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Evaluating the Effectiveness of a Company's Online Health and Safety Training
Program by Assessing Its Employees Perceptions and Knowledge

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A thesis

presented to

the faculty of the Department of Environmental Health

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Master of Science in Environmental Health

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by

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August 2005

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Keywords: Survey, HAZWOPER, Online, Safety, Training

ABSTRACT

Evaluating the Effectiveness of a Company's Online Health and Safety Training
Program by Assessing Its Employees Perceptions and Knowledge

by

Jo Nell Mullins

A cross-sectional study was conducted to evaluate a company's online H & S training program.
The ABC Company's online 8-hr HAZWOPER refresher course is based on current OSHA
standard topics required for certification and principles flexible to fit site- or task-specific
situations and conditions.

An 18-question survey was used to evaluate employee perceptions of online training compared
to traditional classroom training. Perceptions were compared by demographic variables (e.g.
gender, position, race, age and longevity with the ABC Company), which suggested that only
age had an influence on employee response. Fifty-five percent of the employees surveyed
preferred online training as compared to 45 percent for classroom training. The difference in
percent was not significant ($p > 0.05$). Comparing pretest with posttest scores from the online
training course identified an increase in retention of knowledge. Therefore, it was determined
that the online training program is effective, at least from the company's perspective.

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CHAPTER 1

INTRODUCTION

Workers at hazardous waste sites are required to perform a variety of technical tasks correctly, safely and efficiently, but they must also work in an often unpredictable and potentially dangerous environment. A primary consideration for most company operations is the health and safety (H & S) of its personnel. Conducting hazardous waste management activities (e.g., site clean up, restoration, and decontamination) while protecting the H & S of employees is a complex and challenging task. Before the H & S government regulations, workers were not prepared to safely perform the required tasks (Hanley 2000). Today companies that are involved with hazardous waste sites strive to achieve H & S compliance status by preparing their employees with proper training and good hazardous waste management. Requiring personnel to participate in an H & S training program should result in a reduction of injuries and exposures. The protection of the public and the environment is also an important consideration in developing and implementing an H & S training program.

Progress has been made toward improving workplace safety for the hazardous waste worker, but the improvements are not consistent among employers and workplaces. Thus, much remains to be done to improve awareness and minimize the hazards at hazardous waste workplaces (Blackman, 1996).

Worker training programs have evolved to meet the challenges of today's diverse workforce. Participants in training courses vary widely in experience and work backgrounds, language preference, literacy levels, and commitment to safety. Therefore, the development of training programs to fit the needs of individual employees can be effective in decreasing injury rates, increasing work force productivity, promoting loyalty, and lowering insurance expenses (Halcarz 2003).

There is no satisfactory substitute for in-depth training in safety, industrial hygiene, hazardous waste/material management, environmental compliance, and other disciplines related to each specific job (Blackman 1996). Obtaining employee feedback about whether an H & S training and education program is working can be beneficial.

Surveys play an important role in helping management obtain a better understanding of the thoughts, feelings, and behaviors of their employees. In this study, employee perceptions of classroom training versus online training and retention of knowledge were demonstrated by surveying workers who are required to complete an annual Hazardous Waste Operations and Emergency Response (HAZWOPER) training refresher course.   The company involved in this research requested to be anonymous, so it will be referred to as the ABC Company.

Since 1986, ABC Company has been a global, full-service consulting, engineering, construction, and operations firm helping public and private clients improve the environment and infrastructure. It serves the environmental management needs of agencies and departments of the federal government, including the U.S. Environmental Protection Agency, the Department of Energy, the Department of Defense, the Bureau of Reclamation, and the U.S. Army Corps of Engineers. The ABC Company strives to achieve compliance with all applicable H & S regulations and client provisions by requiring its employees to participate in its H & S program. Under the ABC Company's H & S Program, employees who enter hazardous waste sites must complete an annual 8-hour HAZWOPER refresher course either online or in the classroom.

The company's online training course resides within the Meridian Knowledge Solutions, Inc. (KSI) Environmental Safety and Occupational Health (ESOH) Knowledge Centre [TM]. Meridian KSI is a full-service e-learning company that was founded in 1997 (Meridian 2004). It enables organizations to manage their specific business training objectives through technology. The ABC Company's online 8-hr refresher course is based on current OSHA standard topics required for certification and principles sufficiently flexible to fit site- or task-specific situations and conditions.

A cross-sectional study was conducted in which perceptions of the company's online H & S refresher training course versus traditional classroom training were determined by surveying employees who had experienced both course designs and employees who had only participated in the online refresher course. There were no employees who only participated in the traditional classroom training. Completion of the surveys was voluntary, but all employees were encouraged to respond. Survey results were tallied and examined for statistical differences between independent variables. The hypotheses that were tested in this study were the following:

1. Employee perceptions of the effectiveness of online training were influenced by their associated demographic variables (e.g., age, gender, race, position, years worked with the ABC Company).

2. Employees preferred online training to classroom training and this preference was influenced by their demographic variables.

3. Employee retention of knowledge increases by the end of the refresher course.

Objectives

The first objective was to administer a survey that supplied employee demographic variables and perceptions about the company's online training compared to traditional classroom training. The second objective was to compare the demographic variables of the surveyed employees (sample) to all of the company employees (population). The third objective was to determine employee training format preference and demographic variables that might influence their responses by analyzing the survey results. A fourth objective was to evaluate the effectiveness of the online training refresher course through determining retention of knowledge by comparing the pretest and posttest scores of the employees.

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<u>Benefits Expected</u>

This study was conducted to evaluate the effectiveness of the ABC Company's online 8-hr HAZWOPER Refresher training program. The survey allowed employees to express their preferences and opinions of the ABC Company's H & S online training program.   The ABC Company will use the results of this study to determine what training format they should use in the future.

<u>Study Limitations</u>

A larger sample size would have resulted in an increase in power. It would have been ideal to compare posttest scores by demographical variables to determine a significant difference of retention of knowledge. Pretest and posttest scores were only available for the online course. Therefore, retention of knowledge from participating in the classroom training compared to online training could not be evaluated. Retention of knowledge was not measured at least six months after completing the course because this option had not been approved by the company. Another limitation of the study is that multivariate statistics were not used to analyze the results. However, confounding was controlled for by stratification.

CHAPTER 2

LITERATURE REVIEW

Occupational Safety and Health Administration (OSHA)

The Occupational Safety and Health Administration (OSHA) is a federal agency that establishes H & S requirements for all work sites. Congress passed the Occupational Safety and Health Act of 1970, (OSH Act), "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources" (OSHA 2002). Title 29 of the Code of Federal Regulations (CFR), Parts 1902-1990, contains OSHA regulations and standards. In 1986, as Congress deliberated the Superfund Amendments and Reauthorization Act (SARA), Section 126 was added to Title I, requiring the Secretary of Labor to promulgate a hazardous waste worker health and safety standard. Interim final standards were issued on December 19, 1986. The final HAZWOPER standards were published on March 6, 1989 and were codified at 29 CFR 1910.120 (Blackman 1996).

Some states have enacted occupational safety and health laws and operate federally approved state plans. Such states adopt and enforce state standards and regulations that are at least as effective as those enacted under federal law (OSHA 2002). As part of its enforcement authority, OSHA inspects workplaces and issues penalties for violations (Hanley 2000). OSHA is also responsible for establishing permissible standards of potentially toxic substances in the workplace (Morgan, Barnett, Carver, Curtis, Davis, Gordon, Iglar, McAllister, and Walker 1997).

Evaluating Working Health and Safety Training Programs

There is a growing awareness of the need for research and evaluation to improve health and safety education programs. Opportunities for evaluations to show how education enhances worker protection continue to be lost, and possibilities for program improvement, innovation,

and diffusion continue to go unrealized (McQuiston 2000). Health and safety training programs for workers are conducted in the U.S. at an annual cost of more than $40 million dollars (Mukherjee, Overman, Leviton, and Hilyer 2000). Attempts to quantify the effectiveness of training on workplace conditions continue to frustrate company management and training providers.

OSHA has found that observing and interviewing employees, supervisors, and managers are the most effective measures for determining their understanding of what is expected of them in practice (OSHA 1989). Thus, a constructive way of evaluating a company's H & S training program effectiveness is through an employee survey.

Benefits of Using Surveys to Evaluate the Effectiveness of a Training Program

Surveys play an important role in helping management obtain a better understanding of the thoughts, feelings, and behaviors of their employees.   Information gathering (data collection) and interpretation is one of the primary roles of better company management. More than 70 percent of U.S. companies survey their employees on an annual to biannual basis (Church and Waclawaki 2001).

Several issues must be taken into consideration when organizing an employee survey. These include: obtaining the necessary resources, support from the organization (population being surveyed), developing questions that appropriately reflect the purpose of the survey, understanding the nature and content of communication, working through conflict and feedback, interpretation of the survey results, and implementing those results (Church and Waclawaki 2001).

If the sampling process is done correctly, the data provided can be just as valid and reliable as those provided by a census involving all employees in the organization. Conversely, a bad sampling process can introduce significant biases that at best skew the data in some specific direction, and at worst render the data useless (Church and Waclawaki 2001). A

sampling survey, which represents a snapshot of the organization, must reflect the demographic, functional, and dispositional makeup of the total population of interest. Administering an individual questionnaire yields greater private responses, which are less susceptible to intentional biases (Church and Waclawaki 2001). The basis for administering employee surveys is that the more feedback obtained, the more significant information company management has in making decisions or implementing organizational changes.

Examples of Using Employee Surveys to Evaluate the Effectiveness of a Training Program

Investigators have tried to identify characteristics of training programs that predict success; however, criteria for "success" do not always include measurable changes of the workplace (Mukherjee, Overman, Leviton, and Hilyer 2000). The University of Alabama Birmingham/Center for Labor Education and Research (UAB/CLEAR) has HAZMAT trained more than 1,000 paper product manufacturing workers. A survey was mailed to a sample of workers and all participating managers who received training from the inception of the program through 1996. The study focused on the assessments of participant satisfaction with the training (using a scaled form or comment sheet), knowledge gain (frequently through pre-and posttests or end-of-course exams), increases in positive attitudes regarding safety (worker self-report on completion of training), and instructor assessment of trainees' specific skills (Mukherjee, Overman, Leviton, and Hilyer 2000).

Survey respondents were not asked for demographic information. However, program statistics represented a picture of the population. Between 1992 and 1997, 859 men and 65 women were trained by UAB/CLEAR. Of the trainees, 92 percent of males and 73.4 percent of females were White, 4.2 percent of males and 15.4 percent of females were African American, 1.5 percent of males and 3.1 percent of females were other racial groups, and 2.3 percent of males and 6.2 percent of females did not provide demographic information. Two groups were surveyed: a random sample of 300 workers, and the total number of managers who participated

in training. Workers were selected from a list of all participants in the program from 1992

through 1996 (Mukherjee, Overman, Leviton, and Hilyer 2000).

One hundred thirty-nine workers responded, for a response rate of 46.3 percent. Sixteen

managers responded for a response rate of 53.5 percent (Mukherjee, Overman, Leviton, and

Hilyer 2000). This study showed that UAB/CLEAR is a successful and effective program. The

majority of workers and managers indicated the training made it easier for them to identify and

recognize hazardous chemicals. There was a significant difference (p<0.00001) between the

responses of workers and the managers about recognizing, identifying, and avoiding hazardous

chemicals and about their personal avoidance of exposure to chemicals. A perception was noted

that managers tend to perceive greater personal influence on changes in the workplace than did

workers. In general, managers tend to have prior education, training, and knowledge of

chemicals and of H & S issues. Plus, managers have greater control in the workplace and, thus,

have a greater opportunity to influence safety improvements (Mukherjee, Overman, and Leviton,

Hilyer 2000).

Ryan, Carlton, and Ali (1999) conducted a study to compare students' impressions of

classroom training and web-based training when the same instructional method was used in each

program. Students in the classroom perceived that the content was covered more adequately

because there was more interaction. They also reported that faculty preparation and expertise

were more important to learning. Students who were included in the web-based training said

that electronic instruction facilitated greater depth of learning and afforded greater ability for

them to participate in discussions as no one student was able to monopolize the conversation.

According to another study, which focused on web-based training and was recognized in

the ERIC Clearinghouse on Adult Career and Vocational Education Digest, students expressed

the need for better communication skills, self-discipline, and knowledge of computer technology

before attempting an online training course (Brown 2000).   Students participating in the web-

based training reported that they felt disconnected from other class members, encountered

difficulties in understanding instruction, were frustrated by a poor flow of communication and technical problems, and were confused by feedback that was not always clear (Brown 2000).

The Environmental and Occupational Health Sciences Institute (EOHSI) conducted a study in which trainees' individual knowledge was measured following hazardous materials training. Use of sound testing principles and creative examination methods and materials and collaboration across programs helped to address concerns for individual programs and the field generally. As a result, those who choose to assess individual knowledge can move the process forward through added rigor, collaboration, and documentation (Weidner 2000).

Education and training through the Internet is becoming more popular. Reduced company training costs, trainer's flexibility, and trainee's flexibility are some of the benefits that have made companies lean toward online learning. The online learning industry is expected to grow from $6.3 billion in 2001 to more than $23 billion in 2004 (Nolan 2002).

Distance education courses, via the Internet or CD-ROM, taught by occupational health and safety professionals were assessed by a random sample of 800 active students. The results of the survey indicated that 87.4 percent of the students were likely to participate in distance education opportunities for continuing education or obtaining an academic degree (Carlson and Olson 2001). The study areas of interest selected most often were occupational health (73 percent), injury prevention (60 percent), and industrial hygiene (53 percent). More than 79 percent of the survey participants said that an on-campus component was not important to their learning experience (Carlson and Olson 2001).

The Industrial Safety & Health News surveyed several companies to describe the most popular safety training methods and tools. Ninety-four percent of the companies surveyed planned to use at least some in-house, instructor-led safety training (lecture and/or video) in 2002. The next most common method was hands-on demonstration training (79 percent), followed by hiring outside instructors to conduct onsite training (55 percent) (ISHN 2002). Safety managers thought the most critical factors for successful safety training were: immediate

answers to students' questions (83 percent); creative, well-prepared instruction (80 percent); customized content (77 percent); measures of training effectiveness (73 percent); ability to modify content (68 percent); group discussions (51 percent); and live hands-on demonstrations (51 percent). Safety managers perceived flexibility (75 percent); documented record keeping (67 percent), timesaving (58 percent), and consistency across multiple locations (51 percent) as advantages of online safety training. Safety managers reported that they did not use online safety training because of insufficient technical infrastructure (50 percent), high cost (43 percent), and employees' lack of necessary computer skills (41 percent) (ISHN 2002).

CHAPTER 3

MATERIALS AND METHODS

A cross-sectional study was conducted to evaluate the effectiveness of the ABC Company's online training refresher. Employee perceptions of online training compared to traditional classroom training were determined through survey questions that addressed demographic information, training experiences, and opinions/perceptions of classroom and online training. The survey was reviewed for completeness. The final draft resulted in a one-page, 18-question document (Appendix A). All survey results were anonymous to protect the employee's confidentiality. Most of the questions were categorical; except for two fill in the blank questions. The survey was administered by email and post mail. Therefore, each participant was given an equal opportunity to decide whether he/she felt more comfortable completing the survey by email or by post mail. An initial email explaining the purpose of the survey was sent out to the targeted population. A follow-up email was sent out two weeks after the initial email. There were three follow-up emails that were sent out to the employees to increase the response rate. After a third email was sent out, only an additional 17 percent of the population had responded. Therefore, it was decided that additional follow-up emails would be ineffective.

One hundred twenty-eight employees were selected for this study. This was accomplished by obtaining the list of those individuals who had completed the online training refresher through the Meridian KSI. Returned surveys were examined for completeness and consistency. Responses were discarded if found to be incomplete or noncompliant with instructions. The data were entered into a Microsoft Excel spreadsheet (Microsoft Corp, Redmond WA) and then edited for completeness. A quality assurance review of the database was necessary to ensure the accuracy of the data. All surveys were organized by assigning them a number. Therefore, a 100 percent quality assurance check (by an independent party) of all

survey responses against the database was performed.   Frequency distributions of responses were computed and sorted in Microsoft Excel.

Pretest and posttest scores of the employees were compared to determine retention of knowledge from completion of the online refresher course. Both sets of scores were obtained from Meridian KSI. Spreadsheets, along with graphs such as pie charts and bar graphs, were used to visualize the survey responses and test score results.

The demographic variables of the overall company population were compared statistically to the demographic variables of the sample of interest. The sample's perception about the effectiveness of the online refresher course was measured and compared statistically by position, longevity with the company, age, gender, and race. The training preferences of employees who had only participated in the online refresher training course were compared statistically by demographic variables to determine if their responses were influenced by such factors. The training preferences of employees who had participated in the online training refresher and classroom training were also compared statistically by their associated demographic information. These nominal variables were tested using Chi-square and z-test statistical analyses with a significance level of 0.05. The chi-square test was chosen because a non-parametric test is appropriate to use when assumptions about the normal distribution in the population cannot be met. The z-test for comparing two proportions was used because binomial populations (e.g. males vs. females, technical vs. non-technical, etc.) and positive perceptions of online training were evaluated to distinguish a significant difference. The retention of knowledge of the company's online training course was tested using a paired t-test.

The sample size validity to detect a significant statistical result was determined using a statistical program called Power and Precision™ (Biostat, Inc., Englewood, New Jersey) Power and Precision™ is a stand-alone software program that can be used alone or as a tool to enhance other statistical packages. It helps find an appropriate balance among effect size, sample size, the criterion required for significance (alpha), and power (Borenstein 2001). The program

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calculates power and precision using effect size, alpha, confidence level, and sample size. For any given effect size and alpha, increasing the sample size will increase the power (Borenstein 2001). Statistical power results were determined for each hypothesis. The formulas involved in determining the power using the chi-square distribution and paired t-test are indicated in Table 1:

Table 1 Power calculations based on a chi-square distribution and paired t-test

Chi-square distribution
The degrees of freedom (df) is computed as (Rows – 1) * (Columns – 1).
Non-Centrality Parameter (NCP) [a] = w^2 * N
N = number in sample w^2 = effect size[b]   alpha = 0.05
[a] The NCP defined in this way is equivalent to the chi-square value computed for a 2 x 2 table.
[b] The discrepancy between the null and the alternate is computed as ((PercentAlternate - PercentNull)^2 / PercentNull). The sum of these squared discrepancies yields w^2, and the square root of this value yields the effect size, w.
Note: Power is then given by the non-central chi-square distribution for df = 1, required chi-square, and NCP. This calculation is based on a nondirectional test.
Paired t-Test[a]
d = ABS(Mean Difference) / SD   d = effect size
SDDiff = Sqrt([SD(1)]2 + [SD(2)]2 – (2 * Corr * SD(1) * SD(2)))
NCP = Abs(d * Sqrt(NCases)).
[a] The t-value required for significance (ReqT) is given by the central t-distribution for significance level alpha (0.05) and/or tails and df = N – 1.
Note : Power is given by the non-central t for NCP, Reqt, and df.

CHAPTER 4

RESULTS

One hundred and twenty-eight surveys were distributed to the ABC Company employees. Ninety-two (72 percent) of the distributed surveys were returned; this exceeded the expected return of 50 percent. Once the percent response was determined, the demographic characteristics of the overall total employee population of ABC Company (n = 128) and the sample (those who actually took the survey) were compared to determine if there was selection bias or significant differences between the overall employee population and sample of interest (Figure 1). There were no significant differences determine between the demographics of the overall population and sample. Therefore, the sample was representative of the total employee population of the ABC Company by gender, race, position, and age. The average age (also referred to as the mean) of the overall population was 40 years old. The mean or average age of the sample was 38.3 years old.
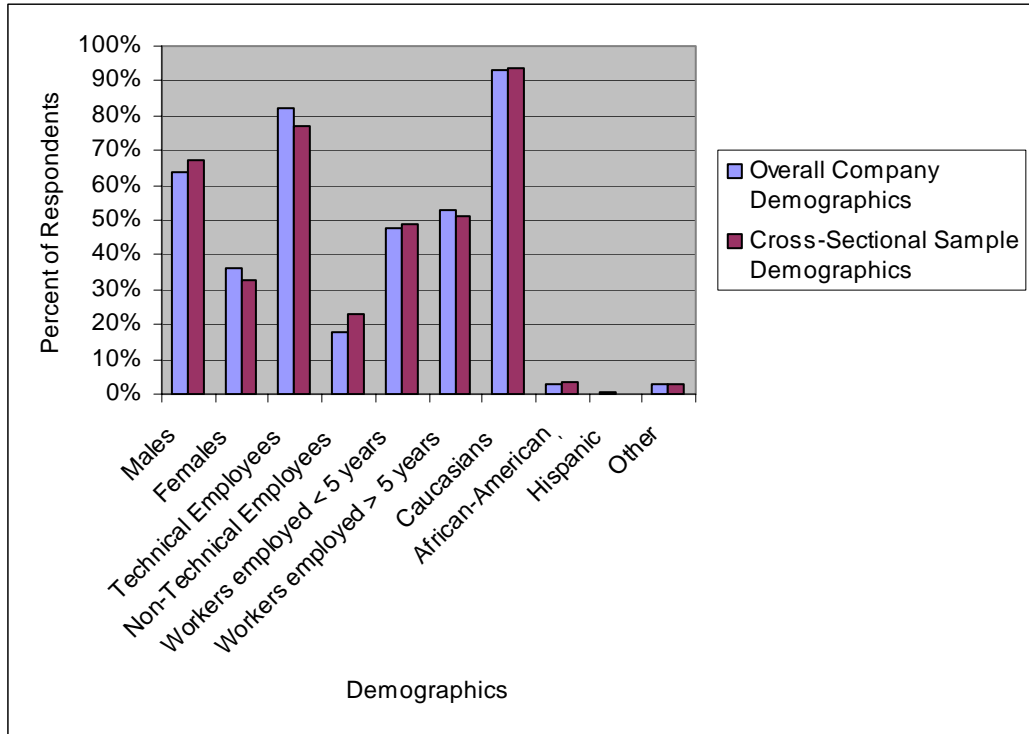
Figure 1 A Comparison of Gender, Position, Longevity with the ABC Company, and
Races of the Overall Company Population and Sample of Interest

The perceptions of the effectiveness of the ABC Company's online refresher were

evaluated by asking the ABC Company employees if the online training refresher had given

them confidence that they could perform their job safely. Seventy-seven percent of males and 63

percent of females said that they felt confident to perform their job.   Nineteen percent of the

male population and 27 percent of the female population answered "somewhat" to question 14.

Two percent of the male population answered "no" or "do not know." Seven percent and three

percent of the female population answered "no" and "do not know" respectively. The perception

of the effectiveness of online training distributed by gender is shown in Figure 2.

Figure 2 Comparison of Male and Female Employee Perceptions about the Effectiveness
of the ABC Company's Online Training HAZWOPER Refresher Program
(Survey Questions 1 and 14).

Position and employee perceptions of the effectiveness of the online training refresher were also compared using questions five and 14 of the survey.   There were 53 technical employees (75 percent) and 14 non-technical employees (67 percent) who answered "yes" that online refresher had given them confidence to perform their job (Figure 3).   Only four percent of the technical employees responded "no" about the online training giving them the confidence to perform their job safely. Eighteen percent of the technical employees and 33 percent of the non-technical employees were "somewhat" confident to perform their job. Three percent of the technical employees answered "do not know."
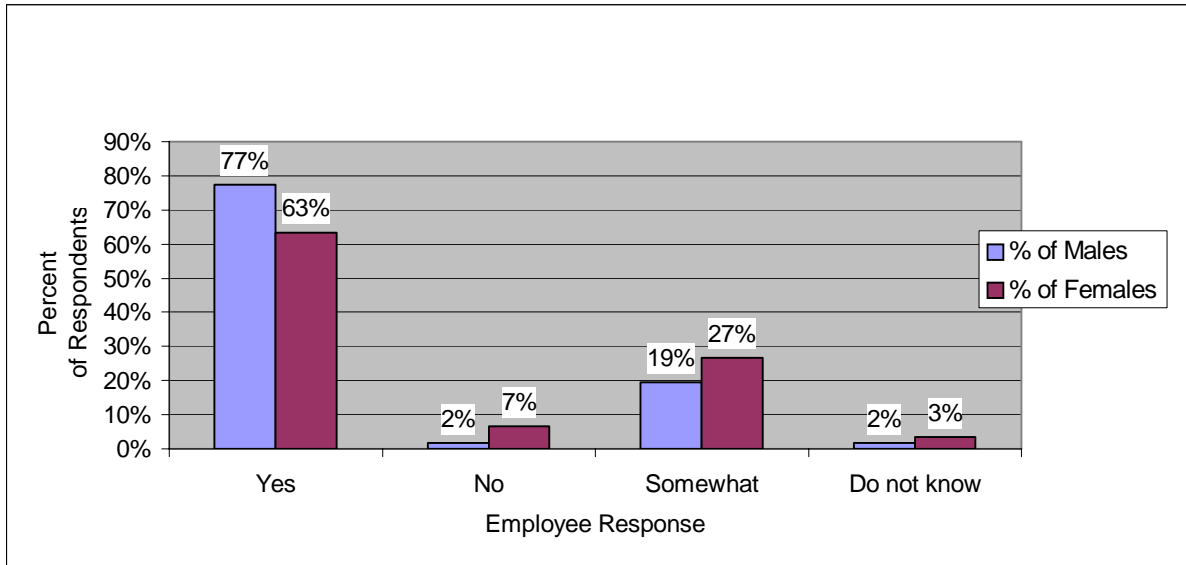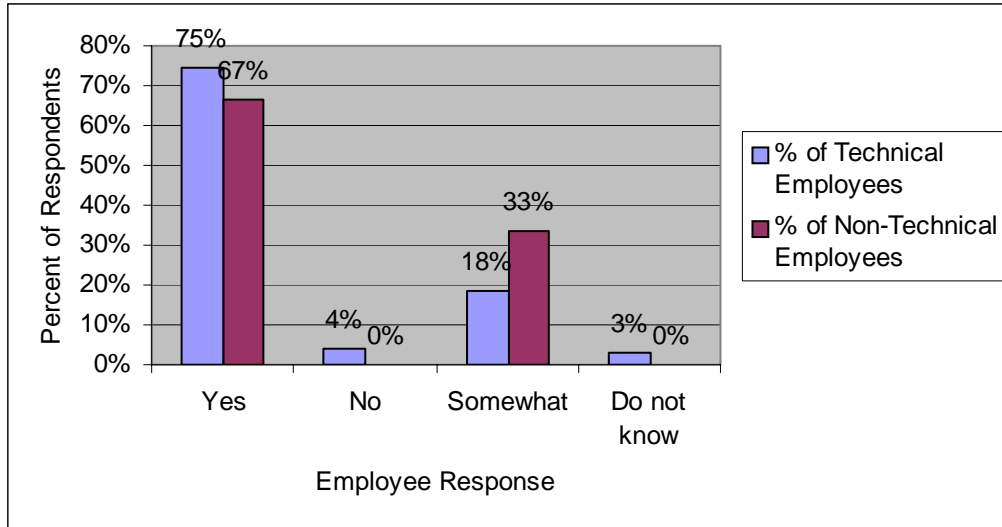
Figure 3 Comparisons of Technical and Non-technical Employee Perceptions about the
Effectiveness of the ABC Company's Online Training HAZWOPER Refresher
Program (Survey Questions 1 and 14).

Race and employee perceptions of the effectiveness of the online training refresher were
also compared using questions 2 and 14 of the survey (figure 4).   However, there was not
enough data to determine a significant difference between employee perceptions of the online
refresher training (question 14) by race (question 2), because there was a large percentage of
Caucasians (93 percent) that were included in the cross-sectional sample.
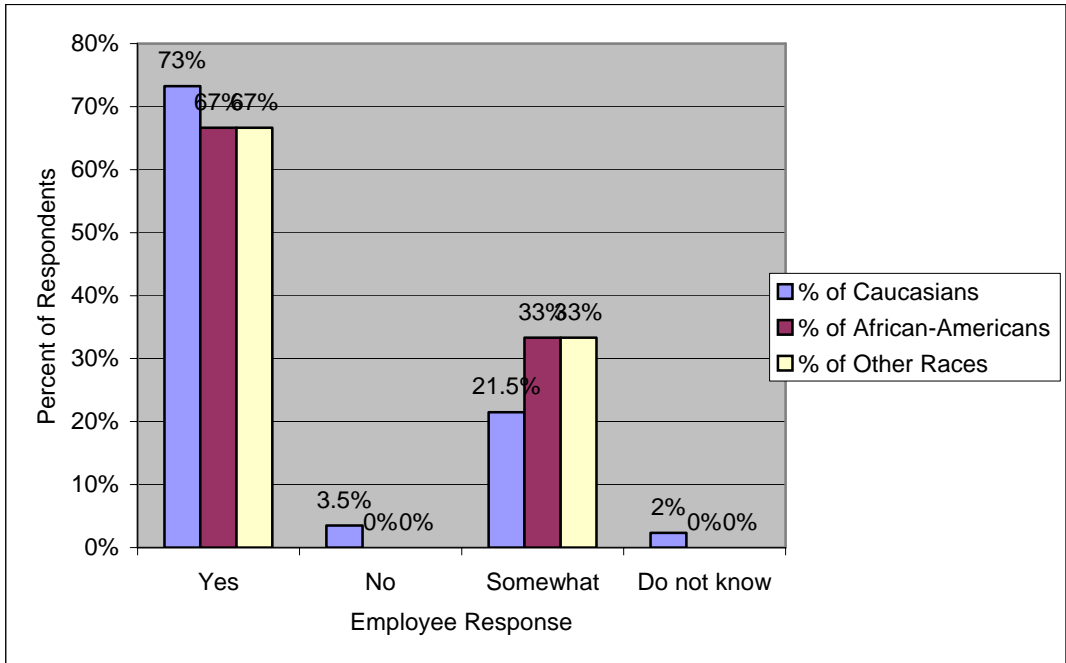
Figure 4 Comparison of Caucasian, African-American, and Others' Perceptions about the Effectiveness of the ABC Company's Online Training HAZWOPER Refresher Program (Survey Questions 1 and 14).

Employee perception was evaluated and compared by length of employment (Figure 5). Seventy-eight percent of those individuals who had worked less than the 5 years said that they felt confident to perform their job. Sixty-eight percent of the individuals who had worked longer than five years also agreed that they felt confident to perform their job based on the online training refresher. There were no employees who had worked less than 5 years that answered that they were not confident to perform their job. Only six percent of the employees who had been with the company longer than 5 years said that they were not confident. There were 18 percent of the employees who had been with the company less than 5 years that answered "somewhat" confident to perform their job. About 26 percent of the employees who had been with the company greater than five years said that they were "somewhat" confident to perform their job based on the online training. Four percent of the employees who had worked less than 5 years had answered "do not know."

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Figure 5 Perceptions about the Effectiveness of the ABC Company's Online Training HAZWOPER Refresher Program by Employees Who had Worked for Less than and Greater than 5 years for the ABC Company (Survey Questions 6 and 14).

Perceptions about the effectiveness of online training between age groups are illustrated in Figure 6. The average age of the employees was 38 years old. There was no difference between both age groups of those who felt confident to perform their job based on the online refresher. Thus, 73 percent of both age groups felt confident to perform their job based on the online training refresher. On the other hand, 17 percent of the employees who were less than 38 years old felt "somewhat" confident. Twenty-seven percent of those who were older than 38 years felt somewhat confident to perform their job based on the online training program. There were only six percent of the employees whose ages were less than the average and median age that answered that they did not feel confident. There were four percent of the employees who answered "do not know."
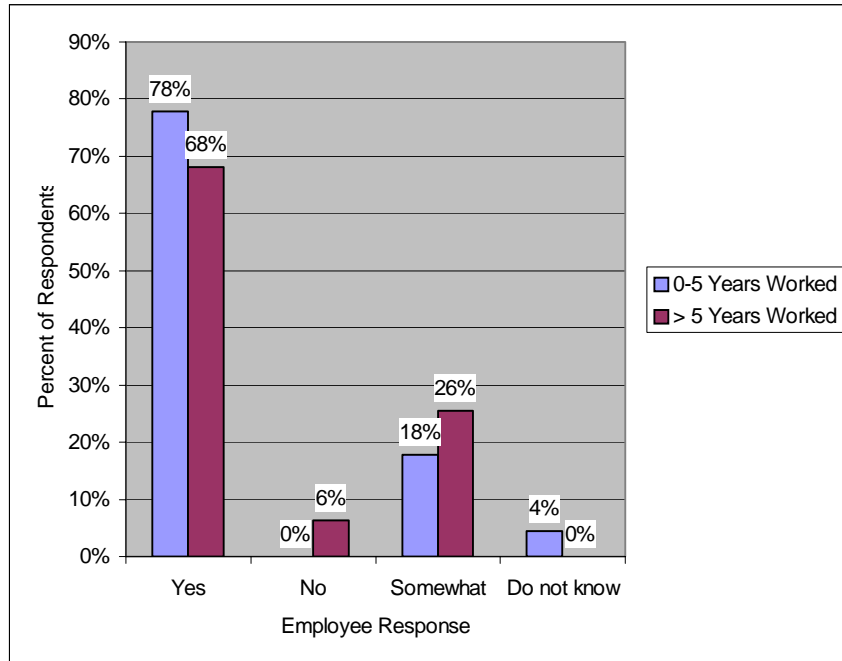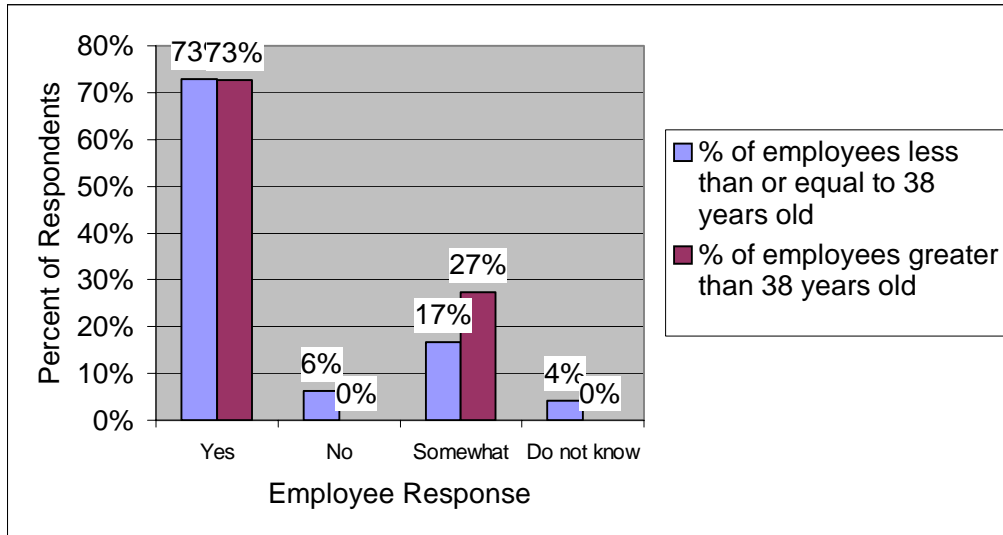
Figure 6 Perceptions about the Effectiveness of the ABC Company's Online Training
         HAZWOPER Refresher Program by Employees Who Were Less Than or
         Greater Than 38 Years Old (Survey Questions 3 and 14).

The statistical power determined from the association of employee perceptions of the

effectiveness of online training and their associated demographic variables (e.g., age, gender,

race, position, years worked with the ABC Company) ranged from 25 to 55 percent. This

indicated the study had one-in-two to one-in-four chance of detecting statistical significant

differences. These power calculations indicated that the study was unlikely to detect a

statistically significant result.

However, the results from the survey were compared despite the small statistical power.

There was not a statistically significant difference detected at the $p = 0.05$ level using the chi-

square test in the overall perception of the quality of online training program between male and

female employees; technical and non-technical employees; those who worked greater than 5

years and those who worked less than 5 years for the company; or those who were less than 38

years of age and those who were greater than 38 years of age. Therefore, the hypothesis was not

supported based on the overall perceptions of the employees.

It was also determined that there were not significant differences at the p=0.05 level between those who felt confident (somewhat confident) about the effectiveness of the online training program by gender, position, and longevity with the company. Thus, these nominal and ordinal variables did not support the hypothesis.

However, the hypothesis was supported by comparing level of confidence with the online training program by age. Although there was no difference for the category of feeling "confident," it was determined by comparing those who were less than 38 years old and those who were greater than 38 years old using the chi-square test at the $p = 0.05$ level that there was a significant difference for the category of feeling "somewhat confident."

In question 15, employees were asked what type of training was more beneficial to them (Figure 7). Forty-five percent of the employees preferred classroom training. Fifty-five percent of the employees felt that online training was more beneficial to them.
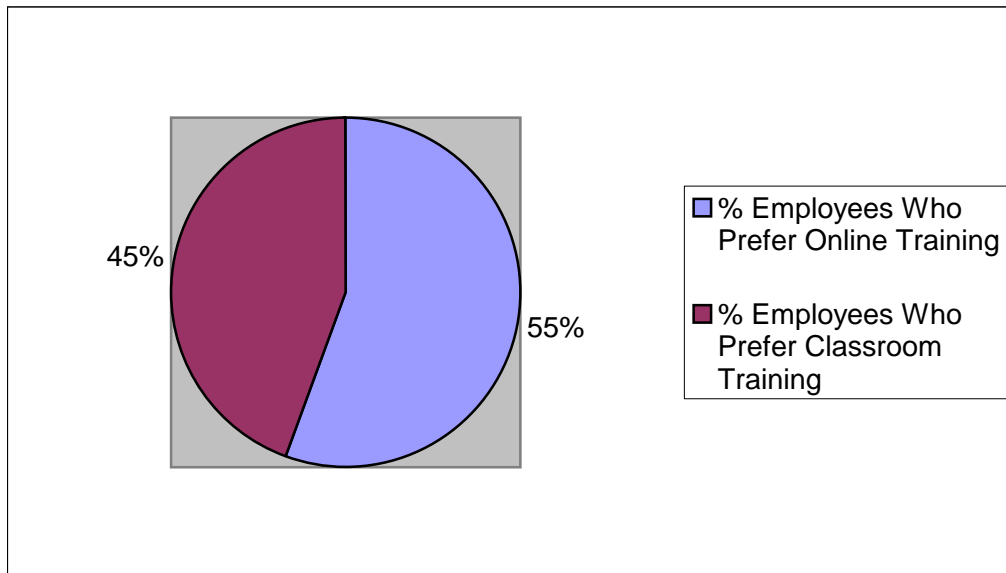

Figure 7 Employee Responses Who Preferred Online Training to Classroom Training (Survey Question 15).

It is important to note that the total sample ($N = 92$) had participated in the online training course. However, 48 employees (N_1) had **only** participated in the online training refresher. The total sample also included employees who had participated in both training

formats ($N_2 = 44$). No employees participated only in the classroom training. The chi-square test was used to determine if employee responses statistically differed by demographic variables (Table 2). Hence, the focus was to distinguish whether or not there was a significant difference between each demographic variable and those who preferred online training.

The statistical power determined from the association of employee demographic variables (e.g., age, gender, race, position, years worked with the ABC Company) and those who preferred the online training ranged from 25 to 55 percent. As a result, this study had one-in-two to one-in-four chance of detecting statistical differences. As previously mentioned, the low power calculations indicated the study was unlikely to detect a statistically significant result.

However, the results were compared despite the small statistical power. It was determined at the $p = 0.05$ level using the chi-square test that there were no significant differences between male and female employees; technical and non-technical employees; those who worked greater than 5 years and those who worked less than 5 years for the company; or those who were less than 38 years of age and those who were greater than 38 years of age who had experienced online training only and preferred this type over classroom training. It was also determined that there were no significant differences between the demographics of those who had experienced both training formats and preferred online training to classroom. No significant differences between demographics of those who had preferred classroom training to online training and had only participated in the online training refresher (and those who had experienced both training formats) were indicated.

Table 2 Percent employees who preferred online training stratified by demographic variables

Sample Group	Demographic Variable		Percent[4]
Entire Sample: n = 92	Total[1]		55%
	Gender	Male	69%
		Female	31%
	Age	≤ 38 years	56%
		> 38 years	44%
	Classification of Employment	Technical	73%
		Non-technical	27%
	Length of Employment	≤ 5 years	57%
		> 5 years	43%
Participated in Online Training Only n = 48	Subtotal[2]		60%
	Gender	Male	55%
		Female	68%
	Age	≤ 38 years	58%
		> 38 years	64%
	Classification of Employment	Technical	54%
		Non-technical	81%
	Length of Employment	≤ 5 years	64%
		> 5 years	50%
Participated in Online & Classroom Training: n=44	Subtotal[3]		50%
	Gender	Male	56%
		Female	27%
	Age	≤ 38 years	47%

		> 38 years	52%
Classification of Employment	Technical	50%	
	Non-technical	50%	
Length of Employment	≤ 5 years	63%	
	> 5 years	45%	

[1] All subjects chose either online training or in-classroom training as a preference. Therefore, 55 percent of the entire population preferred online training to classroom (n=51). All percentages per demographic variable were based on the number of employees who preferred online training (n=51).

[2] The subtotal is the percent of the 48 employees who preferred online training and had participated only in online training. All percentages per demographic variable were based on the number of employees (n=48).

[3] The subtotal is the percent of the 44 employees who preferred online training and participated in both online and classroom training. All percentages per demographic variable were based on the number of employees (n=44).

[4] All associations were not statistically significant.

Employee perceptions of the quality of the H & S online training vs. classroom training were evaluated by asking how they would describe their acquired knowledge and retention level from participating in the company's online and/or classroom eight-hour HAZWOPER training program (questions 9 and 10). The survey results from questions 9 and 10 are identified in Figure 8. Thirty-six percent of the employees who had taken the HAZWOPER course online said that they were "confident in their ability." Thirty-five percent of the employees who had taken the refresher course in the classroom also said that they were "confident in their ability." Fifty-seven percent who had taken the refresher course online and 26 percent of those employees who had taken the course in the classroom felt that they "need questions answered from time to time."
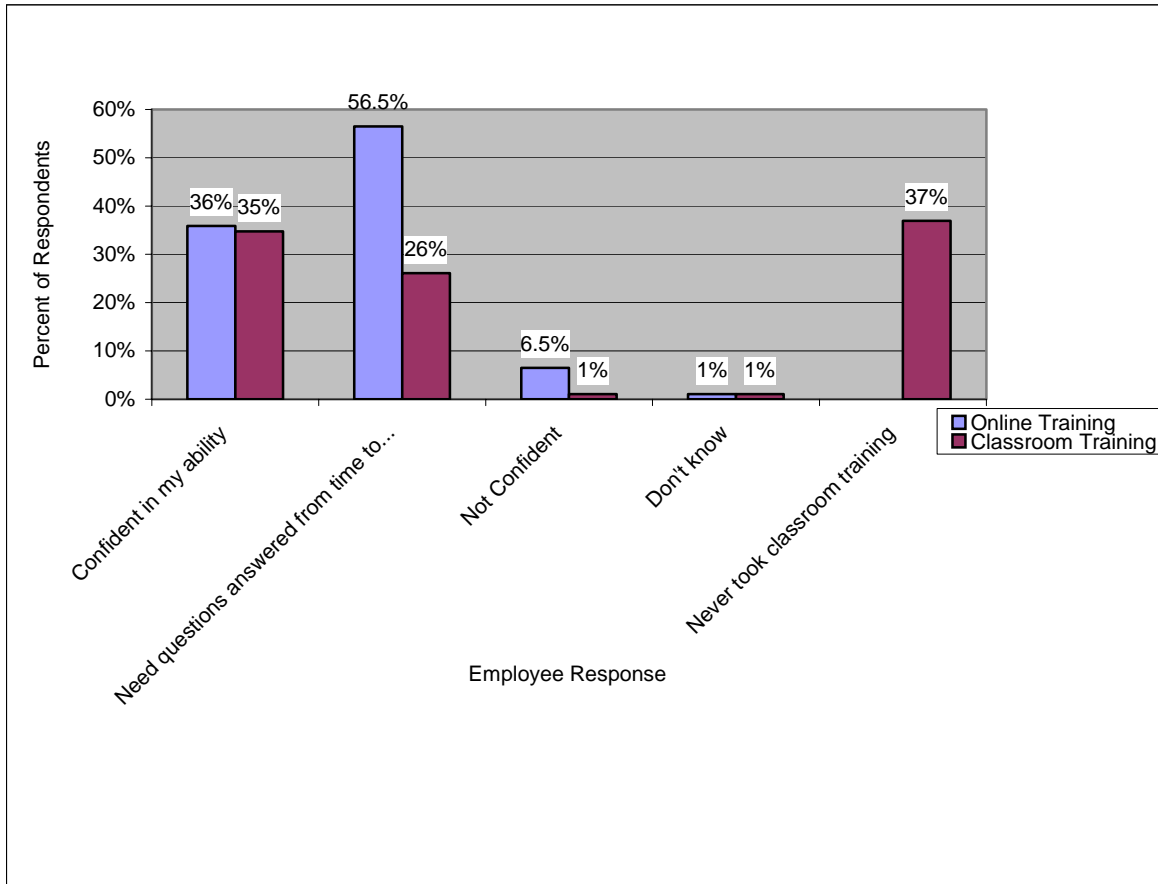
Figure 8 ABC Company Employees' Overall Perceptions of Acquired Knowledge and Retention Level Based on Online and Classroom Training (Survey Questions 9 and 10).

Figure 9 shows the type of field activities (question 13) performed by the employees compared to the training type (question15) that they felt was beneficial to them. It was illustrated that 53 percent of the employees who preferred online training to classroom performed walkdowns/inspections compared to those who preferred classroom training (47 percent). Sixty-three percent of the employees in the sample that preferred online training spent the majority of their time sampling in the field. Those who also spent time sampling but preferred classroom over online training was only 38 percent of the sample. There were 67 percent of those who preferred online that spent most of their time drilling. The other 33 percent

of those who performed drilling activities preferred classroom training. The 100 percent of those who preferred online training was indicative that there was only one individual that spent the majority of their time in the field transporting deliverables. There were 62 percent of those who preferred classroom training to online training by performing other activities besides those listed on the survey.
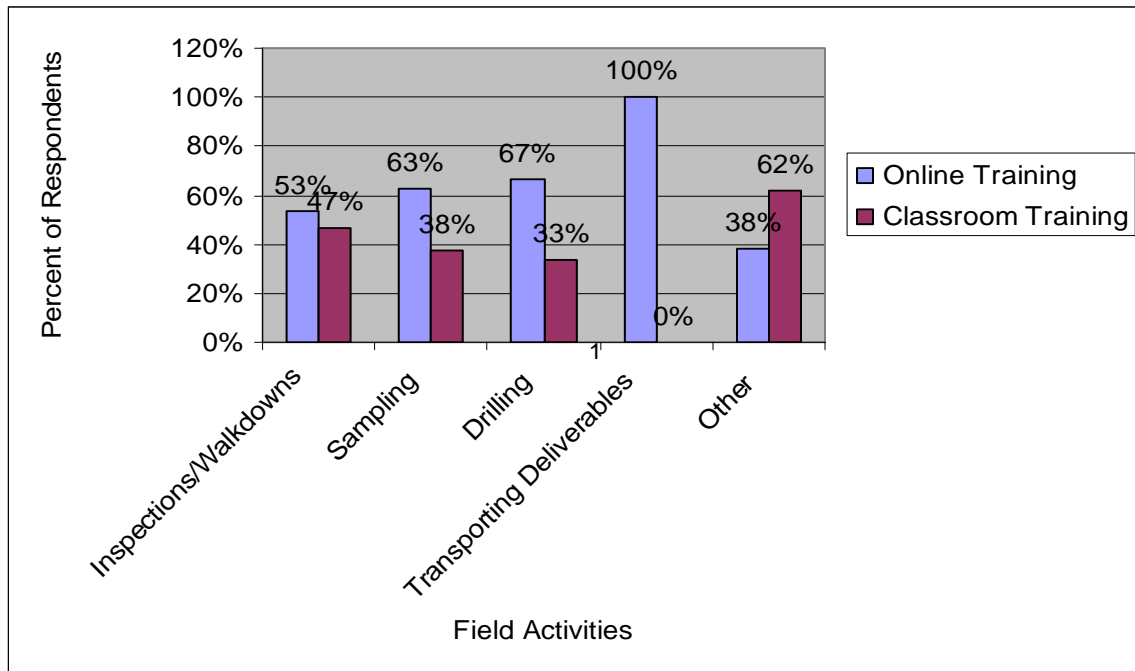
Figure 9 ABC Company Employees' Preferences of Online Training to Classroom Training by Their Associated Field Activities (Survey Questions 13 and 15).

Figure 10 identifies the frequency of field visits compared to the type of training preferred. According to this figure, it should be noted that the most frequent field visits occurred from daily to quarterly. Those who had visited the field on a daily basis showed that there were 71 percent who preferred online to classroom (29 percent). Those who had visited the field once a week showed that there were 62.5 percent that preferred online to classroom (37.5 percent). Those who had visited the field once a month showed that there were 62 percent who preferred online to classroom (38 percent). Thus, those who had perceived that online training was more

beneficial fell in the range of field visits from daily to once a month. Those who had field visits

on a quarterly basis indicated that were 60 percent of those who preferred classroom to online

(40 percent). Those who had field visits on an annual basis indicated that were 80 percent of

those who preferred classroom to online (20 percent). Those who felt that classroom training

was more beneficial fell in the range of field visits from quarterly to never going out to the field.

Therefore, it can be concluded that those who preferred online to classroom training performed

more frequent field activities. In addition to responses given to survey questions, several

employees provided comments and suggestions concerning why they chose one training format

over the other, which are noted in Appendix B.
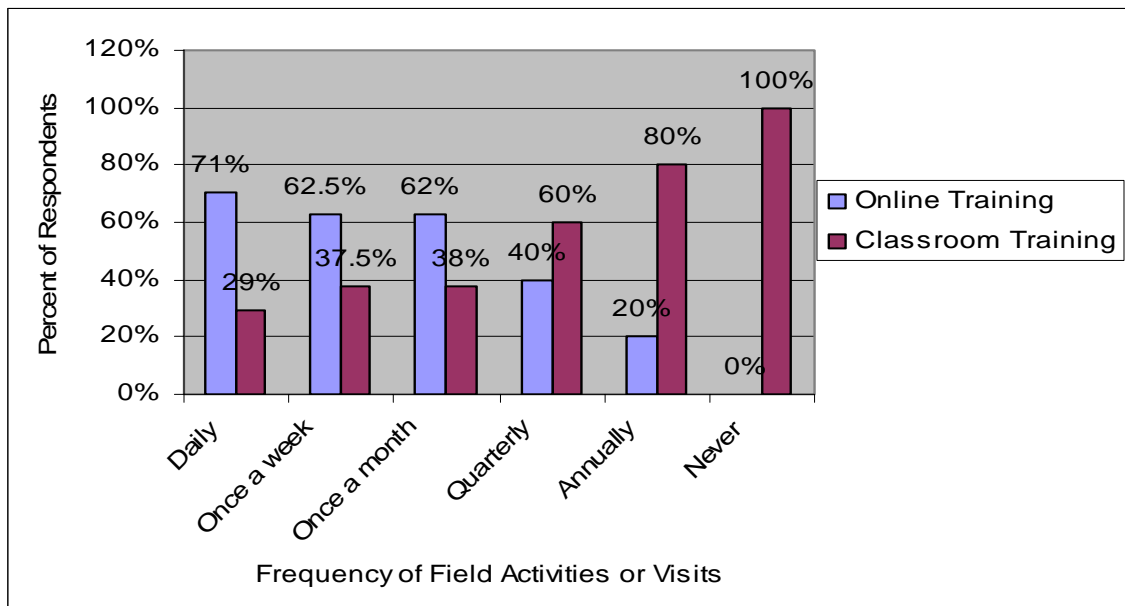
Figure 10 Comparison of ABC Company Employees' Preferences of Online Training to
Classroom Training by Field Activity Frequency (Survey Questions 12 and
15).

The effectiveness of the online training program was also evaluated by demonstrating

employee retention of knowledge after completing the online refresher course by comparing

pretest and posttest scores (Table 3).   The results from using a paired t-test indicated a

significance of $p < 0.0001$ with degrees of freedom = 109 (n-1). The sample size (n) of 110

reflects everyone who had taken the online refresher as of June 2004. This included 18

employees who did not participate in the survey but had completed the refresher. Therefore,

their pretest and posttest scores were available and used as part of the sample size.

Table 3   Online refresher pretest and posttest scores

Test	Average Score percent	Mean Difference	Std. Deviation
Current Pretest	74.7	-14.25	12.7
Current Posttest	89		

CHAPTER 5

DISCUSSION

The first hypothesis was that employee perception about the effectiveness of the online training program was influenced by position, longevity with the company, age, gender, and race. Recall that there was not enough data to determine a significant difference between employee perceptions of the online refresher training between races considering the large percent of Caucasians that were included in the sample. It should also be noted that out of the 128 employees surveyed there was only one Hispanic. This employee might not have responded, because the survey was written in English. Therefore, the survey might have been a challenge or useless to the individual. The employees' overall perceptions about the effectiveness of the online training refresher program were not influenced by any of the demographics.

Those who perceived that the online training gave them confidence (which also included those who felt somewhat confident) to perform their job were compared statistically by gender, position, longevity with the company, and age. Age was the only demographic variable that influenced those who responded that the online training refresher had given them confidence to perform their job. It is important to note there was no difference in those who were confident when compared by age (i.e. 73% for both age groups). However, the conclusion that there was a significant difference between perception and age was based on the fact that the perception of "somewhat confidence" was also included in the overall confidence perception. The significant difference between perception and age can possibly be explained, because those who were less than 38 years of age were probably more positive and comfortable with online training considering technology based training is more common. Those who were greater than 38 years old seemed not as confident because they probably had been used to traditional classroom training.

Another hypothesis was tested which indicated that employees preferred online training to classroom training and this preference was influenced by their associated demographics. This study determined that there were more employees who preferred online over classroom training although the difference was not statistically significant. It was also concluded that the demographics, for those who had participated in online training only and those who had participated in both training types, did not influence their response. It is important to note that those who preferred online to classroom included employees who had never experienced the HAZWOPER training refresher in the classroom. Therefore, they really had no way of comparing both training formats.

Statistical power calculations for each of the hypotheses mentioned above indicated that the study was unlikely to detect statistically significant results. The only way to have increased the sample size would have been to survey all subsidiaries of the ABC Company.

According to a study conducted by the EOHSI, actual knowledge measured from individuals greatly aided evaluating program effectiveness. The study concluded that programs could be improved through fully considering the benefits of assessing knowledge gained in training (Weidner 2000). In the current study, the retention of knowledge from participating in the online training program annually was investigated. The hypothesis was tested by comparing current pretest and posttest scores. All employees who had completed the online refresher course received a passing posttest score. Therefore, it was determined that retention of knowledge increased after completing the online refresher course.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Study outcomes reported in the literature review emphasized that obtaining employee feedback can be beneficial about whether an H & S training and education program is working. This study demonstrated that surveys can play an important role in helping management obtain a better understanding of the thoughts, feelings, and behaviors of their employees. The evaluation of the ABC Company's online training program based on assessing its employees perceptions and their acquired knowledge suggests that it is effective, at least from the company's perspective. Thus, the statistical results from this study presented the overall employee perceptions as being positive about the ABC Company's 8-hr HAZWOPER online training program. Appendix A indicates employee comments concerning why they feel the ABC Company's online training refresher is effective (e.g. cost, convenience, easy). It is important to note that if the employee were to fail the online refresher training course the first time, then they would have to attend a classroom training course. There is no guarantee that online test takers will not cheat. They have the luxury to take it from any location (e.g. work or home). Therefore, these factors could have possibly influenced those who preferred online to classroom training.

Because there was a significant difference between the employees' perception that the online training program had given them confidence (somewhat confidence) and their associated age, then the company might consider modifying its program to avoid such differences in perceptions based on this factor. However, the results from this research do not necessarily indicate that the ABC Company needs to modify its program based on the fact there were no other significant differences between employee perceptions and demographics.   For those who prefer classroom to online training, then it is suggested that the company allow the individual the

option of taking classroom training. Of course, changing training delivery platforms alone does not guarantee improved training results (Summit Training Source, Inc. 2003).

Technology alone cannot enhance H & S training efforts. It should be understood that technology is only a tool, and decisions to use any technology must be made as a part of an overall instructional plan (Summit Training Source, Inc. 2003).

Recommendations

- Increase the study population size to allow for greater statistical power.

- An evaluation of retention and knowledge 6 months after completion of the 8-hr HAZWOPER.

- Compare classroom test scores to online test scores to distinguish a significant difference in retention of knowledge.

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APPENDICES

APPENDIX A

Employee Survey

1. What is your sex?
   a. Male
   b. Female

2. What is your race?
   a. Caucasian
   b. African-American
   c. Hispanic
   d. Native American
   e. Other_____

3. Age?_____

4. Which best describes your job title?
   a. Engineer
   b. Geologist
   c. Environmental Scientist
   d. Upper Management
   e. None of the above (Please enter title_____)

5. Which job category do you spend a greater part of your time doing?
   a. Technical (e.g. engineer, geologist, scientist
   b. Non-Technical (upper management/administrative)

6. Work experience (Years) within ABC Company?
   a. 0-5
   b. 6-11
   c. 12-17
   d. 18-23
   e. 24-over

7. Have you ever completed the 8-hour HAZWOPER online training course?
   a. Yes
   b. No

8. Have you ever taken a 8-hour HAZWOPER training course in a classroom setting while
   working for the ABC company?
   a. Yes
   b. No

9. If you took the online course, then how would you describe your acquired knowledge and retention level from participating in the company's online training program?
    a. Confident in my ability
    b. Need questions answered from time to time
    c. Not confident
    d. Do not know

10. If you took the HAZWOPER training course in the classroom, then how would you describe your acquired knowledge and retention level from participating in the company's classroom training program?
    a. Confident in my ability
    b. Need questions answered from time to time
    c. Not confident
    d. Do not know

11. Do you think awareness of environmental impacts to the workers and/or members of the public should be a major concern?
    a. Yes
    b. No
    c .Don't know
    d. Don't care

12. How often do you visit or work in the field?
    a. Daily
    b. Once a week
    c. Once a month
    d. Quarterly
    e. Annually
    f. Never

13. Which describes your activities in the field?
    a. Inspections/Walkdowns
    b. Sampling
    c. Drilling
    d. Transporting deliverables
    e. Other_____

14. If you have taken the online training refresher course, then has it given you enough confidence to perform your job?
   a. Yes
   b. No
   c. Somewhat
   d. Don't know

15. Which training method would you prefer that is more beneficial to you?
   a. On-line
   b.Classroom/Lecture

16. Why would you prefer that type of training method?_____

17. If required to wear PPE or other engineering controls, are you confident enough to decide when to use them?
   ❑ Yes
   ❑ No
   ❑ Don't know
   ❑ Exempt

18. Do you feel the results from this employee survey will impact how the company manages or recognizes the employees' perceptions of the 8-hour refresher H&S training course offered in the future?
   a. Yes
   b. No
   c. Maybe
   d. Don't know
   e. Don't care

APPENDIX B

Employee Comments and Suggestions

Survey Question 16: Why would you prefer one training format over the other?

Answers from employees who prefer OnlineTraining:	Answers from employees who prefer Classroom Training:
It is easier to go at a pace necessary for retention of knowledge	Classroom setting was more personal and company oriented.
Convenience.	I function better with hands-on training and a lecturer or facilitator.
Much easier to schedule.	Better retention factor.
Consistent delivery.	Interaction with a live instructor makes training more customizable to your particular cimcumstances.
It takes less than 8 hours to complete. Plus, no travel is involved.	Interaction with instructor and others and hands-on activities provides better imprint.
It gives a more comprehensive overview of the HAZWOPER requirements and has references readily available.	Opportunities to interact with the instructor(s) by asking questions and listening to others who may have first hand experience.
Can split time over several days.	More hands on experience (e.g. dressing out)
It is quicker and you can look up answers to specific questions without spending a lot of time on topics that you already have a good understanding of.	I am required to pay attention and there aren't distractions that can sometimes interfere at work.
Cost efficiency.	Beneficial to technical workers that perform hazardous material functions in the field.

APPENDIX C

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