Pre	6.0846	68	0.2463		0.000
		Post	6.3309	68			
Injunctive Norm-Consumer	PI	Pre	6.3000	15	0.1833		0.375
		Post	6.4833	15			
	SSL	Pre	6.4537	27	0.2315		0.021
		Post	6.6852	27			
	DI	Pre	6.4291	67	0.1455		0.026
		Post	6.5746	67			
Injunctive Norm-Auditors	PI	Pre	6.3500	15	0.1000		0.727
		Post	6.4500	15			
	SSL	Pre	6.4815	27	0.1019		0.125
		Post	6.5833	27			
	DI	Pre	6.5672	67	0.1493		0.013
		Post	6.7164	67			

Table 2.40 continued

Overall Injunctive Norm	PI	Pre	6.0833	15	0.2542		0.754
		Post	6.3375	15			
	SSL	Pre	6.2917	27	0.2477		0.078
		Post	6.5394	27			
	DI	Pre	6.2484	67	0.1741	0.000	
		Post	6.4226	67			
Descriptive Norm- Supervisor	PI	Pre	5.6000	15	0.2500		0.063
		Post	5.8500	15			
	SSL	Pre	6.0093	27	0.2778		0.454
		Post	6.2870	27			
	DI	Pre	5.9265	68	0.0993		0.009
		Post	6.0257	68			
Descriptive Norm- Plant Manager	PI	Pre	6.2167	15	-0.1167		0.727
		Post	6.1000	15			
	SSL	Pre	6.1296	27	0.1296		0.227
		Post	6.3611	27			
	DI	Pre	5.9926	68	0.1679		0.029
		Post	6.1605	68			
Descriptive Norm- Employee	PI	Pre	4.9333	15	0.4500		0.039
		Post	5.3833	15			
	SSL	Pre	5.3056	27	0.1296		0.581
		Post	5.4352	27			
	DI	Pre	5.2862	69	0.4239		0.000
		Post	5.7101	69			

Table 2.40 continued

Overall Descriptive Norm	PI	Pre	5.5833	15	0.1944		0.070
		Post	5.7778	15			
	SSL	Pre	5.8148	27	0.2130		1.000
		Post	6.0278	27			
	DI	Pre	5.7391	69	0.2285		0.005
		Post	5.9676	69			
Perceived Norm	PI	Pre	5.8333	15	0.2243		0.109
		Post	6.0576	15			
	SSL	Pre	6.0532	27	0.2303	0.022	
		Post	6.2836	27			
	DI	Pre	5.9924	67	0.1948	0.000	
		Post	6.1871	67			
Perceived Control-Safety	PI	Pre	6.1000	15	0.2333		0.453
		Post	6.3333	15			
	SSL	Pre	6.4537	27	0.0370		1.000
		Post	6.4907	27			
	DI	Pre	6.2065	69	0.3659		0.007
		Post	6.5725	69			
Perceived Control-Occasion	PI	Pre	6.0500	15	0.3000		0.031
		Post	6.3500	15			
	SSL	Pre	6.4722	27	0.1389		0.092
		Post	6.6111	27			
	DI	Pre	6.3659	69	0.0544		0.123
		Post	6.4203	69			

Table 2.40 continued

Overall Perceived Control	PI	Pre	4.0500	15	2.2917		0.000
		Post	6.3417	15			
	SSL	Pre	4.3086	27	2.2423		0.000
		Post	6.5509	27			
	DI	Pre	4.1908	69	2.3056		0.000
		Post	6.4964	69			
Self-Efficacy	PI	Pre	6.4000	15	0.0833		0.375
		Post	6.4833	15			
	SSL	Pre	6.6296	27	0.0648		0.727
		Post	6.6944	27			
	DI	Pre	6.4746	69	-0.0399		0.700
		Post	6.4348	69			
Personal Agency	PI	Pre	3.4833	15	2.9292		0.000
		Post	6.4125	15			
	SSL	Pre	3.6461	27	2.9766		0.000
		Post	6.6227	27			
	DI	Pre	3.5552	69	2.9104		0.000
		Post	6.4656	69			
Intention	PI	Pre	5.9667	15	0.1667		0.039
		Post	6.1333	15			
	SSL	Pre	6.4537	27	0.1111		0.180
		Post	6.5648	27			
	DI	Pre	6.3122	67	0.0945		0.007
		Post	6.4067	67			

Table 2.40 continued

Knowledge Question 1- Symptoms of Illness	PI	Pre	0.8670	15	0.0533		0.500
		Post	0.9200	15			
	SSL	Pre	0.8580	24	0.0500		0.727
		Post	0.9080	24			
	DI	Pre	0.8730	63	0.0317		0.180
		Post	0.9050	63			
Knowledge Question 2- Exposure to Illness	PI	Pre	1.0000	15	-0.0670	0.317	
		Post	0.9300	15			
	SSL	Pre	0.8500	27	-0.1110	0.257	
		Post	0.7400	27			
	DI	Pre	0.8300	65	0.0317	0.366	
		Post	0.7800	65			
Knowledge Question 3- Spread of Disease	PI	Pre	1.00a	14	-	1.000	
		Post	1.00a	14			
	SSL	Pre	0.9600	26	0.0380	0.317	
		Post	1.0000	26			
	DI	Pre	0.9800	62	0.0160	0.317	
		Post	1.0000	62			
Knowledge Question 4- Time to Return to Work	PI	Pre	0.3600	14	0.0710		1.000
		Post	0.4300	14			
	SSL	Pre	0.3800	26	0.3460		0.004
		Post	0.7300	26			
	DI	Pre	0.2100	63	0.2060		0.001
		Post	0.4100	63			

Table 2.40 continued

Knowledge Question 5- Outside Food in Plant	PI	Pre	0.6400	14	-0.0710		-
		Post	0.5700	14			
	SSL	Pre	0.7800	27	0.1110		0.375
		Post	0.8900	27			
	DI	Pre	0.7800	64	0.0160		1.000
		Post	0.8000	64			
Knowledge Question 6- Changing Gloves/Aprons	PI	Pre	0.6000	15	0.1330		0.500
		Post	0.7300	15			
	SSL	Pre	0.5000	18	0.0560		-
		Post	0.5600	18			
	DI	Pre	0.4300	58	0.1210		0.039
		Post	0.5500	58			
Knowledge Question 7- Hand Washing	PI	Pre	0.9167	15	0.0333		
		Post	0.9500	15			0.500
	SSL	Pre	1.0000a	27	-		
		Post	1.0000a	27			1.000
	DI	Pre	0.9851	67	0.0112		0.375
		Post	0.9963	67			
Knowledge Question 8- Changing Uniform	PI	Pre	1.0000	15	-0.0670	0.317	
		Post	0.9300	15			
	SSL	Pre	1.0000	25	-0.0400	0.317	
		Post	0.9600	25			
	DI	Pre	1.00a	66	-	1.000	
		Post	1.00a	66			

Table 2.40 continued

Total Knowledge Score	PI	Pre	78.1250	15	1.9167		0.289
		Post	80.0417	15			
	SSL	Pre	75.7407	27	5.4630		
		Post	81.2037	27			0.383
	DI	Pre	73.8636	66	4.6117		
		Post	78.4754	66			0.067

Table 2.41- Wilcoxon and Sign Test Results of Integrated Behavior Model Constructs for Allergen Controls Training Model

Construct	Training Topic	Timing	Mean	N	Mean Difference (Post-Pre)	Significance (2-tailed) Wilcoxon	Significance (2-tailed) Sign test
Experiential Attitude	PI	Pre	4.000a	2	-		
		Post	4.000a	2			1.000
	SSL	Pre	6.0167	15	-0.0167		0.453
		Post	6.0000	15			
	DI	Pre	5.8333	57	-0.2573		0.864
		Post	5.5760	57			
Instrumental Attitude	PI	Pre	4 .000a	2	-		1.000
		Post	4.000a	2			
	SSL	Pre	6.0417	18	0.3750		0.109
		Post	6.4167	18			
	DI	Pre	6.5216	58	-0.1595		1.000
		Post	6.3621	58			
Overall Attitude	PI	Pre	4.0000a	2	-		1.000
		Post	4.000a	2			
	SSL	Pre	5.9667	15	0.2000		0.745
		Post	6.1667	15			
	DI	Pre	6.1820	57	-0.2098		1.000
		Post	5.9722	57			

Table 2.41 continued

Injunctive Norm-Supervisor	PI	Pre	4.00000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.5938	16	-0.0313		1.000
		Post	6.5625	16			
	DI	Pre	6.4364	55	-0.0227		1.000
		Post	6.4136	55			
Injunctive Norm-Company	PI	Pre	4.00a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.5833	15	-0.0500		1.000
		Post	6.5333	15			
	DI	Pre	6.3580	54	0.0772		0.774
		Post	6.4352	54			
Injunctive Norm-Consumer	PI	Pre	4	2	0.5	0.317	
		Post	4.5	2			
	SSL	Pre	6.5500	15	0.0333		1.000
		Post	6.5833	15			
	DI	Pre	6.2277	56	0.0848		0.839
		Post	6.3125	56			

Table 2.41 continued

Injunctive Norm-Auditors	PI	Pre	4.0000000a	2	-		-
		Post	4.0000a	2			
	SSL	Pre	6.6111	15	0.0222		1.000
		Post	6.6333	15			
	DI	Pre	6.5364	55	-0.1182		0.118
		Post	6.4182	55			
Overall Injunctive Norm	PI	Pre	4	2	0.125		0.317
		Post	4.125	2			
	SSL	Pre	6.5819	15	-0.0069		1.000
		Post	6.5750	15			
	DI	Pre	6.3999	56	0.0138		0.747
		Post	6.4137	56			
Overall Descriptive Norm	PI	Pre	4.0000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.1833	15	0.0833		1.000
		Post	6.2667	15			
	DI	Pre	5.6379	58	0.0603		0.472
		Post	5.6983	58			
Perceived Norm	PI	Pre	4	2	0.0625		0.317
		Post	4.0625	2			
	SSL	Pre	6.5238	14	0.0811		1.000
		Post	6.6049	14			
	DI	Pre	6.0302	58	0.0154		0.658
		Post	6.0456	58			

Table 2.41 continued

Perceived Control-Safety	PI	Pre	4.000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.4375	12	-0.2708		1.000
		Post	6.1667	12			
	DI	Pre	5.9872	52	0.2949		0.307
		Post	6.2821	52			
Perceived Control-Occasion	PI	Pre	4.000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6 .6944	12	-0.1528		1.000
		Post	6.5417	12			
	DI	Pre	6.1275	51	0.3023		0.031
		Post	6.4297	51			
Overall Perceived Control	PI	Pre	4.0000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.5660	12	-0.2118		0.687
		Post	6.3542	12			
	DI	Pre	6.0441	52	0.3101		0.054
		Post	6.3542	52			
Self-Efficacy	PI	Pre	4.000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.8846	13	-0.0962		0.500
		Post	6.7885	13			
	DI	Pre	6.4136	54	0.2238		0.648
		Post	6.6373	54			

Table 2.41 continued

Perceived Control-Safety	PI	Pre	4.000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.4375	12	-0.2708		1.000
		Post	6.1667	12			
	DI	Pre	5.9872	52	0.2949		0.307
		Post	6.2821	52			
Perceived Control-Occasion	PI	Pre	4.000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6 .6944	12	-0.1528		1.000
		Post	6.5417	12			
	DI	Pre	6.1275	51	0.3023		0.031
		Post	6.4297	51			
Overall Perceived Control	PI	Pre	4.0000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.5660	12	-0.2118		0.687
		Post	6.3542	12			
	DI	Pre	6.0441	52	0.3101		0.054
		Post	6.3542	52			
Self-Efficacy	PI	Pre	4.000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.8846	13	-0.0962		0.500
		Post	6.7885	13			
	DI	Pre	6.4136	54	0.2238		0.648
		Post	6.6373	54			

Table 2.41 continued

Personal Agency	PI	Pre	4.000a	2	-		1.000
		Post	4.000a	2			
	SSL	Pre	6.7830	12	-0.1163		0.678
		Post	6.6667	12			
	DI	Pre	6.2598	51	0.2410		0.377
		Post	6.5008	51			
Intention	PI	Pre	4.00000 000a	2	-		1.000
		Post	4.0000a	2			
	SSL	Pre	6.8036	14	-0.0536		1.000
		Post	6.7500	14			
	DI	Pre	6.5424	55	-0.0879		1.000
		Post	6.4545	55			
Knowledge Question 1- Big 8	PI	Pre	0.8	1b	-		1.000
		Post	0.8	1b			
	SSL	Pre	0.8830	12	-0.1000		0.219
		Post	0.7830	12			
	DI	Pre	0.8840	55	-0.0073		0.093
		Post	0.8760	55			
Knowledge Question 2- Allergic Reactions	PI	Pre	1.00a	2	-		1.000
		Post	1.00a	2			
	SSL	Pre	0.6400	11	-0.1820		0.625
		Post	0.4500	11			
	DI	Pre	0.8500	46	-0.0430		0.754
		Post	0.8000	46			

Table 2.41 continued

Knowledge Question 3- % of Allergens	PI	Pre	.00a	2	-		0.500
		Post	1.00a	2			
	SSL	Pre	0.5300	15	0.0670	0.317	
		Post	0.6000	15			-
	DI	Pre	0.7300	56	0.1430		0.039
		Post	0.8800	56			
Knowledge Question 4- Treated as Allergens	PI	Pre	0.5	2	0.5		-
		Post	1	2			
	SSL	Pre	0.7100	17	0.0000		1.000
		Post	0.7100	17			
	DI	Pre	0.7600	49	0.1220		0.070
		Post	0.8800	49			
Knowledge Question 5- Source of Contamination	PI	Pre	0.6	2	0.025		1.000
		Post	0.625	2			
	SSL	Pre	0.4820	17	-0.0559	0.819	
		Post	0.4265	17			
	DI	Pre	0.5750	57	0.1132		0.291
		Post	0.6886	57			
Knowledge Question 6- Cleaning Procedure	PI	Pre	0.5	2	-0.5		-
		Post	0	2			
	SSL	Pre	0.4200	12	0.3330		0.125
		Post	0.7500	12			
	DI	Pre	0.6000	47	0.1060		0.125
		Post	0.7000	47			

Table 2.41 continued

Knowledge Question 7- Processing Schedule	PI	Pre	1.00a	2	-		-
		Post	1.00a	2			
	SSL	Pre	0.8800	16	0.0000		1.000
		Post	0.8800	16			
	DI	Pre	0.8600	56	-0.0890		0.267
		Post	0.7700	56			
Knowledge Question 8- Rework	PI	Pre	.33333a	2	-		-
		Post	.33333a	2			
	SSL	Pre	0.3939	11	0.0909	0.395	
		Post	0.4848	11			
	DI	Pre	0.7075	49	-0.0476		0.302
		Post	0.6599	49			
Total Knowledge Score	PI	Pre	54.166	2	16.5625		0.500
		Post	70.7291	2			
	SSL	Pre	53.6765	17	6.0172		0.143
		Post	59.6936	17			
	DI	Pre	69.8182	55	4.1515		0.470
		Post	73.9697	55			

Table 2.42- Wilcoxon and Sign Test Results of Integrated Behavior Model Constructs for Food Defense Training Model

Construct	Training Topic	Timing	Mean	N	Mean Difference (Post-Pre)	Significance (2-tailed) Wilcoxon	Significance (2-tailed) Sign test
Experiential Attitude	PI	Pre	6	1	-0.4286		-
		Post	6	1			
	SSL	Pre	5.9746	23	-0.1449		0.263
		Post	5.8297	23			
	DI	Pre	5.8472	60	-0.2250		0.874
		Post	5.6222	60			
Instrumental Attitude	PI	Pre	7	1	-0.4732		-
		Post	7	1			
	SSL	Pre	6.0652	23	0.0978		0.791
		Post	6.1630	23			
	DI	Pre	6.4237	59	-0.1653		0.617
		Post	6.2585	59			
Overall Attitude	PI	Pre	6.5	1	-0.4821		-
		Post	6.5	1			
	SSL	Pre	6.0199	23	-0.0236	0.876	
		Post	5.9964	23			
	DI	Pre	6.1384	59	-0.1992	0.262	
		Post	5.9393	59			

Table 2.42 continued

Injunctive Norm-Supervisor	PI	Pre	6	1	0.0086		-
		Post	6	1			
	SSL	Pre	6.0625	24	0.1389		1.000
		Post	6.2014	24			
	DI	Pre	6.4816	59	-0.1172		0.690
		Post	6.3644	59			
Injunctive Norm-Company	PI	Pre	6	1	0.1466		-
		Post	6	1			
	SSL	Pre	6.5000	25	0.2433		0.581
		Post	6.7433	25			
	DI	Pre	6.5523	59	-0.1314		0.503
		Post	6.4209	59			
Injunctive Norm-Consumer	PI	Pre	6	1	-0.1474		-
		Post	6	1			
	SSL	Pre	6.2391	23	0.2433		0.687
		Post	6.4928	23			
	DI	Pre	6.2632	57	0.1754		0.064
		Post	6.4386	57			
Injunctive Norm-Auditors	PI	Pre	6	1	-0.2981		-
		Post	6	1			
	SSL	Pre	6.3368	24	0.2882		0.453
		Post	6.6250	24			
	DI	Pre	6.4871	58	0.1293		0.180
		Post	6.6164	58			

Table 2.42 continued

Overall Injunctive Norm	PI	Pre	6	1	-0.0471		-
		Post	6	1			
	SSL	Pre	6.2781	23	0.2409		0.581
		Post	6.5190	23			
	DI	Pre	6.4559	59	0.0473		0.216
		Post	6.5032	59			
Descriptive Norm-Supervisor	PI	Pre	6	1	-0.6133		-
		Post	6	1			
	SSL	Pre	6.5233	25	-0.0933		0.344
		Post	6.4300	25			
	DI	Pre	6.3814	59	0.0339		1.000
		Post	6.4153	59			
Descriptive Norm-Employee	PI	Pre	6	1	-0.0096		-
		Post	6	1			
	SSL	Pre	5.9100	25	-0.0700		0.581
		Post	5.8400	25			
	DI	Pre	5.5847	62	0.1976		0.596
		Post	5.7823	62			
Overall Descriptive Norm	PI	Pre	6	1	-0.3381		-
		Post	6	1			
	SSL	Pre	6.2167	25	-0.0817		0.143
		Post	6.1350	25			
	DI	Pre	5.9775	61	0.1291		
		Post	6.1066	61			0.864

Table 2.42 continued

Perceived Norm	PI	Pre	6	1	-0.2696		-
		Post	6	1			
	SSL	Pre	6.2242	23	0.0870		1.000
		Post	6.3111	23			
	DI	Pre	6.2332	59	0.0904		0.165
		Post	6.3236	59			
Perceived Control-Safety	PI	Pre	7	1	0.2609		-
		Post	7	1			
	SSL	Pre	5.1250	24	0.4097		
		Post	5.5347	24			0.118
	DI	Pre	5.9722	60	0.2069		0.719
		Post	6.1792	60			
Perceived Control-Occasion	PI	Pre	7	1	0.1884		-
		Post	7	1			
	SSL	Pre	5.2967	25	0.0400		0.804
		Post	5.3367	25			
	DI	Pre	5.7458	60	0.3167		0.009
		Post	6.0625	60			
Overall Perceived Control	PI	Pre	7	1	0.2246		-
		Post	7	1			
	SSL	Pre	5.2483	25	0.0400		0.824
		Post	5.4650	25			
	DI	Pre	5.8590	60	0.2618		**0.037**
		Post	6.1208	60			

Table 2.42 continued

Self-Efficacy	PI	Pre	7	1	-0.2283		-
		Post	7	1			
	SSL	Pre	5.8433	25	-0.0033		0.774
		Post	5.8400	25			
	DI	Pre	6.2500	60	0.0375		1.0000
		Post	6.2875	60			
Personal Agency	PI	Pre	7	1	-0.0018		-
		Post	7	1			
	SSL	Pre	5.5458	25	0.1067		1.000
		Post	5.6525	25			
	DI	Pre	6.0545	60	0.1497		0.091
		Post	6.2042	60			
Intention	PI	Pre	6	1	0.0800		-
		Post	6	1			
	SSL	Pre	6.3993	24	-0.4514		0.754
		Post	5.9479	24			
	DI	Pre	6.5250	60	-0.3778		0.230
		Post	6.1472	60			
Knowledge Question 1- Food Defense Program	PI	Pre	0.75	1	-0.0521		-
		Post	0.75	1			
	SSL	Pre	0.8229	24	-0.0208		0.625
		Post	0.8021	24			
	DI	Pre	0.8833	60	-0.0125		0.629
		Post	0.8708	60			

Table 2.42 continued

Knowledge Question 2- Food Defense vs. Food Safety	PI	Pre	-	0	0.3570		-
		Post	-	0			
	SSL	Pre	0.5800	12	-0.0830	0.317	
		Post	0.5000	12			
	DI	Pre	0.5300	47	0.1280		**0.070**
		Post	0.6600	47			
Knowledge Question 3- Reporting to a Supervisor	PI	Pre	1	1	-0.0119		-
		Post	1	1			
	SSL	Pre	0.9600	25	-0.0300	0.317	
		Post	0.9300	25			
	DI	Pre	0.9881	63	0.0040		1.000
		Post	0.9921	63			
Knowledge Question 4- Outside Drivers	PI	Pre	1	1	-		-
		Post	1	1			
	SSL	Pre	.96a	25	-		1.000
		Post	.96a	25			
	DI	Pre	0.9500	63	0.0480		0.250
		Post	1.0000	63			
Knowledge Question 5- Product Vulnerability	PI	Pre	0.67	1	-0.0000		-
		Post	0.67	1			
	SSL	Pre	0.4722	24	0.1528		0.008
		Post	0.6250	24			
	DI	Pre	0.6722	60	0.1222		0.002
		Post	0.7944	60			

Table 2.42 continued

Total Knowledge Score	PI	Pre	68.34	1	3.9683		-
		Post	68.34	1			
	SSL	Pre	68.8667	25	3.5333		0.065
		Post	72.4000	25			
	DI	Pre	77.6455	63	5.2646		**0.082**
		Post	82.9101	63			

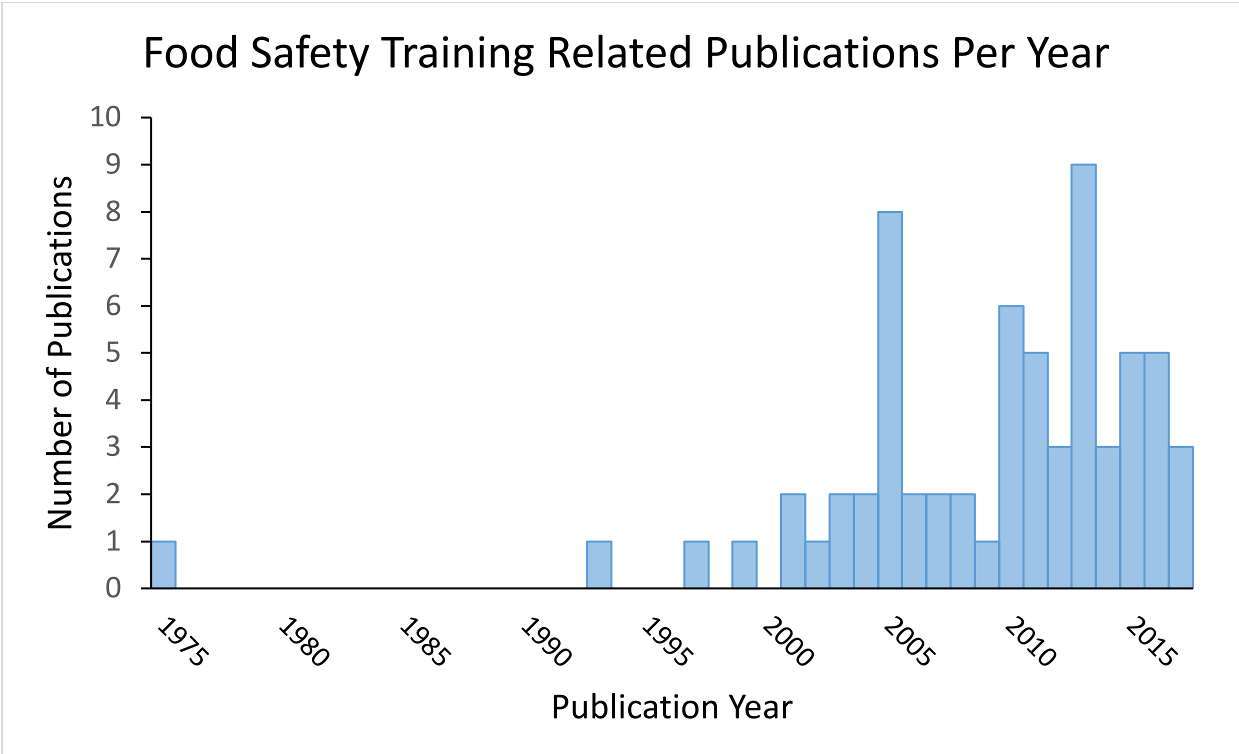

Figure 2.1- ***Peer-Reviewed Food Safety Training-Related Publications Per Year.***

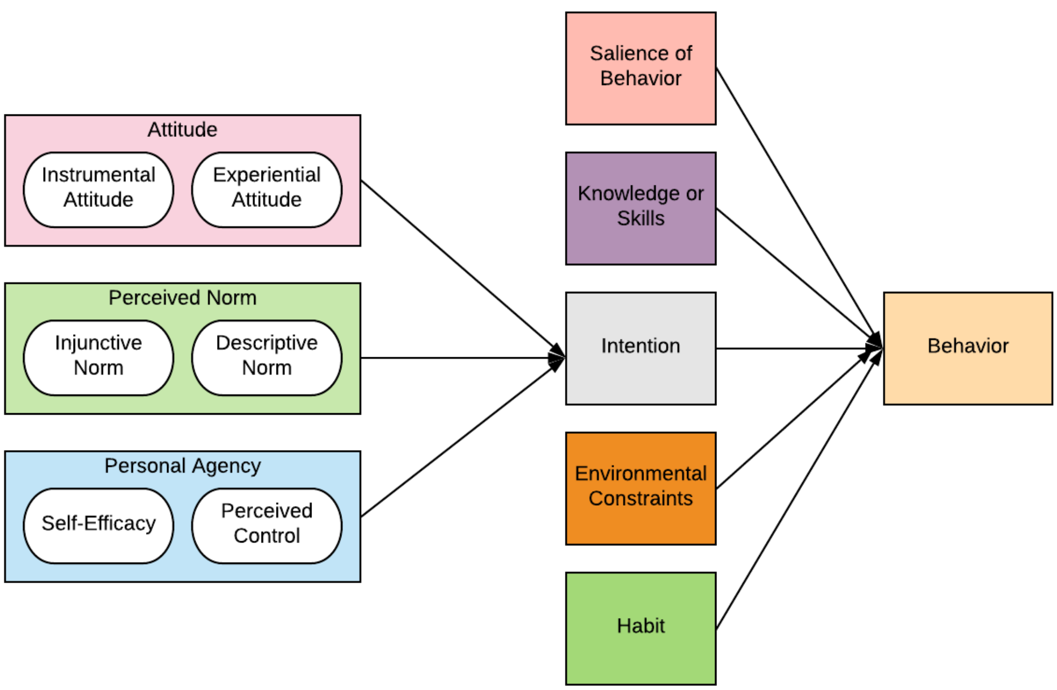

Figure 2.2- ***The Integrated Behavior Model.***

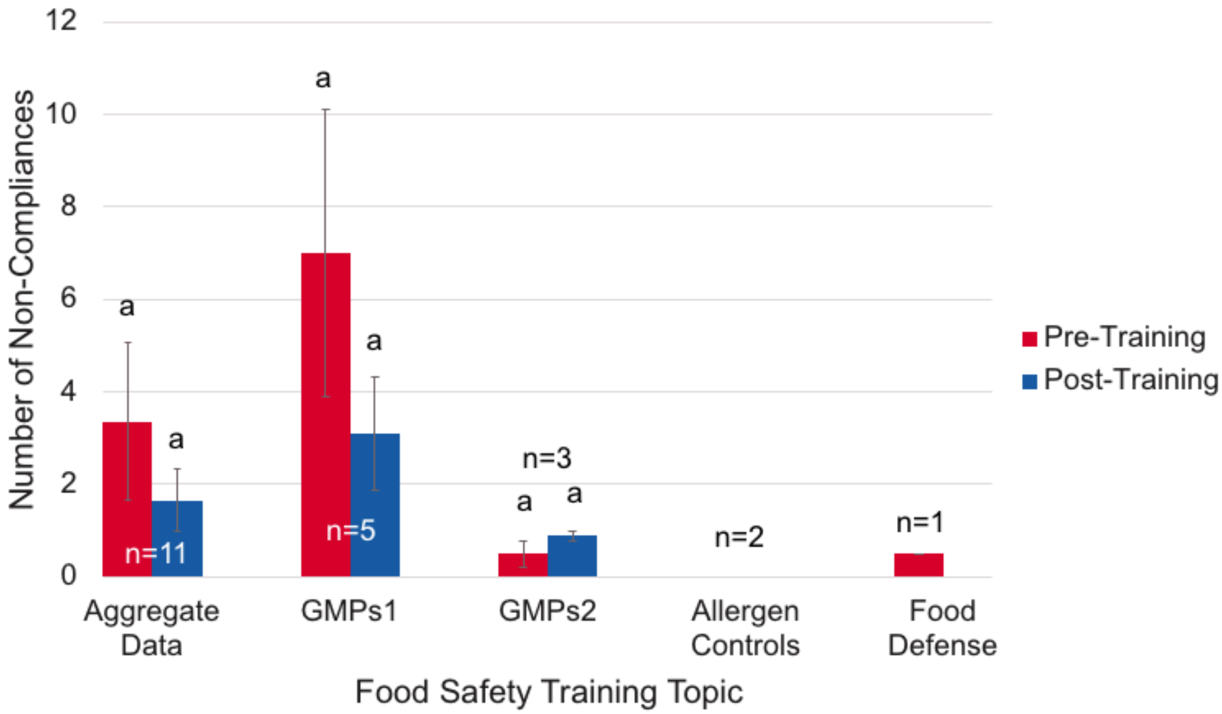

Figure 2.3- ***The Effect of Food Safety Training on Non-Compliances.*** GMPs 1 training covered Introduction to Good Manufacturing Practices (GMPs) and Material Controls. GMPs 2 training covered. Standard error bars are shown.

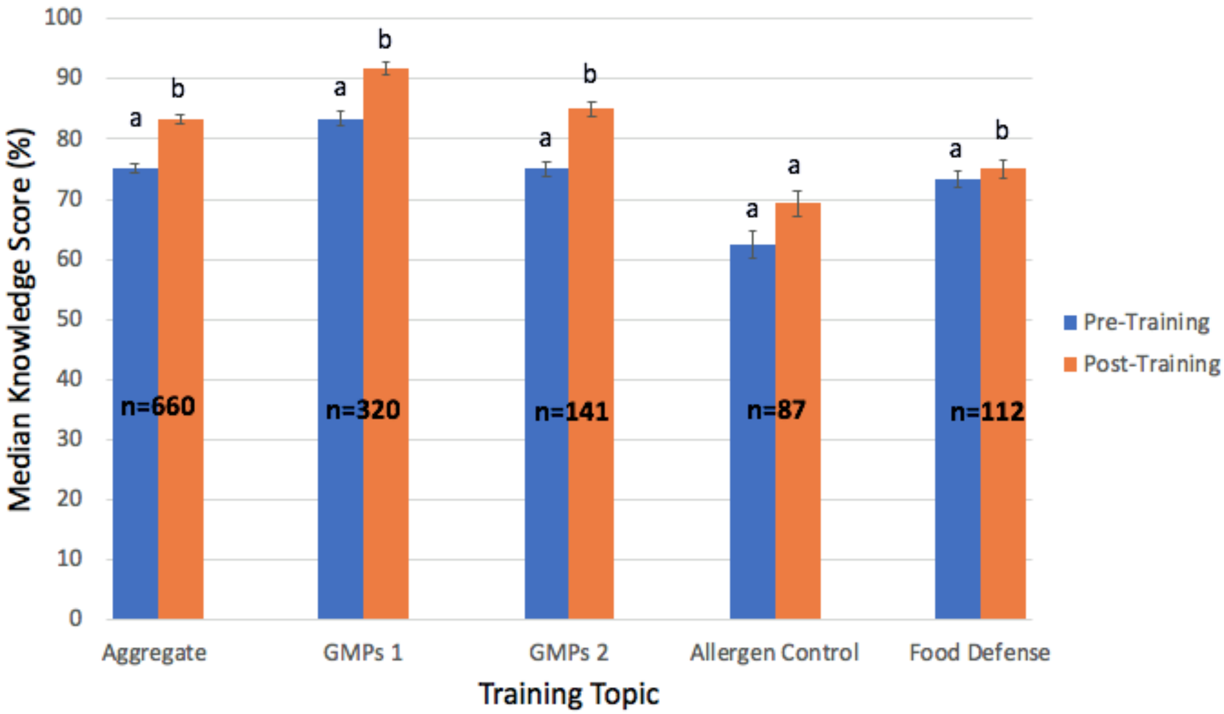

Figure 2.4- ***The Effect of Food Safety Training on Knowledge Scores for Aggregate Data and by Training Topic.*** Median values are shown.

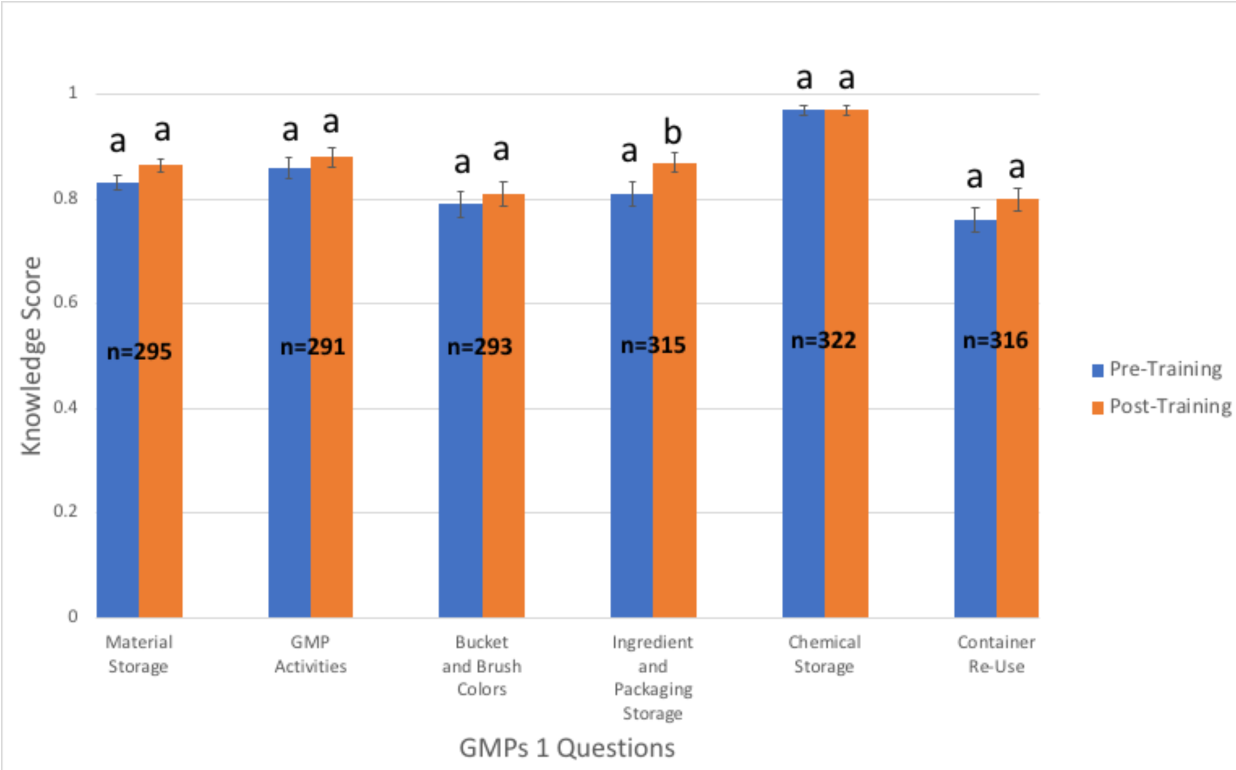

Figure 2.5- ***The Effect of Food Safety Training on Knowledge Scores for Introduction to Good Manufacturing Practices and Material Controls Training.*** Mean scores shown. Questions scored on a scale of 0-1.

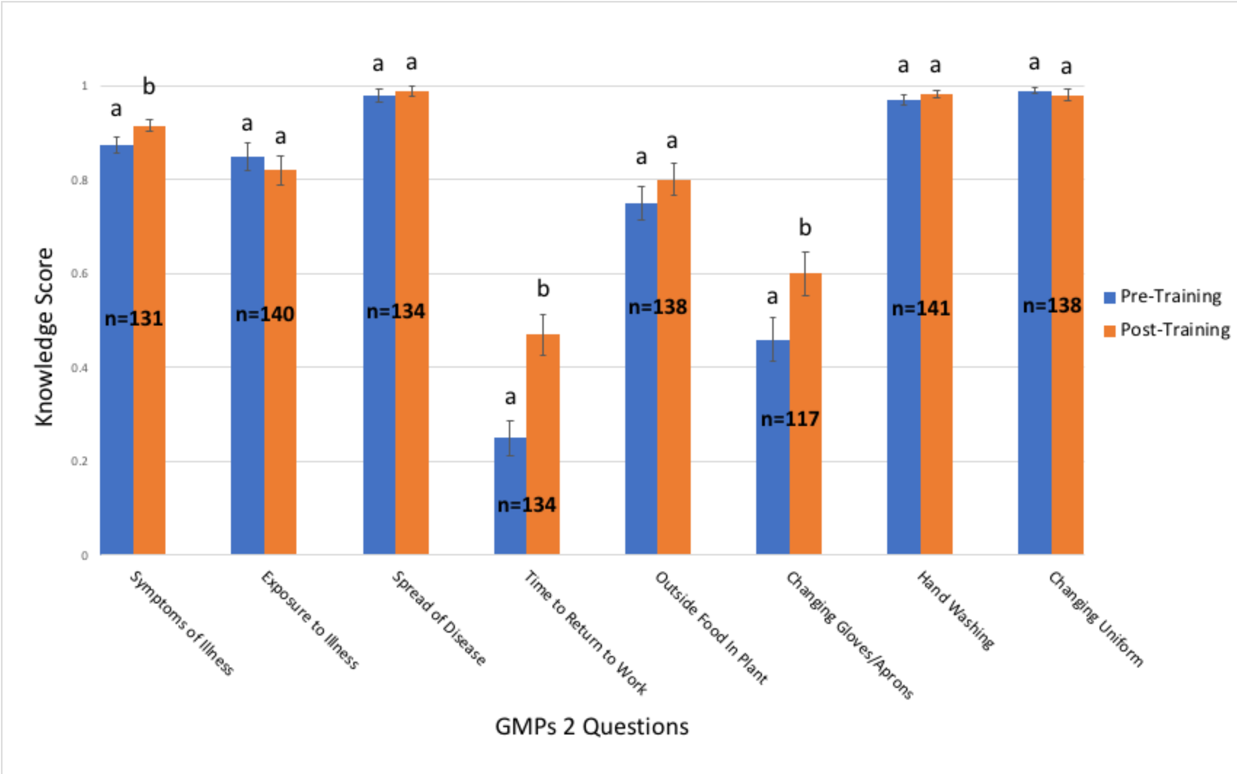

Figure 2.6- ***The Effect of Food Safety Training on Knowledge Scores for Personal Responsibility and Communicable Diseases Training.*** Mean scores shown. Questions scored on a scale of 0-1.

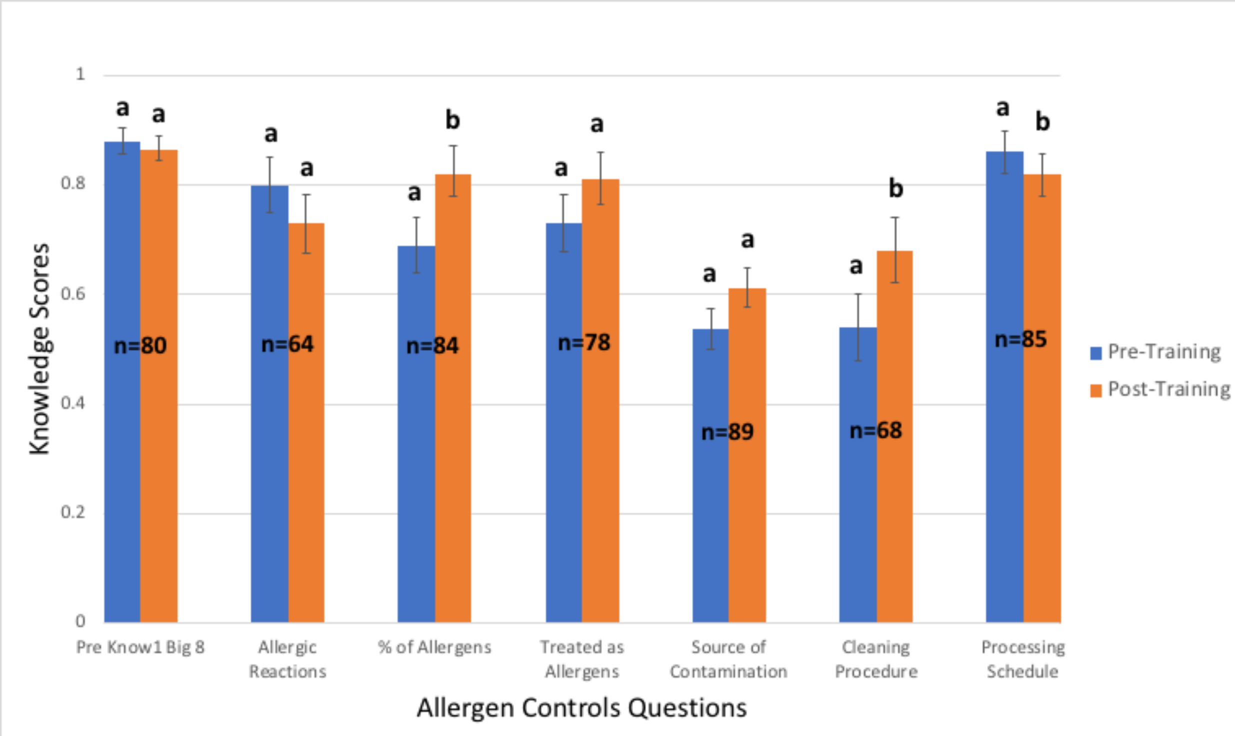

Figure 2.7- ***The Effect of Food Safety Training on Knowledge Scores for Allergen Controls Training.*** Mean scores shown. Questions scored on a scale of 0-1.

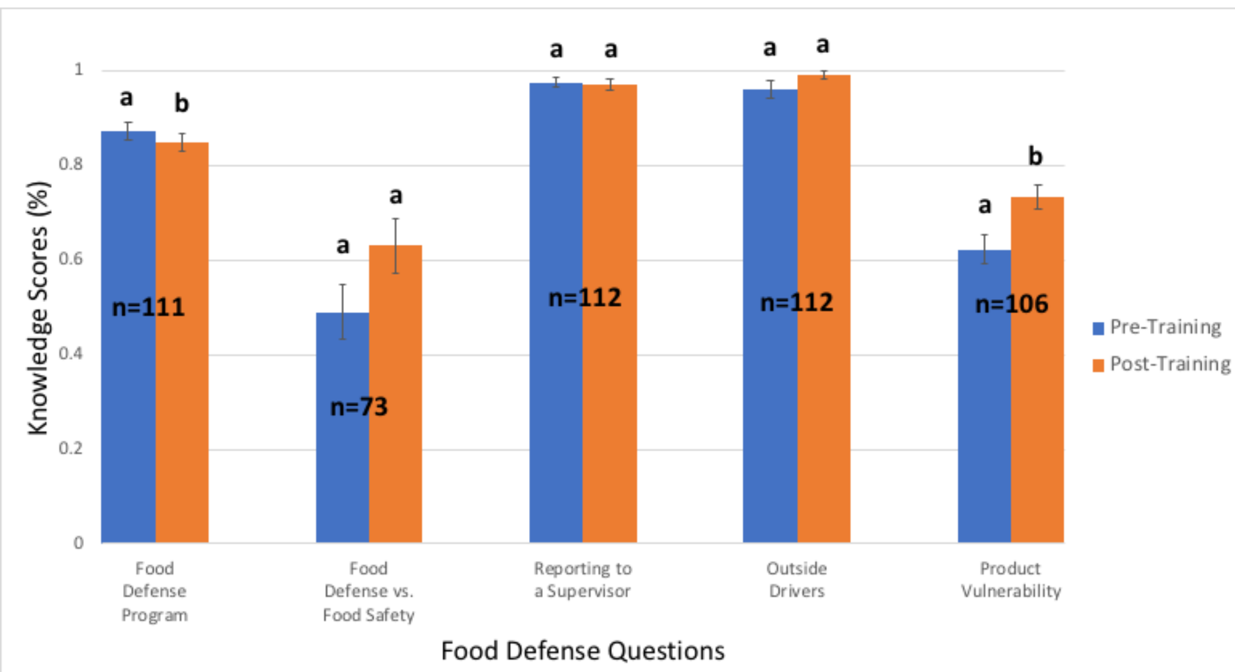

Figure 2.8- ***The Effect of Food Safety Training on Knowledge Scores for Food Defense Training.*** Mean scores shown. Questions scored on a scale of 0-1.

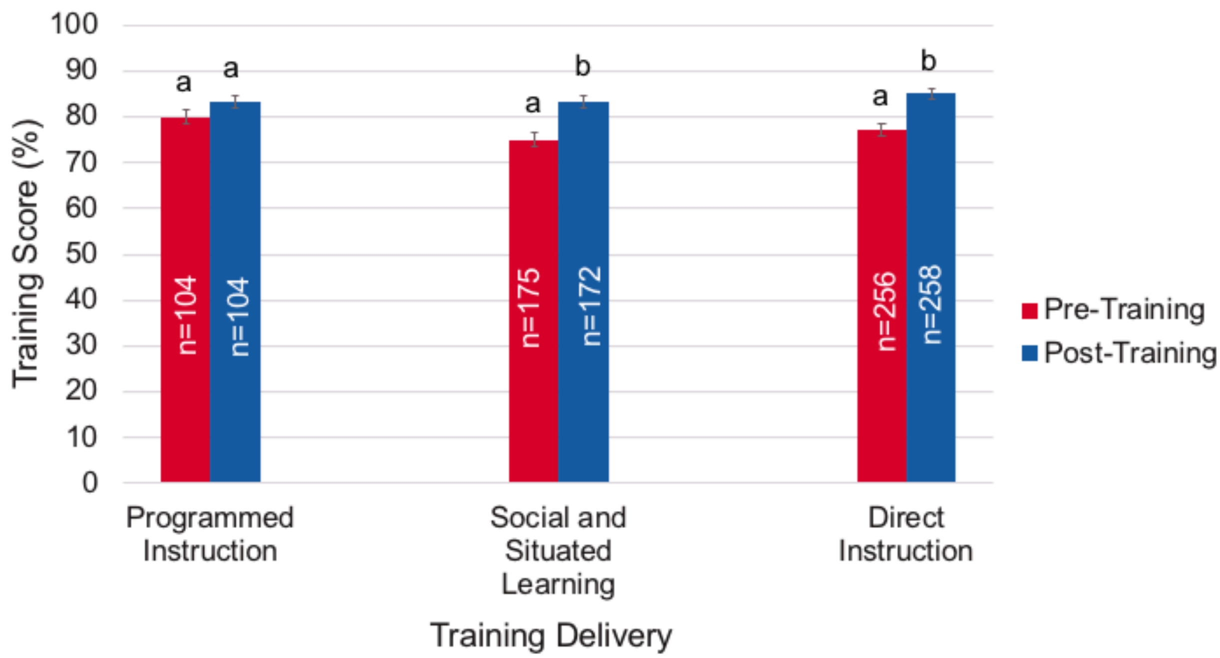

Figure 2.9- ***Effect of Training Delivery on Change in Food Safety Knowledge.***

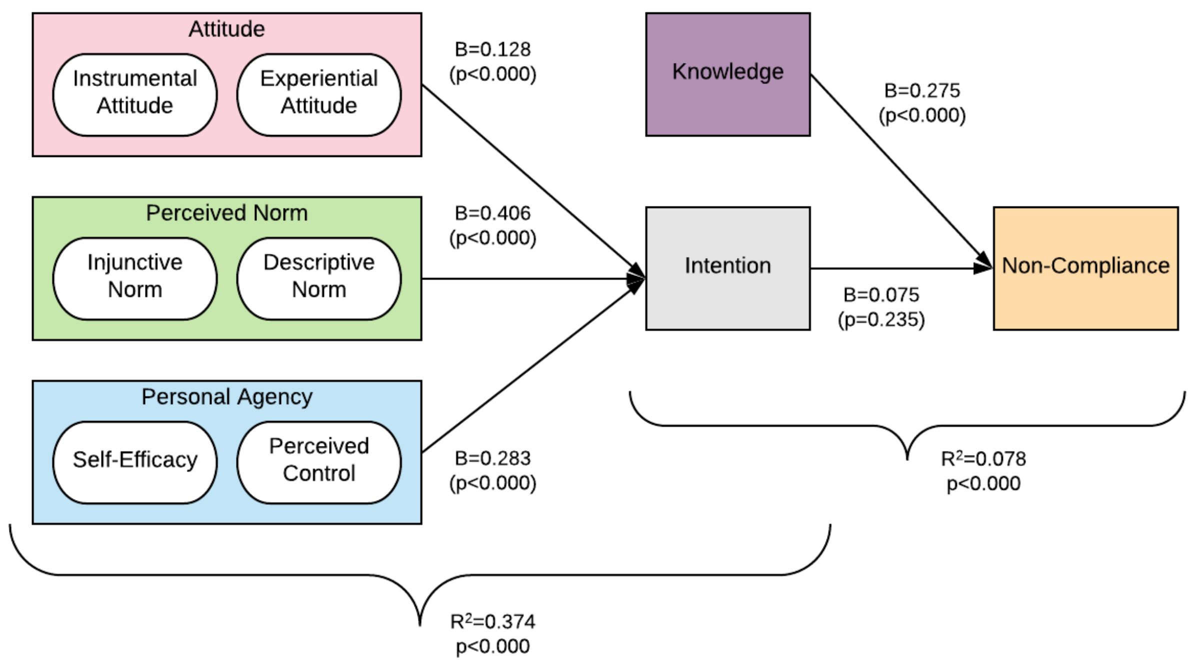

Figure 2.10- ***Regression of the Integrated Behavior Model with Pre-Training Results.*** Attitude, Perceived Norm, Personal Agency, Intention, and Knowledge measured via employee surveys. Non-compliance measured for each site via supervisor audits.

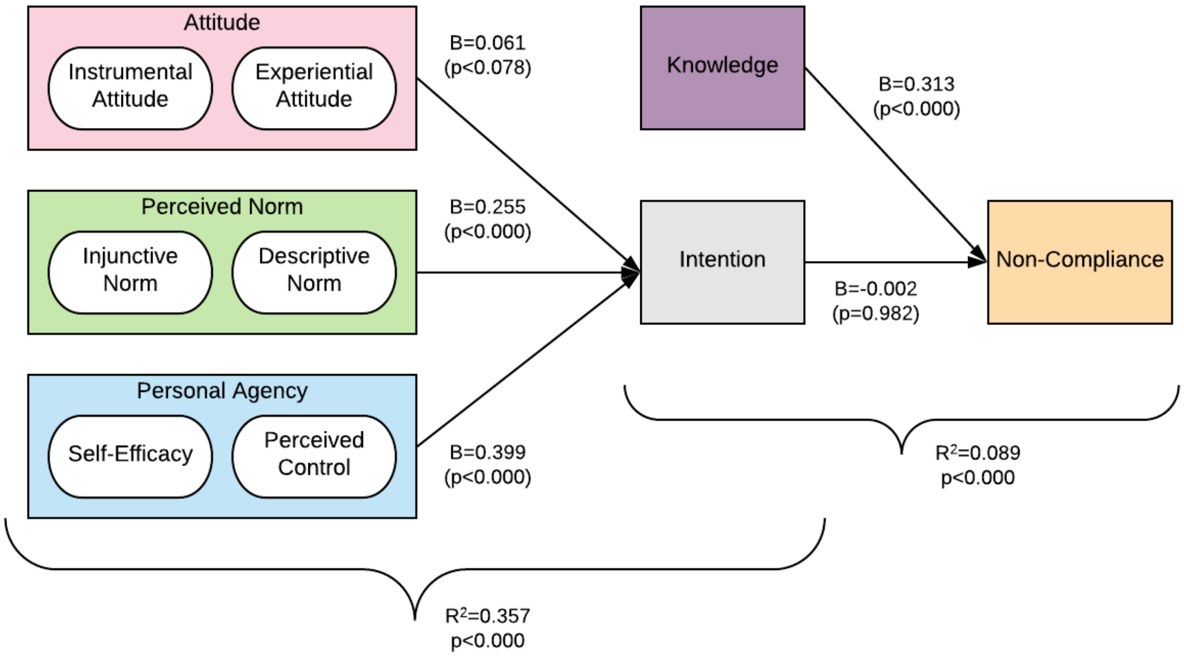

Figure 2.11 ***Regression of the Integrated Behavior Model with Change After Training Results.*** Attitude, Perceived Norm, Personal Agency, Intention, and Knowledge measured via employee surveys. Non-compliance measured for each site via supervisor audits.

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CHAPTER THREE

The Effects of Food Safety Culture on Food Safety Training Outcomes and Food Safety Attitudes and Knowledge

INTRODUCTION

In the past 20 years, the concept of food safety culture has been developed, refined, and studied. Increasing emphasis is being put on food safety culture as a method to improve food safety behaviors. Food safety culture is a subset of organizational culture, similar to how occupational safety culture is a subset of organizational culture. Frameworks of organizational culture have been studied extensively in the field of industrial and organizational psychology. Shader and Fox (1992) define organizational culture as the "beliefs, and patterns of behavior which employees follow". They also recognize that employee performance is not just determined by training, but also by the organizational culture.

Food safety culture is a growing buzzword in the industry and many in the industry are interested in learning how to improve their food safety culture in order to improve employee attitudes and behaviors. Frank Yiannas, the vice president of food safety for Wal-Mart and a leading expert in food safety culture, claims that "culture is just as important as the science" and claims that advances in food safety will not be as effective if there is not a strong food safety culture in place (Orgel, 2009). A strong food safety culture is also believed to improve food safety behaviors and performance (Sarter and Sarter, 2012).

The High Performance Cycle is a framework used in the field of organizational psychology that indicates that there are certain predictors and drivers of employee performance (Locke and Latham, 1990). The model indicates that setting high goals, self- efficacy, and commitment to an organization and goals has a positive effect on employee job performance. When proper feedback and moderating factors are in place, the relationship will "spiral" upwards and employee performance will continue to improve. If feedback and rewards are removed or certain moderating factors are altered, employee performance will be negatively affected. This will have a "domino effect" on the following constructs in the cycle and there is potential for the employee to become increasingly withdrawn from the organization as their performance continues to decrease. The high performance cycle indicates that there is a relationship between organizational culture and job performance, and thus there may be a relationship between food safety culture and food safety knowledge and behaviors.

Other studies have found evidence to suggest that food safety culture has an effect on food safety behaviors of employees. Schein (1985) recognize that training can influence the organizational culture by capturing the organizational culture and teaching it to the employees. Yiannas (2009) even states that changes in organizational culture can lead to changes in employee behaviors. Frank Yiannas has also made a connection between food safety culture and training by saying that ways to create a stronger food safety culture include: "setting high expectations, educating and training, communicating throughout an organization, establishing goals and measurement systems, and reinforcing positive and negative consequences" (Orgel 2009). Nyarugwe et al. (2016) has also drawn a connection between food safety culture and training by claiming training as one of the factors to consider when conducting food safety culture research. Bunch (2007) claims that poor culture can cause training to fail and be ineffective because of incompetence of trainers, unwillingness of management to invest in training, existing values, beliefs, and assumptions of employees, and various cultural barriers.

METHODS

Training Module and Tour Development

Three training deliveries were evaluated to test four learning theories: direct instruction (DI), programmed instruction (PI), and social and situated learning (SSL) (Table 3.1). Direct instruction, programmed instruction, and the social learning theory are principles of the behaviorism learning theory and situated learning is a principle of the constructivism learning theory (Wu et al., 2011). The behaviorism learning theory suggest that learning is created through stimulation and reinforcement from the environment. Wu et al. (2011) described direct instruction as “a general term for explicit teaching using lectures rather than exploratory models such as inquiry-based learning”. Programmed instruction involves technology that presents structured material in a sequence that allows students to progress through the material at their own speed. Social learning involves learning through observation or imitation of others. The constructivism learning theory suggests that learning is an active process. Situated learning suggests that “learning is embedded within activity, context, and culture” and is “a product of the social practices of its educational professionals” (Wu et al, 2011).

The programmed instruction training was completed by employees individually, at their own pace, on a company computer, at work (Appendix B). It was created using Articulate Storyline e-learning software (Articulate). Each module began by reviewing the learning outcomes of the module. Each chapter or “page” of the module was accompanied by voiceover narration and had buttons on the bottom of the screen to advance the user to the next page. Each page had graphics or a type of animation requiring user interaction. “Knowledge Check” questions were embedded throughout the module to ensure and measure user comprehension. If the questions were answered incorrectly, a narrated page would appear to explain why the chosen answer is incorrect and inform the user of the correct answer. After completing the module, the user's knowledge score would appear informing them of whether or not they had passed the module.

The direct instruction trainings consisted of supervisors or managers guiding a group of employees through the same computer module used in the programmed instruction training (Appendix B). However, these trainings allow for employee-employee interaction, as well as employee-manager interaction to facilitate discussions and questions.

The social and situated learning training consisted of a virtual tour, guided by a manager or supervisor, and performed in a group setting. This training was developed using Panotour virtual tour creation software (Panotour). 360° still-images were taken in 10 locations in a dairy processing plant using six GoPro cameras mounted in a Freedom 360 mount. The chosen dairy processing plant processed both liquid milk and ice cream and therefore was representative of the majority of the company's plants, whether those plants processed liquid milk, ice cream, or other dairy products. Each social and situated learning began in the training room and had a hotspot that opened a 1-3 minute introductory video or introductory text. Each room within the tour contain hot spots, or buttons that could be clicked to reveal informative text and images. Transitional hot spots were also present and allowed the user to progress to the next room or return to the previous room. The social and situated learning trainings were designed to be led by a facilitator, either a plant manager or supervisor, and was accompanied by a facilitator's guide that contained instructions of how to navigate the tour. The facilitator's guide also contained accompanying narration and discussion-based knowledge questions that encourage group engagement and interaction.

The PI, DI, and SSL training interventions were developed on the four following topics: Allergen Controls, Introduction to Good Manufacturing Practices and Material Controls, Personal Responsibility and Communicable Diseases, and Food Defense. Each training module was developed in partnership between an instructional designer and several subject matter experts, including three regional directors of quality, a professor of food science, and food science graduate student, to ensure that the training material was relevant, effective, and engaging.

Table 3.1- Learning Theories of Training Deliveries

	Individual Training	**Group Training**
Computer Module	Programmed Instruction (PI)	Direct Instruction (DI)
Virtual-Tour		Social and Situated Learning (SSL)

Instrument Development

The Food Safety Culture Evaluation (Appendix K) was developed based on the structure outlined by Nyarugwe et al. (2016) This paper identified the determinant of food safety culture in research to be organizational and administrative characteristics (food safety vision, communication, commitment, leadership, and training), technical facilities/resources (food hygiene/safety tools, equipment, facilities), employee characteristics (attitudes, knowledge, perceptions, and risk awareness), group characteristics, food safety management system characteristics, and food safety performance. Several aspects of this model, such as technical resources, group characteristics, food safety management system characteristics, and actual food safety performance, were not able to be included because measuring them would be outside the scope of capabilities of this project. The survey instrument only focused on the following constructs: food safety vision, communication, commitment, leadership, training, attitudes, knowledge, perceptions, and risk awareness.

A food safety questionnaire was also administered to employees to gauge employee knowledge. The questionnaire was administered to employees immediately before and after the employees experienced training. Supervisor observation audits were also used to collect behavioral data by measuring non-compliances twice one month prior to the training being implemented and twice after the training had been completed. These observation audits recorded the level of compliance to various food safety policies that are covered in the training modules. These data were used to provide a complete picture of the effectiveness of the current training system.

Data Collection

Training programs were implemented at 66 Dairy processing plants at Company X across the United States. Data was intended to be collected from all 66 dairy processing plants at Company X. Sixty-Seven Quality Assurance managers and supervisors were trained via a webinar about how to implement the programmed instruction and social and situated learning trainings and how to proceed in the data collection process. Each plant was randomly assigned one training topic for which to perform the evaluations, in an effort reduce the extra workload assigned to each facility and the time taken during the training process.

Employees at each plant were offered a pre- and post-training survey (Appendix C-F), which they were instructed to place in a sealed “ballot box” created by Human Resources. The pre-training survey contained the FSTEQ and the post-training survey contained the FSTEQ and demographic questions. Once training at each location has been completed, the human resources manager shipped the box to researchers at NC State without breaking the seal on the box. All data collection methods and data collection tools were approved by the North Carolina State University Institutional Review Board prior to any data being collected.

Pilot Testing

The survey instrument was tested during a pilot study prior to being used to collect data. The pilot test was performed at a single processing plant. Data was collected from twenty employees using an online form of the survey. Only the Allergen Control programmed instruction training delivery was evaluated.

Populations and Sample

Since data was not able to be collected from every processing location or every employee from responding processing locations, a multiple linear regression was performed with response rate and SQF audit scores to determine if there was a difference in audit scores between plants that responded and those that didn't. If so, it could indicate that responding plants are skewing the data and are not a representative sample if those plants exhibit better food safety standards. A logistic regression was performed to determine if there was a difference between the SQF audit scores of plants that completed and returned supervisor audits and those that did not. There was not a statistically significant difference between the audit scores of plants that submitted supervisor audits and those that did not ($p=0.372$) (Table 3.2).

Data Analysis

All pre-training food safety culture construct questions were tested for reliability by calculating the Cronbach's alpha scores. Before the analyses were run, all responses were adjusted to be measured on a negative (1) to positive (7) Likert scale.

Using SPSS a linear regression was performed to determine if food safety culture was a predictor of pre-training knowledge and intentions or changes in knowledge, intentions, and compliance. The food safety culture constructs measured (vision, commitment, communication, leadership, training, attitude, perception, risk awareness, and knowledge) were combined to create an overall food safety culture score. Knowledge scores were adjusted to be measured on a 7-point scale, as the other constructs were measured (IBM Corp).

$$Food\ Safety\ Culture = Vision + Commitment + Communication + Leadership$$
$$+Training + Attitude + Perception + Risk\ Awareness + (Knowledge/0.07)$$

Response Rate

The programmed instruction and social and situated learning trainings were implemented at all 66 of Company X's dairy processing plants. Evaluations were assigned and sent to each location. Response rate based on the number of responding plants ranged from 23% to 33% (Table 3.3).

RESULTS

Reliability

The Cronbach's alpha score for the food safety culture was higher than 0.7 (Table 3.4). Therefore, all food safety culture questions were deemed to be reliable (Hair et al., 2010).

Food Safety Culture Prediction of Pre-Training Knowledge and Intention Scores

For the aggregate training data, there was a positive($B=0.218$) significant overall regression of food safety culture on pre-training knowledge data (Table 3.5). The regression explained 4.8% of the variance in the model $F(1, 708)=35.493$, $p<0.000$ (Figure 3.1). There was also a positive ($B=0.320$), significant overall regression of food safety culture constructs on pre-training intentions that explained 10.1% of the variation in the data $F(1, 692)=78.670$, $p<0.000$ (Table 3.6) (Figure 3.2).

Food Safety Culture Prediction of Change in Food Safety Knowledge and Intention Scores

For the aggregate training data, there was a significant overall regression of food safety culture on change in knowledge data. The regression explained 1.1% of the variance in the model $F(1,633)=8.062$, $p=0.005$ (Table 3.7) (Figure 3.3). However, this was a negative regression ($B=-0.112$). When comparing by training delivery, there was only a statistically significant regression of food safety culture on change in knowledge for the direct instruction training $F(1, 243)=12.560$, $p<0.000$; $B=-0.502$ (Table 3.8). This regression was negative, demonstrating that higher pre-training food safety culture scores were associated with smaller changes in knowledge.

For the aggregate training data, there was not a statistically significant regression of food safety culture on change in intentions ($p>0.05$) (Table 3.9). However, programmed instruction training was associated with a statistically significant change in intention $F(1, 108,)=9.027$, $p=0.003$ ($B=0.032$) (Table 3.10). The positive relationship in this regression demonstrates that higher food safety culture scores were associated with larger increases in intention scores.

DISCUSSION

Food safety culture was significant predictors for aggregate pre-training knowledge and intention scores ($p<0.000$). This suggests that employees perception of a strong food safety culture in their workplace may be associated with better food safety knowledge and intentions. As modeled by the Integrated Behavior Model, knowledge and intentions are two predictors of behavior. Therefore, perception of a strong food safety culture may lead to better employee food safety behaviors. The idea that food safety culture and employee behaviors are related has been suggested by several researchers and professionals (Sarter and Sarter, 2012; Yiannas, 2009, Powell et al., 2011; Griffith et al., 2017). This finding supports previous research and supports the push for an increased focus on food safety culture in order to improve employee behaviors.

The R^2 indicated that these models only explain a small amount of variation in the data (4.8% and 10.1% for pre-training knowledge and intentions, respectively). This can be attributed to the fact that the food safety culture construct measured consisted of organizational and administrative characteristics and employee characteristics. Nyarugwe et al. (2016) identifies that food safety culture research should consider organizational and administrative characteristics, technical resources, employee characteristics, group characteristics, food safety management characteristics, food safety performance, hierarchical levels, and the impact of national culture. Because of the scope and capabilities of this research, not all of these factors were able to be considered or measured, so the calculated food safety culture score does not create a complete reflection of food safety culture.

There was a significant, negative regression between food safety culture and changes in knowledge scores for the aggregate data (p=0.005), demonstrating that employees that perceive a higher food safety culture experienced smaller changes in knowledge after training, which directly contradicted the hypothesis of this study. However, as previously discussed, employees that perceived a higher food safety culture received higher scores on pre-training knowledge quizzes. Employees with higher pre-training scores have less potential improvement to make on knowledge quizzes than employees that receive lower scores. Therefore, it is logical that employees who perceive a higher food safety culture would not increase their training quiz scores as much as their colleagues who receive lower scores pre-training and can make more improvement post-training. However, the relationship between food safety culture and training outcomes should be studied further. Gyimah (2015) found that management support for training is a significant factor of the effectiveness of training. Further research should be performed to study other factors impacting employee food safety training effectiveness.

CONCLUSION

The hypotheses that food safety culture positively affects food safety training outcomes was not supported by the findings of this study. However, it is likely that this is because there was a positive regression between food safety culture and pre-training knowledge and intention scores ($p<0.05$), and employees with higher pre-training knowledge quiz scores have less room to improve their scores than employees with lower pre-training scores. These findings support findings from other research studies that food safety culture affects employee knowledge and, potentially, behavior. These findings indicate that there may be a relationship between food safety culture and employee knowledge and compliance, but this should be studied further.

Because of the limitations of this study, direct behavioral data was not able to be collected and indirect behavioral data (non-compliances via supervisor audits) were only able to be measured for a short period of time after training was completed. Performing long-term behavioral observations over a longer period of time would increase the accuracy of the measurement of behavioral data. The supervisor audit data also risks being biased since the data is being collected and reported by employees of Company X.

Another limitation of this study was time, which restricted the length of the survey. The instrument could be improved by adding several questions to measure other food safety culture constructs in order to ensure reliability and validity of the questions. Data collection could also have been improved upon if survey data was collected from employees at various hierarchical levels within the organization. There is also a risk that employees may feel pressured to alter their evaluations of their company if they are completing the evaluations at work surrounded by other employees and their employer. To reduce this bias, future studies should consider having data collected solely from outside parties.

Table 3.2. Logistic Regression of SQF Audit score on Supervisor Audit Response Rate

Step 1	B	Standard Error	Wald	df	Sig.	Exp(B)
Audit Score	-0.103	0.115	0.797	1	0.372	0.902
Constant	9.205	10.988	0.702	1	0.402	9951.417

Table 3.3- Response Rate for Training Evaluation Surveys and Audit Forms

Training Topic	Number of plants contacted	Number of plants responded	Plant response rate	Estimated employees contacted	Employee surveys received	Estimated Response Rate	Supervisor audits received	Supervisor Audit response rate
Introduction to Good Manufacturing Practices and Material Controls	20	9	**45 .0%**	1742	380	**21.8**	5	**25.0%**
Personal Responsibility and Communicable Diseases	19	6	**31.6%**	791	165	**20.9**	3	**15.8%**
Allergen Control	13	3	**23.1%**	224	99	**44.2**	4	**30.8%**
Food Defense	14	4	**28.6%**	863	224	**17.3**	2	**14.3%**
Total	**66**	**22**	**33.3%**	**3620**	**793**	**21.9**	**14**	**21.2%**

Table 3.4- Reliability Analyses for Food Safety Culture Construct

Construct	Cronbach's Alpha
Food Safety Culture	0.863

Table 3.5- Regression of Food Safety Culture on Pre-Training Knowledge Scores for Aggregate Data

Predictor	Standardized Coefficients Beta	significance
Food Safety Culture	0.218	0.000

Table 3.6- Regression of Food Safety Culture on Pre-Training Intention Scores for Aggregate Data

Predictor	Standardized Coefficients Beta	significance
Food Safety Culture	0.320	0.000

Table 3.7- Regression of Food Safety Culture on Change in Knowledge Scores for Aggregate Data

Predictor	Standardized Coefficients Beta	significance
Food Safety Culture	-0.112	0.005

Table 3.8- Regression of Food Safety Culture on Change in Knowledge Scores by Training Delivery

Training Type	Standardized Coefficients Beta	significance
Programmed Instruction	-0.099	0.332
Direct Instruction	-0.222	0.000
Social and Situated Learning	-0.082	0.298

Table 3.9- Regression of Food Safety Culture on Change in Intention Scores for Aggregate Data

Predictor	Standardized Coefficients Beta	significance
Food Safety Culture	0.073	0.067

Table 3.10- Regression of Food Safety Culture on Change in Intention Scores by Training Delivery

Training Type	Standardized Coefficients Beta	significance
Programmed Instruction	0.278	0.549
Direct Instruction	0.073	0.257
Social and Situated Learning	0.075	0.347

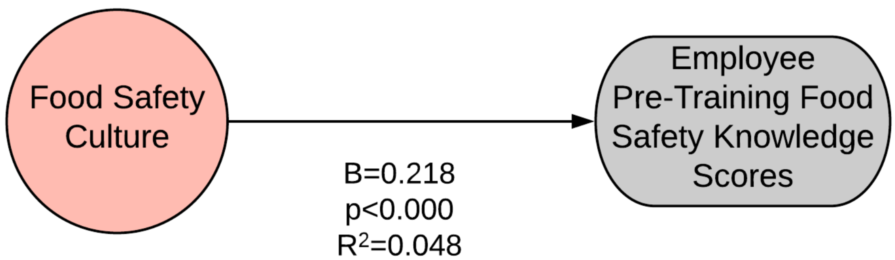

Figure 3.1 Regression of Food Safety Culture on Pre-Training Knowledge Scores

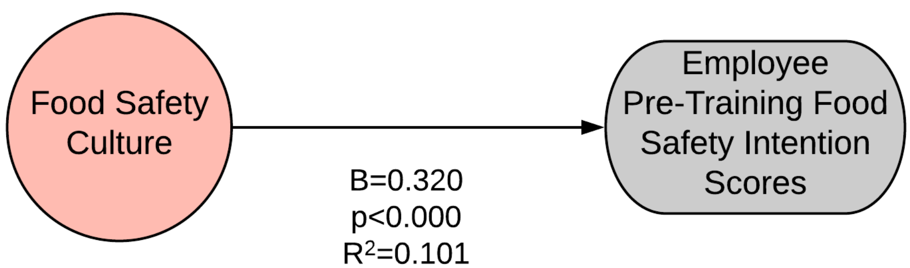

Figure 3.2 Regression of Food Safety Culture on Pre-Training Intention Scores

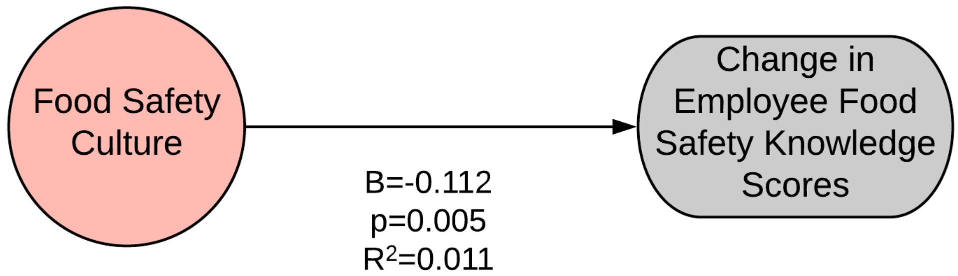

Figure 3.3 Regression of Food Safety Culture on Change in Knowledge Scores

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CONCLUSION

While the number of food safety training-related publications per year has increased over the last 20 years, few of these publications performed research to evaluate the effectiveness of food safety training programs or to compare various training styles and formats. Furthermore, literature searches performed were not able to find any studies investigating the effect of learning theories applied to employee training programs. Although food safety training is receiving increased focus in academia and industry, there are still major noticeable gaps in the effectiveness of training, mainly that there are documented incidents that some trainings are not causing a behavioral change. Additionally, although food safety culture continues to be discussed and researched, the relationship between food safety culture and food safety training has not been studies extensively. However, current research has established that a relationship does exist between food safety culture and employee training.

This research serves as a case study to examine factors affecting food safety, focusing on the application of learning theories to various training platforms. Although this research was performed within the dairy industry, it provides knowledge that can be applied to all areas of food manufacturing, as well as serving as a spring board for future research.

One of the key findings of this research was that training delivery impacts the effect of training on employee knowledge. Group e-module trainings that implemented direct instruction and group discussion-based virtual tours that implemented social and situated learning had a significant increase in knowledge scores of employees, while individual, e-module trainings that implemented Programmed Instruction did not.

Another key finding was that food safety culture had a positive of pre-training food safety knowledge and intentions of employees, suggesting that employees who perceive a strong food safety culture may have better food safety knowledge and intentions than employees who perceive a weak food safety culture. Contrary to the hypothesis of this study, a negative relationship was found between food safety culture and food safety training. However, considering that employees who perceive a stronger food safety culture scored higher on pre-training knowledge and, therefore, have less room for improvement on post-training knowledge quizzed compared to employees who perceive a weaker food safety culture and receive lower scores on pre-training knowledge quizzes.

Overall, this work reveals that training effectiveness is a complex issue that requires attention training design. The data from this study suggests that training platforms and the application of learning theories make an impact in the effectiveness of employee training programs in terms of increases in employees' knowledge and intentions. More research should be performed to more closely study the effects of various learning theories applied to training and to compare the effectiveness of training platforms (e-modules, discussion-based virtual tours, etc.) in terms of increasing knowledge and improving behaviors. This research supports the argument that previous studies have made that employee food safety training can be an effective tool to increase employees' food safety knowledge and, potentially, improve employees' food safety behaviors. In order for employee food safety training to be an effective tool, greater attention should be placed on training design.

APPENDICES

Appendix A

Recent Conference Proceedings on Food Safety Training

IAFP Conference proceedings
2017

- S54- Tools to Improve Interactive Food Safety Training for Small Food Facilities
- RT11- National and Regional FSMA Training Centers: Application of Lessons Learned
- S51- Establishing Effective Metrics to Advance Your Food Safety Training and Education Programs
- T3-11- Valuable Metrics that Link Training to Successful Implementation
- T12-05; Evaluating a Demonstration-based Training Model for Educating Environmental Health Specialists on Validation and Verification of HACCP Plans
- T12-06- Analysis of Certified Food Protection Manager Examination Results After a New Training Approach
- P2-96- Evaluation of a Training Program for Volunteer Food Handlers

2016

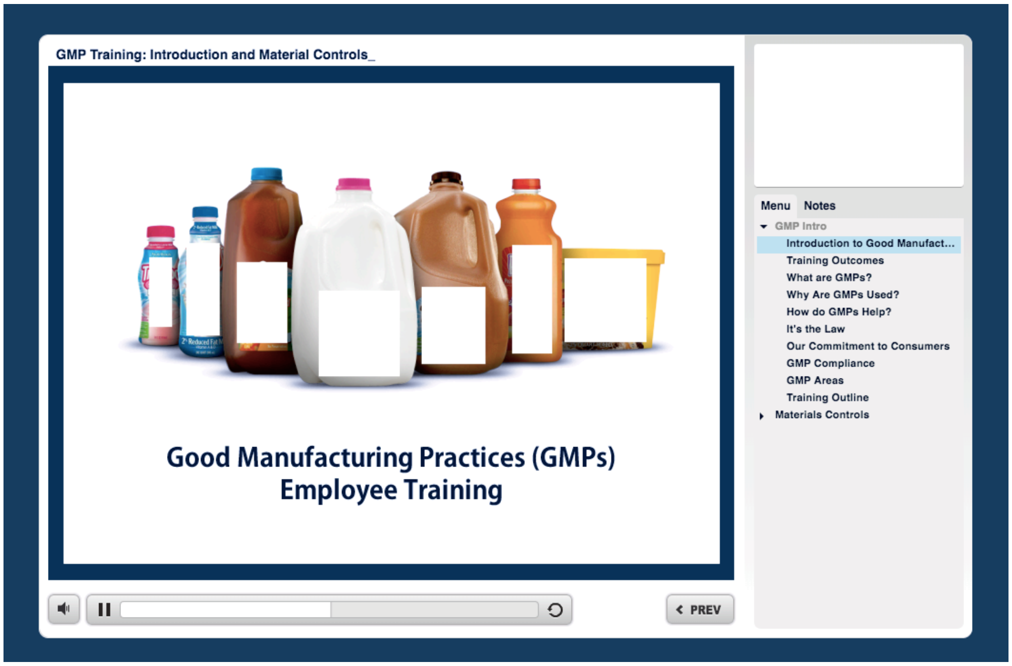
- RT6- How to Fix Food Safety Education and Enhance Training Effectiveness
- P3-28- Perceived Quality of Food Safety Training Based on Generation, Gender, Job Position, and Education

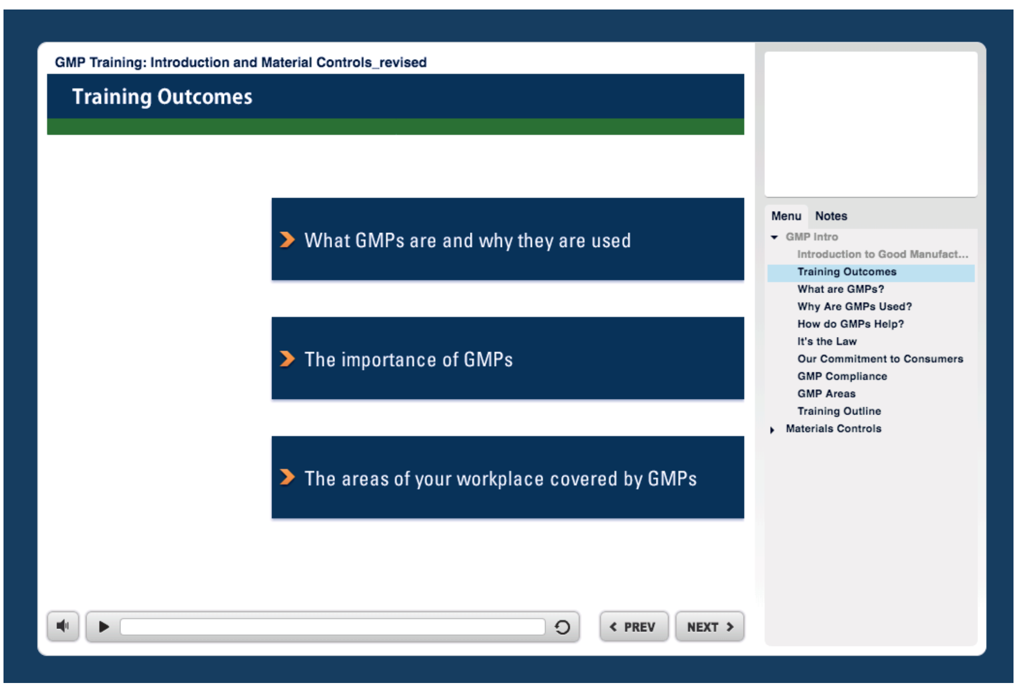
2015

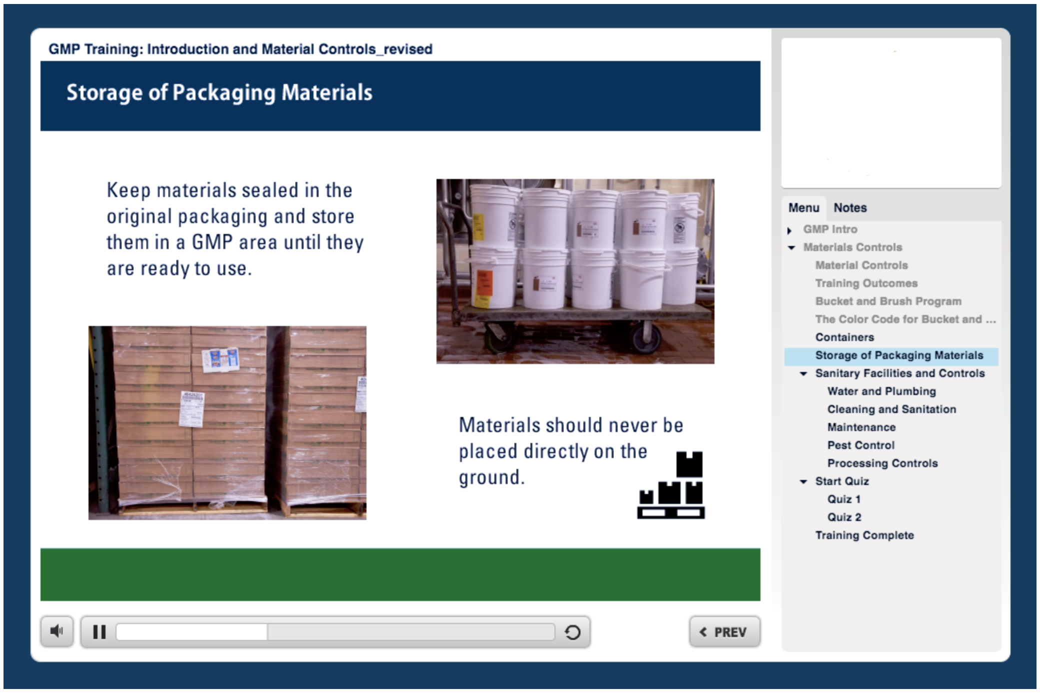
- RT6- Food Safety Training for Non-native English Speakers
- T6-07- Evaluation of a Multi-day Good Agricultural Practices Training and Farm Food Safety Plan Writing Workshop
- S1- Global Lab Capacity Building- Training for Ensuring Food Safety

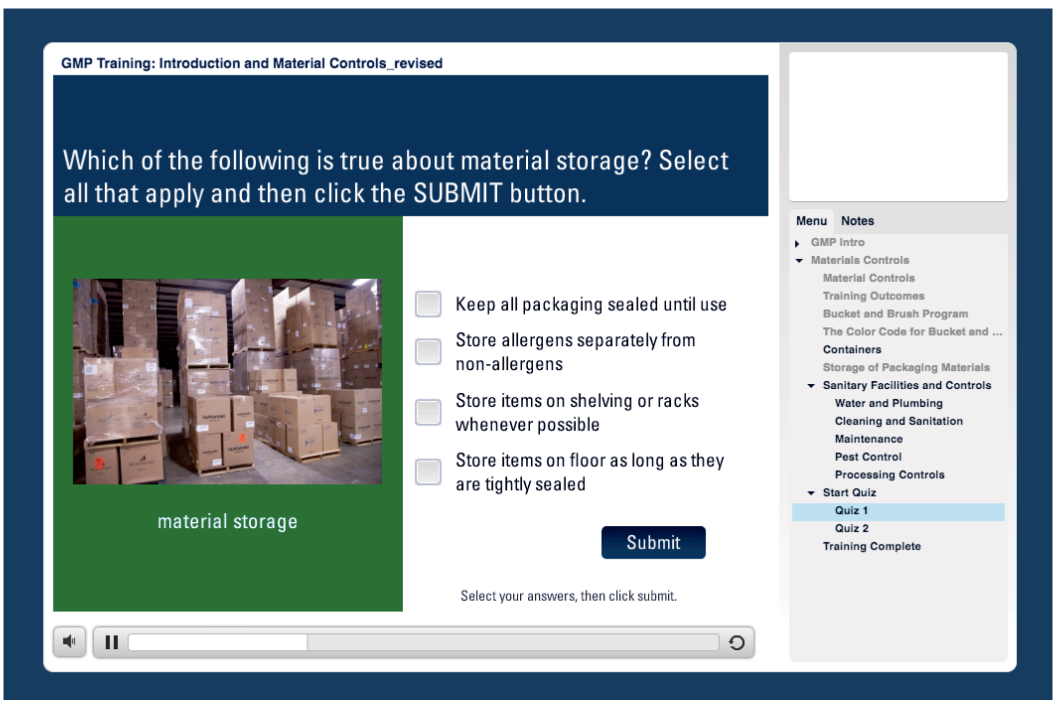
Appendix B

Programmed Instruction and Direct Instruction Training Modules for Introduction to Good Manufacturing Practices and Material Controls






GMP Training: Introduction and Material Controls_revised
Storage of Packaging Materials
Keep materials sealed in the original packaging and store them in a GMP area until they are ready to use.
Materials should never be placed directly on the ground.
PREV
Menu
Notes
GMP Intro
Materials Controls
Material Controls
Training Outcomes
Bucket and Brush Program
The Color Code for Bucket and ...
Containers
Storage of Packaging Materials
Sanitary Facilities and Controls
Water and Plumbing
Cleaning and Sanitation
Maintenance
Pest Control
Processing Controls
Start Quiz
Quiz 1
Quiz 2
Training Complete


GMP Training: Introduction and Material Controls_revised
Which of the following is true about material storage? Select all that apply and then click the SUBMIT button.
material storage
Keep all packaging sealed until use
Store allergens separately from non-allergens
Store items on shelving or racks whenever possible
Store items on floor as long as they are tightly sealed
Submit
Select your answers, then click submit.
Menu
Notes
GMP Intro
Materials Controls
Material Controls
Training Outcomes
Bucket and Brush Program
The Color Code for Bucket and ...
Containers
Storage of Packaging Materials
Sanitary Facilities and Controls
Water and Plumbing
Cleaning and Sanitation
Maintenance
Pest Control
Processing Controls
Start Quiz
Quiz 1
Quiz 2
Training Complete

Appendix C

Introduction to Good Manufacturing Practices and Material Controls Training Evaluation Survey

6. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying	Does not apply to me
Using the correct color of buckets and brushes to prevent contamination.	❍	❍	❍	❍	❍	❍	❍	❍
Keeping my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure than cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

7. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Using the correct color of buckets and brushes supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Keeping my workplace clean throughout my shift supports the safety of the product	❍	❍	❍	❍	❍	❍	❍
Making sure that cleaning compounds are properly labeled and stored separately from raw materials supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Ensuring that materials and ingredients are properly labeled, stored, and sealed supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

8. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

9. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

10. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

11. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

12. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Uses the correct color of bucket and brushes.	❍	❍	❍	❍	❍	❍	❍
Keeps the workplace clean during their shift.	❍	❍	❍	❍	❍	❍	❍
Makes sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍
Makes sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍

13. Rank how much control you have over the safety of our products by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Using the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keeping my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

14. At every possible occasion, I am able to:

	1-Not under my control	2	3	4- Neutral	5	6	7- Under my control.	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

15. I have the ability to:

	1- I could not	3	3	4- Neutral	5	6	7- Certain I could	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

16. I will:

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

17. Which of the following are true about material storage? **Select all that apply**.
- ❑ Store allergens separately from non-allergens
- ❑ Keep all packaging sealed until use
- ❑ Store items on shelving or racks whenever possible
- ❑ Store items on floor as long as they are tightly sealed.

18. GMPs only cover activities within the plant and do not extend to the outside of the building or distribution of product.
- ❍ True
- ❍ False

19. Which color of buckets and brushes are used for food contact only on pasteurized product surfaces?
- ❍ Red
- ❍ White
- ❍ Black
- ❍ Yellow

20. Ingredients, packaging, and other materials can be stored directly on the floor as long as they are sealed.
- ❍ True
- ❍ False

21. Detergents, sanitizers, and other hazardous materials must be stored separately from food products.
- ❍ True
- ❍ False

22 Containers can be reused for uses other than their intended purposes as long as they are labeled appropriately.
- ❍ True
- ❍ False

BREAK FOR TRAINING MODULE.
THEN CONTINUE ON TO NEXT PAGE.

1. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very unenjoyable	Does not apply to me
Using the correct color of buckets and brushes to prevent contamination.	❍	❍	❍	❍	❍	❍	❍	❍
Keeping my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that cleaning compounds are properly labeled and stored separately from raw material.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

2. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Using the correct color of buckets and brushes supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Keeping my workplace clean during my shift supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Making sure that cleaning compounds are properly labeled and stored from raw materials supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Making sure that materials and ingredients are properly labeled, stored, and sealed supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

3. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

4. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

5. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

6. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

7. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Uses the correct color of bucket and brushes.	❍	❍	❍	❍	❍	❍	❍
Keeps the workplace clean during their shift.	❍	❍	❍	❍	❍	❍	❍
Makes sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍
Makes sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍

8. Rank how much control you have over the safety of our products by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Using the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keeping my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

9. At every possible occasion, I am able to:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

10. I have the ability to:

	1- I could not	2	3	4- Neutral	5	6	7- Certain I could	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

11. I will:

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree	Does not apply to me
Use the correct color of buckets and brushes.	❍	❍	❍	❍	❍	❍	❍	❍
Keep my workplace clean during my shift.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that cleaning compounds are properly labeled and stored separately from raw materials.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure that materials and ingredients are properly labeled, stored, and sealed.	❍	❍	❍	❍	❍	❍	❍	❍

12. Which of the following are true about material storage? **Select all that apply**.

❑ Store allergens separately from non-allergens
❑ Keep all packaging sealed until use
❑ Store items on shelving or racks whenever possible
❑ Store items on floor as long as they are tightly sealed.

13. GMPs only cover activities within the plant and do not extend to the outside of the building or distribution of product.

❍ True
❍ False

14. Which color of buckets and brushes are used for food contact only on pasteurized product surfaces?

❍ Red
❍ White
❍ Black
❍ Yellow

15. Ingredients, packaging, and other materials can be stored directly on the floor as long as they are sealed.
❍ True
❍ False

16. Detergents, sanitizers, and other hazardous materials must be stored separately from food products.
❍ True
❍ False

17. Containers can be reused for uses other than their intended purposes as long as they are labeled appropriately.
❍ True
❍ False

18. Rank your agreement with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This training increased my knowledge of GMPs	❍	❍	❍	❍	❍	❍	❍
This training was helpful.	❍	❍	❍	❍	❍	❍	❍
This training was engaging.	❍	❍	❍	❍	❍	❍	❍

19. Is English your primary language?
❍ Yes
❍ No

20. What is your job title?

____

21. What is your gender?
❍ Male
❍ Female

22. What is your ethnicity?
❍ Asian
❍ African American
❍ Hispanic
❍ Caucasian
❍ Native American
❍ Other

23. How long have you worked for Company X?
❍ Less than 1 year
❍ 1-5 years
❍ 6-10 years
❍ More than 10 years

24. How did you experience training?
❍ In a group setting
❍ On my own

25. Which type of training did you complete?
❍ Narrated online module
❍ Virtual plant tour

Please place your completed survey in the sealed box provided in the training room.

Appendix D
Personal Responsibility and Communicable Diseases Training Evaluation Survey

6. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying
Properly washing my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wearing gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP area.	❍	❍	❍	❍	❍	❍	❍
Not coming into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

7. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Properly washing my hands when necessary supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Correctly wearing gloves, hair nets, and beard nets supports the safety of the product	❍	❍	❍	❍	❍	❍	❍
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Not coming into work when I am sick supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

8. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

9. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

10. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

11. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets	❍	❍	❍	❍	❍	❍	❍
Not from eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

12. My supervisor:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly washes their hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wears gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Does not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Does not come into work when they are sick.	❍	❍	❍	❍	❍	❍	❍

13. My plant managers:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash their hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Do not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Do not come into work when they are sick.	❍	❍	❍	❍	❍	❍	❍

14. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly washes their hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wears gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Does not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Does not come into work when they are sick.	❍	❍	❍	❍	❍	❍	❍

15. Rank how much control you have over the safety of our product by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control
Properly washing my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wearing gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not coming into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

16. At every possible occasion, I am able to:

	1-Not under my control	2	3	4- Neutral	5	6	7- Under my control.
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

17. I have the ability to:

	1- I could not	3	3	4- Neutral	5	6	7- Certain I could
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

18. I will:

	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

19. Which of the following are likely symptoms of a foodborne illness? **Select all that apply.**
- ❑ Upset stomach
- ❑ Nausea
- ❑ Vomiting
- ❑ Itchy eyes
- ❑ Diarrhea

20. If you have been exposed to illness and do not show any symptoms, you do not need to take any precautions.
- ❍ True
- ❍ False

21. Can communicable diseases spread from infected employees to consumers through food?
- ❍ Yes
- ❍ No

22. If you have been sick, how long should you be symptom free before returning back to work?
- ❍ 12 hours
- ❍ 24 hours
- ❍ 36 hours
- ❍ 48 hours

23. It is OK to bring outside food into the plant as long as it does not contain allergens.
- ❑ True
- ❑ False

24. Single use gloves and aprons must be changed after:
- ❍ Each break, they become unsanitary or damaged AND re-entry into a processing area
- ❍ Re-entry into a processing area AND they become unsanitary or damaged
- ❍ They become unsanitary or damaged AND each break
- ❍ They become unsanitary or damaged

25. After which activities must you wash your hands? **Select all that apply.**
- ❑ Using the bathroom.
- ❑ Eating or drinking.
- ❑ Picking something up off the floor.
- ❑ Touching body parts.

26. If a uniform becomes unreasonably soiled throughout the day, it must be changed.
- ❍ True
- ❍ False

BREAK FOR TRAINING MODULE.
THEN CONTINUE ON TO NEXT PAGE.

1. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying
Properly washing my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wearing gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not coming into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

2. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Properly washing my hands when necessary supports the safety of the product	❍	❍	❍	❍	❍	❍	❍
Correctly wearing gloves, hair nets, and beard nets supports the safety of the product	❍	❍	❍	❍	❍	❍	❍
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Not coming into work when I am sick supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

3. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

4. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

5. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

6. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

7. My supervisor:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly washes their hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wears gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Does not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Does not come into work when they are sick.	❍	❍	❍	❍	❍	❍	❍

8. My plant managers:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly washes their hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wears gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Do not eat, drink, chew gum/toothpicks, use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Does not come into work when they are sick.	❍	❍	❍	❍	❍	❍	❍

9. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly washes their hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wears gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Does not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Does not come into work when they are sick.	❍	❍	❍	❍	❍	❍	❍

10. Rank how much control you have over the safety of our product by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control
Properly washing my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wearing gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eating, drinking, chewing gum/toothpicks, or using tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not coming into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

11. At every possible occasion, I am able to:

	1-Not under my control	2	3	4- Neutral	5	6	7- Under my control.
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

12. I have the ability to:

	1- I could not	3	3	4- Neutral	5	6	7- Certain I could
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

13. I will:

	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
Properly wash my hands when necessary.	❍	❍	❍	❍	❍	❍	❍
Correctly wear gloves, hair nets, and beard nets.	❍	❍	❍	❍	❍	❍	❍
Not eat, drink, chew gum/toothpicks, or use tobacco products in GMP areas.	❍	❍	❍	❍	❍	❍	❍
Not come into work when I am sick.	❍	❍	❍	❍	❍	❍	❍

14. Which of the following are likely symptoms of a foodborne illness? **Select all that apply.**

❑ Upset stomach
❑ Nausea
❑ Vomiting
❑ Itchy eyes
❑ Diarrhea

15. If you have been exposed to illness and do not show any symptoms, you do not need to take any precautions.

❍ True
❍ False

16. Can communicable diseases spread from infected employees to consumers through food?

❍ Yes
❍ No

17. If you have been sick, how long should you be symptom free before returning back to work?
- ❍ 12 hours
- ❍ 24 hours
- ❍ 36 hours
- ❍ 48 hours

18. It is OK to bring outside food into the plant as long as it does not contain allergens?
- ❑ True
- ❑ False

19. Single use gloves and aprons must be changed after:
- ❍ Each break, they become unsanitary or damaged AND re-entry into a processing area
- ❍ Re-entry into a processing area AND they become unsanitary or damaged
- ❍ They become unsanitary or damaged AND each break
- ❍ They become unsanitary or damaged

20. After which activities must you wash your hands? **Select all that apply.**
- ❑ Using the bathroom.
- ❑ Eating or drinking.
- ❑ Picking something up off the floor.
- ❑ Touching body parts.

21. If a uniform becomes unreasonably soiled throughout the day, it must be changed.
- ❍ True
- ❍ False

22. Rank your agreement with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This training increased my knowledge of GMPs.	❍	❍	❍	❍	❍	❍	❍
This training was helpful.	❍	❍	❍	❍	❍	❍	❍
This training was engaging.	❍	❍	❍	❍	❍	❍	❍

23. Is English your primary language?

❍ Yes

❍ No

24. What is your job title?

____

25. What is your gender?
- ❍ Male
- ❍ Female

26. What is your ethnicity?
- ❍ Asian
- ❍ African American
- ❍ Hispanic
- ❍ Caucasian
- ❍ Native American
- ❍ Other

27. How long have you worked for Company X?
- ❍ Less than 1 year
- ❍ 1-5 years
- ❍ 6-10 years
- ❍ More than 10 years

28. How did you experience training?
- ❍ In a group setting
- ❍ On my own

29. Which type of training did you complete?
- ❍ Narrated online module
- ❍ Virtual plant tour

Please place your completed survey in the sealed box provided in the training room.

Appendix E

Allergen Controls Training Evaluation Survey

1. Please rank how much you agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Company X values food safety and includes food safety as part of their company goals.	❍	❍	❍	❍	❍	❍	❍
Managers at Company X are effective at communicating about food safety.	❍	❍	❍	❍	❍	❍	❍
Company X is committed to producing safe food.	❍	❍	❍	❍	❍	❍	❍
Management actively lead and encourage employees to make food safety a priority.	❍	❍	❍	❍	❍	❍	❍
Company X supplies proper resources to train employees to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍

2. Please rank how enjoyable you find the following statement.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying
Following food safety rules is:	❍	❍	❍	❍	❍	❍	❍

3. Please rank how likely you find the following statement.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Following proper food safety rules will create a safe product.	❍	❍	❍	❍	❍	❍	❍

4. Rank the following from most valued by Company X to least valued by Company X.
(1=most valued; 4=least valued)
_______ Meeting production goals
_______ Producing a product that meets quality standards
_______ Producing a product that will not get consumers sick
_______ Producing a delicious product that consumer will enjoy

5. Please rank how much you agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
My supervisor wants me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
My company wants me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
Our consumers want me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
Outside auditors want me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
Working in a food processing plant, there is no risk of harming the public.	❍	❍	❍	❍	❍	❍	❍

6. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying	Does not apply to me
Properly stacking and storing raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly cleaning machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Following the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

7. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Properly stacking and storing raw materials supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Making sure the correct label packaging is on the product supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Properly cleaning machines and equipment supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Following the production schedule supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

8. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

9. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

10. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

11. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

12. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly stacks and stores raw materials to prevent allergen cross contact.	❍	❍	❍	❍	❍	❍	❍
Makes sure the correct label and packaging it on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍
Properly cleans machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍
Follows the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍

13. Rank how much control you have over whether someone has an allergic reaction to our product by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Properly stacking and storing raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly cleaning machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Following the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

14. At every possible occasion, I am able to:

	1-Not under my control	2	3	4- Neutral	5	6	7- Under my control.	Does not apply to me
Properly stack and storing raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

15. I have the ability to:

	1- I could not	2	3	4- Neutral	5	6	7- Certain I could	Does not apply to me
Properly stack and storing raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

16. I will:

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly Agree	Agree	Strongly Agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

17. Which of the following are part of the "Big 8" and are considered allergens? **Select all that apply**.

- ❑ Peanuts
- ❑ Wheat
- ❑ Sulphites
- ❑ Milk
- ❑ Eggs
- ❑ Corn syrup
- ❑ Tree nuts

18. Which of the following are reactions that some people have to allergens?
- ❍ Skin rash and fever
- ❍ Skin rash, digestive problems, and anaphlyactic shock
- ❍ Digestive problems, anaphylactic shock, and fever
- ❍ Skin rash and digestive problems

19. How many food ingredients count toward 90% of all food allergies in the United States?
- ❍ 5
- ❍ 8
- ❍ 9
- ❍ 10

20. Company X policy states that the following ingredients must be treated as food allergens:
- ❍ Yellow #5 and sulphites
- ❍ Yellow #5 and carragenan
- ❍ Sulfites and carageenan
- ❍ Sulfites and salt

21. Which of the following are sources of contamination of undeclared food allergens? **Select all that apply.**
- ❍ Ingredients
- ❍ Improper Labeling
- ❍ Rework
- ❍ Cross-contact between equipment
- ❍ Cross-contact from improper cleaning

22. What are the steps for cleaning after processing an allergen?
- ❍ ATP swabbing and visual Inspection
- ❍ Visual inspection and allergen testing
- ❍ ATP swabbing and allergen testing
- ❍ Visual inspection

23. What is the rule for production scheduling in regard to allergen control?
- ❍ Allergen containing ingredients should be scheduled to run after non-allergen containing ingredients and on different machines
- ❍ Allergen containing ingredients should be scheduled to run before non-allergen containing ingredients
- ❍ Allergen containing ingredients should be scheduled to run after non-allergen containing ingredients
- ❍ Allergen containing ingredients should be scheduled to run before non-allergen containing ingredients and on different machines

24. Which of the following are rules for rework in regard to allergen control? **Select all that apply**.
- ❑ Rework containing allergens will only be reincorporated into the same product or products containing the same allergens
- ❑ Rework must be documented for traceability
- ❑ Strain out allergens from food if being reincorporated into a non-allergen containing product
- ❑ Clean and label all rework containers

BREAK FOR TRAINING MODULE.
THEN CONTINUE ON TO NEXT PAGE.

1. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying	Does not apply to me
Properly stacking and storing raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure the correct label and packaging is on the product in order to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly cleaning machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Following the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

2. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Properly stacking and storing raw materials supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Making sure the correct label and packaging is on the correct product supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Properly cleaning machines and equipment supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Following the production scheduling supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

3. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

4. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

5. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

6. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Properly stack and store raw to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

7. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Properly stacks and stores raw materials to prevent allergen cross contact.	❍	❍	❍	❍	❍	❍	❍
Makes sure the correct label and packaging is on the correct product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍
Properly cleans machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍
Follows the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍

8. Rank how much control you have over whether someone has an allergic reaction to our product by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Properly stacking and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure the correct label and packaging is on the product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly cleaning machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Following the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

9. At every possible occasion, I am able to:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the correct product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

10. I have the ability to:

	1 I could not	2	3	4 Neutral	5	6	7 Certain I could	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the correct product in order to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

11. I will:

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly Agree	Agree	Strongly Agree	Does not apply to me
Properly stack and store raw materials to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Make sure the correct label and packaging is on the correct product to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Properly clean machines and equipment to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍
Follow the production schedule to prevent allergen cross-contact.	❍	❍	❍	❍	❍	❍	❍	❍

12. Which of the following are part of the "Big 8" and are considered allergens? **Select all that apply**.

- ❑ Peanuts
- ❑ Wheat
- ❑ Sulphites
- ❑ Milk
- ❑ Eggs
- ❑ Corn syrup
- ❑ Tree nuts

13. Which of the following are reactions that some people have to allergens?

- ❍ Skin rash and fever
- ❍ Skin rash, digestive problems, and anaphylactic shock
- ❍ Digestive problems, anaphylactic shock, and fever
- ❍ Skin rash and digestive problems

14. How many food ingredients count toward 90% of all food allergies in the United States?

- ❍ 5
- ❍ 8
- ❍ 9
- ❍ 10

15. Company X policy states that the following ingredients must be treated as food allergens.

- ❍ Yellow #5 and sulfites
- ❍ Yellow #5 and carrageenan
- ❍ Sulfites and carageenan
- ❍ Sulfites and salt

16. Which of the following are sources of contamination of undeclared food allergens? **Select all that apply.**
- ❑ Ingredients
- ❑ Improper Labeling
- ❑ Rework
- ❑ Cross-contact between equipment
- ❑ Cross-contact from improper cleaning

17. What are the steps for cleaning after processing an allergen?
- ❍ ATP swabbing and visual Inspection
- ❍ Visual inspection and allergen testing
- ❍ ATP swabbing and allergen testing
- ❍ Visual inspection

18. What is the rule for production scheduling in regard to allergen control?
- ❍ Allergen containing ingredients should be scheduled to run after non-allergen containing ingredients and on different machines
- ❍ Allergen containing ingredients should be scheduled to run before non-allergen containing ingredients
- ❍ Allergen containing ingredients should be scheduled to run after non-allergen containing ingredients
- ❍ Allergen containing ingredients should be scheduled to run before non-allergen containing ingredients and on different machines

19. Which of the following are rules for rework in regard to allergen control? **Select all that apply.**
- ❍ Rework containing allergens will only be reincorporated into the same product or products containing the same allergens
- ❍ Rework must be documented for traceability
- ❍ Strain out allergens from food if being reincorporated into a non-allergen containing product
- ❍ Clean and label all rework containers

20. Rank your agreement with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This training increased my knowledge of allergen controls	❍	❍	❍	❍	❍	❍	❍
This training was helpful.	❍	❍	❍	❍	❍	❍	❍
This training was engaging.	❍	❍	❍	❍	❍	❍	❍

21. Is English your primary language?

❍ Yes

❍ No

22. What is your job title?

____

23. What is your gender?

❍ Male

❍ Female

24. What is your ethnicity?

❍ Asian

❍ African American

❍ Hispanic

❍ Caucasian

❍ Native American

❍ Other

25. How long have you worked for Company X?
- ❍ Less than 1 year
- ❍ 1-5 years
- ❍ 6-10 years
- ❍ More than 10 years

26. How did you experience training?
- ❍ In a group setting
- ❍ On my own

27. Which type of training did you complete?
- ❍ Narrated online module
- ❍ Virtual plant tour

Please place your completed survey in the sealed box provided in the training room.

Appendix F

Food Defense Training Evaluation Survey

6. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying	Does not apply to me
Making sure that doors to the facility are secured.	❍	❍	❍	❍	❍	❍	❍	❍
Reporting unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly documenting product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Making sure that incoming and outgoing trucks and trailers are sealed.	❍	❍	❍	❍	❍	❍	❍	❍

7. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Making sure that doors to the plant are secured supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Reporting unusual activities or visitors to supervisors supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Documenting product and lot numbers supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Making sure that incoming and outgoing trucks and trailers are sealed supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

8. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

9. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

10. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

11. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

12. My supervisor:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensures that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Reports unusual activities or visitors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly documents product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensures that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

13. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Ensures that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍
Reports unusual activities or visitors.	❍	❍	❍	❍	❍	❍	❍
Properly documents product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍
Ensures that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍

14. Rank how much control you have over the safety of our product by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Ensuring that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Reporting unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly documenting product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensuring that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

15. At every possible occasion, I am able to:

	1-Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

16. I have the ability to:

	1- I could not	3	3	4- Neutral	5	6	7- Certain I could	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

17. I will:

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly Agree	Agree	Strongly Agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

18. Which of the items listed below are considered to be part of a good food defense program. **Select all that apply.**
❑ An unescorted visitor in the production room
❑ Incoming loads are sealed and locked
❑ Zone control- restricted access to certain parts of the plant
❑ Reporting unusual activity to your supervisor
❑ Code dates of loaded products are recorded in case of recall

19. How does a food defense program differ from a food safety program?
❍ A food defense program's primary goal is prevention.
❍ A food defense program involves efforts to prevent unintentional contamination of food.
❍ A food defense program involves efforts to prevent intentional contamination of food.
❍ None of the above. A food defense and food safety program are the same thing.

20. It is your responsibility to report which of the following to a supervisor as soon as possible? **Select all that apply.**
- ❍ Unusual activities
- ❍ Visitors without a proper ID
- ❍ Unescorted visitors
- ❍ Anyone taking photos outside or inside the plant

21. True or False: Outside drivers or other personnel are allowed inside the finished goods cooler.
- ❍ True
- ❍ False

22. Which of the following make dairy products vulnerable to intentional contamination? **Select all that apply.**
- ❑ produced in large batches
- ❑ short shelf life
- ❑ uniform mixing
- ❑ cold storage temperature

BREAK FOR TRAINING MODULE.
THEN CONTINUE ON TO NEXT PAGE.

1. Please rank how gratifying you find the following tasks.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying	Does not apply to me
Ensuring that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Reporting unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly documenting product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensuring that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

2. Please rank how likely you find the following statements.

	Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Ensuring that doors to the facility are properly secured supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Reporting unusual activities or visitors to supervisors supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Properly documenting product and lot numbers throughout the process supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍
Ensuring that incoming and outgoing trucks and trailers are properly sealed supports the safety of the product.	❍	❍	❍	❍	❍	❍	❍

3. My supervisor wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

4. My company wants me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

5. Our consumers want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

6. Outside auditors want me to:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

7. My supervisor:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Does not apply to me
Ensures that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Reports unusual activities or visitors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly documents product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensures that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

8. My fellow employee:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Ensures that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍
Reports unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍
Properly documents product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍
Ensures that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍

9. Rank how much control you have over the safety of our product by:

	1- Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Ensuring that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Reporting unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly documenting product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensuring that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

10. At every possible occasion, I am able to:

	1-Not under my control	2	3	4- Neutral	5	6	7- Under my control	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

11. I have the ability to:

	1- I could not	2	3	4- Neutral	5	6	7- Certain I could	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

12. I will

	Strongly agree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree	Does not apply to me
Ensure that doors to the facility are properly secured.	❍	❍	❍	❍	❍	❍	❍	❍
Report unusual activities or visitors to supervisors.	❍	❍	❍	❍	❍	❍	❍	❍
Properly document product and lot numbers throughout the process.	❍	❍	❍	❍	❍	❍	❍	❍
Ensure that incoming and outgoing trucks and trailers are properly sealed.	❍	❍	❍	❍	❍	❍	❍	❍

13. Which of the items listed below are considered to be part of a good food defense program. **Select all that apply.**

- ❑ An unescorted visitor in the production room
- ❑ Incoming loads are sealed and locked
- ❑ Zone control- restricted access to certain parts of the plant
- ❑ Reporting unusual activity to your supervisor
- ❑ Code dates of loaded products are recorded in case of recall

14. How does a food defense program differ from a food safety program?

- ❍ A food defense program's primary goal is prevention.
- ❍ A food defense program involves efforts to prevent unintentional contamination of food.
- ❍ A food defense program involves efforts to prevent intentional contamination of food.
- ❍ None of the above. A food defense and food safety program are the same thing.

15. It is your responsibility to report which of the following to a supervisor as soon as possible? **Select all that apply.**

- ❍ Unusual activities
- ❍ Visitors without a proper ID
- ❍ Unescorted visitors
- ❍ Anyone taking photos outside or inside the plant

16. True or False: Outside drivers or other personnel are allowed inside the finished goods cooler.

- ❍ True
- ❍ False

17. Which of the following make dairy products more vulnerable to intentional contamination? **Select all that apply.**

- ❍ Produced in large batches
- ❍ Short shelf life
- ❍ Uniform mixing
- ❍ Cold storage temperature

18. Rank your agreement with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This training increased my knowledge of food defense.	❍	❍	❍	❍	❍	❍	❍
This training was helpful.	❍	❍	❍	❍	❍	❍	❍
This training was engaging.	❍	❍	❍	❍	❍	❍	❍

19. Is English your primary language?
- ❍ Yes
- ❍ No

20. What is your job title?

____

21. What is your gender?
- ❍ Male
- ❍ Female

22. What is your ethnicity?
- ❍ Asian
- ❍ African American
- ❍ Hispanic
- ❍ Caucasian
- ❍ Native American
- ❍ Other

23. How long have you worked for Company X?
- ❍ Less than 1 year
- ❍ 1-5 years
- ❍ 6-10 years
- ❍ More than 10 years

24. How did you experience training?
- ❍ In a group setting
- ❍ On my own

25. Which type of training did you complete?
- ❍ Narrated online module
- ❍ Virtual plant tour

Please place your survey in the sealed box provided in the training room.

Appendix G

Introduction to Good Manufacturing Practices and Material Controls Supervisor Audit

Please walk through the plant and use the table below to perform an internal audit that will be used to evaluate the GMP training program. When finished, please e-mail the completed form to knsaniga@ncsu.edu

GMP Topic	Compliant-yes/no?	If there are non-compliances, how many did you find?	Were non-compliances addressed?
The correct color of buckets and brushes are being used for the proper purpose.			
Buckets and brushes are properly stored.			
All containers are properly labeled and are used for their intended purpose.			
No materials, ingredients and products are stored directly on the floor.			
Cleaning and sanitizing chemicals are properly labeled and stored away from the production area.			
The work area is clean of trash and debris. Product spills are washed away.			
Trash is stored in such a way to protect against invasion by pests.			

Date of audit: ___________________________

Role of person who performed audit: ____

Location of plant: ____

Appendix H

Personal Responsibility and Communicable Diseases Supervisor Audit

Please walk through the plant and use the table below to perform an internal audit that will be used to evaluate the GMP training program. When finished, please e-mail the completed form to knsaniga@ncsu.edu

GMP Topic	**Compliant-yes/no?**	**If there are non-compliances, how many did you find?**	**Were non-compliances addressed?**
The correct color of buckets and brushes are being used for the proper purpose.			
Buckets and brushes are properly stored.			
All containers are properly labeled and are used for their intended purpose.			
No materials, ingredients and products are stored directly on the floor.			
Cleaning and sanitizing chemicals are properly labeled and stored away from the production area.			
The work area is clean of trash and debris. Product spills are washed away.			
Trash is stored in such a way to protect against invasion by pests.			

Date of audit: ___________________________

Role of person who performed audit: ____

Location of plant: ____

Appendix I

Allergen Controls Supervisor Audit

Please walk through the plant and use the table below to perform an internal audit that will be used to evaluate the allergen training program. When finished, please e-mail the completed form to knsaniga@ncsu.edu

Allergen Control Topic	Compliant- yes/no?	If there are non-compliances, how many did you find?	Were non-compliances addressed?
All ingredients in the warehouse are properly labeled.			
Ingredients in the warehouse are stored properly to prevent allergen cross-contact			
The vision system is in use to detect for errors in product label.			
Proper changeover cleaning procedures are being followed between production runs			
The production schedule has allergen-containing products to be run after non-allergen containing products.			
The production schedule is being adhered to.			
Products are properly stored in the cooler to prevent allergen cross-contact			

Date of audit: ____________________________

Role of person who performed audit: ____

Location of plant: ____

Appendix J

Food Defense Supervisor Audit

Please walk through the plant and use the table below to perform an internal audit that will be used to evaluate the food defense training program. When finished, please e-mail the completed form to knsaniga@ncsu.edu

Food Defense Topic	**Compliant-yes/no?**	**If there are non-compliances, how many did you find?**	**Were non-compliances addressed?**
Incoming loads are checked to ensure that they are properly sealed and locked.			
Warehouse doors are secured.			
Cooler doors are secured and outside personnel are not permitted.			
Product lot numbers are properly recorded and tracked through production.			
All visitors are required to sign in and wear proper identification.			
Doors to the facility are secured to limit access.			
Trailers are properly locked and sealed and are not left unattended unless locked and sealed.			

Date of audit: ___________________________

Role of person who performed audit: ____

Location of plant: ____

Appendix K

Food Safety Culture Survey

1. Please rank how much you agree with the following statements.

	Strongly Disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Company X values food safety and includes food safety as part of their company goals.	❍	❍	❍	❍	❍	❍	❍
Managers at Company X are effective at communicating about food safety.	❍	❍	❍	❍	❍	❍	❍
Company X is committed to producing safe food.	❍	❍	❍	❍	❍	❍	❍
Management actively leads and encourages employees to make food safety a priority.	❍	❍	❍	❍	❍	❍	❍
Company X supplies proper resources to train employees to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍

2. Please rank how enjoyable you find the following statement.

	Very gratifying	Gratifying	Somewhat gratifying	Neither gratifying or ungratifying	Somewhat ungratifying	Ungratifying	Very ungratifying
Following food safety rules is:	❍	❍	❍	❍	❍	❍	❍

3. Please rank how likely you find the following statement.

	Extremely Unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
Following proper food safety rules will create a safe product.	❍	❍	❍	❍	❍	❍	❍

4. Rank the following from most valued by Company X to least valued by Company X.
(1=most valued; 4=least valued)
_______ Meeting production goals
_______ Producing a product that meets quality standards
_______ Producing a product that will not get consumers sick
_______ Producing a delicious product that consumer will enjoy

5. Please rank how much you agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
My supervisor wants me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
My company wants me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
Our consumers want me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
Outside auditors want me to follow food safety rules.	❍	❍	❍	❍	❍	❍	❍
Working in a food processing plant, there is no risk of harming the public.	❍	❍	❍	❍	❍	❍	❍