

ASSESSING A FOOD SAFETY TRAINING PROGRAM
INCORPORATING ACTIVE LEARNING IN VEGETABLE
PRODUCTION USING KIRKPATRICK'S
FOUR LEVEL MODEL

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Agricultural Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

April 2016

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GLOSSARY

1. Food Safety:

The practice of handling, preparing, and storing food in a way that avoids contamination that can lead to foodborne illness (World Health Organization, 2014).

2. Food Safety Training Program:

A set of lessons presented to the vegetable production employees by the food safety staff. The trainings are aimed at various food safety topics. The purpose of the trainings are to teach employees about the risks of contaminating food and how to avoid food contamination.

3. Vegetable Products:

Any plant or plant part, can be raw or cooked, that is intended to be consumed by a human.

4. Standard Operating Procedures (SOPs):

Established or prescribed methods to be followed routinely for the performance of designated operations or in designated situations

ABSTRACT

Gilliss reported that “contaminated food consumed in the United States causes an estimated 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths annually” (2011, p. 749). The risk of contaminated food reaching consumers can be reduced by the use of food safety training programs. As the number of vegetable consumers increases and the consumers’ concern for quality food grows, there is a need to improve food handler training programs. The over-arching question guiding this research was: What enhancements can be made to the vegetable producer’s food safety training program to ensure improvement in the safe practices/behaviors and increases in food safety knowledge of vegetable production employees? The purpose of this study was to determine the influence of active learning teaching strategies on the Growers Express food safety training program among vegetable packing employees using Kirkpatrick’s four level model of training evaluation. A mixed-method time series design was used. Sixty-one subjects from one vegetable packaging facility participated in the evaluation. The subjects were split into two groups where they completed a food safety knowledge pre-test, participated in either an active learning or traditional training series (depending on group), and submitted a training reaction survey. The active learning training group showed significant improvement in their test scores on three of the test sections. The traditionally trained group only improved significantly on one test section and their scores decreased on one test section. All participants reacted positively to the training program, but the active learning group agreed or strongly agreed to the statements more often on the training reaction survey. Based on the results of this study, it was determined that the addition of active learning methods positively influenced the subjects’ reactions to the training program, increased test scores on the food safety knowledge exam, enhanced the subjects’ on job behaviors and actions, and improved the overall effectiveness of the program.

INTRODUCTION

Vegetable production in California was worth 6.9 billion dollars in 2012. This amount accounted for 50% of the nation's vegetable production value (Agriculture, 2012). These vegetables were harvested and shipped around the world. Vegetable consumption has increased 31% since 1970 (Parker, Wilson, LeJeune, & Doohan, 2012). Consumers expect a safe product they can enjoy with little risk of becoming ill. "Contaminated food consumed in the United States causes an estimated 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths annually" (Gilliss, 2011, p. 749). Food safety has become increasingly important in recent years. In the past, consumers were not as concerned about where their food came from and the practices that were used to produce it. Many people today are concerned about the risk their food presents to them (Miles et al., 2004).

In the vegetable production industry, food safety training programs are essential in reducing the risk of shipping contaminated vegetables to consumers around the world. "Training is crucial to any food safety systems. Poor staff training in food hygiene is a real threat to the safety of food, hence effective training is an important prerequisite to successful implementation of a food safety management system" (Soon, 2012, p. 438).

Food safety training programs are focused on the employees handling the products being knowledgeable about how food can become contaminated and what to do if food becomes contaminated. Food safety training programs in the vegetable industry generally consist of short, field based lessons presented informally to vegetable production, harvest, and packing employees. Production employees are the people who

work the ground, plant the seed, and grow the plants to be harvested. Harvest employees are the workers who are in the field harvesting the produce; they are in direct contact with the produce. Packing employees are the people who take the harvested produce and place it in its final packaging to be sold. These are the last people to touch the products before they are shipped to customers. It is important each group of employees be trained on food safety topics so they can be aware of food contamination and procedures related to preventing customers from becoming ill.

In 2015, a total of 907 people infected with the outbreak strains of *Salmonella* Poona were reported (Center for Disease Control and Prevention [CDC], 2016). These reports came from 40 states and 204 infected people were hospitalized. Six deaths were reported. The company that distributed the contaminated cucumbers issued two recalls to remove the products from the markets. As a result of the outbreak, two lawsuits were filed against the company by consumers who became ill. In a 2016 outbreak, the CDC reported 18 hospitalizations and one death linked to *Listeria* in packaged salads (CDC, 2016). This outbreak resulted in a recall of all associated products and the processing facility being shut down for investigation.

Vegetable production is a collaborative effort between growers, harvesters, and shippers. The growers produce the vegetable products that are then harvested. The shippers buy the products from the growers and turn around to sell the products to consumers and retail stores. Many of the participants in the vegetable industry have become vertically integrated, combining all of these stages under one parent company with ownership of each stage. For example, just 120 growers produce 99% of

California's vegetable output (Parker, Wilson, LeJeune, & Doohan, 2012). This accounts for three quarters of the United States' produce (Parker, Wilson, LeJeune, & Doohan, 2012).

Growers Express LLC is a grower, harvester, packer, and shipper of produce. The company was founded in 1987 and now grows and distributes more than 40 produce products throughout the United States as well as exporting products abroad. Growers Express LLC facilitates two vegetable harvest seasons in four locations. The winter season runs from late November through March in Yuma, Arizona; Brawley, California; and Mexicali, Baja California, Mexico. The summer harvest season runs from April through early November in the Salinas Valley of California. Depending on the crop, vegetable plantings start 60 to 120 days prior to the seasons (Growers Express, 2015).

The food safety training program at Growers Express LLC included the following topics: animal intrusion, product cross contamination, employee health (injuries and illnesses), equipment sanitation practices, food security, foreign materials in product, good agricultural practices, employee hygiene, and hand washing. Each employee was trained at the beginning of each season. The first training was an overall training covering each topic in the program. From there, the employees were trained every two weeks on a specific topic throughout the season. The follow-up trainings are done to refresh the employees' knowledge of the topics, as well as incorporate more in-depth information into the trainings. (Express, 2015).

Traditionally, these trainings used a lecture based teaching method. The trainer arrived to the employees' location and the employees gathered around while the trainer

talked through the material. There was little interaction between the trainer and the employees, the employees and the material, or the employees with other employees. In *Democracy and Education*, John Dewey (1916, p. 46) stated, “education is not an affair of ‘telling’ and being told, but an active and constructive process.”

During the summer of 2014, I was working at Growers Express LLC in the food safety department between semesters studying to become an agricultural educator. I was tasked working with the food safety trainers to update the training program using my experience in the education field. Following the push in education, we worked to develop lessons (trainings) that incorporated hands on experiences, visuals, and active learning strategies (Silberman, 1996). These newer trainings had the employees making drawings and infographics, acting out scenarios, and communicating with the trainer as well as their peers. During these sessions, the trainer utilized the same information as in the traditional lecture style trainings but would actively include the employees to reinforce the concepts. Shenge (2014, p. 50) stated, “training is an organized approach to positively impacting individuals’ knowledge, skills, and attitudes in order to improve individual, team, and organizational effectiveness.” The goals of the active trainings were to cover the necessary material, actively involve the employees, and build employees’ investment in the food safety training program to build a culture of food safety within the company.

The active learning methods required more preparation by the trainer, more training materials, and more of the employees’ time away from production than the traditional trainings. In total, the active trainings cost Growers Express LLC more money and time than the traditional trainings. To make the new trainings worth the time and

money, they needed to be tested and proven to provide an increase in employee food safety knowledge as well as employee satisfaction with the trainings.

Kirkpatrick and Kirkpatrick's (2006) four level model of training evaluation has been widely used and accepted for training program evaluation. The model defined the four levels of program evaluation: level one: reaction; level two: learning; level three: behavior; and level four: results. The reaction level was concerned with the degree to which participants reacted favorably to the learning event. Level two examined the degree to which participants acquired the intended knowledge, skills, and attitudes based on their participation in the learning event. The behavior level focused on the degree to which participants applied what they learned during training in their workplace. Finally, the fourth level is concerned with the degree to which targeted outcomes occur as a result of the learning event. Collecting and analyzing information on each level of the training evaluation model is important to completing a thorough training evaluation.

Evaluating current food safety training programs should become a priority for vegetable production companies because they need to ensure the products they grow and ship are safe for all consumers.

Research Question

The over-arching question guiding this research was, in what specific ways can active learning methods within a food safety training program impact safe practices, behaviors, and food safety knowledge of vegetable packing employees?

Purpose and Objectives

The purpose of this study was to determine the influence of active learning teaching strategies on the Growers Express LLC food safety training program among vegetable packing employees in the Salinas Valley of California using Kirkpatrick's four level model of training evaluation. The following objectives were developed as a means toward accomplishing the purpose:

1. Assess subjects' reactions to the mandatory training program.
2. Assess subjects' food safety knowledge prior to participating in the mandatory training program.
3. Determine the food safety training program's influence on subjects' knowledge and behaviors.

Limitations

This study only included employees from one vegetable production company in the Salinas Valley of California and the company's specific training program. Every vegetable production company has its own training program so the results from this study are specific to this program. The population of the study was also small in size compared to all of the vegetable employees in the industry. The testing and training sessions must be kept short because of time constraints of the vegetable production, harvest, and packaging industry. It would be helpful to complete the study over several seasons to compare results, but time constraints were present.

Assumptions

During this study, it was assumed that: all the employees tested completed the pre-test and post-test to the best of their ability, all employees completed reaction survey and demographic survey truthfully, and all participants represented a typical vegetable industry employee and did not represent any unusual cases. These assumptions were formed to focus the results of this study to typical food handling workers.

Significance/Need for Study

In recognizing the risk of contaminated food to consumers, food safety training programs were developed. The assessment and improvement of these programs is essential to reducing food safety risks. Findings of this study contain implications for improving food safety training programs throughout the vegetable industry. Improving the effectiveness of food safety training programs has the potential to reduce risk of foodborne illness outbreaks and the contamination of food products.

REVIEW OF LITERATURE

In this chapter I referred to the literature and reported on the need for food safety, how food safety programs are evaluated, what active learning is and how it is being used, and what Kirkpatrick's model of training evaluation is. I started by examining the risks in food production and how those risks can be reduced. I then explored how others have evaluated food safety training programs and assessed their trainees. I also investigated active learning and active learning strategies used in formal and non-formal settings. Lastly I examined Kirkpatrick's (2006) four level model of training evaluation.

Food Safety

Need for Food Safety

In a blog for the United States Department of Agriculture (USDA), United States Secretary of Agriculture Tom Vilsack wrote that America has the most abundant, affordable and safest food supply on earth (Vilsack, 2012). Although the Secretary of Agriculture claimed the safest food supply on earth, "food consumed in the United States causes an estimated 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths annually" (Gilliss, 2011, p. 749). Approximately two to three percent of these infected Americans have long term complications from their infections (Olson, 2011). *Salmonella* was the most reported foodborne illness in 2010 (Gilliss, 2011), and was responsible for about one million infections and \$365 million in medical costs annually (Scallan, 2011, p. 11). Another major bacteria of concern in food production was *Escherichia coli* 0157 (*E. coli* 0157). Frenzen (2005) estimated that illnesses due to *E. coli* 0157 cost approximately

\$405 million (in 2003 dollars) annually, including the costs of medical care, lost productivity, and premature deaths.

Despite the grim outlook of these foodborne illness statistics, the Secretary of Agriculture's claim remains true.

The US food supply remains safe if critical behaviors are observed in food handling. Hazard Analysis Critical Control Point (HACCP) programming and employee education can control and prevent hazards that are present in the foods, that may form in the foods, or that may be introduced to foods. (McCabe-Sellers, 2004, p. 1714)

Parker, Wilson, LeJeune, and Doohan (2012) conducted a study using interviews with growers and food safety experts to address food safety concerns. They asked the participants to identify possible farm problem areas and preventable measures that could be taken in their operation.

Experts identified water quality, manure, good handling practices (including personal hygiene and equipment sanitation), and traceability as critical farm problem areas that, if addressed, are likely to decrease risk associated with microbial contamination of fresh produce from all scales of agriculture. (p. 304)

Large scale growers with a gross income of greater than \$500,000 a year identified consumer food preparation, employee hygiene and health, and food handling by employees as primary contamination concerns (Parker et al., 2012). Further these authors noted that growers saw worker health and hygiene as important to reducing food contamination. While discussing employee hygiene issues most of the large scale growers discussed the importance of training employees. The growers cited "good" health and hygiene and employee education as the most effective preventative practices to reduce food contamination risks (Parker et al., 2012).

Ekanem, Mafuyai-Ekanem, Tegegne, and Singh (2011) administered a questionnaire to 70 participants who attended a Small Farms Expo in Tennessee. Ninety percent of the participants said they considered food safety to be a very important or important issue. More specifically, these Tennessee consumers' concerns involved sickness from contaminated food, cleanliness of food, proper food handling, food handlers' food safety education, harmful bacteria (*Salmonella* and *E. coli*), and cross contamination.

In 2012, Ekanem, Mafuyai-Ekanem, Tegegne, and Adamu conducted a focus group study of food service staff members in Tennessee. The focus groups concentrated on the improvement of food safety training for food handlers. The participants suggested food safety certification and specific training on cooking, chilling temperature, and personal hygiene. "According to the responses shared by the participants, offering specific training that emphasize the basic concepts of food safety will allow workers to learn the principles that explain actions they take to keep food safe" (p. 10).

Evaluation of Food Safety Programs

In 2014, Shenge concluded "effective training evaluation is necessary for successful management of training programs and organizational growth and development" (p. 50). Further, to effectively determine the strengths and weaknesses of a training program, the program must be assessed. This was done by evaluating the employees' performance after the training compared to their performance before training, changes in attitude, and changes in knowledge. Training objectives should also be examined to determine the overall goals of the training program. Nickols (2003) argued

the only way to prove that training was working was to have a control group with no training with which to compare. While a worthy research goal, that idea was not feasible in food safety because of the risks posed to consumers and the government mandated training programs.

Lillquist, McCabe, and Church (2005) conducted a study titled “A Comparison of Traditional Handwashing Training with Active Handwashing Training in the Food Handler Industry.” The study goal was to compare the effectiveness of lecture based handwashing trainings with active practice hand washing trainings. The subjects were asked to participate in a lecture or active handwashing training based on their group and then all participants were given a 20 item multiple-choice test. “The active training consisted of participants observing the instructor performing an FDA handwashing demonstration, followed by the participants performing the FDA handwashing procedure under the supervision of the instructor” (p. 14). Demographics including age, gender, education level, and months of employment as a food handler were collected. The results showed that the active participation group’s mean test scores were statistically higher than the traditional lecture group. “The results of the study suggest that it would be beneficial for food handler trainers to incorporate actual handwashing practice in their courses” (Lillquist et al., 2005, p. 16).

In the United Kingdom, Soon and Baines (2012) conducted a study in which they evaluated farm workers’ hand washing knowledge. They administered pre- and post-training questionnaires to 62 produce workers from six farms. The results revealed there was an increase in food safety knowledge from the pre-test to the post-test. During the

instructional session, the trainer used four different teaching tools: a booklet, presentation slides, a video, and a hands on demonstration. As part of the questionnaire, the participants were asked to identify the training tools they thought worked best for them. Most of the participants chose the video and the hands on demonstration. Soon and Baines (2012) concluded “practical and hands-on sessions will create a much more vivid experience for the workers” (p.446).

An ever-present concern in food safety training is how long the information is retained by employees. In the vegetable industry, food handling employees are required to be trained at least once per season. In the food preparation industry, including restaurants, food handlers were required to successfully complete a certified training program only once. Up until 2013, the completion certificate would not have expired; as of 2016, FOODSAFE certification expires after five years (FOODSAFE, 2016). FOODSAFE is a training protocol used widely in Canada to certify food handling employees in the restaurant industry. Before the updated expiration rules, McIntyre, Vallaster, Wilcott, Henderson, and Kosatsky (2012) tested the food safety knowledge of 499 FOODSAFE trained and 199 untrained food handlers’ food safety knowledge. The instrument consisted of 13 multiple choice food safety knowledge questions. The researchers found the food handlers who had completed a training program scored statistically higher than the untrained group. Perhaps more importantly, they also discovered the more time that passed since a person was trained the more likely they were to score lower than someone trained more recently. There was a direct correlation between a participant’s years since FOODSAFE training and their test score.

In 2007, Egan et al. compiled a review of food safety and food hygiene training studies. These researchers only examined studies that met certain stated criteria: the study had use outcome measures to assess the effectiveness of training and the study had to be based in the commercial setting. Forty-six studies of food safety and food hygiene were included in their review. “Twenty-two studies (48%) included a training intervention and twenty-nine studies (63%) measured knowledge” (Egan et al., 2007, p.1182). The most common method used to assess knowledge was with multiple choice questions. The general topics covered by these tests included high-risk foods, foodborne pathogens, cross-contamination, personal hygiene, temperature control and cleaning. Most of the studies that included pre- and post-training tests of knowledge reported improvements in the post-training tests. These authors concluded “there is a need to develop training methods that are proven to change behavior as well as imparting knowledge” (Egan et al., 2007, p.1188).

Active Learning

Active learning has become a common term in teaching. Prince (2004) defined active learning as a method that engages the student in the learning process. Characteristics associated with active learning include: student activity, engagement, involvement, and development of student skills (Prince, 2004; Bonwell & Eison, 1991).

Formal Settings

Classroom based instruction is labeled as formal education (Enhancing Education, 2002). Formal educational settings are characterized by consistent meeting places, consistent students, consistent times, formal lesson planning, and assessment.

Hake (1998) conducted a study involving 62 physics classes using traditional lecture style instruction and interactive-engagement methods. The 6,542 students were asked to complete a pre-test and a post-test. The test scores were analyzed for gains between the two tests. On average the students from the interactive-engagement classes gained significantly more than the students from the traditional classes. Hake concluded that the use of interactive-engagement methods increased problem-solving abilities and course effectiveness well beyond traditional methods.

In a study exploring the effectiveness of active learning, collaborative learning, cooperative learning, and problem based learning, Prince (2004) found that incorporating activities into lectures can significantly improve recall of content and increase engagement. In this study, Prince reviewed the relevant research literature and made suggestions for their teaching colleagues in the engineering field. Prince suggested that teachers incorporate active learning throughout their classes. The author recommended using note sharing and breaks between lecture sections for the students to discuss their notes and fill in parts they may have missed.

Weltman and Whiteside (2010) compared the success of traditional and active learning methods in seven statistics classes. The 300 students were exposed to three different teaching methods. The methods were a traditional lecture method, a fully-active

workshop, and a hybrid method. In the hybrid method the teacher lectured in a traditional way but incorporated short activities. The authors found that the students with higher cumulative grade point averages (GPAs) scored lower on the assessment when they were exposed to the fully-active workshop than when they were exposed to the traditional lecture format. The authors also noted that students with lower GPAs benefited more from the fully-active methods than the traditional methods. The authors did not conclude which was the best teaching method for the overall good of the students.

Non-formal Settings

Non-formal education takes place in locations other than a classroom. It is in after-school programs, on the training, at home, or in libraries (Enhancing Education, 2002). Food safety training programs fall into the non-formal setting. The trainings do not take place in a classroom and often there is no assessment of learning. Active learning strategies can still take place and be beneficial in non-formal education.

In a study of characteristics and processes that enhance learning in the workplace Cunningham and Hillier (2013) asked supervisors to identify learning experiences and the processes behind those experiences. Active learning was identified as a process that helped facilitate their learning by 44.6% of the supervisors.

Ota et al. (2006) reason that adults have different learning needs than younger students. Additionally the authors suggest using the following teaching methods for adults in non-formal settings: lecture spaced with active learning activities, problem based learning, case studies, educational games, role playing, and discussions.

McKeachie (2002) explained that discussion is the original teaching method of active learning.

Theoretical Framework

Kirkpatrick's Model of Training Evaluation

Training evaluation must be focused and clearly directed. Without direction, assessment and evaluation can become unclear and difficult. Kirkpatrick and Kirkpatrick's (2006) four level model of training evaluation aims to identify what and who should be evaluated to determine the effectiveness of a training or training program. This section will discuss each of the four levels of Kirkpatrick's model and their importance to training evaluation. Figure 2.1 summarizes the four levels of Kirkpatrick's (2006) model of training evaluation.

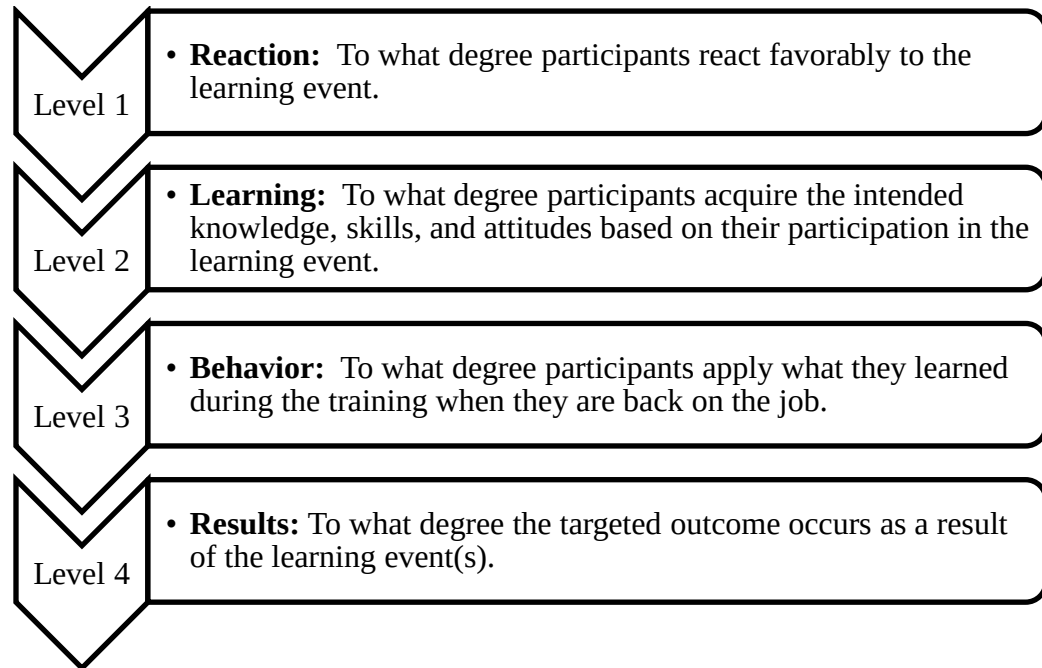


Figure 2.1. Kirkpatrick's Four Levels of Evaluation. adapted from Kirkpatrick, D. & Kirkpatrick, J. (2006). *Evaluating Training Programs: The Four Levels*.

The Kirkpatrick model of training evaluation was created when Don Kirkpatrick wrote four articles for the American Society of Training and Development in 1959 (Kirkpatrick & Kirkpatrick, 2009). The articles gained popularity among trainers and educators and became known as the Kirkpatrick model of training evaluation. In 1993, Don Kirkpatrick completed the book titled *Evaluating Training Programs: The Four Levels*. In 2006, Don and his son, Jim Kirkpatrick released the third edition of "Evaluating Training Programs." Jim Kirkpatrick is a training consultant, author, and speaker. He also heads the Kirkpatrick Partners training business (Kirkpatrick & Kirkpatrick, 2009).

Level 1: Reactions

The reaction level is concerned with evaluating the participants' reactions to a training event or events. "Reaction may be best defined as how well the trainees liked a particular training program" (Kirkpatrick, 1993, p.25). Questions that could be asked in this level include: Did they like the training? Was the training material relevant to their work? Did you connect with the trainer (Shenge, 2014)? Assessment at this level can occur formally (written survey) or informally (verbal questions). This level is most often measured at the end of the training, but "... reactions are also measured during the training, even if only informally in terms of the instructor's perceptions" (Nickols, 2003, p. 5). Kirkpatrick and Kirkpatrick (2006) advised that this level should be evaluated by all training programs to determine places where improvement can happen. "Furthermore, the participants' reactions have important consequences for learning (level two). Although a positive reaction does not guarantee learning, a negative reaction almost certainly reduces its possibility" (Winfrey, 1999, p. 1).

Level 2: Learning

The goal of evaluating learning is to determine if trainees advanced in their knowledge, skills, or attitudes. Similar to level one, learning can be evaluated formally or informally. Most training experts would agree that a quality trainer would be consistently assessing their trainees' knowledge during the trainings. Trainee knowledge can be measured during or at the end of a training program, but in order to determine if the training impacted the trainees' knowledge, the trainees' entering knowledge must be known or measured (Nickols, 2003). "To assess the amount of learning that occurred due

to a training program, level two evaluations often use tests conducted before (pre-test) and after training (post-test)” (Winfrey, 1999, p. 2).

Level 3: Behavior

The purpose of behavior evaluation is to determine the transfer of the knowledge assessed in level two to the trainees’ behavior and skills in the learners’ everyday workplace. A successful training must impact the employees’ on-the-job behaviors. “...Behavior changes are acquired in training and they then transfer (or don’t transfer) to the workplace” (Nickols, 2003, p. 5). Winfrey (1999) stated the goal of evaluating level three was summed in the question: “Are the newly acquired skills, knowledge, or attitude being used in the everyday environment of the learner” (p. 2)? Winfrey (1999) also noted that level three represented the truest assessment of a training programs’ success.

Level 4: Results

There is a shift between levels three and four where “the first three elements center on the trainees; their reactions, their learning, and changes in behavior. The fourth element shifts to a concern with organizational payoffs or business results” (Nickols, 2003, p. 5). Level four measures the success of a training program in a way that managers and executives can appreciate: business results, increased production, improved quality, decreased costs, reduced accident frequency, increased sales, higher profits, and increased return on investment (Shenge, 2014; Winfrey, 1999). All of the results above apply to food safety as well as the following: reduced risk of contamination, safer products, safer employees, and lower cost to community from foodborne illnesses.

Although these results are important to the business and to the community, it was difficult to prove there was a tangible impact for business because of a food safety training program. “Determining results in financial terms is difficult to measure, and is hard to link directly with training” (Winfrey, 1999, p. 3). Training programs compete for resources with other programs and departments; therefore, a company must decide to fund a food safety program without the ability to always see direct impacts on their return on investment. Creating a culture of promoting and backing a food safety program within the managers and executives of a company is important for them to see the benefits of a program. Results from the first three levels can help show those results and build a culture of food safety.

Kirkpatrick and Kirkpatrick (2006) suggested evaluation should start with level one and then progress in order through the other levels as time and money allow. “...each succeeding level represents a more precise measure of the effectiveness of the training program, but at the same time requires a more rigorous and time consuming analysis” (Winfrey, 1999, p. 1).

In this chapter, I referred to the related literature. I provided justification for the need of food safety training programs and the risk food presents to consumers. I examined how others have evaluated food safety programs and the methods they used. In the second section of the literature review I explored related research of active learning and its use in formal and non-formal settings. Finally, I examined Kirkpatrick’s four level model of training evaluation and its applicability to the purpose and objectives of this study.

METHODOLOGY

The purpose of this study was to determine the influence of active learning teaching strategies on the Growers Express food safety training program among packing employees in the Salinas Valley of California using Kirkpatrick's four level model of training evaluation. This chapter will explain the study's design, population selection, sampling procedure, instrumentation, data collection, and analysis.

Research Design

Design

This research incorporated mixed-methods in order to utilize each level of Kirkpatrick's (2006) training evaluation model in evaluating a food safety training program. Level one, reaction, was assessed using a four point Likert-scale asking the subjects to rate their reaction to the training. Level two, learning, was assessed using a control-group, time series design with a pre- and post-test. Level three, behavior, was assessed by observing food safety participants in the packing facility. Level four, results, was not able to be fully assessed because I did not have access to information related to the financial impact of the training programs. Further, Growers Express LLC did not separate funds for the two groups. Food safety training budgets applied to both groups and the returns on investments also applied to both groups. Food safety training programs do not lend themselves to being assessed by level four. To determine the true effect of a training program, it would have to be shut down completely (Nickols, 2003). This is not possible in food safety because the risk it would pose to consumers. Despite these issues

with assessing level four, I used a count of food safety incidents at the end of the training program to compare the effectiveness of the two groups.

Subjects were assigned to two groups. The control group participated in the pre-test, observations, the training series using traditional methods, and a post-test. The test group participated in the pre-test, observations, the training series using active learning techniques, and a post-test. The two groups participated in the pre-test, observations, trainings, and post-test of the study as determine by figure 3.1.

Group	Time 					
	7/8/2015	7/15/2015	7/22/2015	7/29/2015	8/5/2015	8/12/2015
Test Group (Active Training Group)	Pre-test	Cross Contamination Training	Observation	Injury & Illness Training	Observation	Post-Test
	Observation		Hand Washing Training		Hygiene, Clothing & Equipment Training	Training Satisfaction Survey
	Food Security Training					Observation
Control Group (Traditional Training Group)	Pre-test	Cross Contamination Training	Observation	Injury & Illness Training	Observation	Post-Test
	Observation		Hand Washing Training		Hygiene, Clothing & Equipment Training	Training Satisfaction Survey
	Food Security Training					Observation

Figure 3.1. *Control Group, Time Series Design*. Adapted from Leedy and Ormrod, 2013. *Practical Statistics for Educators*.

IRB Process and Approval

The researcher completed the Collaborative Institutional Training on September 10th, 2014. This study's methods and materials were approved by the Institutional

Review Board (IRB) on May 12th, 2015. The collaborative institutional training completion report and IRB approval form can be found in appendix A and appendix B respectively. On July 7th, the study was explained to the potential participants. They were told that participation was voluntary and that they could elect to opt-out at any time during the study. They were also informed that their participation in the study in no way impacted their employment or the way their employer viewed their performance.

Population

Participants were purposefully selected from the Express Harvesting LLC, Gonzales, CA packing facility employees. Express Harvesting LLC was a separate packing entity of Growers Express LLC. Both companies are under the same owners and are operated by the same executive, management, and food safety team. The facility offered a more controlled environment with this group of subjects than a field setting would. This particular Express Harvesting LLC facility packs Brussels sprouts, broccoli, broccollette, cauliflower, herbs, and baby romaine for shipment and sale. There were 108 ($N=108$) employees working at the packing facility at the time of the study. Leedy and Ormrod (2013) suggested that for a population of one hundred, 100% should be sampled. Therefore, one hundred percent of the population was asked to participate in the study. Based on employment records and statements from Growers Express management, these participants demographically represented the total population of all employees involved in vegetable production, harvest, and packing at Growers Express.

Demographics for all subjects were collected using a self-reported survey. These demographics included age, education level, years employment in the vegetable industry, years employment with Express Harvesting, and preferred language.

Sampling Procedure

All packing employees working in the Express Harvest facility were invited to participate in this study. The employees who agreed to participate were assigned to one of two groups (Active training group, $n = 32$; Traditional training group, $n = 37$). Assignment was based on the number of new employees, average age, education level, average years with the company, and sizes of the groups.

Instrumentation

This study examined the influence of differing teaching methods on an existing food safety program. The testing instruments included the pre-test, the post-test, and the reaction survey. All were used to evaluate the training programs' effectiveness in improving food safety knowledge and behaviors. The researcher developed each instrument based on the vegetable company's food safety standard operating procedures (SOPs). The SOPs outlined what employees must know and the procedures they must take in a given situation.

Observations were also made before, during, and after the training period. The researcher focused on 20 key areas of interest identified by Growers Express food safety staff. These observation points have direct ties to the company's SOPs.

The pre-test, post-test, and reaction survey were developed in English. To meet the language needs of the subjects, two competent Spanish speakers familiar with the vegetable production industry translated each instrument to Spanish.

The pre-test was made up of 15 multiple choice questions broken into five sections of three questions each. Each section focused on a specific food safety training area. The areas included in the pre-test and post-test were food security, cross contamination, hand washing, employee illness and injury, and hygiene, clothing, and equipment safety. The same 15 questions in the same format made up the post-test; however, the sections were reordered so that the order of the test sections matched the order that the subjects participated in the trainings. The correct answers within the multiple choice questions were reordered to minimize memory effect.

The reaction survey included ten statements asking the participants to rate their training experience and their interactions with the trainer. A Likert-type scale was used by the subjects to rate their agreement with the statements. The survey asked participants to rate the statements using the following scale: 1- Strongly Disagree, 3- Disagree, 7- Agree, and 9- Strongly Agree. A neutral or opinion response was not included in the response options. Several recognized research methods authors (Gall, Borg, and Gall, 1996; Leedy and Ormrod, 2016) caution on allowing respondents to select a neutral or no opinion response.

Validity and Reliability

The pre-test, post-test, reaction, survey, and observation sheets were developed by the researcher in consultation with educational evaluation specialists. The pre-test and

post-test were also evaluated by education professionals to determine if the educational level of the questions were of an appropriate level of difficulty for the population tested. The instruments were then evaluated for validity and reliability by food safety professionals in the vegetable production industry. These professionals were asked to appraise the instruments for accuracy to the companies SOPs and for translation accuracy. All instrumentation was developed by examining Growers Express LLC and industry standard operating procedures. The instruments were then reviewed by an assessment expert at Montana State University. A panel of three food safety professionals examined the instruments to determine the content and face validity. The panel was made up of experts in food safety and industry SOPs. Based on the steps of instrument development before the study began, a pilot study was deemed unnecessary.

Data Collection Procedures

Treatments

Demographic Survey: The participants were asked to self-identify their age, education level, time in the vegetable industry, time at Express Harvesting LLC, and preferred language. The participants' demographics were collected for two reasons. First, they were collected so that the participants could be assigned to the two groups with the goal of making the two groups equal. Assignment was based on the number of new employees, average age, education level, average years with the company, and sizes of the groups. The second reason the demographics were collected was because all of the factors collected impact how an individual learns and views a training program.

Pre-test: A pre-test was given to participants in both groups to determine their food safety knowledge before training.

Trainings: The trainings were a series of sessions covering various food safety topics from the company's SOPs. The treatment group participated in the training portion of the study with active learning teaching methods used. The control group participated in the training portion of the study with traditional teaching methods used.

The traditional trainings were designed to cover the necessary material quickly in a non-traditional setting. For example, the trainer would arrive to a field harvesting crew. The crew would stop working and walk to the edge of the field where the trainer was parked. The trainer would gather the crew around in a circle and begin explaining the material. The material was explained in a lecture style with no visuals or participation from the audience. Once the trainer was through all the material the crew would return to working the field and the trainer would move to the next crew and repeat the process.

The active learning trainings were designed to cover the same material as the traditional trainings but with an emphasis on demonstrations, audience participation and incorporating active learning strategies. For example, during the cross contamination training, the trainees were split into small groups and given a large piece of paper and markers. They were then asked to draw as many contamination issues they could think of in five minutes. The groups then displayed their drawings to the other groups and explained what they had drawn. During the food security training, the trainees were asked to develop short skits to present to the other groups. The skits were to be focused on a food security issue that the subjects had noticed within the packing facility. While one

group was presenting their skit, the other groups were to be guessing what was happening.

Reaction Survey: The active training and traditional training groups completed a survey to assess the participants' reactions to the training sessions at the end of the training period.

Post-test: Both groups participated in the post-test employee evaluation portion of the study to assess their food safety knowledge after all trainings were completed.

Observations: Both groups' safe food handling behaviors were observed before the training sessions began, once every two weeks, and after all training sessions were completed, for a total of 4 observations per group. The researcher walked through the facility making observations based on the 20 observation points in Figure 3.1.

Observations lasted a minimum of 20 minutes for each of the scheduled observations. Scheduled observations were conducted starting at 10:00 AM. Observations that did not fit the 20 points of interest were also recorded. Observations made on not scheduled observation days were recorded as well.

Observation Points

Cross Contamination

1. No food or drink in packaging facility.
2. All contaminated food is treated properly (washed or thrown away).
3. No cartons or packaging touching the floor.

Food Security

4. All doors are closed and locked to the outside (except main office entrance and employee entrance).
5. All visitors asked to sign in with office.
6. No cameras or phones are allowed inside the packaging facility without written approval from Express Harvesting.

Hygiene, Clothing, Equipment

7. All subjects and visitors wearing gloves, hairnets, and helmets.
8. All subjects and visitors clothing is properly cared for (no bedazzles, clean, and very limited torn clothing).
9. No subjects or visitors are wearing jewelry (except plain wedding band).
10. All subjects or visitors sanitize gloves and step in foot wash before entering packaging facility.
11. All work knives and aprons are stored and sanitized properly while subjects are not using them.
12. Work areas are maintained in a clean manor and all equipment is sanitized before beginning work each day (check logs).
13. All chlorine and water logs are up to date and filled out correctly (check daily logs).

Hand Washing

14. All subjects washed hands before returning to work after break time.
15. All subjects wash hands after any contamination incident (touching contaminated product, touching the floor or something that touched the floor, and coughing or sneezing into hands).
16. All subjects and visitors wash hands after using restroom (assumed subjects and visitors wash hands in bathroom but need to wash again at main hand wash area before entering packaging facility).

Injury Illness

17. No ill subjects are working in packaging facility.
 18. All injuries are handled correctly (cleaned and covered, machinery and equipment is sanitized, and contaminated product is disposed of).
 19. All subjects working in safe manor.
 20. No subjects are coughing or sneezing into food or hands.
-

Figure 3.2. Specific observation points used when recorded observations were made. These points of interest were determined by food safety staff and are aligned to company SOPs.

Subject identification numbers were used to keep track of data. Subjects created their own identification numbers to use on assessments. Subject identification numbers were kept confidential and were never connected to the names of the subjects. Data from each instrument was collected from each subject. Scores on the pre-tests and post-tests were recorded and organized in Microsoft Excel. The reaction survey results, demographic information, and observation data was also recorded and organized in Microsoft Excel.

Data Analysis Procedures

The active training group and the traditional training group were compared to determine the influence of the different training method on subjects' food safety knowledge and safe food handling behaviors. The results of each data collection instrument were analyzed separately to triangulate final results and conclusions.

The analysis of variance (ANOVA) is used to compare two or more independent samples and to determine if differences in means are statistically significant (Ravid, 2011). When using ANOVA tests it is assumed that groups are independent, the dependant variable is measured on an interval or ratio scale, the dependant variable is normally distributed, the scores are random samples from their population, and the variances of the populations are drawn equal (Ravid, 2011). Ravid (2011) stated "ANOVA is considered a robust statistic and can stand some violation of the third and fourth assumptions..." (p. 158) The significance level was set at $p < .01$ for all analyses of variance (ANOVA) used in analyzing the collected data. The significance level was set

at $p < .01$ because the sample size was small. Effect size was calculated each time an ANOVA was run. Effect size was reported as eta squared (η^2). Cohen (1992) states that for a one-way ANOVA, $\eta^2 = 0.01 - 0.06 =$ small effect size, $\eta^2 = 0.06 - 0.14 =$ medium effect size, and $\eta^2 > 0.14 =$ large effect size.

Pre-test

The pre-test and post-test consisted of five sections. Each section had questions focused on the specific training areas. Each section of the pre-test was graded separately to give a section score for each employee. The section scores were also tallied to give a total score for the pre-test. Each section was worth a maximum of three points (one point per question) and the maximum total test score was 15. Pre-test scores from the active training group were compared to pre-test scores from traditional group using a one-way analysis of variance test (ANOVA) to determine if the two groups were comparable. This was done for each section as well as for total pre-test scores.

Post-test

In the same manner as the pre-tests, the post-tests were scored by section and tallied for a total score. The post-test scores from both groups were compared using a one-way ANOVA to determine if the groups' post-test scores for each section and total were comparable.

Pre-test to Post-test

The pre-test scores from each group were compared to their post-test scores using a one-way ANOVA. This test was used to determine if significance existed between a

group's pre-test scores and the group's post-test scores. This was done for each section as well as for total post-test scores.

Reaction Survey

The training reaction survey completed by the participants from the active training group and the traditional group were analyzed to determine how the participants reacted to the training sessions. Each of the 10 survey questions were analyzed for central tendency and variability. Boone and Boone (2012) suggest using median or mode to analyze central tendency and frequencies to analyze variability.

Observations

Before, during, and after training observations were compared to determine influence of the trainings on the subjects' safe food handling behaviors. The goal of the observations was to note when the subjects recognized issues in the ways they work that could lead to contaminated product, food security concerns, unsafe work conditions, or other food safety issues. When the participants were observed doing something against company SOPs, the researcher highlighted that observation. In the following observation periods the researcher checked to see if the issues had been resolved or the employee behaviors had changed. The goal was to observe subject behaviors changing in areas directly related to training material.

A mixed methods approach was designed to fully address the four levels of Kirkpatrick's (2006) model of training evaluation. The purpose of this study was to determine the influence of active learning teaching strategies on the Growers Express

LLC food safety training program among vegetable packing employees. The mixed method design allowed for triangulation and assessment of the training program from different angles.

RESULTS

In this chapter I presented the results of the study. I explained the group assignments and demographic survey results. I then presented the scores from the food safety pre-test and post-test. Results of the training reaction survey were then described. Lastly, the observation results are explained.

Sampling

Due to company standards and industry regulations all food handling employees are required to be trained in food safety. For purposes of this research, employees were interchangeably referenced as either research subjects or research participants. The participating subjects were asked to go above the standard training procedure by participating in the testing portion of this study. Of the 108 ($N = 108$) food handling packing facility employees that made up the population for this study, 69 ($n = 69$) signed the Institutional Review Board form agreeing to complete all trainings and assessment instruments. Participants were divided into two groups, based on results from the demographic survey; it was important to ensure relatively equal age, education level, and employment ranges within each group. The active training group began the study with 32 subjects but due to testing mortality, 27 ($n = 27$) subjects completed all parts of the study. The traditional training group began the study with 37 subjects but due to participant mortality, 34 ($n = 34$) subjects completed all parts of the study. Participant mortality in both groups included employees that no longer worked in the packing facility and subjects that did not complete each of the required study components: pre-test, post-test,

reaction survey, or demographic survey. The effective response rate for this research was 88.4%; 39.1% were in the treatment group and 49.3% were in the control group.

Demographic Survey

All participants were asked to self-identify their age group, highest level of education completed, number of years employed in the vegetable industry, number of years employed by Express Harvesting, and preferred language. The active training group's most frequently chosen (44%) age group was 35-44 years old. The traditional group also selected the 35-44 years old most frequently (38%). The overwhelming majority of both the treatment and control groups (86% and 92% respectively) reported completing high school or less. Both groups had subjects that ranged from ten or more years of work in the vegetable industry to less than one year of experience. A majority of the participants in both groups had worked for Express Harvesting for less than five years (active group 85%; traditional group 97%). Approximately 90% of all participants reported Spanish as their preferred language. The remaining 10% of participants reported Spanish and English as their preferred language. No participants chose English only as their preferred language. Complete demographic data for the treatment and control groups was reported in Table 4.1.

Table 4.1 *Demographic Data Summary for all Subjects*

Category	Treatment (Active Training) (<i>n</i> = 27)		Control (Traditional Training) (<i>n</i> = 34)	
	<i>f</i>	%	<i>f</i>	%
Age Group				
18-24	3	11	5	15
25-34	5	19	8	21
35-44	12	44	15	38
45-54	6	22	3	9
>55	1	4	3	9
Education Completed				
Grade School	8	30	16	47
Some High School	5	19	4	12
High School	10	37	13	38
Trade School	2	7	0	0
Some College	1	4	0	0
College Degree	1	4	1	3
Time In Vegetable Industry				
< 1 year	3	11	5	15
1-3 years	6	22	10	29
3-5 years	3	11	7	21
5-10 years	6	22	6	18
> 10 years	9	33	6	18
Time Employed by Express Harvesting				
< 1 year	11	41	21	62
1-3 years	10	37	10	29
3-5 years	2	7	2	6
5-10 years	4	15	0	0
> 10 years	0	0	1	3
Preferred Language				
Spanish	24	89	31	91
English	0	0	0	0
Spanish and English	3	11	3	9

Note: All data was self-reported by participants.

Knowledge Pre-test and Post-test

Participants completed the 15 question multiple choice test twice, once before the training sessions and once after the training sessions. A one-way analysis of variance was used to determine if statically significant differences were present between the treatment group's pre-tests and the control group's pre-tests, the control group's post-tests and the treatment group's post-tests, the treatment group's pre-tests and post-tests, and the control group's pre-tests and post-tests. Separate one-way ANOVAs were used to analyze each test section as well as the total test score.

Pre-test to Pre-test

Table 4.2 displays the pre-test means and standard deviation. The mean scores reveal the pre-treatment knowledge of both groups was similar. Interestingly, the mean scores on the illness and injury section of the pre-test for both groups was the same ($M = 2.59$). The review of the standard deviations within each test section shows there were not large differences for pre-test scores within the groups.

Table 4.2 *Pre-test to Pre-test Mean Scores*
(Treatment group $n = 27$; Control group $n = 34$)

Test Section	<i>M</i>		<i>SD</i>	
	Active Group	Traditional Group	Active Group	Traditional Group
Cross Contamination	2.07	2.41	0.78	0.61
Food Security	2.67	2.74	0.78	0.51
Hygiene, Clothing, Equipment	1.81	1.71	0.56	0.68
Hand Washing	2.11	2.24	0.97	0.70
Illness and Injury	2.59	2.59	0.57	0.56
Total Test Score	11.26	11.68	2.23	1.79

Table 4.3 shows the results of the one-way analysis of variance between the treatment groups and the control groups' pre-test scores. Upon running the ANOVA test, there was no statistically significant ($p < .01$) difference between the active group's and the traditional group's pre-test scores for any section. As expected, the F ratio for the illness and injury pre-test section was 0.00 and the p value was approaching 1, showing almost no difference between the two groups.

Table 4.3 *Pre-test to Pre-test One-way ANOVA*
(Treatment group $n = 27$; Control group $n = 34$)

Test Section	$F(1,59) =$	p	η^2
Cross Contamination	3.60	.063	.058
Food Security	0.17	.682	.003
Hygiene, Clothing, Equipment	0.46	.502	.008
Hand Washing	0.34	.565	.006
Illness and Injury	0.00	.976	.000
Total Test Score	0.66	.420	.011

Post-test to Post-test

When comparing the treatment and control subjects' scores on the post-test, several notable differences were revealed (Table 4.4). In the hand washing test section the participants in the active training group scored higher on average ($M = 2.93$, $SD = 0.27$) than the participants in the tradition group ($M = 2.65$, $SD = 0.49$). Similarly, the active training group scored higher ($M = 13.52$, $SD = 1.25$) on the total test score than the traditional group ($M = 12.44$, $SD = 1.67$).

Table 4.4 *Post-test to Post-test Mean Scores*
(Treatment group $n = 27$; Control group $n = 34$)

Test Section	<i>M</i>		<i>SD</i>	
	Active Group	Traditional Group	Active Group	Traditional Group
Cross Contamination	2.70	2.50	0.47	0.66
Food Security	2.96	2.88	0.19	0.33
Hygiene, Clothing, Equipment	2.22	1.97	0.58	0.58
Hand Washing	2.93	2.65	0.27	0.49
Illness and Injury	2.70	2.44	0.47	0.66
Total Test Score	13.52	12.44	1.25	1.67

The test for analysis of variance reflected there was a statistically significant difference between the treatment and control groups when comparing post-test scores. Participants in the active group scored statistically higher ($p < .01$) than their peers in the traditional group on the hand washing test section $F(1,59) = 7.180$, $p = .009$, ($\eta^2 = .108$). Further, the eta squared (η^2) effect size ($\eta^2 = .108$) suggested a moderate practical significance. As was indicated from the means for the total test scores, the statistical analysis showed a statistically significant difference between treatment and control on the total test score $F(1,59) = 7.741$, $p = .007$, ($\eta^2 = .116$). The effect size for the total test score ($\eta^2 = .116$) also suggested a medium level of practical significance.

Table 4.5 *Post-test to Post-test One-way ANOVA*
(Treatment group $n = 27$; Control group $n = 34$)

Test Section	$F(1,59) =$	p	η^2
Cross Contamination	1.83	.181	.030
Food Security	1.28	.262	.021
Hygiene, Clothing, Equipment	2.86	.096	.046
Hand Washing	7.18	.009*	.108
Illness and Injury	3.06	.086	.049
Total Test Score	7.74	.007*	.116

* $p < .01$

Treatment Group's Pre-test to Post-test

The active training group's overall mean scores from pre-test to post-test increased in every section (Table 4.6). Of particular note was the hand-washing section in which the post-test mean was 0.82 points higher than the pre-test mean. There was also a gain of 0.63 points on the cross contamination section of the test from pre-test to post-test.

Table 4.6 *Treatment Group Pre-test to Post-test Mean scores (n = 27)*

Test Section	<i>M</i>		<i>SD</i>	
	Pre-test	Post-test	Pre-test	Post-test
Cross Contamination	2.07	2.70	0.78	0.47
Food Security	2.67	2.96	0.78	0.19
Hygiene, Clothing, Equipment	1.81	2.22	0.56	0.58
Hand Washing	2.11	2.93	0.97	0.27
Illness and Injury	2.59	2.70	0.57	0.47
Total Test Score	11.26	13.52	2.23	1.25

Table 4.7 summarizes the data revealing the active training group scored statistically higher ($p < .01$) on the cross contamination $F(1,52) = 12.96$, $p < .001$, ($\eta^2 = .199$), the hand washing $F(1,52) = 17.58$, $p < .001$, ($\eta^2 = .253$) sections, and on the total test score $F(1,52) = 21.09$, $p < .001$, ($\eta^2 = .289$) during the post-test compared to the pre-test. It was noteworthy that the p values for the cross contamination, hand washing, and total test score sections exceeded the set significance level of $p < .01$ and reached a higher significance level of $p < .001$. It was also noteworthy that the effect size for each of these test sections suggested a large level of practical significance ($\eta^2 > 0.14$).

Table 4.7 *Treatment Group Pre-test to Post-test One-way ANOVA (n = 27)*

Test Section	$F(1,52) =$	p	η^2
Cross Contamination	12.96	<.001**	.199
Food Security	3.63	.062	.065
Hygiene, Clothing, Equipment	6.96	.011	.118
Hand Washing	17.58	<.001**	.253
Illness and Injury	0.61	.437	.012
Total Test Score	21.09	<.001**	.289

* $p < .01$, ** $p < .001$

Control Group Pre-test to Post-test

The traditional training group's mean scores increased from pre-test to post-test in all but the injury and illness section, where scores actually decreased from pre-test to post-test. The control group's mean total test scores also increased from pre-test to post-test. The average mean gains were 0.15 points, including the injury and illness section and excluding the total test score section. The traditional group's mean test scores can be found in Table 4.8.

Table 4.8 *Control Group Pre-test to Post-test Mean scores (n = 34)*

Test Section	M		SD	
	Pre-test	Post-test	Pre-test	Post-test
Cross Contamination	2.41	2.50	0.61	0.66
Food Security	2.74	2.88	0.51	0.33
Hygiene, Clothing, Equipment	1.71	1.97	0.68	0.58
Hand Washing	2.24	2.65	0.70	0.49
Illness and Injury	2.59	2.44	0.56	0.66
Total Test Score	11.68	12.44	1.79	1.67

The traditional training group received statistically significant ($p < .01$) difference between their pre-test ($M = 2.24$, $SD = 0.70$) and post-test ($M = 2.65$, $SD = 0.49$) scores on the hand washing section $F(1,66) = 7.97$, $p = .006$, ($\eta^2 = .108$) of the test. It was

noteworthy that the effect size ($\eta^2 = .108$) suggested moderate practical importance. The one-way ANOVA results for each test section of the traditional training group's pre-test to post-test comparison can be found in Table 4.9

Table 4.9 Control Group Pre-test to Post-test One-way ANOVA (n = 34)

Test Section	$F(1,66) =$	p	η^2
Cross Contamination	0.33	.570	.005
Food Security	2.00	.162	.029
Hygiene, Clothing, Equipment	3.02	.087	.044
Hand Washing	7.97	.006*	.108
Illness and Injury	0.99	.324	.015
Total Test Score	3.32	.073	.048

* $p < .01$

Training Reaction Survey

The instrument was given to the subjects after they had completed all of the training sessions as well as the post-test. The survey consisted of ten statements which the participants were asked to rate their agreement or disagreement using the following Likert-type scale: 1- Strongly Disagree, 3- Disagree, 7- Agree, 9- Strongly Agree. Following Boone and Boone's (2012) recommendation, each question was analyzed for central tendency using median and variability was assessed using frequencies. The treatment group's median was nine on all but one of the statements when the median was a seven. The statement was "the content of the training was new information to me." The control group's median was a nine on eight of the ten statements. Their median was a seven for "the content of the training was new information to me" and an eight for "the trainer had a strong understanding of the information being presented." It was noteworthy

that the treatment group had six subjects choose disagree on the new information statement. The subjects from the treatment group did not chose disagree or strongly disagree on any other statement. The control group had subjects chose disagree or strongly disagree on eight of the ten statements. The treatment and control group's reaction survey medians and frequencies can be found in Table 4.10.

Table 4.10 *Treatment and Control Groups' Reaction Survey Results*
(Active group $n = 27$; Traditional group $n = 34$)

Question	Active Group			Traditional Group		
	<i>Mdn</i>	<i>f</i>	%	<i>Mdn</i>	<i>f</i>	%
1. The content of the trainings was important to my job						
Strongly Agree	9	24	89%	9	21	62%
Agree		3	11%		13	38%
Disagree		0	0%		0	0%
Strongly Disagree		0	0%		0	0%
2. The trainings added to my food safety knowledge						
Strongly Agree	9	18	67%	9	20	59%
Agree		9	33%		12	35%
Disagree		0	0%		1	3%
Strongly Disagree		0	0%		1	3%
3. The content of the trainings was new information to me						
Strongly Agree	7	11	41%	7	15	44%
Agree		10	37%		15	44%
Disagree		6	22%		3	9%
Strongly Disagree		0	0%		1	3%
4. I plan on using the content of the trainings at my job						
Strongly Agree	9	25	93%	9	27	79%
Agree		2	7%		6	18%
Disagree		0	0%		0	0%
Strongly Disagree		0	0%		1	3%

Table 4.10 – Continued

5. I enjoyed attending the trainings						
Strongly Agree	9	22	81%	9	26	76%
Agree		5	19%		8	24%
Disagree		0	0%		0	0%
Strongly Disagree		0	0%		0	0%
6. The trainer had a strong understanding of the information being presented						
Strongly Agree	9	21	78%	8	17	50%
Agree		6	22%		14	41%
Disagree		0	0%		1	3%
Strongly Disagree		0	0%		2	6%
7. The trainer was excited about the training						
Strongly Agree	9	24	89%	9	20	59%
Agree		3	11%		11	32%
Disagree		0	0%		2	6%
Strongly Disagree		0	0%		1	3%
8. The trainer provided 1 or more opportunities to practice new information/skills						
Strongly Agree	9	22	81%	9	19	56%
Agree		5	19%		13	38%
Disagree		0	0%		1	3%
Strongly Disagree		0	0%		1	3%
9. The trainer's attitude was positive						
Strongly Agree	9	24	89%	9	22	65%
Agree		3	11%		11	32%
Disagree		0	0%		1	3%
Strongly Disagree		0	0%		0	0%
10. The trainer did a good job teaching me the content of the trainings						
Strongly Agree	9	25	93%	9	23	68%
Agree		2	7%		10	29%
Disagree		0	0%		1	3%
Strongly Disagree		0	0%		0	0%

Behavior Observations

Observation data was collected once before the training sessions, twice during, and once after the training sessions were completed. The goal of the observations was to note when participants recognized issues in the ways they work that could lead to contaminated product, food security concerns, unsafe work conditions, or other food safety issues. In an effort to minimize internal validity concerns, I used unobtrusive observation measures; the Hawthorne effect is an example of reactivity in which subjects modify behavior when they believe they are being observed (Leedy and Ormrod, 2016). In performing the observations, I walked through the facility dressed as an employee, carrying the standard clipboard of a food safety monitoring employee. The subjects did not know if they were seeing me as a fellow employee or as a researcher. When the subjects were observed doing something against company SOPs I highlighted that observation. In the following observation periods I checked to see if the issues had been resolved or the employee behaviors had changed. The goal was to observe subject behaviors changing in areas directly related to training material. Due to having scheduled observation days and not being at the packing facility every day, it was not possible to observe the exact moment or day that a change in behavior happened. Although this limitation decreased the effectiveness of the behavior observations there were still a few key observations.

Observations Applied to Both Groups

On July 8th, I observed the doors leading into the facility were unlocked to the outside, anyone (employee or not) could enter the facility without checking into the office. This observation applied to both groups as not one specific group was assigned to this task. The company SOPs state that employees must enter through the designated employee entrance and visitors are required to enter through the main office and check in.

On July 22nd, all extra doors were locked so that the only open entrances were the main office door, the employee entrance and the shipping office door. According to the company SOPs all of these entrances were allowed to be unlocked as long as visitors were directed to the main office before they entered the production areas.

On July 8th and July 22nd, visitors to the facility were observed entering through the employee entrance and walking through the washroom to access the main office.

On August 5th and 12th, no visitors were observed entering through the employee entrance. I observed two visitors use the main office door on each of these dates during the scheduled observation period. From August 5th forward all visitors were asked to check in with the office and were escorted to their proper entrance.

On August 7th, a visitor was not required to wear gloves while touring the facility. This visitor was wearing a required hairnet and helmet.

On all observation days, subjects were observed washing their hands before beginning work, after breaks, and after using the restroom. Although, the subjects were not scrubbing their hands for the 20 seconds that company SOPs state.

Active Training Group Observations

On July 8th, approximately 10 packaging bags were observed on the floor. The subject at that station picked them up, threw them all away, replaced their gloves and continued working. This is the correct procedure for the incident.

On July 22nd, one subject was observed not wearing the proper gloves. They were wearing white cotton gloves but were not wearing nitrile gloves. Nitrile gloves are required by company SOPs and industry regulations.

On August 5th, five cartons of broccoli were knocked over and spilled on to the floor. The product was thrown away, the cartons were discarded, and the participant that cleaned up the broccoli replaced their gloves.

On August 5th, a participant was observed coughing or sneezing into the crook of their arm facing away from the production area. According to the company SOPs, the crook of the arm is the preferred place to cough or sneeze if it is a must.

A few times throughout the training period I noticed that participants from the active group had asked what the next training activity was going to include. It seemed that they were interested in the trainings and wanted to know what the activities were going to be. I did not observe participants from the traditional group asking questions like those.

Excluding the specific observations described previously, the active training group was not observed with food or drinks in the facility, with cameras or phones, with unapproved clothing, or with jewelry. No employees were observed that were ill or injured and no participants were observed working unsafely. No employees were

observed avoiding the required foot wash at the entrance of the packing area. All employees stored their knives and other equipment properly and the chlorine and water logs were filled correctly. During the training period, all equipment sanitation logs were up to date and filled correctly.

Traditional Training Group Observations

On all observation days, it was observed that the Brussel's sprout size sorting machine spilled product and debris onto the floor. An employee from the control group was assigned to clean up the spilled product and debris and throw it away so that it was not packed.

On July 8th, there was a control employee inside the packing facility wearing his beard net around his neck instead of covering his facial hair. Industry standards and company SOPs regulate that all hair must be covered.

On August 12th, three empty cartons fell on the floor of the packaging area. The cartons were thrown away and the employee that picked them off the floor replaced their gloves.

Excluding the specific observations described previously, the traditional training group was not observed with food or drinks in the facility, with cameras or phones, with unapproved clothing, or with jewelry. No subjects were observed that were ill or injured and no participants were observed working unsafely. No subjects were observed avoiding the required foot wash at the entrance of the packing area. All subjects stored their knives and other equipment properly and the chlorine and water logs were filled correctly.

During the training period all equipment sanitation logs were up to date and filled correctly.

CONCLUSIONS AND RECOMMENDATIONS

Discussion

In this chapter I discussed the results of the study, drew conclusions, and provided recommendations for food safety professionals as well as for further research. At the end of this chapter I discussed the implications of the study.

Demographics

The participants' demographics were collected for two reasons. First, they were collected so that the participants could be assigned to the two groups with the goal of making the two groups equal. Assignment was based on the number of new employees, average age, education level, average years with the company, and sizes of the groups. The second reason the demographics were collected was because all of the factors collected impact how an individual learns and views a training program. For example, younger subjects may enjoy a faster paced training with more activities than an older employee. Another factor collected by the demographic data was education level completed. This was an important data point to collect because knowing the education level of the trainees is a factor when designing trainings and how in-depth the information provided should be. Data on the participants' time in the vegetable industry and time employed by Express Harvesting was important to determine the amount of previous food safety training a participant had received either with Express Harvesting or another company. Preferred language was collected because it has a large impact on how material is communicated. For example, if an employee only spoke English but the

training was in Spanish that employee would not be able to access the material. It is vitally important to know the targeted audience when developing training programs. These data points could be used to adapt a training program to best fit the target population.

Kirkpatrick and Kirkpatrick's Level 1

The goal of the level 1 reaction survey was to assess the subjects' reaction to the training program. The reaction survey resulted in frequencies showing a positive reaction from both groups in all of the areas surveyed. The positive results from the reaction survey could be interpreted as the participants from the active training group as well as the participants from the traditional training group enjoyed the trainings they participated in. "Although a positive reaction does not guarantee learning, a negative reaction almost certainly reduces its possibility" (Shenge, 2014, p. 55).

The lowest level of agreement for both groups came on the statement "the content of the trainings was new information to me." Both groups had a majority of subjects that have been in the vegetable industry for at least one year. Because food safety training is mandatory at every vegetable company, it is likely that these employees had been trained on similar topics before this training series.

Kirkpatrick and Kirkpatrick's Level 2

The goal of the level 2 learning assessment was to determine the gains made by the groups from the pre-test to the post-test. Prior to this research project the mandated training program had been accomplished by Growers Express LLC, but no systematic

effort to assess knowledge had been used. The level 2 knowledge assessment yielded significant results. When the treatment group's pre-test was compared to the control group's pretest there was not a statistically significant difference. The two groups were starting the training program with approximately the same amount of previous knowledge.

Comparisons of the post-test scores from both groups showed that the active group achieved significantly higher scores on the handwashing section of the post-test as well as on the overall post-test score. The higher scores on the handwashing section support the findings of Lillquist et al. (2005). The handwashing training for both groups included the trainer demonstrating proper handwashing techniques and the subjects practicing their handwashing technique. On top of the trainer demonstration, the active training group used Glo Germ lotion and a black light to allow subjects to practice washing their hands and review how they did. The Glo Germ lotion glowed under the black light and showed areas that were missed during the hand washing. The participants in the active group were able to see the results of how good or bad hand washing techniques affected the amount of simulated germs that remained on their hands. The extra practice and active interaction with the content of the training resulted in higher post-test scores for the active training group than the traditional group that did not use the Glo Germ lotion during their handwashing training.

Although both groups did well on the post-test overall, the active training group on average scored higher on the post-test total score than the traditional training group.

The active training group was able to outscore the traditional group on every section leading to a significantly ($p < .01$) higher total score.

The active training group improved their mean scores from the pre-test to the post-test in all of the test sections. They significantly improved in the cross contamination and handwashing training, as well as in the total test scores. The improvement in all of the test section shows that the active training program as a whole worked to increase participant knowledge. The active cross contamination training included an activity in which the participants used a large piece of paper to draw possible contamination incidents. This activity allowed the participants to brainstorm possible contamination issues as well as discuss how those incidents could be avoided. For example, one of the participants drew a picture of a person chewing gum while working inside the facility. The group then discussed that gum was not allowed at work and why that rule was in place.

The traditional training group also improved their mean scores from the pre-test to the post-test in each of the test sections. The traditional group's scores were significantly ($p < .01$) higher in the handwashing section of the test. Quality handwashing is essential to food safety and the most common way to train an employee to effectively wash their hands is to demonstrate the technique to them and then let them practice. The handwashing training was the only training that included an activity for the traditional group. The activity of practiced handwashing is common practice among food safety training programs and was included in the traditional training group for this reason. During the training, the subjects practiced washing their hands under the supervision of

the trainer. This group did not use the Glo Germ lotion and thus were not able to see the areas they miss while washing their hands. It was interesting to see that the only section that the traditional group received significant gains in was the section that included an activity for the subjects to participate in.

Kirkpatrick and Kirkpatrick's Level 3

The goal of the level 3 observations was to determine if the subjects were recognizing food safety issues in the way the facility was run, applying what they learned during the training sessions, and changing their behaviors to fix the issues. There was an expectation on the part of Growers Express LLC that, regardless of training method, their employees would meet at least the minimum knowledge expectation once training was completed.

Before the training program began, I observed extra doors unlocked and that visitors were entering through doors other than the main office door that they should have been using. The first training session that the groups went through was on food security. This training included discussing facility entrances, visitors, and reporting suspicious activity to the management team. During the second scheduled observation I noticed that the extra doors were locked. This change in behavior could not be applied to just one of the groups, but it did show that the subjects changed the way they were looking at the doors and what could happen if they remained unlocked.

I also observed that before the training sessions began visitors were entering the facility through the employee entrance instead of through the main office entrance. A couple of weeks after the food security training, I observed the subjects referring visitors

to the main office door instead of allowing them to enter through the employee entrance. Along with this, during the food security training, the participants suggested that a full time security employee should be hired to check doors and locks throughout the facility and to check-in visitors at the entrances. The management team agreed and added this position to the facility staff. The added security member aided in directing visitors to the main office and was tasked with observing for suspicious activity by employees or visitors.

During each of the scheduled observation days I observed subjects from both groups washing their hands before entering the facility. I noted that the subjects were not scrubbing their hands with soap for the 20 seconds defined in the company's SOPs and practiced during the hand washing training. When asked why they did not wash their hands for 20 seconds, they responded that their supervisors would write them up for being late if they spent that much time washing their hands. Conversations like these highlight the conflict between food safety and fast paced, quantity driven production.

After the cross contamination and equipment trainings had been completed by both the active and traditional groups, I observed packaging and/or product fall onto the floor. Both groups' subjects handled the situation quickly and correctly. They picked up the spilled packaging and product and threw them away. They then replaced their gloves that had touched the contaminated items.

Kirkpatrick and Kirkpatrick's Level 4

The results level of Kirkpatrick's model of training evaluation were the most difficult to evaluate in this study. Level 4 is concerned with the return on investment of

training. In food safety, this looked like reduced risk of contaminated food, safer products, and educated employees (people in contact with food). A food safety training program costs the company time and money, but it may result in lower costs to the company if an incident occurred and product had to be recalled and thrown out or customers became ill and needed to be compensated. It is impossible to determine if a food safety incident was avoided because a food safety training program was in place. Food safety incidents can occur at any time and at a variety of locations during the production, harvesting, packing, and shipping process. Therefore, it is essential that training programs exist at all levels to reduce the risk of costly contamination incidents. Growers Express LLC food safety staff was not willing to risk consumers becoming ill or employees getting injured, so all food contact employees were trained.

Although incorporating active learning techniques into the food safety training program cost the company more money and increased the amount of time employees were away from production, the results of this study showed that the return on the increased cost of training was more knowledgeable employees than when traditional training methods were used.

During the final post-training scheduled observation, I observed zero food safety incidents in the treatment group while I observed one food safety incident in the control group. The food safety incident in the control group was handled in accordance to the proper procedures. I cannot conclude that the treatment group avoided food safety incidents better than the control group. I cannot conclude this because often incidents were simple mistakes that could be made by anyone at any time. As long as they were

handled correctly there was no potential harm to consumers. I did not observe any critical errors made by either group during the duration of the study.

As stated in the introduction of this study, “the goals of the active trainings were to cover the necessary material, actively involve the employees, and build employees’ investment in the food safety training program to build a culture of food safety within the company.” The results of this study cannot be tied directly to these goals, but the subjects’ food safety knowledge increased, they were involved in the active trainings, were asked to participate in the trainings rather than just listen, and the subjects’ food safety concerns were able to be expressed. Allowing the subjects to express their concerns helped them feel involved in the food safety improvements that could be made. It also helped the subjects become involved in the building of a food safety community throughout the company.

Conclusions

The purpose of this study was to determine the influence of active learning teaching strategies on the Growers Express food safety training program among packing employees in the Salinas Valley of California using Kirkpatrick’s four level model of training evaluation. The following objectives were developed as a means toward accomplishing the purpose:

1. Assess subjects’ reactions to the mandatory training program.

The subjects’ reactions to the training were overall positive. On all but one of the ten statements from the reaction survey the treatment group rated their experience higher

than the control group. I concluded that both the active and traditional training methods used were positively received by the subjects, but the subjects enjoyed the active trainings more.

2. Assess subjects' food safety knowledge prior to participating in the mandatory training program.

The subjects' food safety knowledge was assessed prior to the beginning of the training program using the pre-test. This pre-test showed that although the participants from both groups knew a fair amount of food safety facts and procedures, there was still room for improvement. An unexpected conclusion was drawn; despite the training method used it was important to assess the subjects' knowledge prior to the beginning of the trainings. This pre-assessment allowed the trainer to gauge the information that the subjects knew and to target trainings to the prior knowledge while maintaining the federal training guidelines.

3. Determine the food safety training program's influence on subjects' knowledge and behaviors.

The study reported here used Kirkpatrick's four level model of training evaluation to determine the influence of active learning strategies on food handling employees' reactions, knowledge behavior, and the training programs results in terms of benefits to the company. Although increased performance on a multiple choice knowledge tests does not prove how employees will perform, it does show that they know the correct protocol (Lillquist, McCabe, Church, 2005). Similarly to the conclusions of Lillquist, et al, I concluded that a food safety training program that incorporates active learning techniques

can result in higher food safety knowledge test scores from employees than traditional training methods. I also concluded that both the active training and traditional methods can increase test score gains from the pre-training test to the post-training test.

Based on the observation results of this study, I concluded both food safety training methods influenced the way subjects behave on the job. The subjects from both the treatment and control groups recognized potential food safety issues and addressed them promptly and correctly. Educational research suggests that active learning strategies can increase students' participation, learning, and can lead to changes in behavior. It is important to apply those principles to all educating formats, formal or non-formal. The vegetable industry provides opportunities to incorporate active learning techniques into their food safety training programs.

The addition of active learning teaching strategies positively influenced the subjects' reactions to the training program, increased test scores on the food safety knowledge exam, enhanced the subjects' on job behaviors and actions, and improved the overall effectiveness of the program. The subjects trained in food safety using active learning methods were able to avoid food contamination and food security incidents. Food safety incidents are costly to food production, processing and food preparation companies as well as the end consumers who can become ill.

Recommendations

The first recommendation, based on conclusions from this study, is that vegetable production, harvesting, packaging, and shipping food safety teams incorporate active

learning strategies into their existing food safety training programs. New trainings should be developed to include active learning methods. The subjects enjoyed the hands on activities, skits, drawings, and demonstrations. Further, each week they were eager to ask what activities they would be trying next. Active learning strategies should be used to increase intellectual excitement and engagement.

Second, I recommend food safety teams utilize pre-assessments (knowledge tests and observations) to determine the level of knowledge and skill of their employees. These pre-assessment results can be used by the trainers to better target individuals with the active learning methods. The results can also be used to identify content areas that need more focus and attention to increase employee knowledge and skills.

I also recommend that more research be conducted on level four of Kirkpatrick's model and how it related to food safety training. Are the inputs related to food safety trainings providing the company with a large enough return to make food safety training worth the costs?

More research is needed in the vegetable industry focusing on the evaluation and improvement of food safety training programs. The risk of contaminated food leading to consumer illnesses and foodborne illness outbreaks is high and a major tool to reduce that risk is the use of quality food safety trainings. At the end of the day, the employees handling the food are the people that can prevent contamination. The better they can be trained and involved in the food safety program, the better off the end consumers are. Specific topics related to food safety training evaluation that need more focused research are new employees with no industry experience, specialized training for supervisors, and

polling trainers to determine the teaching methods they use, how, when, and with whom they use them. In referencing level one of Kirkpatrick's model, I recommend conducting research that includes the food handling employees in the discussion of training program development. Determining their wants, needs, reactions, and preferences pertaining to how and on what content they are trained could lead to more effective training programs and more effective food handlers. Evaluating food safety training programs over more than one season would also be beneficial to the industry. A longitudinal study would allow for the analysis of knowledge retention, employee reactions to the same methods being used repeatedly, and would allow the researcher to examine the changes in the worker population. A longitudinal study may show strong evidence for the adoption of active learning strategies over traditional strategies. I also recommend including multiple production companies in a larger study. Including multiple companies would allow for the comparison of how active learning strategies work in different training systems. Research in these areas would allow trainers to better modify their training programs to meet the needs of their trainees with the goals of improving the safety the food the consumers eat and reducing the risk of contamination leading to food borne illnesses.

Implications

This study has important findings for both the vegetable industry and education. Industry should take note of the increased food safety knowledge and positive reactions to the active trainings. If industry can find a way to increase employee engagement with the food safety content, they can increase the knowledge of their employees and further

reduce the risks of food contamination. Contamination issues are present in food production. Well trained food handlers are one of the ways those risks can be reduced.

The results of this study demonstrate the impact of active learning methods used in the non-formal setting of vegetable packaging. Related research should also be conducted in the production, harvest, and shipping areas of the vegetable industry, as well as in different locations than the Salinas valley of California. Similar research should be conducted in other industries. This would allow training to be tested and possibly improved in a variety of different job areas.

When similar research is considered, I would suggest a similar approach to assessing levels one, two, and three of Kirkpatrick's model of training evaluation but would aim for a larger sample size. I would also suggest a stronger approach to level four, results. I would calculate the costs of providing the two training methods and compare that to the outcome of the trainings. It is important for a company to determine the amount they are willing to spend on training and how much time they are willing to pull their employees away from production to be trained. Providing the company with the results of the study will allow them to see the impact of active learning and evaluate the costs and benefits of incorporating active learning further. I suggest continued research into food safety training to increase the effectiveness of the programs to reduce contamination risks.

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APPENDICES

APPENDIX A

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE REPORT

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI)
STUDENTS CURRICULUM COMPLETION REPORT
 Printed on 09/10/2014

LEARNER	Kyle Gavin (ID: 4374337)
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INSTITUTION	Montana State University
EXPIRATION DATE	09/09/2017

STUDENTS - CLASS PROJECTS : This course is appropriate for students doing class projects that qualify as "No More Than Minimal Risk" human subjects research.

COURSE/STAGE:	Basic Course/1
PASSED ON:	09/10/2014
REFERENCE ID:	13985405

REQUIRED MODULES	DATE COMPLETED
Belmont Report and CITI Course Introduction	09/10/14
Students in Research	09/10/14
History and Ethical Principles - SBE	09/10/14
Defining Research with Human Subjects - SBE	09/10/14
Informed Consent - SBE	09/10/14

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI Program participating institution or be a paid Independent Learner. Falsified information and unauthorized use of the CITI Program course site is unethical, and may be considered research misconduct by your institution.

Paul Braunschweiger Ph.D.
 Professor, University of Miami
 Director Office of Research Education
 CITI Program Course Coordinator

APPENDIX B

IRB APPROVAL



INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

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 c/o Immunology & Infectious Diseases
 Montana State University
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Chair: Mark Quinn
 406-994-5721
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Administrator:
 Cheryl Johnson
 406-994-6783
 cherylj@montana.edu

MEMORANDUM

TO: Kyle Gavin and Carl Igo

FROM: Mark Quinn *Mark Quinn*

DATE: May 12, 2015

RE: "Evaluation and Improvement of a Food Safety Training Program in Vegetable Production" [KG051215-EX]

The above research, described in your submission of **May 12, 2015**, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

- ☐ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- ☒ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.
- ☐ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
- ☐ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.
- ☐ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.
- ☐ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

**SUBJECT CONSENT FORM FOR
PARTICIPATION IN HUMAN RESEARCH AT
MONTANA STATE UNIVERSITY**

Evaluation of Food Safety Training Program

You are being asked to participate in a research study of teaching methods used in food safety training program. This study may help us obtain a better understanding of effective food safety training programs. You were identified as a possible subject by Express Harvesting food safety staff because the packing facility is an essential part of the food safety system. Participation is voluntary. If you agree to participate you will be asked to participate in a set of food safety trainings, complete a survey about the food safety training program, be observed at work in the packaging facility, and complete two multiple choice tests. Participation is voluntary and you can choose to not answer any questions you do not want to answer and/or you can stop at anytime. You will participate in food safety training sessions with your crew. You will individually complete a survey explaining your experience with the training program and identify certain characteristics about yourself. Your crew will be observed five (5) times in the packing facility throughout the training period (May-August). You will individually complete two (2) tests about the information presented in the food safety trainings. The results from this study will be used to evaluate how well the food safety training program is working to educate you.

Risk: There are no foreseen risks to participating in this study.

Benefits: This study is of no specific benefit to you. The benefit of the project will be to improve food safety training in the vegetable industry.

Alternative: If you do not want to participate you will still participate in the mandatory trainings but will not be asked to complete the survey or tests.

Cost to subject: None.

Confidentiality: All information and results will be kept confidential. Your test scores will be tracked using your employee identification (ID) number. The researcher will not be able to connect your employee ID number to your name. You will not be asked to write your name on the survey or the tests.

If you have any questions about participating in this research project please do not hesitate to ask. Should you have questions about the research, you can contact Kyle Gavin, (831) 233-8532 [kylegavin@aol.com]. If you have additional questions about the rights of human subjects you can contact the Chair of the Institutional Review Board, Mark Quinn, (406) 994-4707 [mquinn@montana.edu].

Fold and tear along dotted line

AUTHORIZATION: I have read the above and understand the discomforts, inconvenience and risk of this study. I, _____ (name of subject), agree to participate in this research. I understand that I may later refuse to participate, and that I may withdraw from the study at any time. I have received a copy of this consent form for my own records.

Employee ID: _____

Signed: _____

Investigator: _____

Date: _____

APPROVED
MSU IRB
05/12/2015
Date approved

APPENDIX C

DEMOGRAPHIC SURVEY

Demographics

Participation is voluntary, and you can choose to not answer any question that you do not want to answer, and you can stop at any time.

Directions: For each of the items below, **fill in the blank** or **circle** the correct response.

- 1) What is your age?
 - a) 18-24 years old
 - b) 25-34 years old
 - c) 35-44 years old
 - d) 45-54 years old
 - e) 55-64 years old
 - f) 65 years or older

- 2) What is the highest degree or level of school you have completed?
 - a) No schooling completed
 - b) Elementary school to 8th grade
 - c) Some high school, no diploma
 - d) High school graduate, diploma or the equivalent (for example: GED)
 - e) Some college credit, no degree
 - f) Trade/technical/vocational training
 - g) College degree

- 3) How long have you worked in the vegetable industry?
 - a) Less than 1 year
 - b) 1-3 years
 - c) 3-5 years
 - d) 5-10 years
 - e) More than 10 years

- 4) How long have you worked for Express Harvesting?
 - a) Less than 1 year
 - b) 1-3 years
 - c) 3-5 years
 - d) 5-10 years
 - e) More than 10 years

- 5) What language do you speak in your home? _____

APPENDIX D

FOOD SAFETY KNOWLEDGE PRE-TEST

Food Safety Knowledge Pre-Test

Directions: Read each question carefully and **circle** the best possible answer.

Food Security

1. Who is responsible for food security?
 - a. Food safety team
 - b. Ranch/facility owners
 - c. Supervisors
 - d. Everyone

2. When you first get to work you notice that the doors are open and people you do not recognize are touching the equipment and products without wearing gloves or hairnets. What should you do?
 - a. Tell your supervisor as soon as possible
 - b. Tell your supervisor the next day
 - c. Tell your supervisor at the end of your shift
 - d. Tell your supervisor when you have time

3. When are personal items allowed in the packing area?
 - a. Always
 - b. Never
 - c. When no products are around
 - d. When the supervisors can't see me

Cross contamination

4. Cross contamination can occur in which of the following ways:
 - a. From people to food
 - b. From equipment to food
 - c. From chemical to food
 - d. All of the above

5. If lubricant from a machine dripped into the product, what type of contamination would this be?
 - a. Physical
 - b. Chemical
 - c. Biological
 - d. All of these

6. You notice that the product on the conveyor belt has rat droppings on it. What should happen?
 - a. Product should not be used and equipment should be cleaned and sanitized
 - b. Product should be packed
 - c. Product should not be thrown away but placed in a separate bin
 - d. Product should be rinsed and then packed

Hand Washing

7. Bacteria divide once every _____.
 - a. 60 minutes
 - b. 1 day
 - c. 20 minutes
 - d. 8 hours
8. When you are washing your hands you should vigorously rub your hands together with soap for at least _____.
 - a. 5 seconds
 - b. 20 seconds
 - c. 40 seconds
 - d. 1 minute
9. Hands should be washed when:
 - a. before work
 - b. after using the bathroom
 - c. after all breaks
 - d. all of the above

Illness and Injury

10. An employee is working in the packing area and their hand becomes injured, they should:
 - a. Continue working until break time
 - b. Stop working immediately
 - c. Hide the injury to avoid being sent home
 - d. Remove glove immediately
11. It is ok to work with which of the following symptoms of illness:
 - a. Diarrhea
 - b. Vomiting
 - c. Fever
 - d. None of these
12. You are working and you notice blood on your hand and the product, it is important to:
 - a. Stop working immediately
 - b. Find the source of the blood
 - c. Tell your supervisor
 - d. All of the above

Hygiene, Clothing, and Equipment

13. Hair and beard nets must be worn:
 - a. When inside the packing facility
 - b. When in direct contact with product
 - c. When in the break room
 - d. When in the bathroom

14. Eating is allowed in which of the following areas?
 - a. Cooling area
 - b. Packing line
 - c. Break room
 - d. All of the above

15. Jewelry NOT is allowed:
 - a. In the packing area
 - b. In the break room
 - c. In the bathroom
 - d. Jewelry is not allowed in any of these

APPENDIX E

FOOD SAFETY KNOWLEDGE POST-TEST

Food Safety Knowledge Post-Test

Directions: Read each question carefully and **circle** the best possible answer.

Food Security

1. Who is responsible for food security?
 - e. Food safety team
 - f. Everyone
 - g. Ranch/facility owners
 - h. Supervisors
2. When you first get to work you notice that the doors are open and people you do not recognize are touching the equipment and products without wearing gloves or hairnets. What should you do?
 - e. Tell your supervisor as soon as possible
 - f. Tell your supervisor the next day
 - g. Tell your supervisor at the end of your shift
 - h. Tell your supervisor when you have time
3. When are personal items allowed in the packing area?
 - e. Always
 - f. When no products are around
 - g. Never
 - h. When the supervisors can't see me

Cross contamination

4. If lubricant from a machine dripped into the product, what type of contamination would this be?
 - e. Physical
 - f. Chemical
 - g. Biological
 - h. All of these
5. You notice that the product on the conveyor belt has rat droppings on it. What should happen?
 - a. Product should be packed
 - b. Product should not be thrown away but placed in a separate bin
 - c. Product should be rinsed and then packed
 - d. Product should not be used and equipment should be cleaned and sanitized
6. Cross contamination can occur in which of the following ways:
 - e. From people to food
 - f. From equipment to food
 - g. From chemical to food
 - h. All of the above

Hand Washing

7. Bacteria divide once every _____.
 - a. 20 minutes
 - b. 60 minutes
 - c. 8 hours
 - d. 1 day
8. When you are washing your hands you should vigorously rub your hands together with soap for at least _____.
 - e. 5 seconds
 - f. 20 seconds
 - g. 40 seconds
 - h. 1 minute
9. Hands should be washed when:
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 - f. after using the bathroom
 - g. after all breaks
 - h. all of the above

Illness and Injury

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 - f. Packing line
 - g. Break room
 - h. All of the above

15. Jewelry NOT is allowed:
 - a. In the break room
 - b. In the bathroom
 - c. In the packing area
 - d. Jewelry is not allowed in any of these

APPENDIX F

TRAINING REACTION SURVEY

Training Survey

Participation is voluntary, and you can choose to not answer any question that you do not want to answer, and you can stop at any time.

Directions: For each of the questions below, **circle** the response that best characterizes how you feel about the statement, where: 1 = strongly disagree, 3 = disagree, 7= agree and, 9 = strongly agree.

	Content	Strongly Disagree	Disagree	Agree	Strongly Agree
1	The content of the trainings was important to my job	1	3	7	9
2	The trainings added to my food safety knowledge	1	3	7	9
3	The content of the trainings was new information to me	1	3	7	9
4	I plan on using the content of the trainings at my job	1	3	7	9
5	I enjoyed attending the trainings	1	3	7	9

	Trainer	Strongly Disagree	Disagree	Agree	Strongly Agree
6	The trainer had a strong understanding of the information being presented	1	3	7	9
7	The trainer was excited about the training	1	3	7	9
8	The trainer provided 1 or more opportunities to practice new information/skills	1	3	7	9
9	The trainer's attitude was positive	1	3	7	9
10	The trainer did a good job teaching me the content of the trainings	1	3	7	9