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Evaluating Effectiveness and Impact of Occupational Safety and Health Training Delivered in Distance Learning Format: Determining Critical Factors for Success

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Executive Summary

Introduction

CPWR: The Center for Construction Research and Training (CPWR) conducts construction safety and health training for members of its consortium partners and affiliates of the North America's Building Trades Unions (NABTU). As a result of the COVID-19 pandemic's impact on businesses and communities, CPWR and its partners led a transition to distance learning for delivering occupational safety and health training to construction workers nationwide. Preliminary evaluations of these trainings found support for the use of synchronous distance learning format for enhancing worker safety and health-related knowledge and skills, both immediately following training as well as three to six months post-training (Sarpy, Stachowski, Gustafson, & Surtees, 2020). However, because these results were demonstrated with shorter (six hours or less) COVID-19 pandemic-related safety trainings (e.g., COVID-19 awareness training; Infection Control Risk Awareness/COVID-19 awareness training), additional research was needed to identify the key features of success for courses of longer duration across a range of training providers. Comparing a series of courses across various training providers using various training design features provides more robust results and greater generalizability regarding the critical features of success when delivering occupational safety and health trainings through distance learning.

Purpose

The present report details a comprehensive evaluation process that assessed the effectiveness of synchronous distance learning in delivering occupational safety and health training in "real time." This study includes comparative analyses of OSHA 510 and OSHA 500 trainings, each of which requires at least 26 hours and is provided by multiple training providers to assess effectiveness and impact of the distance learning format on both subjective and objective measures (i.e., reactions, learning, performance). The evaluation assessed the following: (1) comparisons of effectiveness of safety trainings delivered face-to-face versus distance learning; (2) comparisons of effectiveness of various distance learning features on training outcomes; (3) impact of distance learning courses on training outcomes 3 to 6 months post-training (e.g., maintenance of training and on-the-job performance); and (4) influence of trainee characteristics (e.g., technological competence) on training outcomes.

Methods

To examine differences in effectiveness of face-to-face versus distance learning, the evaluation assessed training outcomes immediately following the completion of training. To examine the extent to which distance learning courses are effectively meeting workers' safety and health-related needs on the job, the evaluation assessed longer-term training outcomes (3 to 6 months) following the completion of training. The evaluation process employed a methodology based on an established evaluation system designed by Sarpy and Associates. This evaluation process is strategically designed such that it: (1) uses a mixed-method approach that incorporates qualitative and quantitative data; (2) incorporates a multiple stakeholder system that will provide 360-degree feedback of effectiveness from major stakeholders; (3) identifies best practices/lessons learned from project findings; and (4) provides general recommendations for consideration to enhance programmatic success and sustainability.

Study 1: Comparative Study of Face-to-Face versus Distance Learning Format

Using face-to-face format as the gold standard for design and delivery of training, occupational safety and health courses were analyzed to compare the effectiveness of face-to-face and distance formats. The focus of the evaluation included: (1) training design features (e.g., length/spacing of training sessions; extent of interaction); and (2) training outcomes (e.g., satisfaction; declarative and procedural knowledge and skill acquisition). Two occupational safety and health training courses (OSHA 510; OSHA 500) were included in Study 1 for a comparative study. These courses were presented by thirteen NABTU affiliates in face-to-face format prior to the COVID-19 pandemic and in distance learning format during the COVID-19 pandemic, thereby allowing for direct comparisons. Two primary sources of data were used to measure training effectiveness: (1) CPWR Training Course Evaluations; and (2) OSHA written tests. Of those attending the OSHA 510 and OSHA 500 courses, 1,429 participants completed the CPWR Course Evaluations and OSHA written tests.

Trainees generally reported high levels of effectiveness for both face-to-face and distance formats, with face-to-face courses rated more positively. Comparative analyses revealed significantly higher ratings of instructor effectiveness for the OSHA 510 and OSHA 500 courses delivered in the face-to-face format. However, there were no significant differences in ratings of training/learning method effectiveness between those attending the OSHA 510 and OSHA 500 courses face-to-face and those attending the trainings using a distance learning format.

Trainees reported learning gains and demonstrated high scores on tests for the two OSHA courses delivered in both the face-to-face and distance learning formats. However, comparative analyses demonstrated significantly greater self-reported learning for those attending the OSHA 500 courses in the face-to-face format and found significantly higher test scores among those attending OSHA 500 and OSHA 510 courses delivered in the face-to-face format. Notably, a large effective size was demonstrated for use of the face-to-face delivery format on post-training test scores for the OSHA 500 courses.

To gain a greater understanding of the differences among the training outcomes, the training features of the distance learning format were explored. Qualitative analysis of interviews with the NABTU training affiliates delivering the trainings revealed that the providers were highly consistent in their design and delivery of the distance learning format but they reported differences in the scheduling of training through distance learning. Training providers reported four distinct considerations when scheduling the OSHA 510 and OSHA 500 courses delivered via distance learning: (1) providing a designated break for lunch; (2) length of training sessions before giving a break; (3) length of break provided; and (4) providing training on consecutive days during the week or providing a weekend break. Although the scheduling largely did not influence ratings of effectiveness and were not consistent for self-reported learning, findings suggest that scheduling did significantly influence test scores. Results demonstrated that the longest training sessions, with extended breaks that included lunch, spread out across more days (weekend break instead of consecutive days) resulted in the highest test scores. On the other hand, shorter training sessions presented with more frequent shorter breaks and no designated lunch break resulted in the lowest test scores. While these results are preliminary, they indicate that the scheduling of training is an important consideration in the use of distance learning.

Study 2: Impact of Training Designed and Delivered Using Distance Learning on Longer-term Outcomes. To provide greater understanding of the findings of Study 1, Study 2 focused on assessing retention and transfer of the knowledge and skills gained during training. Simply put, Study 2 examined the effects of the distance learning format on longer-term learning and performance. All OSHA 510 and OSHA 500 courses developed and delivered via distance learning during the COVID-19 pandemic were targeted for the study. These trainings were inclusive of the distance learning courses detailed in Study 1. Two questionnaires were developed and administered online to assess effectiveness and the trainings delivered in distance learning format. Separate questionnaires were designed to capture feedback from instructors presenting the training (*CPWR Distance Learning Evaluation: Instructor version)* as well as the participants receiving the training (*CPWR Distance Learning Evaluation: Trainee version)*.

Three to six months following training, trainees and instructors continued to report high levels of effectiveness for various aspects of the trainings presented in the distance learning format. Additionally, the expertise and skills of the instructors were consistently rated as the most effective aspect of the courses, whereas the distance learning format itself received the lowest ratings from both instructors and trainees. It should be noted that the instructors, while providing positive ratings, reported slightly lower ratings of effectiveness relative to the trainees.

In general, trainees self-reported high levels of safety-related knowledge and skills three to six months following training. These ratings suggest that trainees maintained the enhanced knowledge and skills learned reported in Study 1 (directly following the distance learning courses). Trainees reported the highest ratings for the knowledge and skills associated with appropriate use of personal protective equipment and the recognition of unsafe work conditions and practices, whereas they provided the lowest ratings for understanding their legal rights.

The findings demonstrated importance of the technological competence for trainees. The trainees' comfort with the technology, change in comfort with technology, and to a lesser extent skill in using the technology and change in skill, had a significant influence on training outcomes when using the distance format. The results also provide preliminary evidence that greater comfort with the technology increased their ability to retain the learned knowledge and skills as well as to transfer that information to improved performance at the worksite. These results emphasize the need for building and supporting trainees' comfort with and expertise in the distance learning format to ensure the greatest impact of the training.

The Net Promoter Score is a core metric in marketing research to gain a greater understanding of customer experience and can be used as a benchmark for success. For the present study, Net Promoter Scores provided an estimate regarding the percentage of users who would recommend the use of distance learning for the OSHA courses. Net Promoter Scores for trainees revealed strong positive support for distance learning to deliver both the OSHA 510 and OSHA 500 courses. On the other hand, Net Promoter Scores for instructors revealed a lack of general support for the continued use of distance learning for those courses.

To better understand these results, qualitative data were gathered from trainees and instructors. Trainees cited critical factors influencing the effectiveness of distance learning including: (1) teaching and learning methods; (2) use of an interactive approach that included discussion and

question and answer session; (3) breakout sessions; (4) presentations and group exercises; (5) adhering to COVID-19 safety; (6) convenience and cost effective/efficiency; and (7) instructors' expertise. On the other hand, trainees indicated several factors that interfered with the effectiveness of distance learning including: (1) difficulty staying engaged; (2) limitations to the effective use of the exercises, activities, discussions, and real time interaction/socializations due to the remote nature of distance learning; (3) technological competence required; (4) technical issues; and (5) organization of materials and content.

Instructors also described the strengths and weaknesses of using distance learning to deliver the training as well as challenges specific to this format. From their perspective, the strengths of distance learning included: (1) enhanced capacity to deliver needed training in a safe environment during the COVID-19 pandemic; (2) cost savings and convenience gleaned from not having to travel to the training centers; and (3) breakout rooms due to the personal level of attention that this technique brings. The weaknesses of distance learning centered around limitations such as: (1) lack of social interaction; (2) preference for in-person interactions and discussions; (3) difficulty in assessing trainees' attention and comprehension of the subject matter; (4) technical issues; (5) varying levels of technological competence; (6) limits on the use of hands-on exercises and activities; and (7) difficulties in providing support in preparing students for their presentations. Finally, instructors provided best practices learned from the use of the distance learning format, including: (1) advanced preparation for instructors; (2) orientation to the technology; (3) use of technological components; (4) inclusion of support teams; and (5) use of student assessments. It should be noted that several of the respondents indicated a strong preference for in-person training. Collectively, these qualitative comments highlight important themes for the successful design and delivery of occupational safety and health courses using distance delivery. Suggestions were provided that consider the needs of both the trainees and the instructors. Importantly, these thematic categories are consistent with those reported for the shorter occupational safety and health courses previously evaluated during the early stages of the COVID-19 pandemic (Sarpy et al., 2020).

Future Research

Overall, these results provide further evidence that distance learning can be used effectively and suggest that strategic decision-making will be needed to determine its best use in improving occupational safety and health training systems. Future research could examine the optimal use of different formats and the best sequencing of distance learning and in-person instruction in combined training efforts. Because of the time and cost efficiencies cited by both trainees and instructors, evaluations could be expanded to include cost/benefit analyses. These analyses could provide additional information to systematically assess various combinations of these hybrid or blended approaches, which is particularly relevant for longer occupational safety and health courses (e.g., 40-hour HAZWOPER) on training outcomes.

Future research is needed to include outcome measures that more directly assess social aspects of training. Although each of the training providers stressed the use of highly interactive techniques, the lack of face-to-face interaction was cited as a barrier to networking and resource sharing among participants. Future research should consider including interpersonal and relationship variables in the assessment of the effectiveness of the distance learning formats to clarify the extent to which

the reduced in-person interactions influence these outcomes (e.g., communication between instructors and trainees; peer support and cohesion among trainees).

The findings of the present study contribute to the understanding of the trainee characteristics and training features critical for success in technology-based formats (Bell et al., 2017; Sarpy et al., 2021). The present findings suggest that trainees' technological competence influences maintenance and transfer of training outcomes. In addition, examination of these training characteristics across a more diverse worker population (e.g., gender, race, ethnicity) is recommended. Systematic evaluations of the trainee characteristics and training features used in distance learning will provide evidence that can be used to improve fidelity of the training to approximate the learning environment engendered in the face-to-face (gold standard) format.

Conclusion

The present evaluation provides additional evidence supporting the effectiveness of synchronous, interactive distance learning techniques in delivering occupational safety and health training. Trainee characteristics and training factors affecting effectiveness and impact are identified, as well as recommendations for continuous quality improvement. Finally, suggestions for future research of use of the distance technology in occupational safety and health training systems are advanced. Taken together, these findings and general recommendations can be used to ensure successful and sustained integration of synchronous distance learning for occupational safety and health trainings.

Introduction

Background. The COVID-19 pandemic has caused great disruptions to and uncertainty for organizations worldwide requiring rapid transitions to remote communications and interactions. Within the occupational safety and health domain, for example, an immediate transition in the design and delivery of training from face-to-face to distance learning format occurred. These remote initiatives provide flexibility to support essential worker needs while ensuring their safety and well-being. However, the immediate and unplanned nature of the transition to distance learning, and subsequent heavy reliance on advanced technology, emphasize the need for systematic evaluations of these trainings' effectiveness to ensure continuous quality improvement.

CPWR - The Center for Construction Research and Training (CPWR) is a nonprofit dedicated to reducing occupational injuries, illnesses and fatalities in the construction industry. CPWR conducts specific types of construction safety and health training for members of its consortium partners and the North America's Building Trades Unions (NABTU). The overarching goal of CPWR training is to enable and empower construction workers to recognize potentially unsafe working conditions and to identify proper ways to eliminate or control those hazards. As a result of the COVID-19 pandemic and its impact on businesses and communities nationwide, CPWR and its consortium partners led the transition to distance learning to deliver occupational safety and health training for construction workers nationwide. It should be noted that for the purposes of this report, distance learning is an umbrella term used to describe training in which instructor and trainee are remote during the instruction, that is, not in the same location (i.e., geographically distant). This report evaluates the use of synchronous distance learning format to provide the training in "real time" (Moore, Dickson-Deane, & Gaylen, 2010). For further discussion, the reader is referred to the Glossary of this report.

Preliminary evaluations of these trainings have found support for the use of synchronous distance learning format for enhancing worker safety and health-related knowledge and skill both immediately following training as well as three to six months post-training (Sarpy, Stachowski, Gustafson, & Surtees, 2020). Importantly, workers also reported a transfer of the learned knowledge and skills to improved safety performance at their workplace during the COVID-19 pandemic. The study also demonstrated that specific characteristics of the trainee (e.g., comfort with the technology) and training features (e.g., interaction, instructor expertise) influenced these results. However, these results were demonstrated with COVID-19 pandemic-related safety trainings. More specifically, initial studies focused on COVID-19 awareness training (1 hour) and the Infection Control Risk Awareness/COVID-19 awareness training (6 hour). Both courses were designed and delivered by master instructors using a highly interactive synchronous distance learning format to deliver the training. Additional research was needed to identify the key features of success for courses of longer duration, using various types of distance learning formats and training providers. Comparisons of a series of courses (e.g., OSHA 500 series courses) across various training providers utilizing various training design features provide more robust results and greater generalizability regarding the key features of success for use of distance learning in delivering occupational safety and health trainings.

Purpose This report details a comprehensive evaluation process designed to assess the effectiveness of distance learning in delivering occupational safety and health training. This includes comparative analyses of OSHA 510 and OSHA 500 trainings—each requiring at least 26

hours and provided by multiple training providers—to assess effectiveness and impact of the distance learning format on subjective and objective measures (i.e., reactions, learning, performance). The evaluation was designed to assess the following: (1) comparisons of effectiveness for safety trainings delivered in face-to-face versus distance learning format; (2) comparisons of effectiveness of various distance learning design features on training outcomes; (3) impact of distance learning courses on training outcomes three to six months post-training (e.g., maintenance of training, on-the-job performance); (4) influence of trainee characteristics (technological competence) on the training outcomes.

Evaluation Process

The evaluation process used for the current project involved a two-pronged approach. To examine differences between the effectiveness of face-to-face versus that of distance learning (Study 1), the evaluation focuses on training outcomes immediately following the completion of training. To examine the extent to which distance learning courses are impacting workers' safety- and health-related needs on the job (Study 2), the evaluation focuses on longer-term training outcomes (three to six months) following the completion of training. The methodology employed in the evaluation process is based on an established evaluation system designed by Sarpy and Associates. This evaluation process is strategically designed such that it: (1) uses a mixed-method approach that incorporates qualitative and quantitative data; (2) incorporates a multiple stakeholder system that will provide 360-degree feedback of effectiveness from major stakeholders; (3) identifies best practices/lessons learned from project findings; and (4) provides general recommendations for consideration to enhance programmatic success and sustainability. The evaluation process also follows Kirkpatrick's framework for training evaluation criteria and includes evaluation of reactions (Level 1), learning (Level 2), transfer to improvements in on-the-job safety performance (Level 3), and organizational results (Level 4). It should be noted that this evaluation process has been used to evaluate the effectiveness and impact of distance learning and face-to-face occupational safety and health and leadership training programs (Sarpy & Burke, 2021; Sarpy, Burke, Rabito, & Hughes, 2017; Sarpy & Kaplan, 2012), emergency management and disaster response (Sarpy et al., 2006; Sarpy, Chauvin, & Anderson, 2003), and resiliency training programs nationwide (Sarpy, Rabito, & Goldstein, 2012). This evaluation process is consistent with recommended best practices in worker training evaluation (NIEHS, 2015).

Study 1: Comparative Study of Face-to-Face versus Distance Learning Format.

An evaluation was conducted to provide direct comparisons between the effectiveness of worker safety and health training courses delivered in a traditional face-to-face format before the COVID-19 pandemic and that of courses delivered in various distance formats during the COVID-19 pandemic on training outcomes. More specifically, using face-to-face format as the gold standard for design and delivery, occupational safety and health courses were analyzed to compare the effectiveness of the course when held in face-to-face (i.e., course offerings pre-COVID-19) and distance (i.e., post-COVID-19 course offerings) formats. The focus of the evaluation included: (1) training design (e.g., length/spacing of training sessions, extent of interaction); and (2) training outcomes (e.g., satisfaction, declarative and procedural knowledge and skill acquisition).

Targeted Courses

Two occupational safety and health training courses (OSHA 510 and OSHA 500) were included in Study 1 for a comparative study. These courses were presented by various training providers in face-to-face format prior to the COVID-19 pandemic and are currently being presented in a distance learning format, thereby allowing for direct comparisons.

More specifically, the OSHA 510: Occupational Safety and Health for the Construction Industry course (hereafter **OSHA 510**) covers OSHA standards, policies, and procedures in the construction industry. Topics include scope and application of the OSHA construction standards, construction safety and health principles, and special emphasis on those areas in construction which are most hazardous. The course requires a minimum of 26 contact hours, although many providers exceed this minimum. Trainees must pass a written exam at the end of the course. It has no prerequisites for enrolling.

The OSHA 500 Trainer Course in Occupational Safety and Health Standards for the Construction Industry (hereafter **OSHA 500**) is designed for individuals interested in teaching the 10- and 30-hour construction safety and health outreach training programs. During this course, students prepare a presentation on an assigned OSHA construction outreach training program topic and pass a written exam at the end of the course. The OSHA 500 course requires a minimum of 26 contact hours. The OSHA 500 prerequisites include completion of the OSHA 510 course and at least five years of safety and health work experience in the construction industry.

Evaluation Method

Two primary sources of data were used to measure training effectiveness: (1) CPWR Training Course Evaluation, and (2) OSHA written tests.

CPWR Training Course Evaluations are used to assess trainees' reactions and learning for all the trainings conducted (see Appendix A). The evaluations are administered to all participants *directly following* training. The questionnaires contain 26 items and require respondents to rate: (1) Instructor's effectiveness (e.g., "The instructor(s) explained how the course content applies to my job or trade."); (2) Teaching/learning method effectiveness (e.g., "The classroom discussions/small group activities are helpful for learning the material covered."); (3) Safety-related knowledge and skill gains (e.g., "The course helped me to improve my ability to recognize health hazards on the job."); and (4) Overall effectiveness in improving the knowledge, skills, and confidence to work safely. Respondents rate each item on a 5-point scale ranging from 1 to 5. The anchors varied with question category: Instructor items (*Rarely* to *Always*), Knowledge items (*Very little* to *A lot*), Method items (*Didn't help at all* to *Really helped*), and Overall Effectiveness (*Not at all* to *Completely*). The questionnaire also contains an open-ended item encouraging respondents to suggest how the course can be improved. The CPWR Course Evaluation Forms are gathered and compiled in a worker training database. The evaluation data for all OSHA 510 and OSHA 500 courses (face-to-face and distance) presented from November 2018 to June 2021 are included in this study.

Written tests are used to assess knowledge and skill gains in the OSHA courses. More specifically, the OSHA 510 course covers material consisting of OSHA standards with an emphasis of hazardous conditions in construction. The test contains multiple choice questions with four

response options per question. A score of 74% must be achieved on the OSHA 510 written exam to demonstrate successful knowledge acquisition. The OSHA 510 course is a prerequisite to OSHA 500.

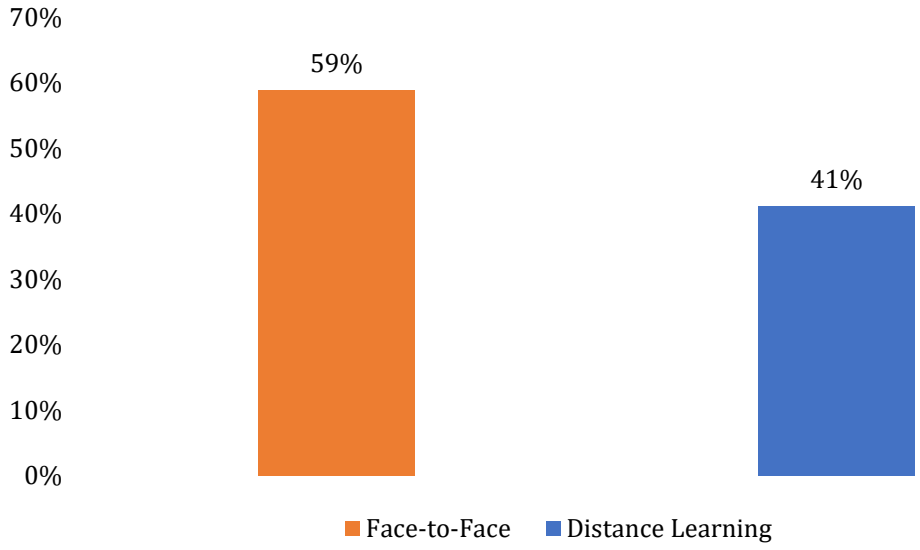
The OSHA 500 course prepares individuals to become an instructor in the OSHA Outreach Training Program. To successfully complete the OSHA 500 course, students must create and present on a specific OSHA Construction Outreach Training Program topic and pass a written exam. The test contains multiple choice questions with four response options per question. A score of 80% is required on the OSHA 500 written exam to demonstrate successful knowledge and skill acquisition.

Written tests are administered at the completion of training.

Participants

Of those attending the OSHA 510 and OSHA 500 courses, 1,429 training participants completed the CPWR Course Evaluations. More specifically, 841 respondents evaluated the face-to-face trainings, whereas 588 respondents evaluated the distance learning trainings . Figure 1.1 below depicts the percentage of respondents completing evaluations according to training format.

Figure 1.1. Percentage of Respondents Completing Evaluations for Face-to-Face and Distance Learning Courses.



Note. Total respondents: N=1,429; Face-to-Face: N= 841; Distance Learning: N=588.

It should be noted that the number of respondents also varied according to the length of course and delivery method. As depicted in Table 1.1, more respondents attended the trainings delivered in the face-to-face format. Further, in the face-to-face format, more respondents attended the OSHA 500 course, whereas in the distance learning format, more respondents attended the OSHA 510 course.

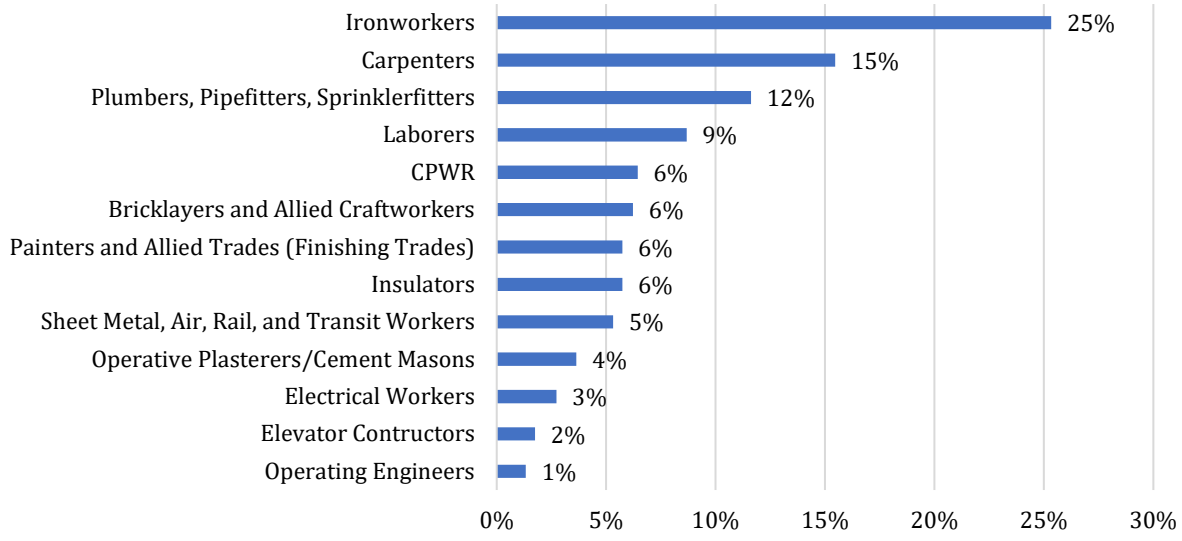
Table 1.1. Number of Post-Course Evaluations by Course and Delivery Method

Course by Delivery Method	Number of Respondents
Face-to-Face Courses	**841**
OSHA 510	350
OSHA 500	491
Distance Learning Courses	**588**
OSHA 510	308
OSHA 500	280

OSHA Training Providers

The training providers for the OSHA 510 and OSHA 500 courses represented 13 NABTU affiliates (see Figure 1.2). The breakdown of courses delivered according to training providers is as follows: Bridge, Structural, Ornamental and Reinforcing Ironworkers [Ironworkers] (25 %); Carpenters and Joiners (15%); Plumbers, Pipefitters, Sprinklerfitters (12%); Laborers (9%); CPWR (6%); Bricklayers and Allied Craftworkers (6%); Painters and Allied Trades; (6%); Heat and Frost Insulators and Allied Workers (6%); Sheet Metal, Air, Rail, and Transportation Workers (5%); Operative Plasterers/Cement Masons (4%); Electrical Workers (3%); Elevator Constructors (2%); and Operating Engineers (1%).

Figure 1.2. Trade Affiliation of OSHA Training Providers.



Note. N=1,429.

Reactions: Effectiveness of Training

Descriptive Analysis. Descriptive statistics were conducted on the CPWR Training Course Evaluation for each item and category of effectiveness according to the format of training attended (face-to-face or distance learning).

Table 1.2 presents the means, standard deviations, and number of survey respondents for evaluations of all courses combined (OSHA 510 and OSHA 500). In general, trainees report *high levels of effectiveness* regarding the instructors and training methods. However, results also demonstrate that respondents in the *face-to-face format report higher levels of Instructor Effectiveness, on average, than those attending the training in the distance learning format.*

Table 1.2. Descriptive Statistics for Face-to-Face and Distance Learning Effectiveness Ratings.

	Face-to-Face			***Distance Learning***		
Evaluation Items	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Instructor Effectiveness	**841**	**4.79**	**0.39**	**588**	**4.61**	**0.52**
1. Described the course and lesson objectives clearly.	840	4.76	0.52	588	4.56	0.65
2. Explained how the course content applies to my job or trade.	833	4.76	0.53	588	4.61	0.61
3. Presented the material clearly, so that I could understand it.	836	4.77	0.50	588	4.55	0.66
4. Kept the class focused on the learning objectives.	833	4.73	0.56	588	4.58	0.64
5. Encouraged class participation.	840	4.86	0.44	588	4.65	0.58
6. Reviewed key points.	836	4.86	0.41	588	4.69	0.54
7. Gave helpful feedback to the class on the exercises and activities.	839	4.85	0.41	588	4.62	0.59
8. Made good use of the student materials / manuals.	835	4.78	0.51	587	4.61	0.61
Training Method Effectiveness	**795**	**4.64**	**0.47**	**588**	**4.65**	**0.46**
9. Lectures (Instructor only talked and responded to questions)	768	4.57	0.69	581	4.63	0.61
10. Classroom discussions / small group activities	783	4.71	0.55	586	4.72	0.55
11. Demonstrations	762	4.65	0.62	554	4.58	0.71
12. Classroom-based activities / exercises	748	4.64	0.69	573	4.73	0.54
13. Hands-on activities / exercises / simulations	758	4.66	0.61	522	4.68	0.63
14. Course manual/handouts	789	4.67	0.60	585	4.66	0.66
15. PowerPoints	795	4.61	0.69	586	4.65	0.67
16. Video / YouTube / DVD	775	4.64	0.61	564	4.58	0.71

Note. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*). Training/learning method effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Table 1.3 presents the means, standard deviations, and number of survey respondents for the OSHA 510 evaluations. In general, trainees report *high levels of effectiveness* regarding the instructors and training methods for the OSHA 510 courses. However, results also demonstrate that respondents in the *face-to-face format report higher levels of Instructor Effectiveness, on average, than those attending the training in the distance learning format.* On the other hand, respondents in the *distance learning format rated the effectiveness of the Training Methods, on average, higher than those in the face-to-face format.*

Table 1.3. Descriptive Statistics for OSHA 510 Face-to-Face and Distance Learning Effectiveness Ratings.

	Face-to-Face			*Distance Learning*		
Evaluation Items	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Instructor Effectiveness	**350**	**4.74**	**0.44**	**308**	**4.60**	**0.53**
1. Described the course and lesson objectives clearly.	350	4.70	0.57	308	4.57	0.64
2. Explained how the course content applies to my job or trade.	346	4.74	0.57	308	4.55	0.65
3. Presented the material clearly, so that I could understand it.	347	4.71	0.56	308	4.54	0.68
4. Kept the class focused on the learning objectives.	347	4.65	0.63	308	4.59	0.63
5. Encouraged class participation.	349	4.80	0.52	308	4.62	0.57
6. Reviewed key points.	347	4.81	0.45	308	4.67	0.57
7. Gave helpful feedback to the class on the exercises and activities.	348	4.80	0.47	308	4.61	0.61
8. Made good use of the student materials / manuals.	347	4.72	0.57	307	4.63	0.59
Training Method Effectiveness	**341**	**4.60**	**0.49**	**308**	**4.66**	**0.47**
9. Lectures (Instructor only talked and responded to questions)	327	4.57	0.64	308	4.70	0.55
10. Classroom discussions / small group activities	335	4.67	0.61	306	4.75	0.52
11. Demonstrations	316	4.57	0.70	286	4.58	0.72
12. Classroom-based activities / exercises	317	4.59	0.76	298	4.72	0.56
13. Hands-on activities / exercises / simulations	311	4.60	0.69	265	4.65	0.70
14. Course manual/handouts	337	4.69	0.57	307	4.71	0.65
15. PowerPoints	341	4.57	0.71	307	4.65	0.66
16. Video / YouTube / DVD	327	4.58	0.69	289	4.56	0.75

Note. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*). Training/learning method effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Table 1.4 presents the means, standard deviations, and number of survey respondents for the OSHA 500 evaluations. In general, trainees report *high levels of effectiveness* regarding the instructors and training methods for the OSHA 500 courses. However, results also demonstrate that respondents in the *face-to-face format report higher levels of Instructor Effectiveness and slightly higher levels of Training Method Effectiveness, on average, than those attending the training in the distance learning format.*

Table 1.4. Descriptive Statistics for OSHA 500 Face-to-Face and Distance Learning Effectiveness Ratings.

	Face-to-Face			*Distance Learning*		
Evaluation Items	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Instructor Effectiveness	**491**	**4.83**	**0.34**	**280**	**4.62**	**0.51**
1. Described the course and lesson objectives clearly.	490	4.80	0.48	280	4.55	0.65
2. Explained how the course content applies to my job or trade.	487	4.78	0.51	280	4.67	0.55
3. Presented the material clearly, so that I could understand it.	489	4.81	0.44	280	4.56	0.63
4. Kept the class focused on the learning objectives.	486	4.78	0.49	280	4.56	0.64
5. Encouraged class participation.	491	4.90	0.36	280	4.67	0.59
6. Reviewed key points.	489	4.89	0.38	280	4.71	0.51
7. Gave helpful feedback to the class on the exercises and activities.	491	4.88	0.36	280	4.64	0.57
8. Made good use of the student materials / manuals.	488	4.82	0.45	280	4.59	0.62
Training Method Effectiveness	**454**	**4.67**	**0.45**	**280**	**4.64**	**0.45**
9. Lectures (Instructor only talked and responded to questions)	441	4.57	0.72	273	4.55	0.67
10. Classroom discussions / small group activities	448	4.74	0.50	280	4.68	0.57
11. Demonstrations	446	4.70	0.56	268	4.59	0.70
12. Classroom-based activities / exercises	431	4.67	0.62	275	4.73	0.52
13. Hands-on activities / exercises / simulations	447	4.70	0.56	257	4.71	0.55
14. Course manual/handouts	452	4.65	0.62	278	4.62	0.66
15. PowerPoints	454	4.63	0.68	279	4.63	0.69
16. Video / YouTube / DVD	448	4.69	0.54	275	4.60	0.67

Note. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*). Training/learning method effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Reactions: Effectiveness of Training

Comparative Analysis. To further explore the similarities and differences between ratings of effectiveness for trainees attending OSHA 510 and OSHA 500 courses in both the face-to-face and distance learning formats, comparative analyses were conducted on the CPWR Training Course Evaluations.

Instructor Effectiveness: OSHA 510 Course

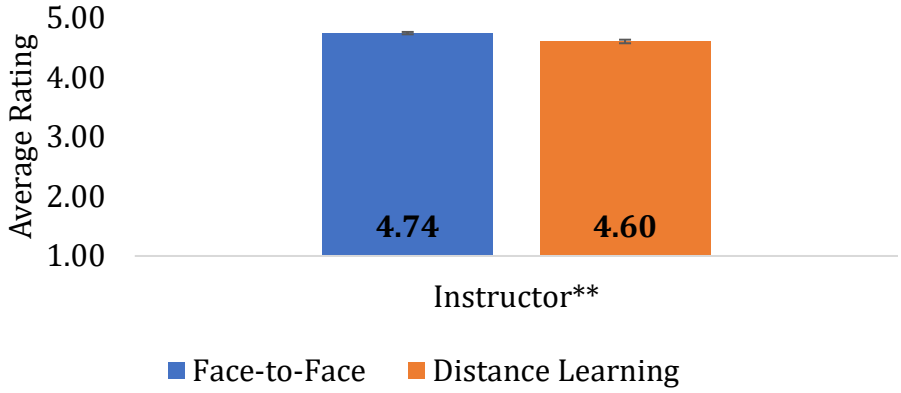
An independent samples t-test was conducted on the ratings of Instructor Effectiveness for trainees attending the OSHA 510 in either face-to-face or distance learning formats. As depicted in Table 1.5, results reveal, on average, respondents in the *face-to-face format report statistically significantly higher ratings of instructor effectiveness than those in the distance learning format* [$t(656) = 3.76$, $p < .001$, $d = .29$].

Table 1.5. T-Test of Instructor Effectiveness by Training Format.

Course Format	N	Mean	SD	p-value
510 Face-to-face	350	4.74	0.44	<.001**
510 Distance Learning	308	4.60	0.53	

Note. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*).

Figure 1.3. Mean Instructor Effectiveness for OSHA 510 Courses



Note. Effectiveness ratings significant at **p<.001. Items ratings range from 1 (*Least Effective*) to 5 (*Most Effective*). Vertical bars represent standard error of the mean.

Instructor Effectiveness: OSHA 500 Course

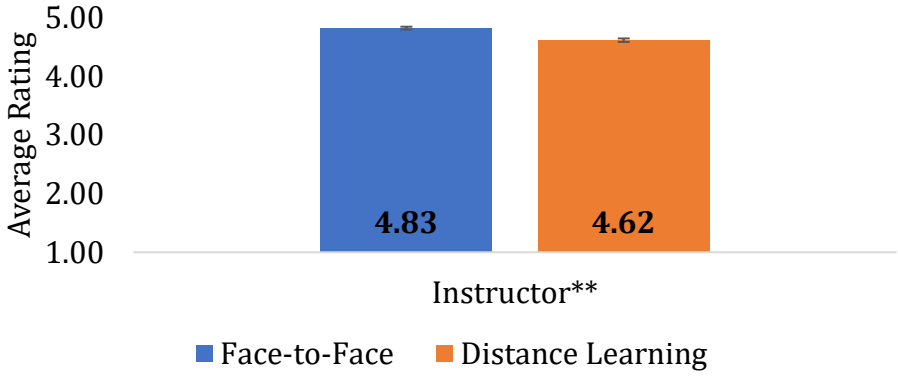
An independent samples t-test was conducted on the ratings of Instructor Effectiveness for trainees attending the OSHA 500 in either face-to-face or distance learning formats. As depicted in Table 1.6, results reveal, on average, respondents in the *face-to-face format report statistically significantly higher ratings of instructor effectiveness than those in the distance learning format* [t (769) = 6.91, p < .001, d = 0.52].

Table 1.6. T-Test of Instructor Effectiveness by Training Format.

Course Format	N	Mean	SD	p-value
500 Face-to-face	491	4.83	0.34	<.001**
500 Distance Learning	280	4.62	0.51	

Note. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*).

Figure 1.4. Mean Instructor Effectiveness by Training Format for OSHA 500 Courses



Note. Effectiveness ratings significant at **p<.001. Item ratings range from 1 (*Least Effective*) to 5 (*Most Effective*). Vertical bars represent standard error of the mean.

Training/Learning Methods Effectiveness: OSHA 510 Course

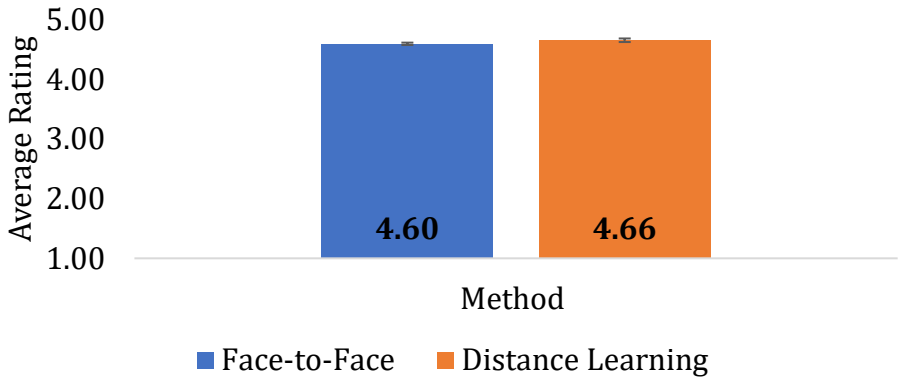
An independent samples t-test was conducted to explore the differences in ratings of effectiveness of the training methods by class format for the OSHA 510 courses. Table 1.7 shows that, on average, there were *not significant differences in training methods between respondents in the face-to-face format and those in the distance learning format* [t (647) = 1.53, p = .127, d = 0.12].

Table 1.7. T-Test of Training Methods Effectiveness by Training Format

Course Format	N	Mean	SD	p-value
510 Face-to-face	341	4.60	0.49	.127
510 Distance learning	308	4.66	0.47	

Note. Training methods effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Figure 1.5. Mean Training Methods Effectiveness by Training Format for OSHA 510 Courses.



Note. Item ratings range from 1 (*Least Effective*) to 5 (*Most Effective*). Vertical bars represent standard error of the mean.

Training/Learning Methods Effectiveness: OSHA 500 Course

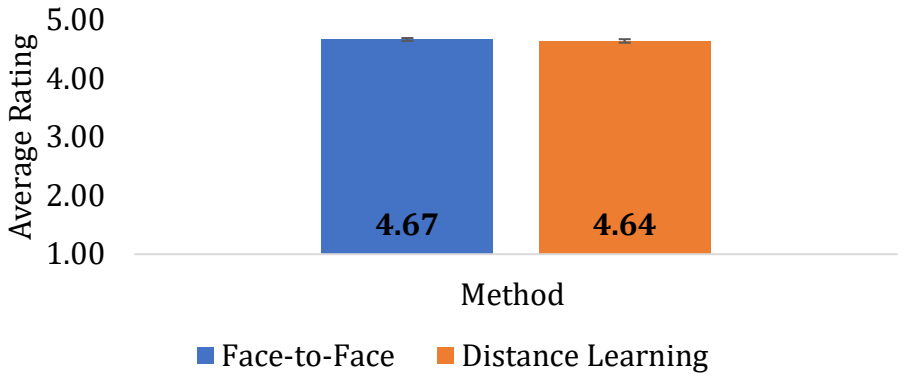
An independent samples t-test was conducted to explore differences in the ratings of effectiveness of the training methods by class format for the OSHA 500 courses. Table 1.8 shows that, on average, there were *not significant differences in training methods between respondents in the face-to-face format and those in the distance learning format* [t (732) = 0.93, p = .350, d = 0.07].

Table 1.8. T-Test of Training Methods Effectiveness by Training Format

Course Format	N	Mean	SD	p-value
500 Face-to-face	454	4.67	0.45	.350
500 Distance learning	280	4.64	0.45	

Note. Training methods effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Figure 1.6. Mean Training Methods Effectiveness by Training Format for OSHA 500 Courses.



Note. Item ratings range from 1 (*Least Effective*) to 5 (*Most Effective*). Vertical bars represent standard error of the mean.

Summary

Trainees in the OSHA 510 and OSHA 500 courses generally reported high levels of effectiveness for both face-to-face and distance learning formats, with the face-to-face format rated more positively than the distance learning format. Comparative analyses revealed that Instructor Effectiveness ratings were significantly higher for the OSHA 510 and OSHA 500 courses delivered in the traditional face-to-face format. However, there were no significant differences in the ratings of Training/Learning Method effectiveness between those attending the OSHA 510 and OSHA 500 courses in the face-to-face format and those attending the courses in the distance learning format.

Learning: Self-reported Safety-related Knowledge and Skills

Self-reported Safety-related Knowledge and Skills

Descriptive Analysis. Descriptive statistics were conducted on the CPWR Training Course Evaluation for each safety-related knowledge and skill reported by trainees according to the format of training attended (face-to-face or distance learning). Table 1.9 presents the means, standard deviations, and number of survey respondents for self-reported learning of all the courses combined (OSHA 510 and OSHA 500).

With respect to learning outcomes, respondents attending *both the face-to-face and distance learning formats reported high levels of learning gains for the safety-related knowledge and skills associated with the trainings.* However, results generally show that trainees in *the face-to-face format reported slightly higher levels of knowledge and skill, on average, for five of the eight knowledge and skills than those in the distance learning format*.

There were three exceptions. The trainees reported equally high levels of attainment of knowledge and skills associated with the use of appropriate personal protective equipment and understanding the importance of jobsite safety plans and emergency response planning regardless of training format. The trainees in the distance learning format reported slightly greater knowledge and skill in understanding legal rights than those in the face-to-face trainings.

Table 1.9. Descriptive Statistics for Face-to-Face and Distance Learning Self-reported Safety-related Knowledge and Skills Ratings Across both Formats.

	Face-to-Face			*Distance Learning*		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
Self-reported Safety-related Knowledge and Skills	**841**	**4.77**	**0.42**	**587**	**4.75**	**0.49**
1. Understand the hazards/dangers of working with/around the topic(s) taught in this class.	841	4.78	0.48	583	4.75	0.52
2. Recognize health hazards on the job.	838	4.78	0.49	583	4.73	0.57
3. Recognize unsafe work conditions and practices.	840	4.80	0.47	583	4.78	0.52
4. Recognize the signs and symptoms that may be related to hazardous environments and exposures.	839	4.74	0.52	584	4.72	0.59
5. Understand when a job hazard needs me to take immediate action.	841	4.79	0.49	585	4.77	0.54
6. Use appropriate personal protective equipment.	834	4.78	0.51	580	4.78	0.53
7. Understand my legal rights.	840	4.69	0.60	585	4.71	0.60
8. Understand the importance of jobsite safety plans and emergency response planning.	839	4.80	0.46	584	4.80	0.49

Note. Training-related Knowledge/Skills items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Table 1.10 presents the means, standard deviations, and number of survey respondents for the OSHA 510 self-reported learning gains. *In general, trainees in the distance learning format reported slightly higher levels of safety-related knowledge and skills than those attending in the face-to-face format.*

Table 1.10. Descriptive Statistics for OSHA 510 Face-to-Face and Distance Learning Self-reported Safety-related Knowledge and Skills Ratings.

	Face-to-Face			*Distance Learning*		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
Self-reported Safety-related Knowledge and Skills	**350**	**4.73**	**0.45**	**308**	**4.80**	**0.40**
1. Understand the hazards/dangers of working with/around the topic(s) taught in this class.	350	4.75	0.51	308	4.79	0.47
2. Recognize health hazards on the job.	347	4.76	0.50	308	4.78	0.50
3. Recognize unsafe work conditions and practices.	350	4.78	0.49	308	4.84	0.44
4. Recognize the signs and symptoms that may be related to hazardous environments and exposures.	350	4.71	0.55	308	4.75	0.57
5. Understand when a job hazard needs me to take immediate action.	350	4.75	0.53	308	4.81	0.47
6. Use appropriate personal protective equipment.	345	4.73	0.57	306	4.82	0.45
7. Understand my legal rights.	349	4.63	0.66	308	4.74	0.54
8. Understand the importance of jobsite safety plans and emergency response planning.	350	4.75	0.53	308	4.83	0.45

Note. Training-related Knowledge/Skills items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Table 1.11 presents the means, standard deviations, and number of survey respondents for the OSHA 500 self-reported learning gains. *In general, trainees in the face-to-face format reported slightly higher levels of safety-related knowledge and skills than those in the distance learning format.*

Table 1.11. Descriptive Statistics for OSHA 500 Face-to-Face and Distance Learning Self-reported Safety-related Knowledge and Skills Ratings.

	Face-to-Face			*Distance Learning*		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
Self-reported Safety-related Knowledge and Skills	**491**	**4.80**	**0.39**	**279**	**4.70**	**0.56**
1. Understand the hazards/dangers of working with/around the topic(s) taught in this class.	491	4.80	0.46	275	4.71	0.58
2. Recognize health hazards on the job.	491	4.80	0.49	275	4.68	0.63
3. Recognize unsafe work conditions and practices.	490	4.81	0.46	275	4.72	0.60
4. Recognize the signs and symptoms that may be related to hazardous environments and exposures.	489	4.77	0.50	276	4.68	0.60
5. Understand when a job hazard needs me to take immediate action.	491	4.81	0.47	277	4.72	0.61
6. Use appropriate personal protective equipment.	489	4.81	0.45	274	4.73	0.61
7. Understand my legal rights.	491	4.73	0.55	277	4.68	0.67
8. Understand the importance of jobsite safety plans and emergency response planning.	489	4.83	0.41	276	4.76	0.53

Note. Training-related Knowledge/Skills items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Self-reported Safety-related Knowledge and Skills

Comparative Analysis. To further explore the similarities and differences between self-reported learning gains for trainees attending OSHA 510 and OSHA 500 courses, comparative analyses were conducted on the CPWR Training Course Evaluation according to the format of training attended (face-to-face or distance learning).

Self-reported Safety-related Knowledge and Skills: OSHA 510 Course

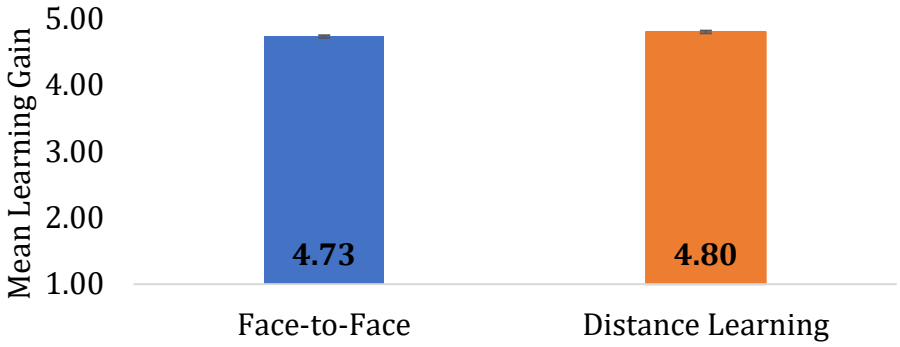
An independent samples t-test was performed to explore if trainees' safety-related knowledge and skill gains varied by training format. Table 1.12 shows that, on average, there were *not significant differences in learning between those in the face-to-face format and those in the distance learning format* [t (656) = 1.87, p = .062, d = 0.15].

Table 1.12. T-Test of Self-reported Safety-related Knowledge and Skill Gain by Training Format.

Course Format	N	Mean	SD	p-value
510 Face-to-Face	350	4.73	0.45	.062
510 Distance Learning	308	4.80	0.40	

Note. Safety-related knowledge and skill items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Figure 1.7. OSHA 510 Course: Mean Self-reported Safety-related Knowledge and Skills.



Note. Items ratings range from 1 (*Very Little*) to 5 (*A Lot*). Vertical bars represent standard error of the mean.

Self-reported Safety-related Knowledge and Skills: OSHA 500 Course

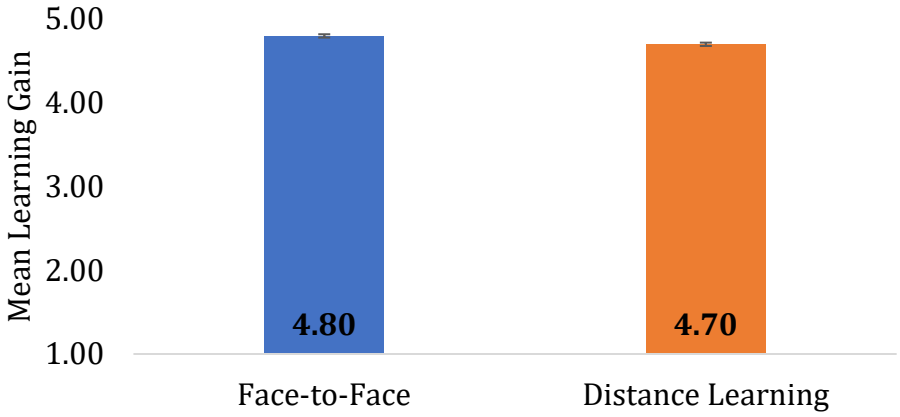
An independent samples t-test was performed to explore if trainees' safety-related knowledge and skill gains varied by training format. Table 1.13 shows that, on average, ratings of knowledge for those in the face-to-face format were *statistically significantly higher* than those in the distance learning format [t (768) = 2.79, p = .005, d = 0.21].

Table 1.13. T-Test of Self-reported Safety-related Knowledge and Skill Gain by Training Format.

Course Format	N	Mean	SD	p-value
500 Face-to-face	491	4.80	0.39	.005*
500 Distance Learning	279	4.70	0.56	

Note. Safety-related knowledge and skill items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Figure 1.8. OSHA 500 Course: Mean Self-reported Safety-related Knowledge and Skills.



Note. This comparison was significant at *$p < .01$. Item ratings range from 1 (*Very little*) to 5 (*A lot*).

Learning: OSHA 510 and OSHA 500 Testing

Descriptive statistics and independent sample t-tests were conducted on the OSHA test scores according to the format of training attended (face-to-face or distance learning).

OSHA 510 Testing

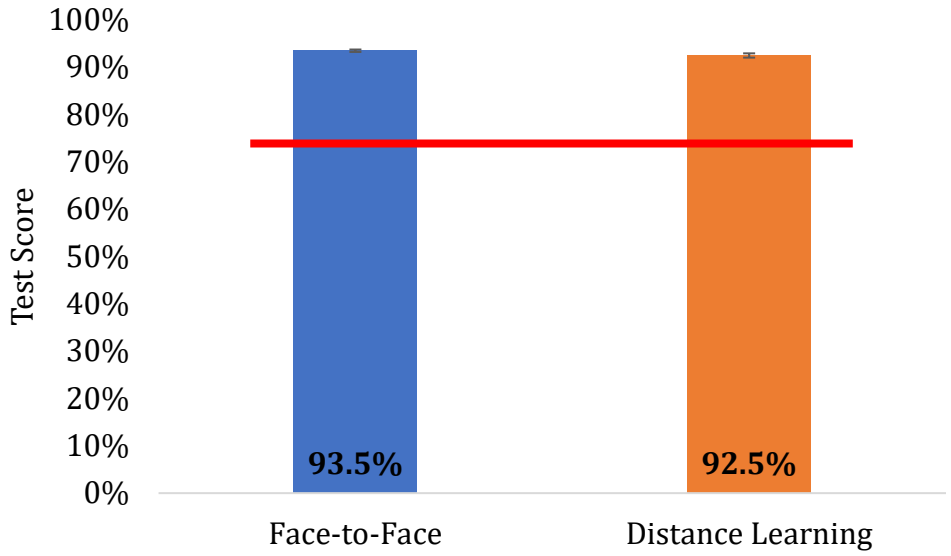
An independent samples t-test was conducted to explore if trainees' test scores varied by training format (see Figure 1.9). Table 1.14 shows that, on average, test scores for those in the face-to-face format were *statistically significantly higher* than those in the distance learning format [t (859) = 2.22, p = 0.027, d = 0.15]. However, it should be noted that the effective size is relatively small.

Table 1.14. T-Test of OSHA Test Scores by Training Format.

Course Format	N	Mean	SD	p-value
OSHA 510 Face-to-Face	500	93.5%	5.79%	.027*
OSHA 510 Distance Learning	361	92.5%	8.58%	

Note. Percentages range from 0-100 possible.

Figure 1.9. OSHA 510: Average Test Scores for Participants in Face-to-Face versus Distance Learning Formats.



Note. Vertical bars represent standard error of the mean. Red line indicates passing score of 74%.

OSHA 500 Testing

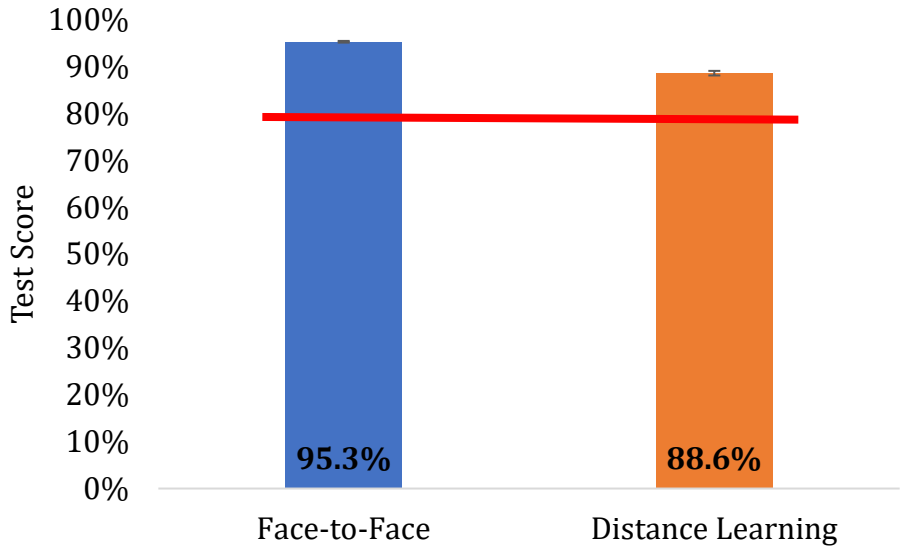
An independent samples t-test was performed to explore if trainees' test scores varied by training format (see Figure 1.10). Table 1.15 shows that, on average, test scores for those in the face-to-face format were *statistically significantly higher* than those in the distance learning format [t (924) = 15.8, p < .001, d = 1.09]. It should be noted that the effective size is relatively large.

Table 1.15. T-Test of OSHA 500 Test Scores by Training Format.

Course Format	N	Mean	SD	p-value
OSHA 500 Face-to-face	609	95.3%	4.40%	<.001**
OSHA 500 Distance Learning	317	88.6%	8.69%	

Note. Percentages range from 0-100 possible.

Figure 1.10. Average Test Scores for OSHA 500 Participants in Face-to-Face versus Distance Learning Formats.



Note. Vertical bars represent standard error of the mean. Red line indicates passing score of 80%.

Summary

Positive learning gains were demonstrated in subjective and objective learning measures. Specifically, trainees reported positive learning gains and demonstrated high scores on tests for each of the OSHA courses delivered in both the face-to-face and distance learning formats. However, results of comparative analyses demonstrated significantly greater self-reported learning for those attending the OSHA 500 courses in the face-to-face format. Furthermore, comparative analyses revealed significantly higher test scores for those attending OSHA 510 and OSHA 500 courses delivered in the face-to-face format than those in the distance learning format. Notably, a large effective size was demonstrated for use of the face-to-face format on post-training test scores for the OSHA 500 courses.

Training Delivered in Distance Learning Format: Training Design Features Affecting Trainees' Reactions and Learning Outcomes

To gain a greater understanding of the significant differences found among the training outcomes, the training design features of the distance learning format were explored. More specifically, training providers utilizing distance learning were contacted and interviewed. The interviews were approximately 30 minutes in length and consisted of 16 questions that targeted various features used by each training provider (see Appendix B). Thirteen training providers were identified and

contacted for the interview process. Nine representatives of the training providers participated in the interviews.

Qualitative analysis of the interviews revealed that the providers were highly consistent in their design and delivery of the distance learning format. The training providers reported that they required the trainees to attend orientation training prior to the training sessions to familiarize them with the technology. The training providers used Zoom as their platform, with most stating that it is the platform most commonly used in the industry. The importance of having multiple instructors and at least one individual responsible for handling technological issues was cited by providers as a best practice. All providers stressed the importance of interaction using breakout rooms, interactive exercises and activities, and discussion in their training sessions. All providers followed the testing standard developed by CPWR in which the trainees were visible (on camera) at all times while they completed the tests.

Scheduling of Training. However, qualitative analysis revealed one difference in the distance learning format: The training schedule varied according to training providers. Training providers approached the training schedule by considering scheduling characteristics:

- Lunch/No Lunch – Several of the training providers did not break for lunch during the day. These providers felt that the trainees could eat lunch at their leisure and did not provide a designated lunch break. Other providers had a designated lunch break in the middle of the training schedule for each day.
- Training Length Before Breaks – Training sessions ranged from 1 hour (shorter) to 2.5 hours (longer) before a break was given.
- Length of Break – Breaks in training ranged from 10–15 minutes (shorter) to 30–45 minutes (longer).
- Consecutive Days/Weekend Break – Training either occurred each day during a business week (M-F) or was divided up to include a weekend break (Th-F, M-W).

Based on these characteristics, training providers were categorized into four classifications. It should be noted that these classifications are ordered along a continuumfrom the shortest training sessions provided with many short breaks over consecutive days to the longest training sessions provided with longer breaks as well as a weekend break.

1. **No Lunch**: Shorter training sessions (1–1.5 hours) with shorter breaks (10–15 minutes) distributed throughout the day.

2. **Longer Training, SB/LB**: Longer training sessions (2 hours) with short break (10–15 minutes) followed by longer break (30–45 minutes for lunch).

3. **Longer Training, LB/SB**: Longer training sessions (2 hours) with longer break (30–45 minutes for lunch) followed by shorter breaks (10–15 minutes).

4. **Weekend Break:** Longest training sessions (2–2.5 hours) with one long break (45 minutes for lunch) that is spread out over several days (weekend break in middle of trainings).

Comparative Analysis. To further explore the similarities and differences between different training schedules for trainees attending OSHA 510 and OSHA 500 courses via the distant learning format, comparative analyses were conducted on the training outcomes.

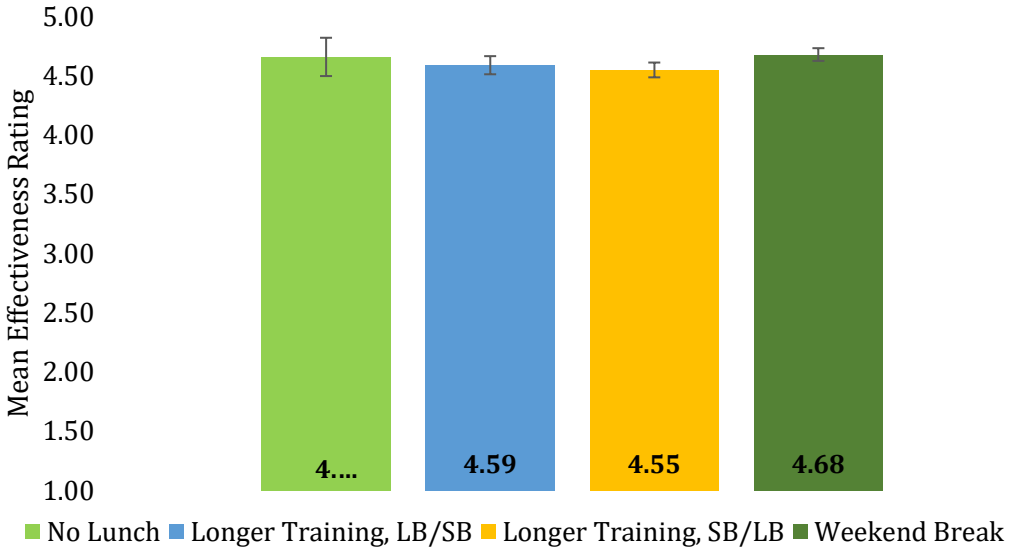
Instructor Effectiveness. A one-way ANOVA was performed to determine if differences existed between trainees' ratings of instructor effectiveness by training schedule (See Table 1.16). There were no significant differences in ratings of instructor effectiveness across OSHA 510 courses based on the training schedule, $F(3, 49.23)$, 0.86, $p = .468$, $\eta^2 = .01$. However, for the OSHA 500 courses, significant differences were found based on the training schedule (see Table 1.17), $F(3, 59.95)$, 10.42, $p < .001$, $\eta^2 = .05$. Figures 1.11 and 1.12 depict the means visually. Post hoc Games-Howell comparisons of two schedules at a time reveal that for the OSHA 500, scheduling with shorter training sessions and No Lunch resulted in higher instructor effectiveness ratings than 1) scheduling with longer training sessions and a long break followed by a short break, and 2) scheduling with the longest training sessions and a weekend break.

Table 1.16. ANOVA of OSHA 510 Instructor Effectiveness by Training Schedule.

Training Schedule	N	Mean	SD	p-value
No Lunch	13	4.66	0.58	.468
Longer Training, LB/SB	44	4.59	0.51	
Longer Training, SB/LB	79	4.55	0.56	
Weekend Break	62	4.68	0.42	

Note. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*).

Figure 1.11. Mean Instructor Effectiveness Ratings for OSHA 510 Course by Training Schedule.



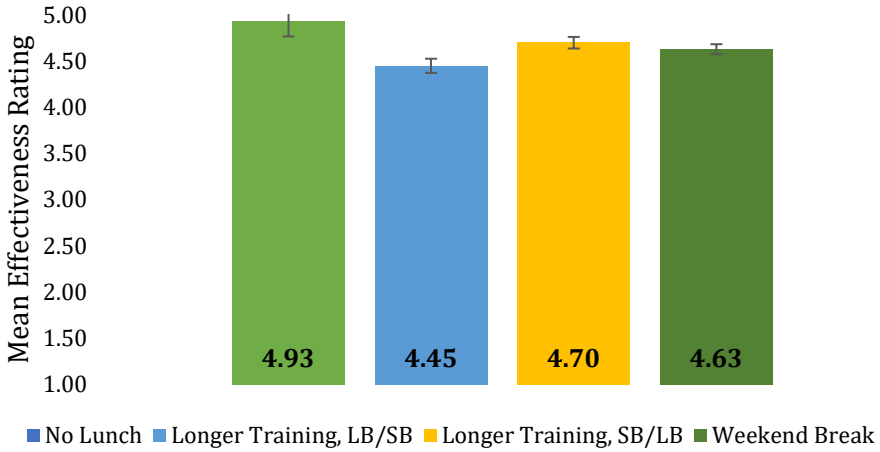
Note. Vertical bars represent standard error of the mean.

Table 1.17. ANOVA of OSHA 500 Instructor Effectiveness by Training Schedule.

Schedule Format	N	Mean	SD	p-value
No Lunch	9	4.93	0.14	<.001**
Longer Training, LB/SB	35	4.45	0.50	
Longer Training, SB/LB	53	4.70	0.60	
Weekend Break	58	4.63	0.46	

Note. Effectiveness ratings significant at **p<.001. Instructor effectiveness items rated on a scale ranging from 1 (*Rarely*) to 5 (*Always*).

Figure 1.12. Mean Instructor Effectiveness Ratings for OSHA 500 Course by Training Schedule.



Note. Vertical bars represent standard error of the mean.

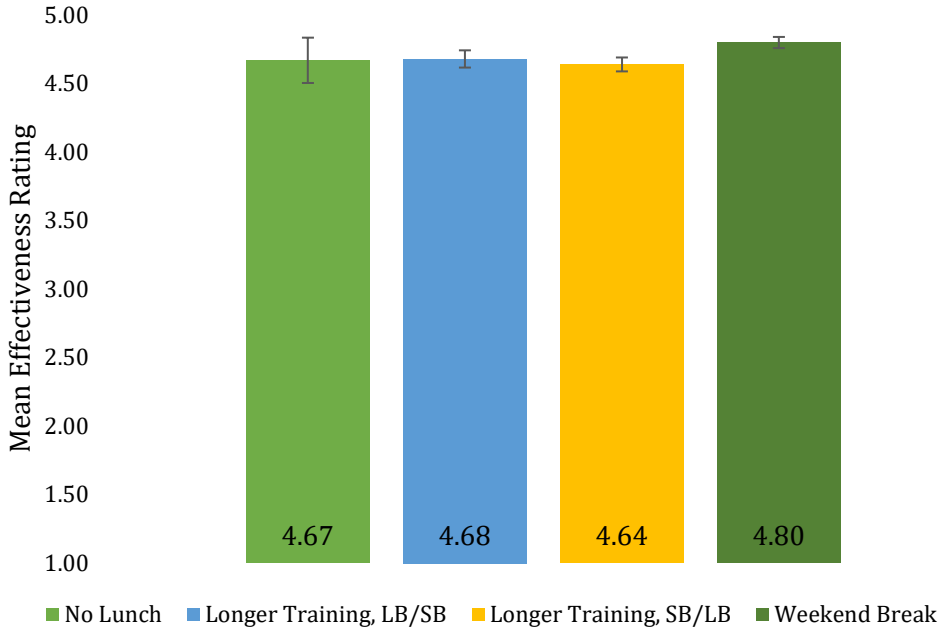
Training Method Effectiveness. A one-way ANOVA was performed to determine if differences existed between trainees' ratings of training and learning method effectiveness as a result of the schedule in which they received the training (See Tables 1.18 and 1.19). As Figures 1.13 and 1.14 depict, there were no significant differences in ratings of training method effectiveness across OSHA 510 (F(3, 47.88), 2.12, p = .110, η^2 = .03) or OSHA 500 courses (F(3, 36.84), 0.88, p = .461, η^2 = .02) by training schedule.

Table 1.18. ANOVA of OSHA 510 Method Effectiveness by Training Schedule

Training Schedule	N	Mean	SD	p-value
No Lunch	13	4.67	0.60	.110
Longer Training, LB/SB	44	4.68	0.42	
Longer Training, SB/LB	79	4.64	0.45	
Weekend Break	62	4.80	0.32	

Note. Method effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Figure 1.13. Mean Training Method Effectiveness Ratings for OSHA 510 Course by Training Schedule.



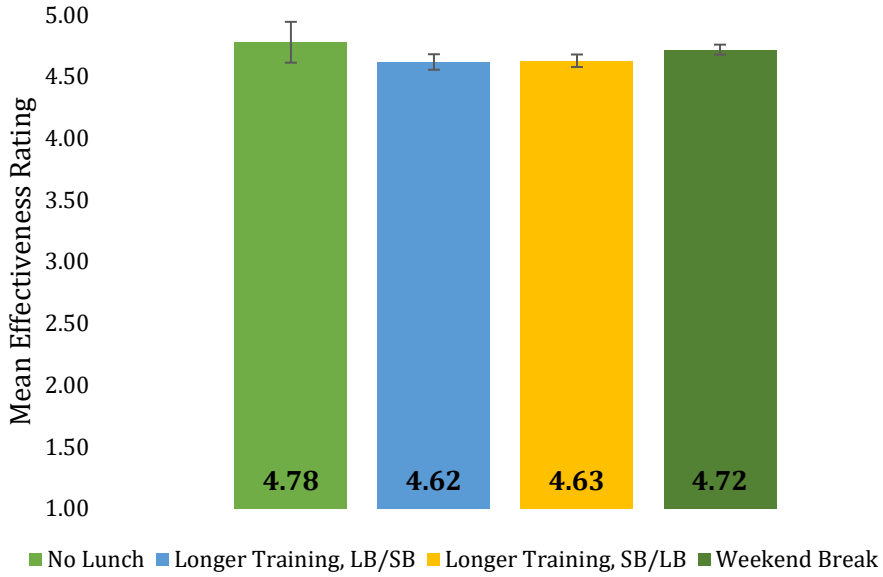
Note. Vertical bars represent standard error of the mean.

Table 1.19. ANOVA of OSHA 500 Method Effectiveness by Training Schedule.

Training Schedule	N	Mean	SD	p-value
No Lunch	9	4.78	0.31	.461
Longer Training, LB/SB	35	4.62	0.45	
Longer Training, SB/LB	53	4.63	0.44	
Weekend Break	58	4.72	0.40	

Note. Method effectiveness items rated on a scale ranging from 1 (*Didn't help at all*) to 5 (*Really helped*).

Figure 1.14. Mean Training Method Effectiveness Ratings for OSHA 500 Course by Training Schedule.



Note. Vertical bars represent standard error of the mean.

Self-reported Safety-related Knowledge and Skills. A one-way ANOVA was performed to determine if differences existed between trainees' ratings of self-reported safety-related knowledge and skills by training schedule (see Tables 1.20 and 1.21, and Figures 1.15 and 1.16). For both the OSHA 510 courses ($F(3, 46.52)$, 3.03, $p = .039$, $\eta^2 = .05$) and the OSHA 500 courses ($F(3, 65.24)$, 3.78, $p = .015$, $\eta^2 = .02$), significant differences were demonstrated according to the training schedule.

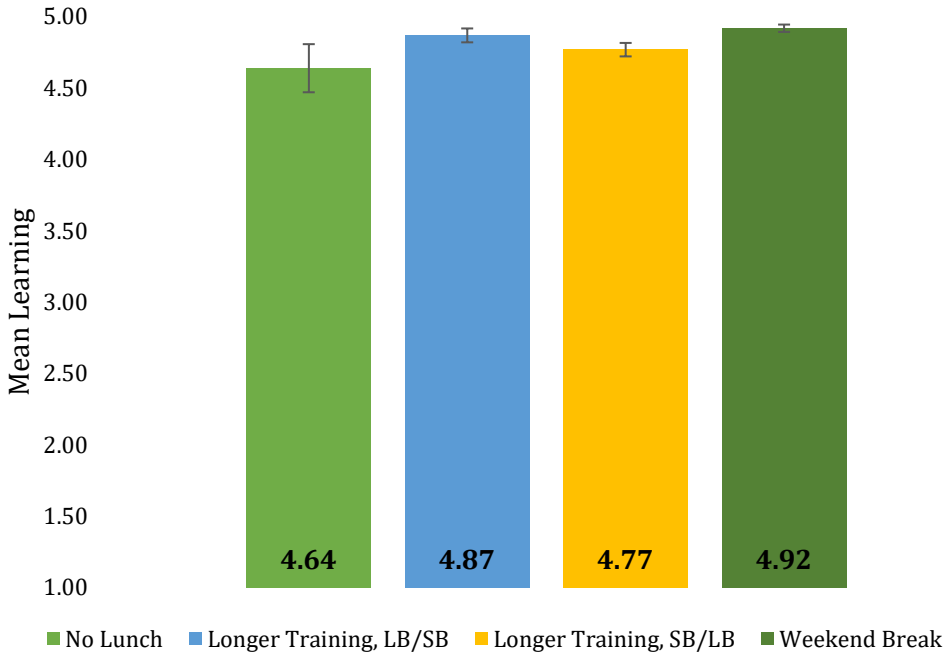
Post hoc Games-Howell comparisons revealed that for the **OSHA 510**, trainees attending the longest training sessions with a weekend break reported significantly higher learning gains than those attending the longer training sessions with a short break/long break and a lunch.

Table 1.20. ANOVA of OSHA 510 Self-reported Safety-related Knowledge and Skills by Training Schedule.

Training Schedule	N	Mean	SD	p-value
No Lunch	13	4.64	0.61	.039*
Longer Training, LB/SB	44	4.87	0.32	
Longer Training, SB/LB	79	4.77	0.42	
Weekend Break	62	4.92	0.20	

Note. Learning gains significant at *p<.05. Training-related Knowledge/Skills items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Figure 1.15. Self-reported Safety-related Knowledge and Skills Ratings for OSHA 510 Courses by Training Schedule.



Note. Vertical bars represent standard error of the mean.

Post hoc Games-Howell comparisons revealed that for the **OSHA 500**, surprisingly, trainees attending the shorter training sessions with no lunch reported higher gains in knowledge and skill than those attending either of the longer training sessions with breaks.

Table 1.21. ANOVA of OSHA 500 Self-reported Safety-related Knowledge and Skills by Training Schedule.

Training Schedule	N	Mean	SD	p-value
No Lunch	9	4.93	0.14	.015*
Longer Training, LB/SB	34	4.60	0.74	
Longer Training, SB/LB	53	4.68	0.62	
Weekend Break	58	4.77	0.56	

Note. Learning gains significant at *p<.05. Training-related Knowledge/Skills items rated on a scale ranging from 1 (*Very little*) to 5 (*A lot*).

Figure 1.16. Self-reported Safety-related Knowledge and Skills Ratings for OSHA 500 Courses by Training Schedule.

Note. Vertical bars represent standard error of the mean.

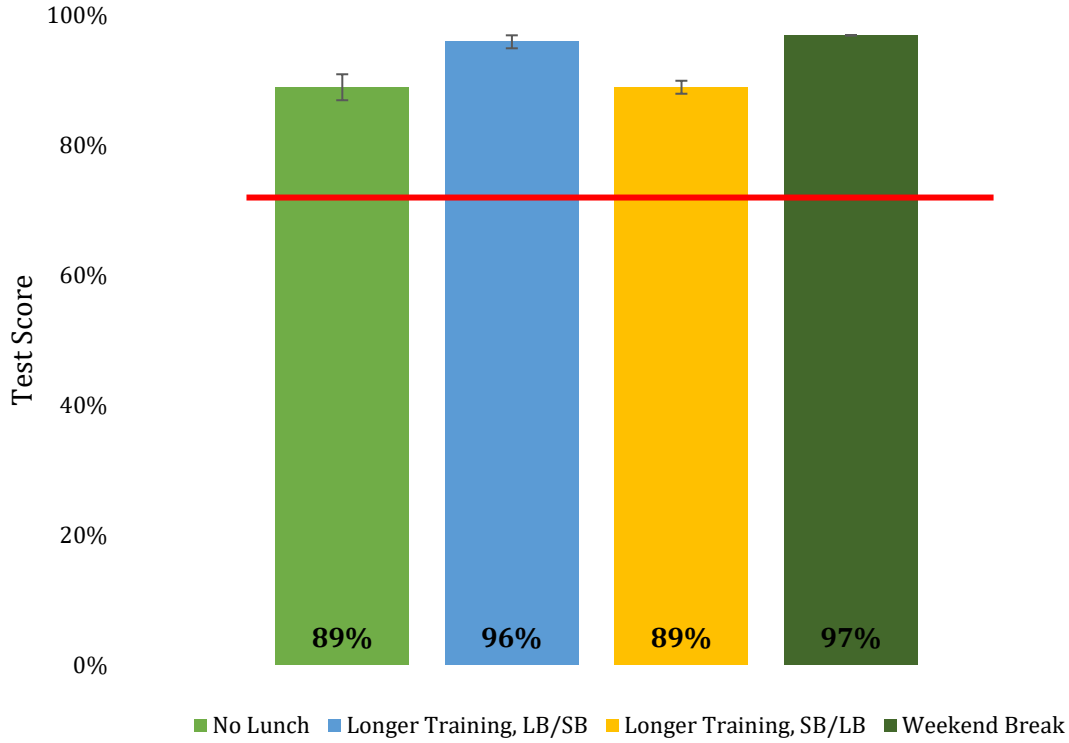
Test Scores. A one-way ANOVA was performed to determine if differences existed between trainees' test scores by training schedule (See Tables 1.22 and 1.23). Figures 1.17 and 1.18 visually display these differences.

There were significant differences in test scores across courses based on training schedule, $F(3, 211)$, 31.10, $p < .001$, $\eta^2 = .31$. Post hoc Games-Howell comparisons of two schedules at a time reveal that for the **OSHA 510**, the longest training sessions with a weekend break resulted in higher test scores than shorter training sessions with no lunch or longer training sessions with a short break followed by a long break. Furthermore, the longer training sessions with a long break/short break resulted in higher test scores than the longer training session with a short break/long break schedule and a lunch or the shorter training sessions with no lunch.

Table 1.22. ANOVA of OSHA 510 Test Scores Skills by Training Schedule.

Training Schedule	N	Mean	SD	p-value
No Lunch	14	0.89	0.07	< .001**
Longer Training, LB/SB	45	0.96	0.06	
Longer Training, SB/LB	85	0.89	0.07	
Weekend Break	71	0.97	0.04	

Figure 1.17. Mean Test Scores for OSHA 510 by Training Schedule.



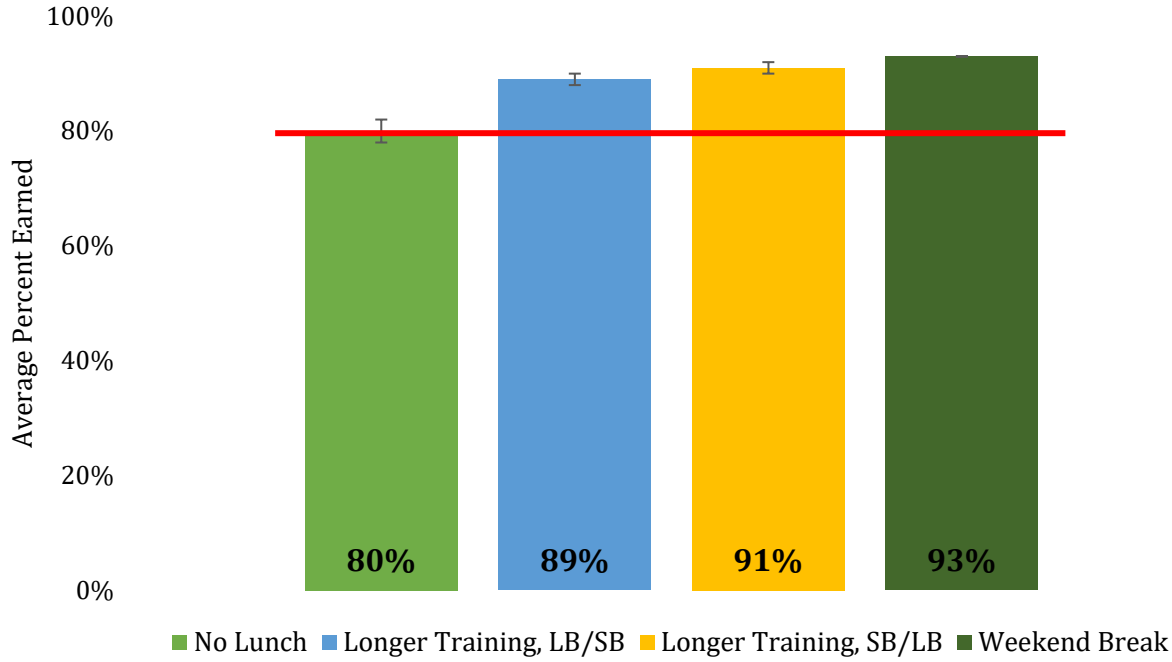
Note. Red line indicates passing score on OSHA 510 test. Vertical bars represent standard error of the mean.

Similarly, for the **OSHA 500**, the longest training sessions with a weekend break resulted in higher test scores than longer training sessions with a long break/short break or the shortest trainings with no lunch, $F(3, 165)$, 16.24, $p < .001$, $\eta^2 = .23$. Also, longer training sessions with the long break/short break and the longer training sessions with the short break/long break were both superior to the shorter training sessions with no lunch schedule.

Table 1.23. ANOVA of OSHA 500 Test Scores by Training Schedule.

Training Schedule	N	Mean	SD	p-value
No Lunch	13	0.80	0.09	< .001**
Longer Training, LB/SB	40	0.89	0.06	
Longer Training, SB/LB	56	0.91	0.07	
Weekend Break	60	0.93	0.06	

Figure 1.18. Mean Test Scores for OSHA 500 by Training Schedule.



Note. Red line indicates passing score on OSHA 510 test. Vertical bars represent standard error of the mean.

Summary

Training providers using the distance learning format for OSHA courses used similar training features. Similar to face-to-face format, which is considered the gold standard, the distance learning format for the OSHA 510 and OSHA 500 courses were presented synchronously (real-time) using the Zoom platform. All providers required trainees to attend orientation training to ensure that participants were familiar with the technology and course expectations. Teams of instructors administered the courses, with all providers dedicating at least one of the team to technical support. Across providers, both OSHA courses incorporated highly engaging learning methods that included small group techniques and discussions. All training providers also reported structured methods, including use of proctors, to ensure that the testing process was fair and accurate.

Training providers did report differences for the distance learning formats with respect to the training schedule. Specifically, four distinct features emerged when training providers were scheduling the OSHA 510 and OSHA 500 courses in the distance learning format: (1) Providing a designated break for lunch; (2) Length of training sessions before giving a break; (3) Length of break provided; and (4) Providing training on consecutive days during the week or providing a weekend break. While the scheduling features largely did not influence ratings of effectiveness and were not consistent with self-reported learning, findings suggest that scheduling did significantly influence test scores. Results demonstrated that the longest training sessions, with an extended break that included lunch, spread out across more days (weekend break instead of consecutive days) resulted in the highest test scores. On the other hand, shorter training sessions presented with more frequent shorter breaks and no designated lunch break resulted in the lowest

test scores. While these results are preliminary in nature, they indicate that the training schedule is important to consider when using the distance learning format.

Study 2: Impact of Training Designed and Delivered Using Distance Learning on Longer-term Outcomes.

As described in Study 1, a series of occupational safety and health trainings using distance learning were designed and conducted by various training providers during the COVID-19 pandemic. An evaluation was conducted to assess the effectiveness of the newly adapted OSHA 510 and OSHA 500 courses delivered using distance learning **3 to 6 months after the initial training sessions. The focus of Study 2 involves assessing the retention and transfer of the training-related knowledge and skills gained during training to improved safety performance on the job. This is intended to provide greater understanding of Study 1 findings.** Simply put, Study 2 examines the effectiveness of the distance learning format with respect to longer-term learning and performance.

Targeted Courses

All OSHA 510 and OSHA 500 courses developed and delivered via distance learning during the COVID-19 pandemic were targeted for the study. These trainings are inclusive of the distance learning courses detailed in Study 1.

Evaluation Method

Two questionnaires were developed and administered online to assess the effectiveness and impact of the trainings conducted in the distance learning format. Separate questionnaires were developed to capture specific feedback from the instructors conducting the training as well as the participants receiving the training.

The CPWR Distance Learning Evaluation: Instructor version contained 37 items. Instructors rated items concerning: (1) Instructor's effectiveness (e.g., "The instructors were well-prepared."); (2) Content effectiveness (e.g., "The training was presented according to the needs of the trainees"); (3) Format effectiveness (e.g., "The group discussions were helpful in trainees exchanging ideas with others."); (4) Transfer of learning (e.g., "The training prepared the trainee to work safely during the COVID-19 pandemic."). Items are rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

The questionnaire also required instructors to rate the general effectiveness concerning: (1) Instructor(s); (2) Content; (3) Format; (4) Overall. Items are rated a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). The extent to which they would recommend the distance learning format are rated on a scale ranging from 1 (*Very Unlikely*) to 7 (*Very Likely*).

The questionnaire also included two items that gathered information specific to the training instructed: (1) specific training(s) they instructed, and (2) month they instructed the training). It also included four items that required instructors to rate their level of technical competence: (1) comfort in instructing additional distance learning courses; (2) change in comfort in instructing additional distance learning courses; (3) skill in using the distance learning format; and (4) change in skill using the distance learning format.

The questionnaires included three open-ended items encouraging instructors to elaborate on: (1) strengths and weaknesses of the distance learning format; (2) significant challenges of the distance learning format and suggestions for improvements; and (3) best practices/lessons learned including any additional comments for using distance learning in other safety and health training in the future. The final section of the evaluation gathered demographic information (gender, race/ethnicity).

The CPWR Distance Learning Evaluation: Trainees' version contained 40 items. The survey required all respondents to rate items concerning: (1) Instructor effectiveness (e.g., "The instructors were well-prepared."); (2) Content effectiveness (e.g., "The content was accurate and up-to-date."); (3) Format effectiveness (e.g., "The group discussions were helpful in exchanging ideas with others."); (4) Transfer of learning (e.g., I have used the content and skills learned in this training on the job."); and (5) Organizational/Supervisory support of training. Items are rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

The questionnaire also required respondents to rate general effectiveness concerning: (1) Instructor(s); (2) Content; (3) Format; (4) Overall. Items are rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). The safety-related knowledge and skill items (from the CPWR Course Evaluation Form) are included on the questionnaire to assess the retention of knowledge (e.g., "The course helped me to improve my ability to recognize health hazards on the job.") and are rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Trainees rated the extent to which they would recommend the use of distance learning to deliver each course on a scale ranging from 1 (*Very Unlikely*) to 7 (*Very Likely*). The questionnaires also included three open-ended items encouraging respondents to elaborate on: (1) most valuable aspects of training; (2) least valuable aspects of training; (3) if training met their training-related needs and suggestions for improvement. The questionnaire also included two items that gathered information specific to the training (specific training(s) attended; month(s) attended); and four items regarding level of technical competence (comfort in and change in comfort in taking additional distance learning courses; skill and change in skill with the distance learning format). Demographic information was gathered including: (1) trade affiliation; (2) gender; and (3) race/ethnicity.

The evaluation was administered to all participants who received the training via synchronous distance learning method as well as the instructors who conducted the trainings. CPWR's Training Program Directors actively participated in administering the survey. This included identifying all training participants and instructors, disseminating the email containing the study description and survey link, and encouraging participants to complete the evaluation. The emails were sent approximately 3 to 6 months following the inception of the distance learning courses. A follow-up email was sent to thank survey respondents and encourage additional participation approximately two weeks later.

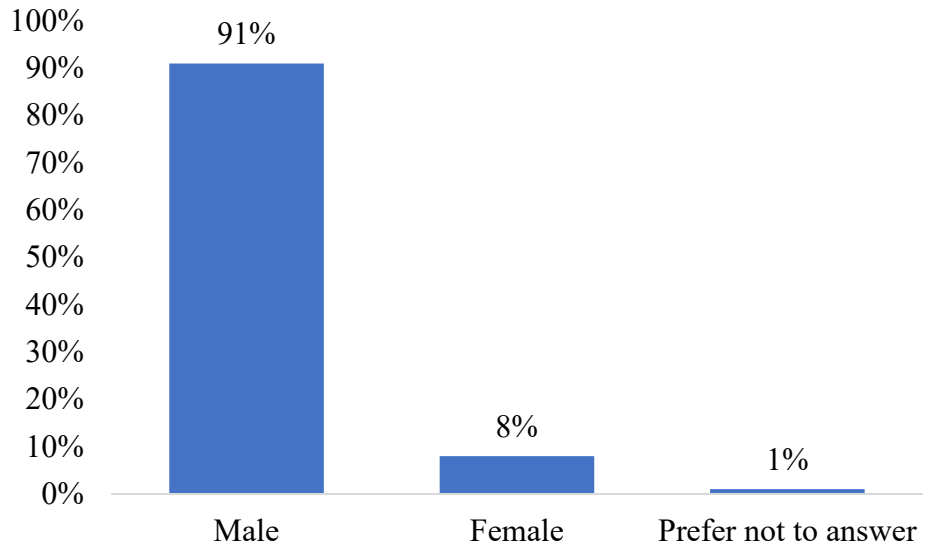
Survey Respondents

There was a total of 116 respondents to the evaluation. Respondents consisted of 100 trainees and 16 instructors.

Trainee and CPWR Instructor Characteristics.

Gender of Trainees. The majority of trainees completing the evaluation were male (see Figure 2.1). More specifically, 91% of those who responded were male, 8% were female, and 1% preferred not to answer.

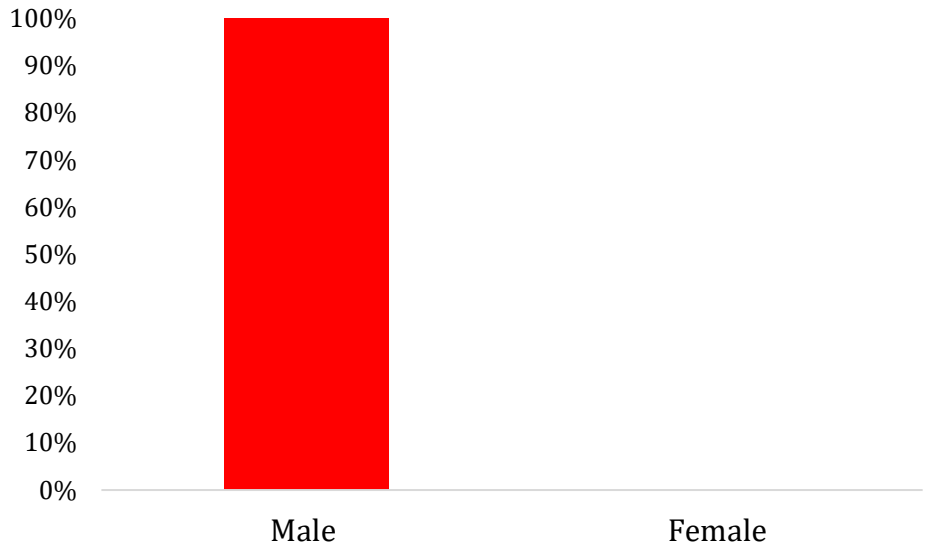
Figure 2.1. Gender of Trainees.



Note. N=96.

Gender of Instructors. All instructors completing the survey were male.

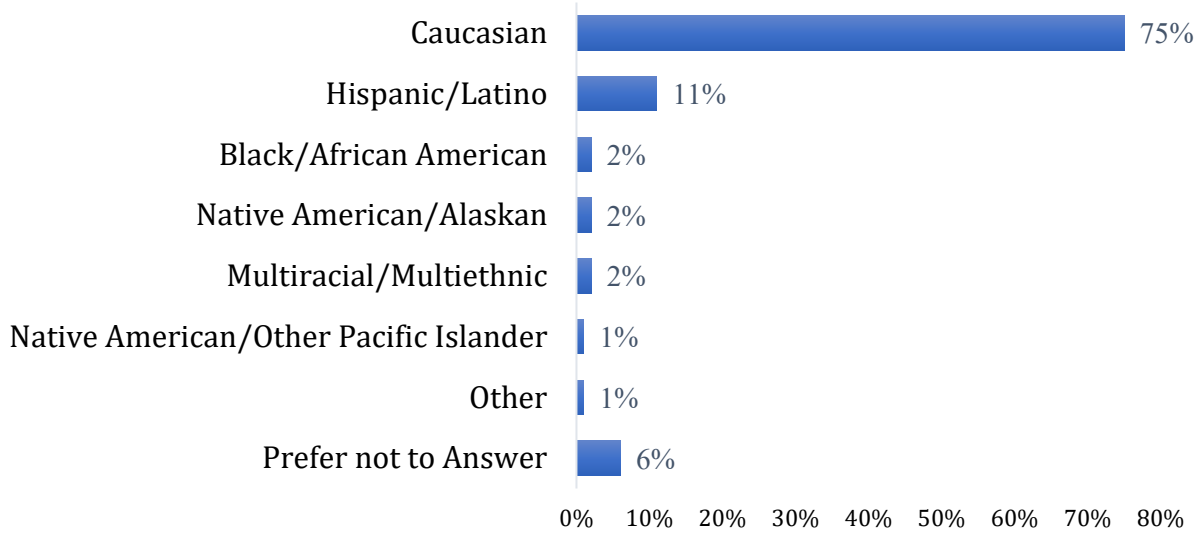
Figure 2.2. Gender of Instructors.



Note. N=15.

Race/Ethnicity of Trainees. The results indicated that, while the majority of respondents were Caucasian, there was a small but varied representation with respect to race/ethnicity of the trainees (see Figure 2.3).

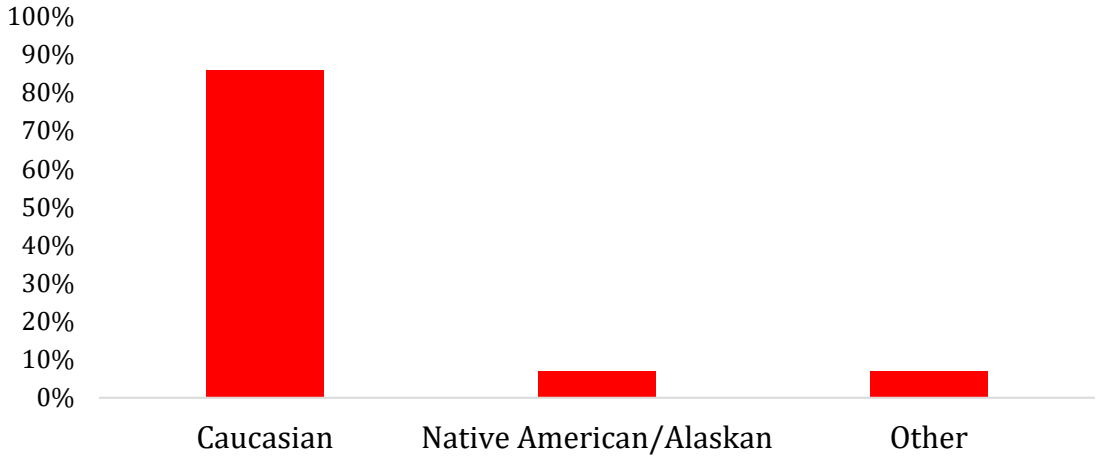
Figure 2.3. Race/Ethnicity of Trainees.



Note. N=96.

Race/Ethnicity of Instructors. As depicted in Figure 2.4, the vast majority of instructors were Caucasian (87%). A smaller percentage of instructors reported that they were either Native American/Alaska Native or Other race/ethnicity.

Figure 2.4. Race/Ethnicity of Instructors.

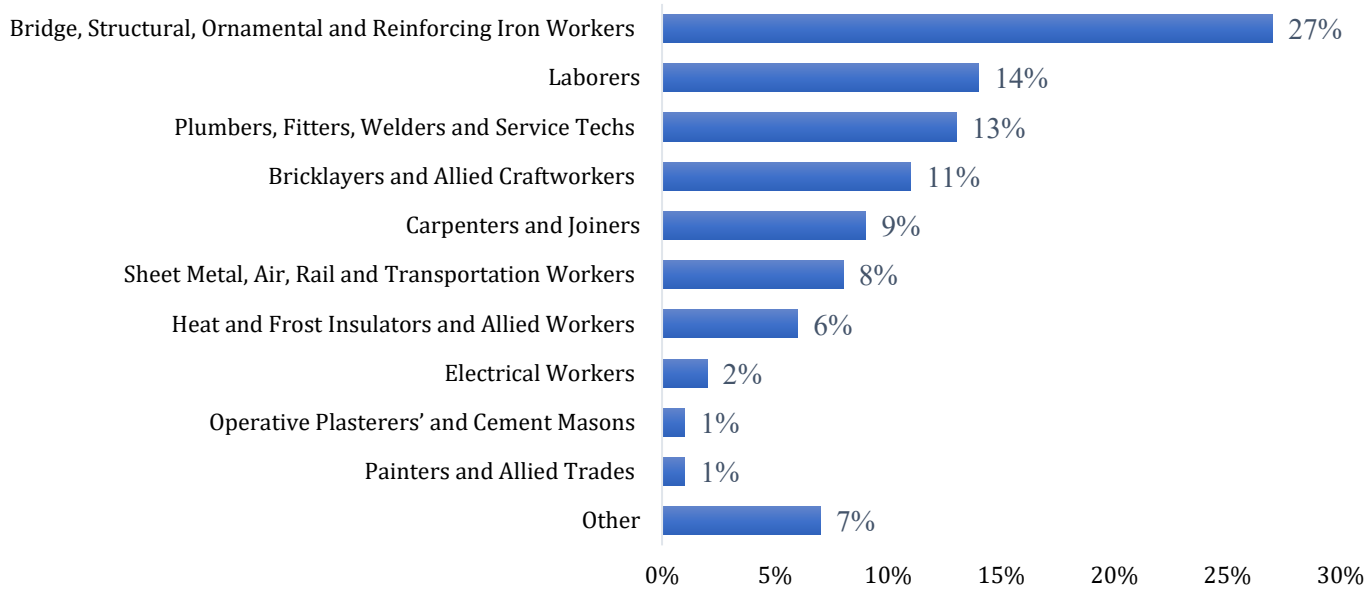


Note. N=15.

Trainee Work and Professional Experience. Information regarding the work and professional experience of trainees was gathered. Specifically, respondents were asked to indicate their trade membership.

Trade Affiliation of Trainees. The survey respondents represented ten NABTU affiliates (see Figure 2.5). The breakdown is as follows: Bridge, Structural, Ornamental and Reinforcing Iron Workers (27 %), Laborers (14 %), Plumbers, Fitters, Welders, and Service Techs (13 %), Bricklayers and Allied Craftworkers (11 %), Carpenters and Joiners (9 %), Sheet Metal, Air, Rail, and Transportation Workers (8 %), Heat and Frost Insulators and Allied Workers (6 %), Electrical Workers (2%), Operative Plasterers' and Cement Masons (1 %), and Painters and Allied Trades (1 %) and Other (7%).

Figure 2.5. Trade Affiliation of Trainees.



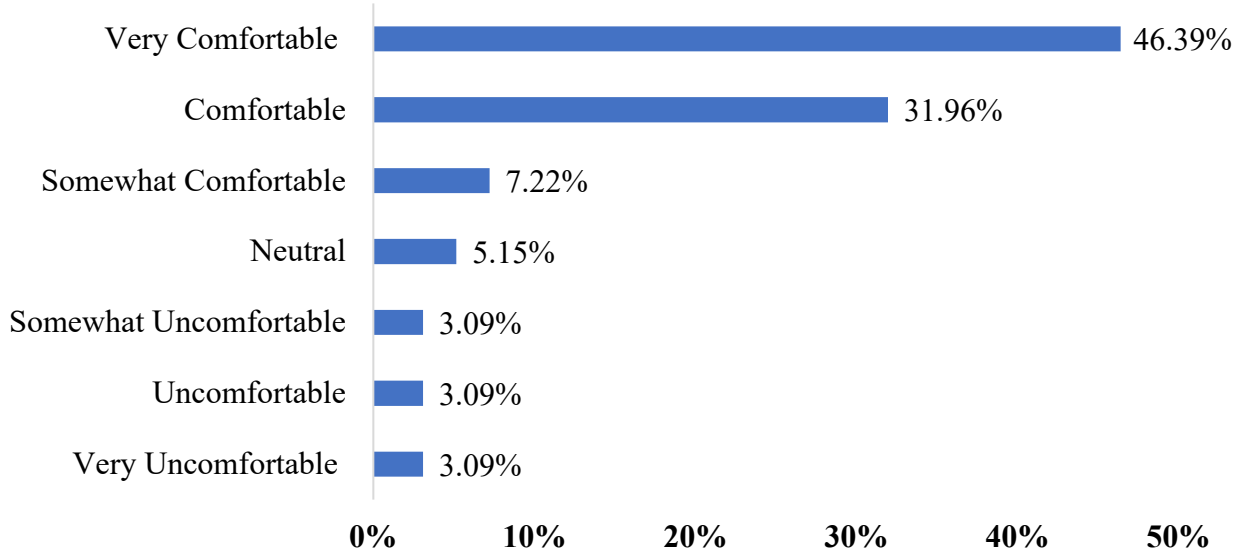
Note. N=96.

Instructor and Trainee Technological Competence

Both instructors and trainees reported their level of technological competence. Technological competence included four related characteristics of instructors and trainees: (1) Comfort with the Technology and (2) Change in Comfort with the Technology; and (3) Skill in Using the Technology and (4) Change in Skill in Using the Technology.

Trainees' Comfort with the Technology. Trainees reported their comfort in attending distance learning courses. As shown in Figure 2.6, the vast majority (approximately 85%) of respondents indicated that they were *Comfortable* with taking distance learning courses, with nearly half of the respondents citing that they were *Very Comfortable* with the technology. However, a small contingent did state that they were less comfortable with the technology, with approximately 3% reporting that they were *Very Uncomfortable* with taking distance learning courses.

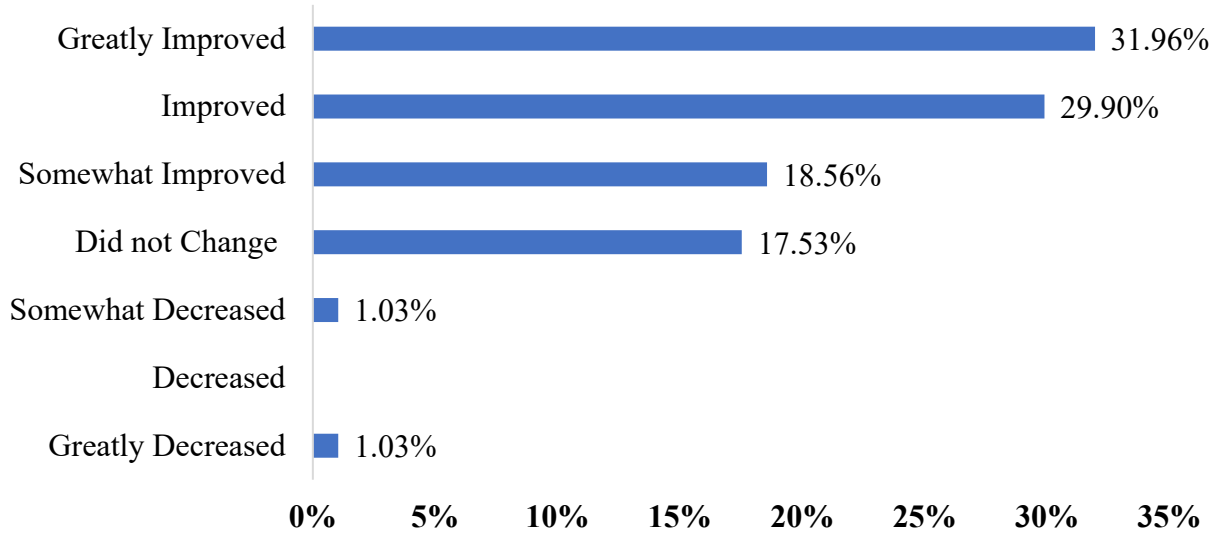
Figure 2.6. Trainees' Comfort in Taking Distance Learning Courses.



Note. N=97.

Trainees' Change in Comfort with Technology. Trainees reported their comfort change in attending training via distance learning methods during the COVID-19 pandemic. As shown in Figure 2.7, respondents reported a positive change in their comfort with the technology. More specifically, most respondents (approximately 80%) indicated that their comfort in taking courses using distance learning had improved since the onset of the COVID-19 pandemic, with nearly one-third of respondents stating that their comfort had greatly improved.

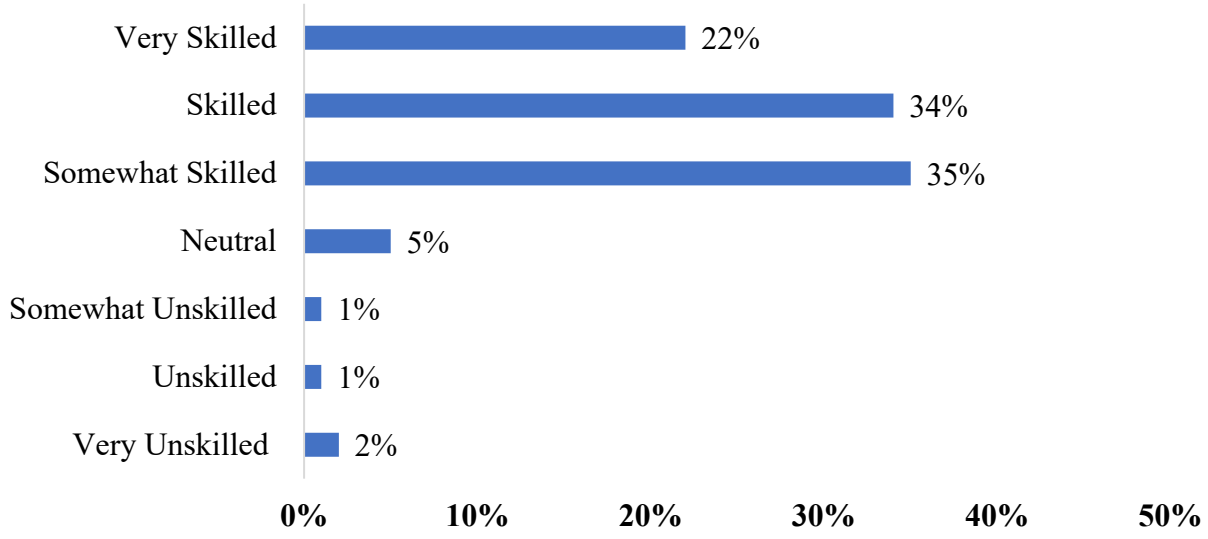
Figure 2.7. Trainees' Change in Comfort in Taking Distance Learning Courses.



Note. N=97.

Trainees' Skill in Using Technology. Trainees reported somewhat less confidence in their skill in using the distance learning format. As shown in Figure 2.8, the majority of respondents (81%) stated that they were at least *Somewhat Skilled* with the distance learning format. A smaller percentage indicated that they were *Very Skilled*, and one respondent indicated minimal skill in using the technology.

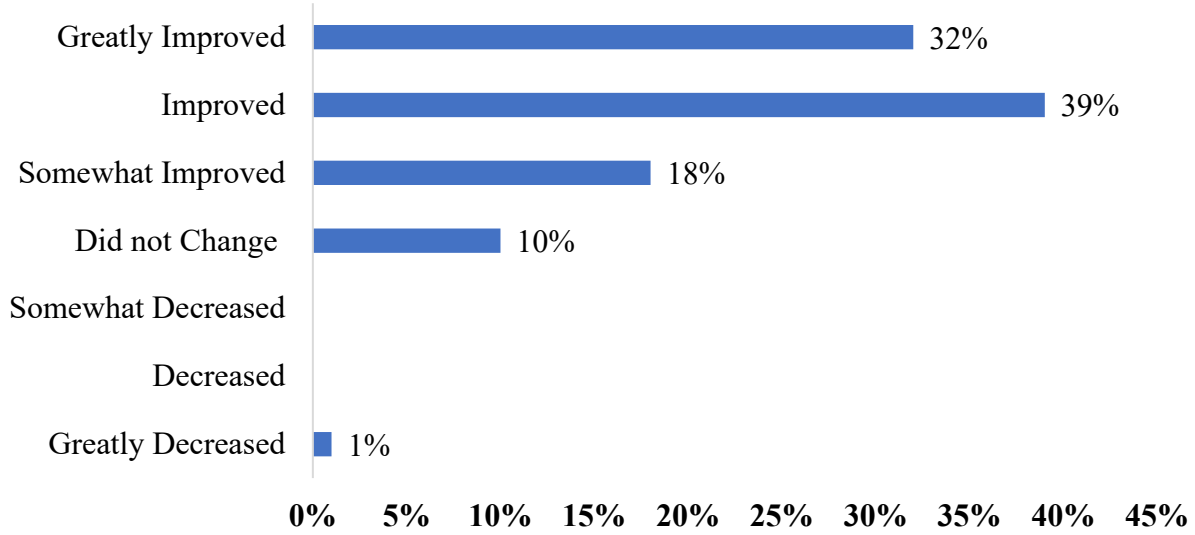
Figure 2.8. Trainees' Skill in Using the Distance Learning Technology.



Note. N=97.

Trainees' Change in Skill in Using Technology. Respondents also indicated their change in skills in using technology to attend distance learning courses during the COVID-19 pandemic. The greatest majority of trainees reported at least some improvement in their skill in using the distance learning format. In fact, 71% reported that they *Improved* or *Greatly Improved*, as shown in Figure 2.9. Importantly, only 1% of trainees reported a decrease in skill using the distance learning format.

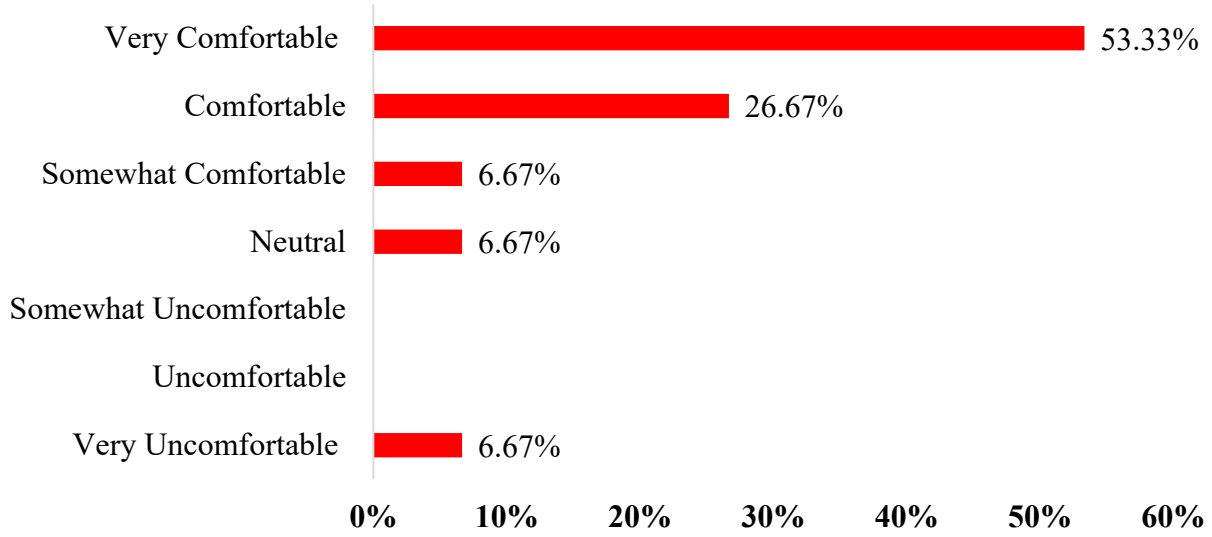
Figure 2.9. Trainees' Change in Skill in Using the Distance Learning Technology.



Note. N=97.

Instructors' Comfort with Technology. Instructors reported their comfort with distance learning to conduct additional trainings (see Figure 2.10). The vast majority of instructors (80%) reported that they were at least *Comfortable* with the distance learning format, with over half of the respondents stating that they were *Very Comfortable* with the technology. Notably, one instructor reported that he was *Very Uncomfortable* with the distance learning format.

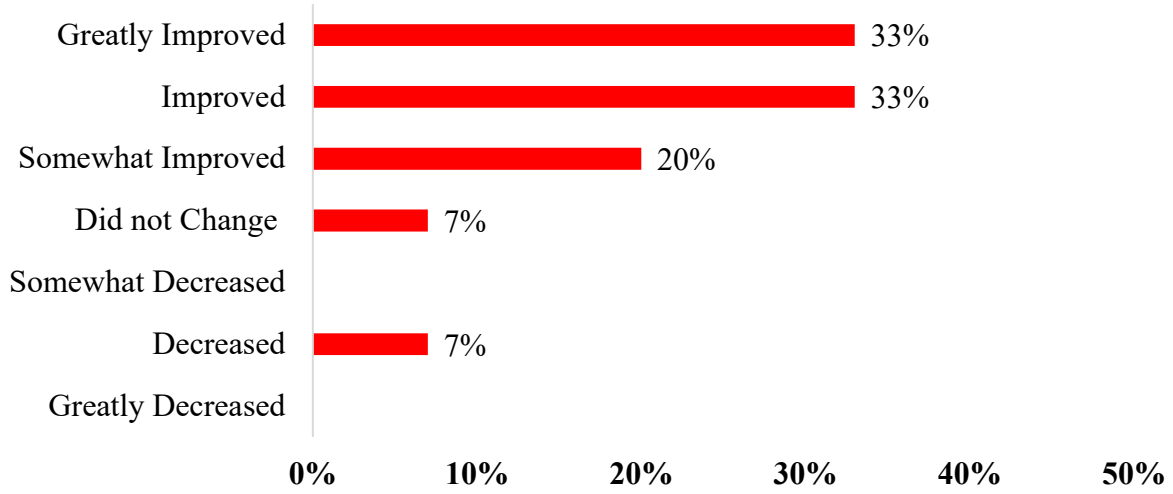
Figure 2.10. Instructors' Comfort with the Distance Learning Format.



Note. N=15.

Instructors' Change in Comfort with Technology. Instructors reported positive changes in comfort with the technology used during the COVID-19 pandemic. The vast majority of instructors (86%) stated that their comfort in instructing safety and health training using the distance learning format largely improved during the COVID-19 pandemic (see Figure 2.11), with only a small percentage indicating that their comfort decreased.

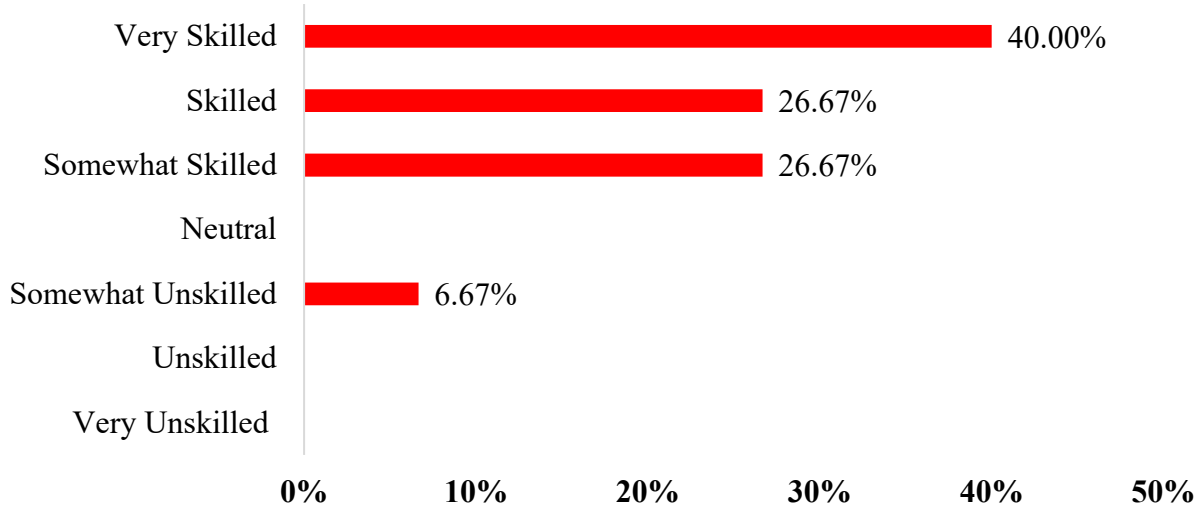
Figure 2.11. Instructors' Change in Comfort with the Distance Learning Format.



Note. N=15.

Instructors' Skill in Using Technology. Relative to reported comfort, instructors reported high levels of confidence in their skill in using distance learning technology. As depicted in Figure 2.12, the majority of instructors (approximately 94%) stated that they were *Skilled* in using the distance learning technology, with 40% reporting that they were *Very Skilled*.

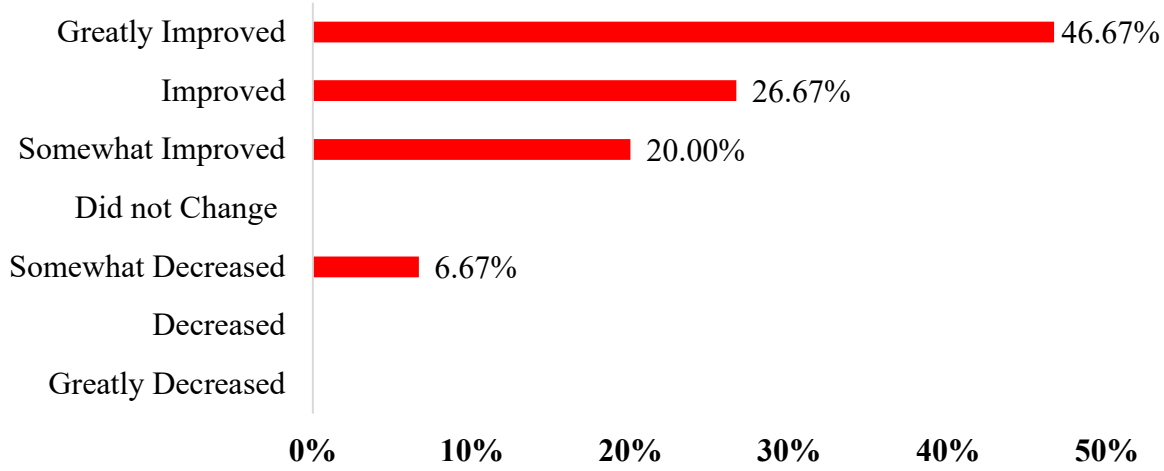
Figure 2.12. Instructors' Skill in Using Distance Learning Technology.



Note. N=15.

Instructors' Change in Skill in Using Technology. Instructors also reported positive increases in their skill in using the distance learning technology during the COVID-19 pandemic. As depicted in Figure 2.13, the vast majority of instructors stated improvements in their skill in using the distance learning technology (approximately 94%) during the COVID-19 pandemic.

Figure 2.13. Instructors' Change in Skill in Using Distance Learning Technology.

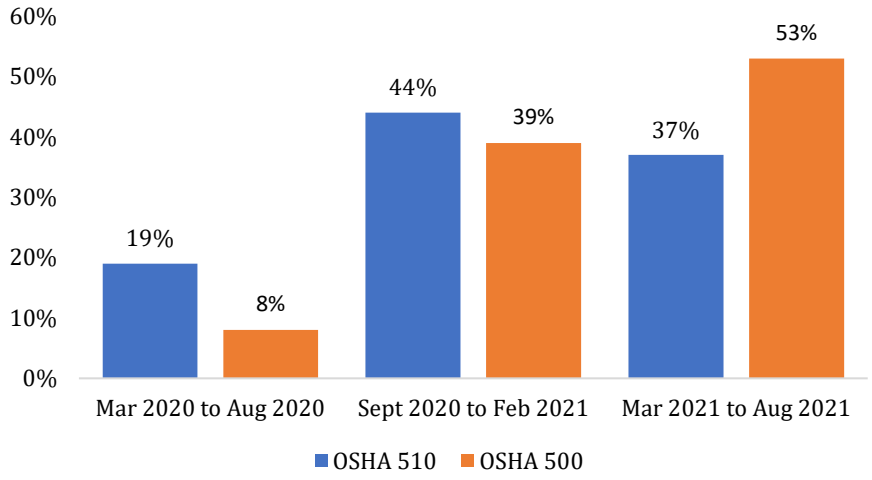


Note. N=15.

Dates of Distance Learning Training Courses.

Date Trainees Attended Trainings. Trainees indicated the dates in which they attended the OSHA 510 and OSHA 500 courses (see Figure 2.14). The largest percentage of trainees attended the OSHA 510 between September 2020 and February 2021. The largest percentage of trainees attended the OSHA 500 training between March 2021 and August 2021.

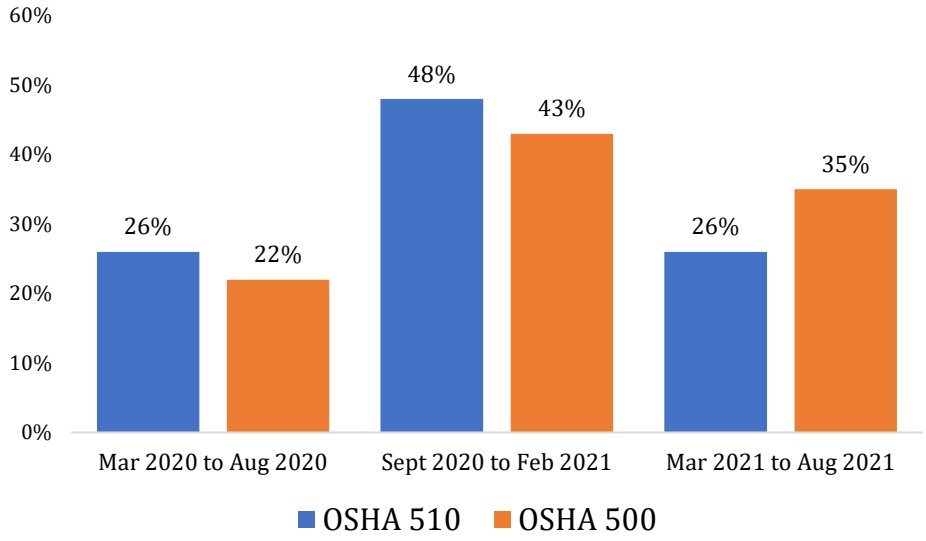
Figure 2.14. Dates Trainees Attended Distance Training.



Note. N=96.

Dates Instructors Presented Training. Instructors indicated the dates they taught the OSHA 510 and OSHA 500 courses (see Figure 2.15). Of those responding, most instructors reported teaching the distance learning courses between September 2020 and February 2021.

Figure 2.15. Dates Instructors Conducted Distance Learning Training.



Note. N=16.

Training Effectiveness Ratings

Descriptive Analysis. Descriptive statistics were conducted on the CPWR Distance Learning Evaluation for each item and category of effectiveness according to the survey respondent of training attended (trainees, instructors). Table 2.1 presents the means, standard deviations, and number of survey respondents.

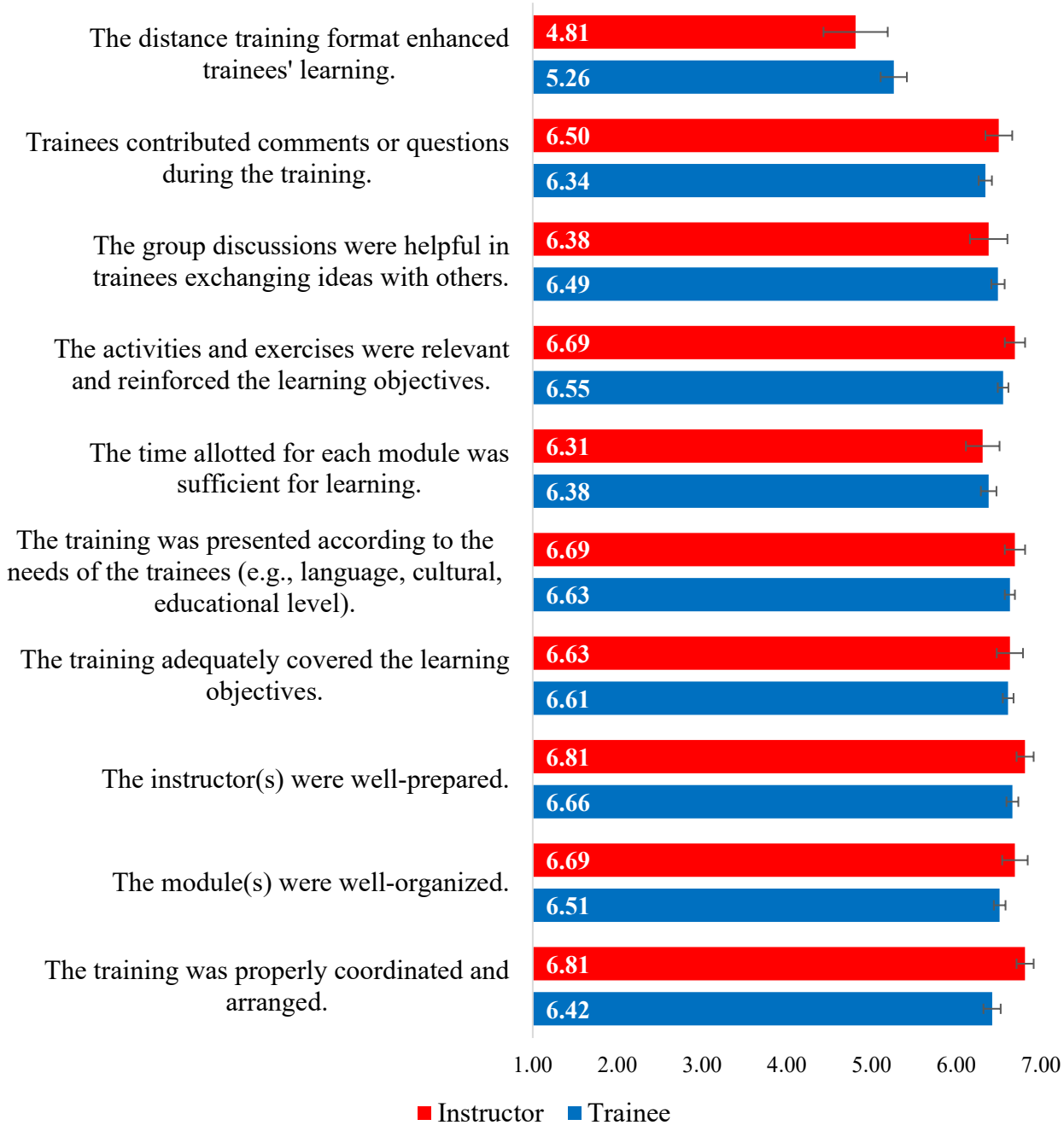
Table 2.1. Descriptive Statistics of Training Effectiveness Ratings for Trainees and Instructors.

	Trainees			Instructors		
Training Effectiveness	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
1. The training was properly coordinated and arranged.	100	6.42	1.02	16	6.81	0.40
2. The module(s) were well-organized.	100	6.51	0.69	16	6.69	0.60
3. The instructor(s) were well-prepared.	100	6.66	0.70	16	6.81	0.40
4. The training adequately covered the learning objectives.	100	6.61	0.63	16	6.63	0.62
5. The training was presented according to the needs of the trainees (e.g., language, cultural, educational level).	100	6.63	0.60	16	6.69	0.48
6. The time allotted for each module was sufficient for learning.	100	6.38	0.92	16	6.31	0.79
7. The activities and exercises were relevant and reinforced the learning objectives.	100	6.55	0.63	16	6.69	0.48
8. The group discussions were helpful in trainees exchanging ideas with others.	100	6.49	0.78	16	6.38	0.89
9. Trainees contributed comments or questions during the training.	100	6.34	0.78	16	6.50	0.63
10. The distance training format enhanced trainees' learning.	100	5.26	1.55	16	4.81	1.52
11. The training prepared trainees to work safely during the COVID-19 pandemic.	99	5.74	1.35	16	5.81	1.42
12. Content Effectiveness	100	6.39	0.90	16	6.44	0.63
13. Instructor(s) Effectiveness	100	6.65	0.89	16	6.56	0.51
14. Format Effectiveness	100	6.11	1.13	16	5.88	1.26
15. Overall Effectiveness	100	6.41	0.88	16	6.13	0.81

Note. Instructor, Training Content, and Training Format Effectiveness items rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). General Effectiveness Items rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*).

In general, trainees and instructors reported similarly *high ratings of effectiveness across nearly all items* (see Figure 2.16). Importantly, both trainees and instructors report*, on average, the highest rating of effectiveness for the preparedness of the instructors.* On the other hand, results also demonstrate that both the instructors and trainees indicated the *lowest ratings for the item regarding distance training enhancing trainees' learning*.

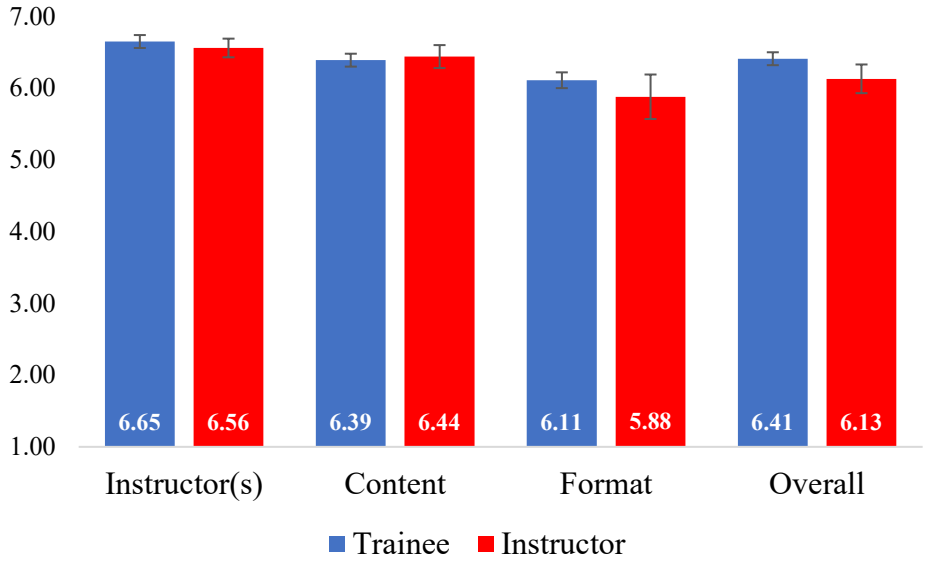
Figure 2.16. Trainees' and Instructors' Mean Ratings of Training Effectiveness.



Note. N=100 Trainees. N=16 Instructors. Items rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Vertical bars represent standard error of the mean.

Similar results are reflected in the ratings of overall effectiveness (see Figure 2.17). The trainees report, on average, the distance learning format to be *Very Effective*. The instructors, while providing positive ratings, report slightly lower ratings relative to that of the trainees. As with the single item ratings discussed above, while the ratings are highly positive, both sets of respondents provide the lowest ratings of overall effectiveness to the distance learning format.

Figure 2.17. Trainees' and Instructors' Mean Ratings of General Training Effectiveness.



Note. N=100 Trainees. N=16 Instructors. General Effectiveness Items rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). Vertical bars represent standard error.

Summary

Three to six months following training, trainees and instructors continue to report high levels of effectiveness for various aspects of the training conducted in the distance learning format. The expertise and skills of the instructors were consistently rated as the most effective aspect of the courses, whereas the distance learning format itself received the lowest ratings from both instructors and trainees. It should be noted that the instructors, while providing positive ratings, report slightly lower ratings relative to that of the trainees.

Post-Training Learning and On-the-job Performance

Descriptive Analysis: Learning. Descriptive statistics were conducted on the items and categories associated with longer-term (three to six months post-training) learning of the CPWR Distance Learning Evaluation. Table 2.2 presents the means, standard deviations, and number of survey respondents.

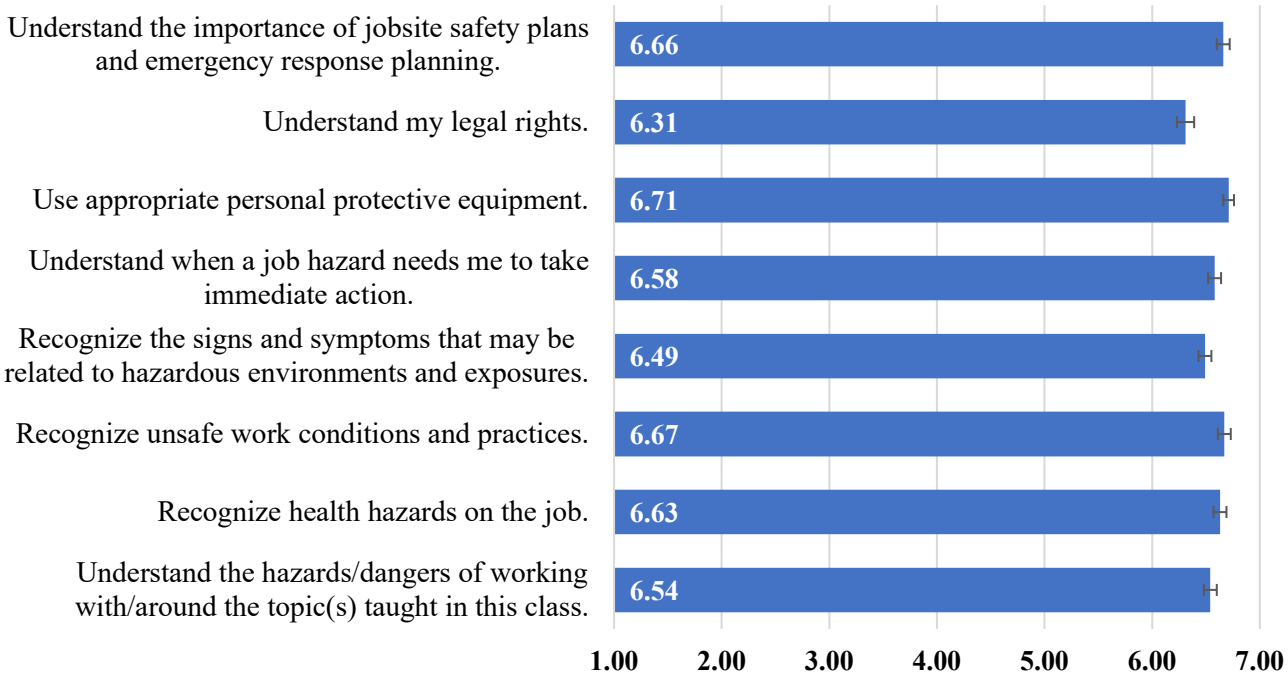
Table 2.2. Descriptive Statistics of Trainee's Post-training (three to six months) Learning and Performance Outcomes.

	Trainees		
	N	**Mean**	**SD**
Safety-related Knowledge and Skills	**99**	**6.57**	**0.51**
1. Understand the hazards/dangers of working with/around the topic(s) taught in this class.	99	6.54	0.58
2. Recognize health hazards on the job.	99	6.63	0.56
3. Recognize unsafe work conditions and practices.	99	6.67	0.55
4. Recognize the signs and symptoms that may be related to hazardous environments and exposures.	99	6.49	0.64
5. Understand when a job hazard needs me to take immediate action.	99	6.58	0.62
6. Use appropriate personal protective equipment.	99	6.71	0.54
7. Understand my legal rights.	99	6.31	0.78
8. Understand the importance of jobsite safety plans and emergency response planning.	99	6.66	0.56

Note: Items rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

In general, trainees report *high levels of self-reported Safety-related Knowledge and Skills three to six months following training* (see Figure 2.18). These ratings suggest that trainees maintained the enhanced knowledge and skills learned reported in Study 1 (directly following the distance learning courses). Noteworthy, trainees reported the *highest ratings for the knowledge and skills associated with appropriate use of personal protective equipment and recognizing unsafe work conditions and practices,* whereas they provided the lowest ratings for *understanding their legal rights.*

Figure 2.18. Retention of Learning Three to Six Months Following Training.



Note. N=100. Items rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Vertical bars represent standard error of the mean.

Descriptive Analysis: On-the-Job Performance and Support. Descriptive statistics were conducted on the items and categories associated with the transfer of learned knowledge and skills to improved performance of the CPWR Distance Learning Evaluation. Table 2.3 presents the means, standard deviations, and number of survey respondents.

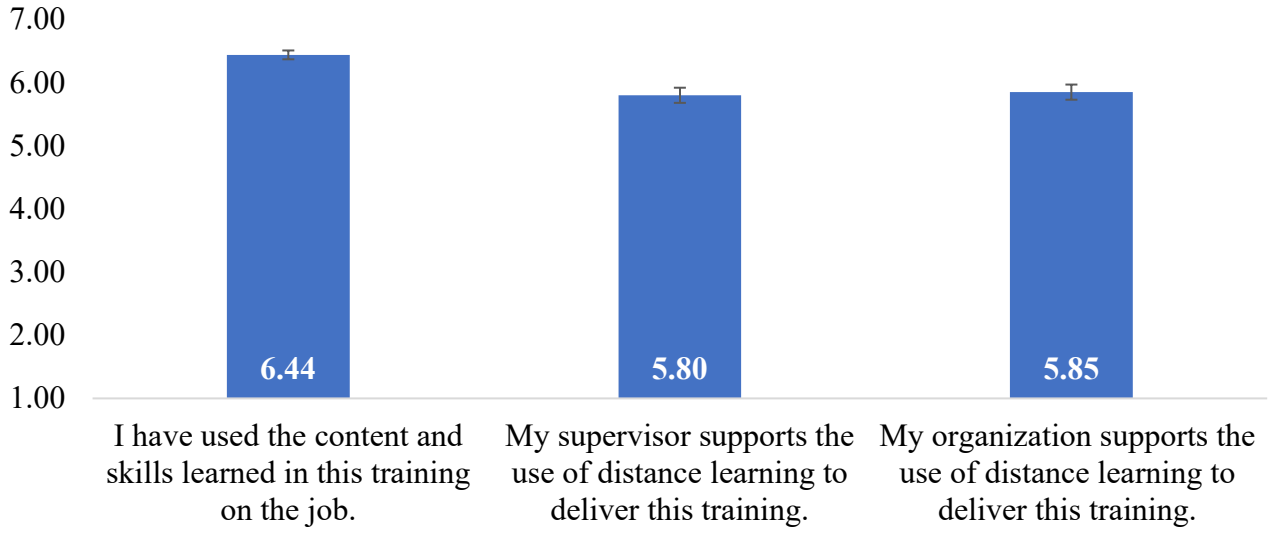
Table 2.3. Descriptive Statistics of Trainee's Post-training (three to six months) Performance Outcomes.

	Trainees		
	N	**Mean**	**SD**
On-the-job Performance			
1. I have used the content and skills learned in this training on the job.	100	6.44	0.74
Training support in the Workplace	**100**	**5.83**	**1.19**
2. My supervisor supports the use of the skills learned in this training	100	5.80	1.25
3. My organization supports the use of the skills learned in this training.	100	5.85	1.21

Note: Items rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

The remaining items were focused on the transfer of self-reported safety-related knowledge and skills learned during training to improved safety on the job and support for this safety at the worksite (see Figure 2.19). Results demonstrate that the trainees used the training to ensure their safety at the worksite. Along a similar vein, the trainees cited that there was strong support for the use of distance learning to conduct the training, with slightly higher ratings given to the organizational support relative to supervisory support.

Figure 2.19. Trainee Training-related Safety Performance and Support at the Workplace.



Note. N=100. Items rated on a scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Vertical bars represent standard error of the mean.

Summary

When considering the impact of the OSHA 510 and OSHA 500 courses, results indicated that training conducted in the distance learning format positively influenced outcomes three to six months after the training. That is, trainees reported maintenance of the safety-related knowledge and skills demonstrated in Study 1 of this report, as well as the transfer of learning to improved safety on the job and support for this safety at the workplace. These results complement the findings for the effectiveness of the OSHA 510 and OSHA 500 training demonstrated in Study 1 of this report.

Comparative Analyses of Trainings Using Distance Learning Format

As a result of the COVID-19 pandemic, the transition to remote/distance learning was rapid and unexpected. The trainings conducted during the COVID-19 pandemic were designed and presented in real time to meet the immediate and ongoing safety and health needs of the workers. To complement the findings of Study 1, additional analyses were conducted to compare the influence of trainee characteristics on longer-term learner outcomes (e.g., three to six months after the training).

Influence of Trainee Characteristics on Post-Training Learning and On-the-job Performance

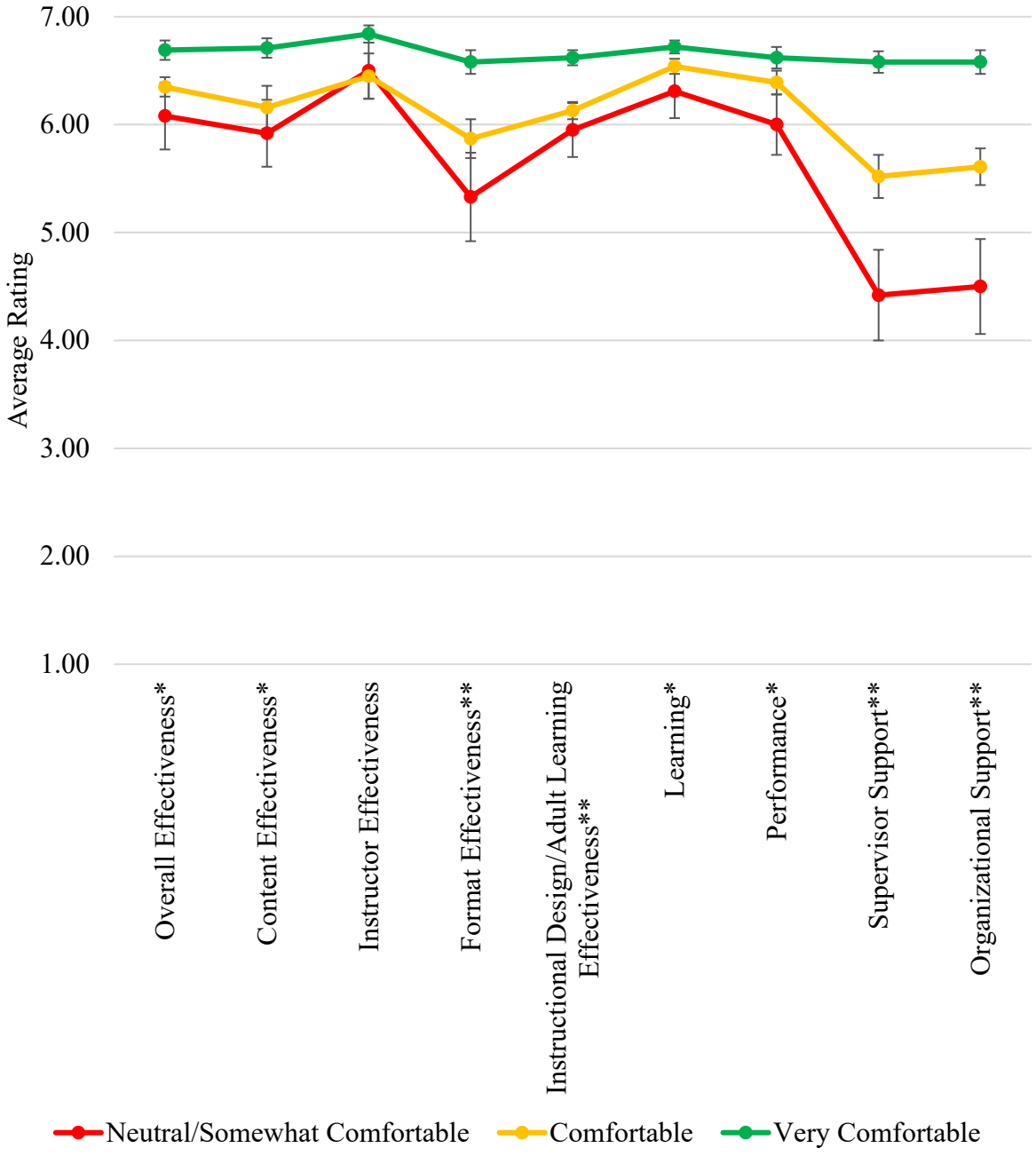
Characteristics of the trainees themselves directly influence the effectiveness and impact of safety and health training. To gain a greater understanding of the role that trainee characteristics play in a successful transition to the distance learning format, two broad categories of trainee characteristics were explored. The first set of characteristics involves work and occupational experience, and the second set involves technological competence of the trainees.

Work/Occupational Experience. The respondents represent a wide variety of trade memberships. Comparative analyses were conducted to explore the effect of trainees' trade affiliation on longer-term training outcomes (three to six months after the training). One-way ANOVAs were performed on training outcomes (see Appendix C). Results of the analyses demonstrated *no statistically significant differences in ratings of training effectiveness, longer-term learning, and performance outcomes between trainees from the various trades*. Note that Painters and Allied Trades, Operative Plasterers and Cement Masons, and Electrical Workers were not represented with sufficient numbers of members to be included in these analyses.

Technological Competence. Because of the rapid transition to distance learning during the COVID-19 pandemic, technological competence of trainees quickly emerged as an essential element for training success. Similar to research in related domains, technological competence was measured using two related trainee characteristics: (1) Comfort; and (2) Skill. Furthermore, additional measures were also gathered to gain a greater understanding of the relative change in trainees' technological comfort and skill resulting from the distance learning format during the COVID-19 pandemic.

Trainees' Comfort with the Technology. As previously described, trainees' comfort with the technology used to attend distance learning courses ranged from *Very Comfortable* to *Somewhat Comfortable*. Comparative analyses were conducted to explore the effect of Comfort with the Technology on successful training outcomes. One-way ANOVAs were performed on effectiveness, learning, and performance ratings (three to six months after the training) for those who were *Neutral/Somewhat Comfortable*, *Comfortable*, and *Very Comfortable* (see Appendix D). As depicted in Figure 2.20, results of the analyses demonstrate the significant influence of trainees' Comfort with the Technology on many of the training outcomes (trainees' reactions, learning, performance). The results suggest that trainees who report higher levels of comfort with the technology also report higher levels of effectiveness, increased retention, greater transfer, and more support of the distance learning training than those who have less comfort with the technology.

Figure 2.20. Effect of Level of Trainee Comfort with the Technology on Training Outcomes.

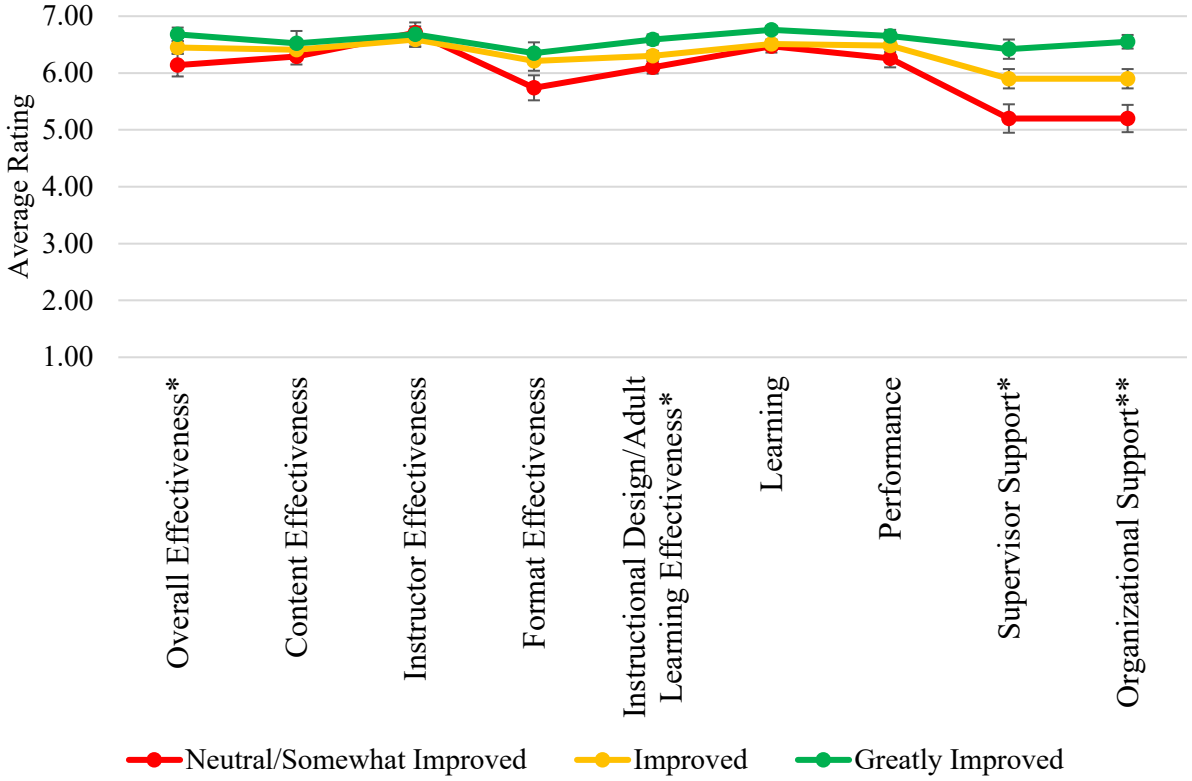


Note. N=88. Effectiveness items rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). Learning, Performance, and Support items rated on a scale ranging from 1(*Strongly Disagree*) to 7 (*Strongly Agree*). **p<.001 and p<.05 indicates a statistically significant differences among the groups. Vertical black bars represent standard error.

Appendix D presents group means and post hoc tests in detail. The general pattern reveals that trainees who reported greater levels of comfort with technology also rated nearly all components of the course higher than those who reported being comfortable, but not to as great an extent. These results suggests that trainees' Comfort with Technology is an important factor for ensuring that distance learning successfully meets trainees' work-related safety needs. Therefore, ensuring that trainees are comfortable with the technology is essential in achieving successful training outcomes when designing and conducting training in a distance learning format.

Trainees' Change in Comfort with the Technology. Comparative analyses were conducted to explore the effect of Change in Comfort with the Technology on successful training outcomes. One-way ANOVAs were performed on effectiveness, learning, and performance ratings (three to six months after the training) for those who reported *Neutral/Somewhat Increased*, *Increased*, and *Greatly Increased* (see Appendix E). As depicted in Figure 2.21, results of the analyses demonstrate the influence of trainees' Change in Comfort with the Technology on the training outcomes.

Figure 2.21. Effect of Change in Level of Trainee Comfort with the Technology on Training Outcomes.

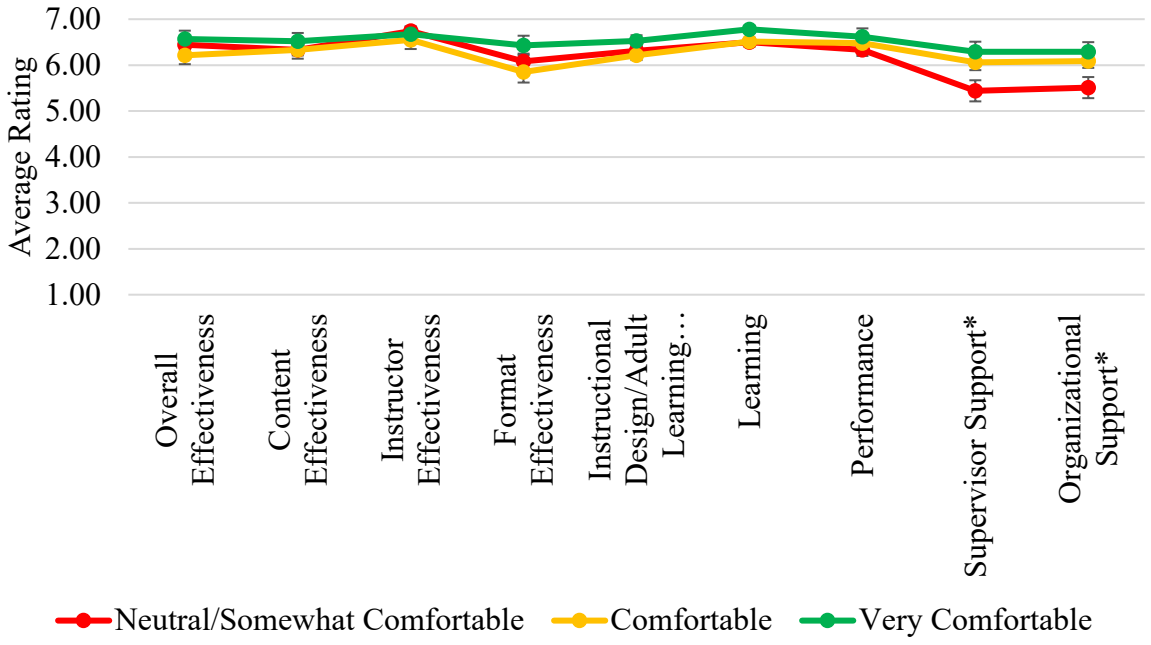


Note. N=95. Effectiveness items rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). Learning, Performance, and Support items rated on a scale ranging from 1(*Strongly Disagree*) to 7 (*Strongly Agree*). **p<.001 and *p<.05 indicates a statistically significant differences among the groups. Vertical bars represent standard error of the mean.

Appendix E presents group means and post hoc tests in detail. The general pattern is similar to that of current comfort with technology, although many of the comparisons were not statistically significant. More specifically, trainees who reported greater improvements in comfort with technology also rated several of the components of the course higher than those who reported less increase in comfort level for four general categories of training outcomes (Overall Effectiveness, Instructional Design/Adult Learning Effectiveness, Supervisor Support, Organizational Support). While many were not statistically significant differences, the patterns of results suggest that trainees' Change in Comfort with Technology is also an important factor for ensuring distance learning successfully meets trainees' work-related safety needs.

Trainees' Skill in Using the Technology. In the present study, trainees' Skills in Using the Technology to participate in distance learning ranged from *Very Skilled* to *Somewhat Skilled*. Comparative analyses were conducted to explore the effect of Skill in Using the Technology in achieving successful training outcomes for distance learning courses. One-way ANOVAs were performed on effectiveness, learning, and performance ratings (three to six months after the training) for those reporting they were *Somewhat Skilled*, *Skilled*, and *Very Skilled* in Using Technology (see Appendix F). As depicted in Figure 2.22, results of the analyses show that Skill in Using the Technology was not largely related to differences in outcomes, with the exception of the outcomes related to supervisory and organizational support of the training. For the most part, those who reported being at least Neutral/Somewhat Skilled reported similar mean ratings to those who reported being *Skilled*, and *Very Skilled* on the majority of the outcomes three to six months post-training.

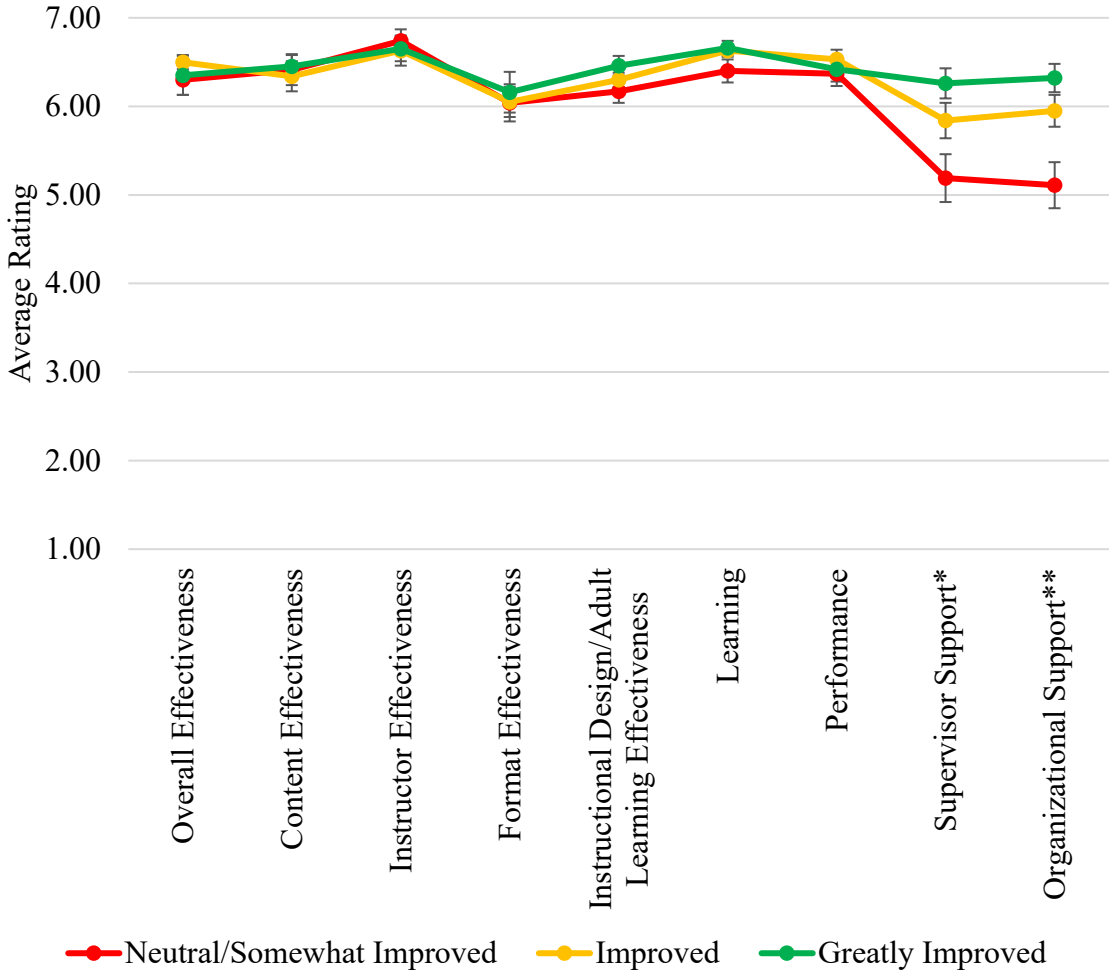
Figure 2.22. Effect of Trainee Skill in Using the Technology on Training Outcomes.



Note. N=96. Effectiveness items rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). Learning, Performance, and Support items rated on a scale ranging from 1(*Strongly Disagree*) to 7 (*Strongly Agree*). * $p<.05$ indicates a statistically significant differences among the groups. Vertical bars represent standard error of the mean.

Trainees' Change in Skill in Using the Technology. Comparative analyses were conducted to explore the effect of Change in Skill in Using the Technology in achieving successful training outcomes for distance learning courses. One-way ANOVAs were performed on effectiveness, learning, and performance ratings (three to six months after the training) for those who report that they were *Somewhat Increased*, *Increased*, and *Greatly Increased* (see Appendix G). As depicted in Figure 2.23, results of the analyses show that Skill in Using the Technology was related to differences in learning and support outcomes. Specifically, those who reported the greatest increase in skill also reported higher levels of supervisory and organizational support.

Figure 2.23. Effect of Change in Trainee Skill in Using the Technology on Training Outcomes.



Note. N=93. Effectiveness items rated on a scale ranging from 1 (*Very Ineffective*) to 7 (*Very Effective*). Learning, Performance, and Support items rated on a scale ranging from 1(*Strongly Disagree*) to 7 (*Strongly Agree*). **p<.001 and p<.05 indicates a statistically significant differences among the groups. Vertical bars represent standard error.

Summary

Taken together, these findings demonstrate the **importance of the technological competence of trainees**. The trainees' Comfort with the Technology, Change in Comfort with Technology, and to a lesser extent Skill in Using the Technology and Change in Skill, had a significant influence on training outcomes when using the distance learning format. The results also provide preliminary evidence that less comfort with the technology negatively influences their ability to retain the learned knowledge and skills as well as to transfer the learned information to improved performance at the worksite. These results make evident the need for building and supporting trainees' confidence with and expertise in the distance learning format to ensure the greatest impact of the training.

Net Promoter Score

The Net Promoter Score is a core metric that is used in gaining a greater understanding of customer experience in marketing research. The Net Promoter Score measures the perception of a product or service by measuring how likely one is to recommend the product or service to a colleague (Reichheld, 2003). In essence, it measures loyalty to that product or service and can be used as a benchmark for success. During the COVID-19 pandemic, the Net Promoter Score has been used to assess the effectiveness of modifications made to products or services to meet the changes to customer needs (e.g., use of the distance learning format as opposed to the traditional face-to-face classroom format to address safety concerns resulting from the COVID-19 pandemic).

Net Promoter Scores provide an estimate regarding the percentage of users that would recommend the use of distance learning for OSHA courses. Net Promoter Scores are calculated from a single survey item (e.g., How likely are you to RECOMMEND the OSHA 510 courses delivered via DISTANCE LEARNING to others) that is rated on a scale ranging from 1 *Very Unlikely* to 10 *Very Likely*. To calculate the score, the respondents are partitioned into the three categories: Promoters, Passives, and Detractors.

Promoters are those who are provide strong support for the distance learning format. Detractors are those who do not feel that the distance learning format meets their needs and thereby do not support using this format and do not recommend it to others. Passives, as the name implies, do not indicate strong negative or positive feelings toward the format.

Promoters: Percentage of respondents who provide ratings of 9 and 10.
Passives: Percentage of respondents who provide ratings of 7 and 8.
Detractors: Percentage of respondents who provide ratings of 0 to 6.

Net Promoter Score = % Promoters - % Detractors

The Net Promoter Score is calculated by subtracting the percentage of Promoters from the percentage of Detractors. This score can then range from the highest score of 100 (100% Promoters – 0% Detractors) to the lowest score of -100 (0% Promoters - 100% Detractors). **The higher the Net Promoter Score, the more support exists for the use of distance learning.**

The general rule of thumb for interpreting Net Promoter Scores is:

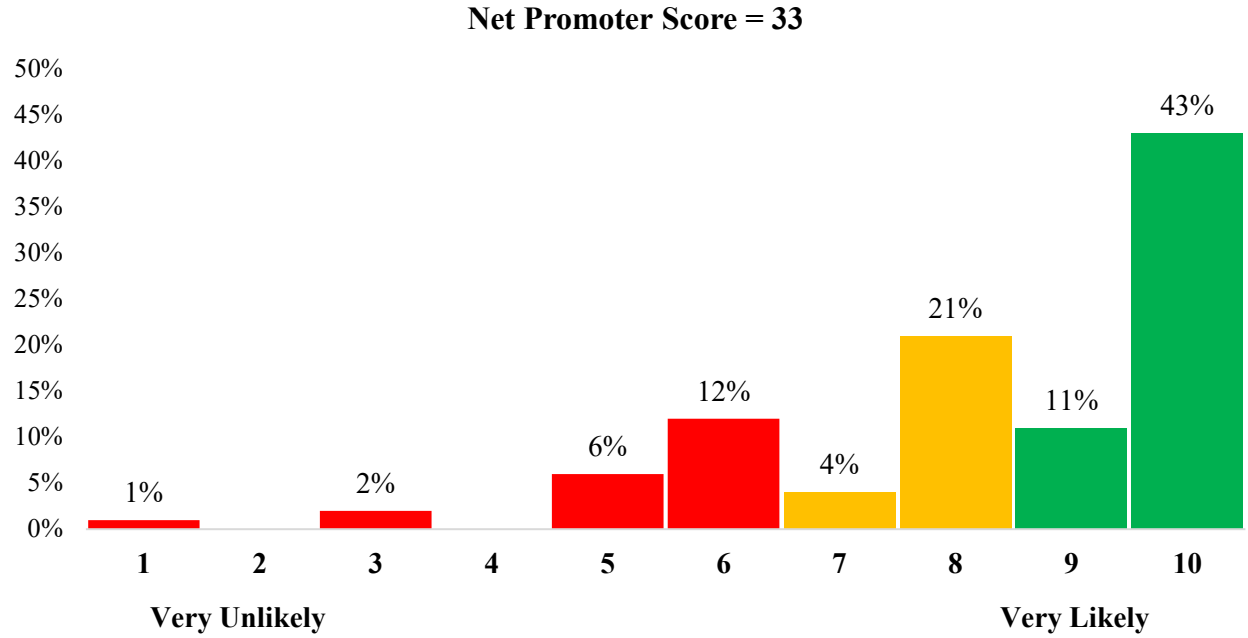
Excellent	71 to 100
Great	31 to 70
Good	1 to 30
Needs Improvement	-100 to 0

In the present study, the Net Promoter Scores were calculated for both the trainees and instructors to measure their perceptions and continued support for of use of distance learning in providing the OSHA 510 and OSHA 500 trainings (Markey, Reichheld, & Dullweber, 2009).

Net Promoter Scores: Trainees. Trainees indicated the likelihood to "RECOMMEND the training delivered via DISTANCE LEARNING to others" on a scale ranging from 1 (*Very Unlikely*) to 10 (*Very Likely*). Trainees' Net Promoter Scores were calculated separately for the OSHA 510 and OSHA 500 courses.

Trainees' Net Promoter Scores: OSHA 510. Figure 2.24 illustrates the percentages of Detractors (recommendation scores of 1-6), Passives (recommendation scores of 7-8), and Promoters (recommendation scores of 9-10) of trainees recommending the OSHA 510 training in distance learning format. The Net Promoter Score was derived by subtracting the percentage of *Detractors* who gave recommendations of 0 to 6 (21%) from the *Promoters* who gave recommendations of 9 to 10 (54%). A Net Promoter Score of 33 indicates strong positive support for the continued use of distance learning for the OSHA 510 training.

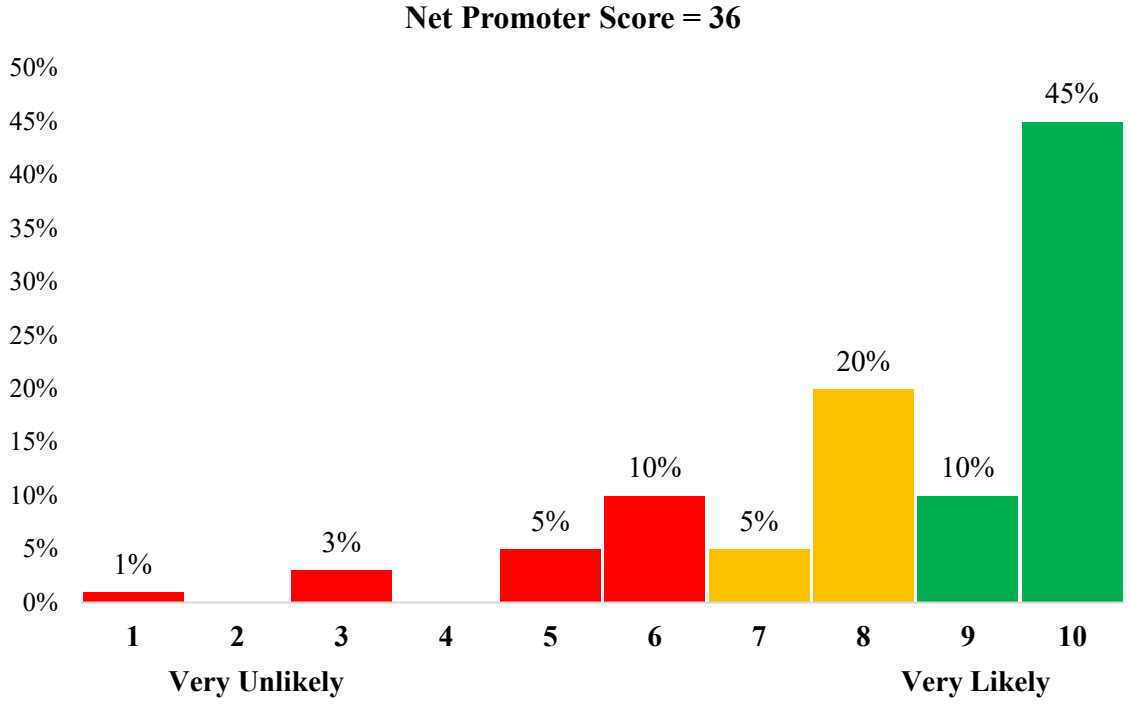
Figure 2.24. Trainee Net Promoter Score for the OSHA 510.



Note. N=100.

Trainees' Net Promoter Scores: OSHA 500. Figure 2.25 depicts the percentages of Detractors (recommendation scores of 1-6), Passives (recommendation scores of 7-8), and Promoters (recommendation scores of 9-10) of trainees recommending the OSHA 500 training in distance learning format. The Net Promoter Score was derived by subtracting the percentage of *Detractors* who gave recommendations of 0 to 6 (19%) from the *Promoters* who gave recommendations of 9 to 10 (55%). A Net Promoter Score of 36 indicates strong positive support for the continued use of distance learning for the OSHA 500 training.

Figure 2.25. Trainee Net Promoter Score for the OSHA 500



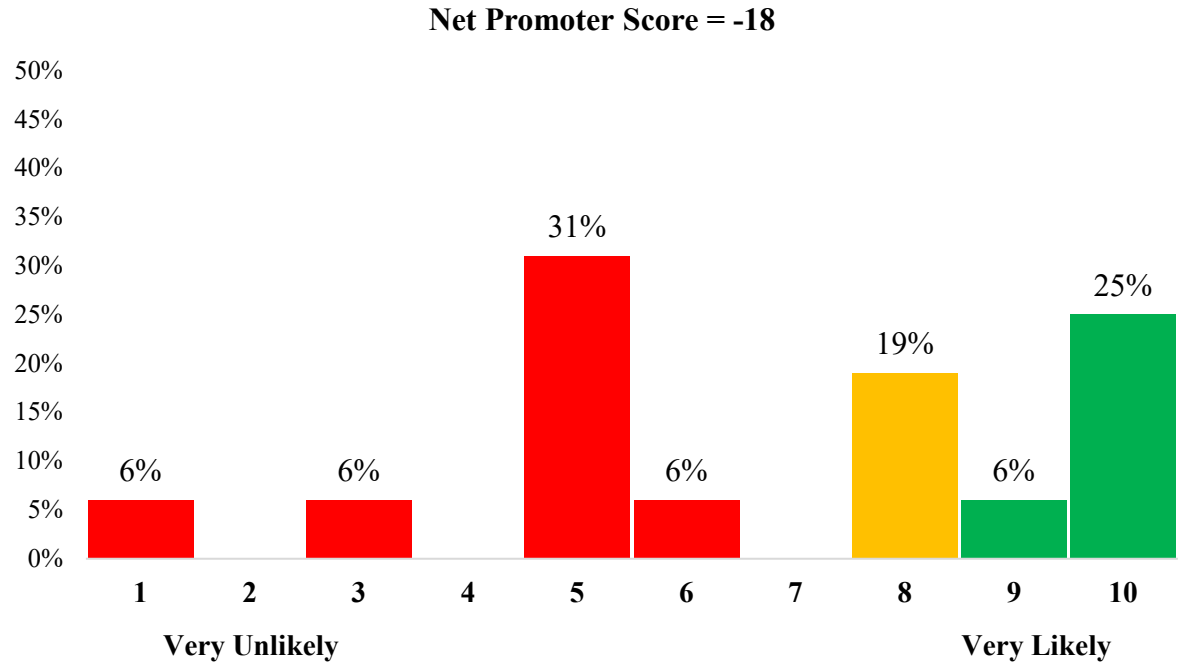
Note. N=100.

Net Promoter Scores: Instructors. Because of the integral role of instructors, as identified in the evaluations, instructors' Net Promoter Scores were also calculated. Instructors indicated their likelihood to "RECOMMEND the training delivered via DISTANCE LEARNING to others" on a scale ranging from 1 (*Very Unlikely*) to 10 (*Very Likely*). Instructors' Net Promoter Scores were calculated separately for the OSHA 510 and OSHA 500 courses. Instructors were less positive than the trainees about their recommendations regarding teaching these courses in a distance learning format.

Instructors' Net Promoter Score: OSHA 510. Figure 2.26 depicts the percentages of Detractors (recommendation scores of 1-6), Passives (recommendation scores of 7-8), and Promoters (recommendation scores of 9-10) of instructors recommending the OSHA 510 training in distance learning format. The Net Promoter Score of -18 was derived by subtracting the percentage of *Detractors* who gave recommendations of 0 to 6 (49%) from the *Promoters* who gave

recommendations of 9 to 10 (31%). A Net Promoter Score of -18 indicates a lack of general support for the continued use of distance learning for the OSHA 510 training.

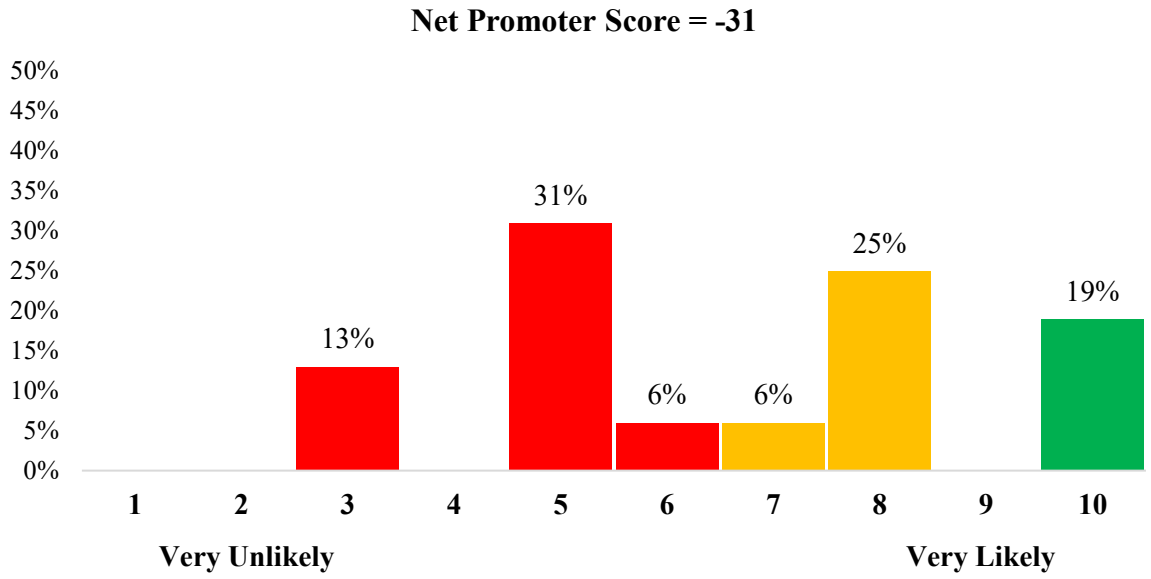
Figure 2.26. Instructor Net Promoter Score for the OSHA 510.



Note. N=16.

Instructors' Net Promoter Score: OSHA 500. Figure 2.27 depicts the percentages of Detractors (recommendation scores of 1-6), Passives (recommendation scores of 7-8), and Promoters (recommendation scores of 9-10) of instructors recommending the OSHA 500 training in distance learning format. The Net Promoter Score of -31 was derived by subtracting the percentage of *Detractors* who gave recommendations of 0 to 6 (50%) from the *Promoters* who gave recommendations of 9 to 10 (19%). A Net Promoter Score of -31 indicates a lack of general support for the continued use of distance learning for the OSHA 500 training.

Figure 2.27. Instructor Net Promoter Score for the OSHA 500.



Note. N=16.

Summary

Net Promoter Scores for trainees revealed that there was strong positive support for the use of distance learning to deliver both the OSHA 510 and OSHA 500 courses. That is, the largest percentage of trainees reported that they highly recommend the trainings conducted in the distance learning format. On the other hand, Net Promoter Scores for instructors revealed a lack of general support for the continued use of the distance learning format.

Qualitative Findings

The findings from the descriptive and comparative analyses provide evidence of the effectiveness and positive impact of the occupational safety and health trainings designed and conducted in the distance learning format on both immediate and longer-term outcomes. To gain a more thorough understanding of why these results occurred, qualitative data were gathered from trainees and instructors. The following sections highlight critical factors for success, including the most and least valuable aspects for those receiving training. Instructors provided information regarding the strengths and weaknesses of using distance learning to conduct the training as well as the challenges that are specific to this format. Finally, instructors were encouraged to provide any best practices and lessons learned through the distance learning format, and trainees were asked to share any additional information that they felt might be helpful.

Most and Least Valuable Aspects of Training Identified by Trainees. Trainees were asked to specify the most and least valuable aspects of the training. Several general themes emerged from the responses.

The **Most Valuable** facets of the training are presented in Table 2.4 in the order of their frequency. The respondents most often cited that the **teaching and learning methods** were critical to the effectiveness of the distance learning format. Of particular importance was the organization of materials and the use of quizzes and repetition to reinforce concepts. Instructors' learning methods are characterized by a **highly interactive approach** that included **discussions and question and answer sessions** and cited as instrumental to the positive learning experience.

Respondents indicated the importance of the **breakout sessions** used for small group exercises and discussions that engage learners and encourage information sharing. Similarly, **presentations and group exercises** provided practice that trainees cited as critical in learning and applying the information for their work. Notably, **instructors' knowledge and experience** were identified as key drivers of success with the distance learning format and critical to ensuring that these teaching and learning methods and general learning environment were effectively executed in the distance learning format. For example, one trainee stated "… *they were extremely effective with presenting the information in a manner that made it understandable, and the way they kept everyone engaged and participating throughout. I think they really helped make the information stick. I can't say enough about what a great job the instructors did*."

Use of distance learning itself was also cited as very valuable by the respondents. The ability to receive the training while **adhering to COVID-19 safety** practices was reported as important for ensuring their own health as well as that of their families. One respondent aptly reported that "*It provided me with the ability to learn from a comfortable environment where I did not have to worry about my health or have to be burdened with wearing a mask. It made it easier to concentrate on the contents that were being taught."*

Related, the distance learning format provided a **convenient and cost effective/efficient manner** (e.g., cost savings related to travel and childcare expenses), in which trainees could attend the courses remotely while gaining the benefits of the training. It should be noted that several of the respondents indicated a strong preference for the face-to-face traditional classroom training.

Table 2.4. Most Valuable Aspects of Distance Learning Reported by Trainees with Representative Examples.

Teaching/Learning Methods
• Regarding the content at first it seemed overwhelming, however being able to break it down and discuss with multiple people their experiences and personal aspects of each topic was incredibly helpful. As well as the repetition of noteworthy material gave me confidence. • The use of Kahoot! to reinforce the topics. Going over the content careful and explaining it in easy-to-understand language. • I really liked that everything was organized. Liked the flow of teaching it wasn't too slow or fast. The visual aids via virtual were easier to read and comprehend rather than looking at a projection screen.
Trainee Presentations
• I believe that allowing us to create our own slide shows was a great tool for learning and teaching us to have confidence when we present for future classes we teach. • Presentations and group exercise formats were extremely valuable and effective. • Learning to have students create scenarios by pictures or recreating incorrect scaffolding or bad cords and letting them show us what they found in the CFR instead of just reading the literature. Making the class more student based makes it more fun and easier to learn OSHA.
Instructors
• I attribute that to the instructors. They were extremely effective with presenting the information in a manner that made it understandable, and the way they kept everyone engaged and participating throughout I think really helped make the information stick. I can't say enough about what a great job the instructors did. • The instructors from the national training institute worked very well with the instructors from CPWR. They made a great team. Very good with the use of distance learning technology. • Instructors did a good job of preparing so they were knowledgeable in the questions that were asked throughout both of the courses.
Discussion/Interaction
• I liked being able to go to break out rooms with different instructors and get different feed back and experiences. I felt it made it more comfortable to engage conversations with new people. It was also quieter in the breakout rooms as to being in person with added background noise. • The group breakouts. Not being physically present gave me a challenge but the groups allowed for discussion and exercises to better understand the topics.
COVID-19 Safety
• It was relieving knowing that I was able to interact with the others and receive information while feeling safe in my own environment. • The simple fact that it was achieved at distance. I couldn't have attended (not comfortably) an in-person class at the time. Covid was in full swing. • It provided me with the ability to learn from a comfortable environment where I did not have to worry about my health or have to be burdened with wearing a mask. It made it easier to concentrate on the contents that were being taught.
Convenience/Efficiency
• The ability to take these courses from the comfort of my own desk were great for me, I didn't have to find childcare to enable me to travel for the classes. • The ease and availability accessibility and having the opportunity to do it when I was able without loss of wage time and effectiveness on my job. • It cut down the cost to my local for travel expenses, but I was still able to get the needed training and was able to retain the information with confidence.
Materials
• It was helpful to me having the handouts and lesson plans easily accessible during the course.

Table 2.4. Most Valuable Aspects of Distance Learning Reported by Trainees with Representative Examples. (continued)

Class Size
• The OSHA 500 was nice because there were only 7 students and 2 instructors. We had a lot of open discussions and one on one time with the instructors. The 510 I did on Zoom during the pandemic.
Content
• Digging deep into the standards was most valuable to me.
Learning Environment
• The atmosphere of the facility, staff, class size and students' willingness to learn without unnecessary interruptions.
General Positive
• It would be very hard for me to single out one individual item to designate as "most valuable." The entire training far exceeded my expectations. I was concerned about retaining the information because of the distant learning format. But when it came time to review and taking the test, I was surprised at how much of the information I was able to retain.
General Negative
• I strongly believe that teaching in person is preferable. When a group of people get together to learn. The group benefits more with in person interactions. • Although a great class, I prefer person to person.

Trainees also elaborated on the **Least Valuable** aspects of the distance learning format. Table 2.5 presents the categories of comments in the order of their frequency. The least valuable aspects cited focused either on limitations that occur due to the lack of face-to-face interactions or on problems and issues surrounding the technology. More specifically, many trainees stated that it is **difficult to stay engaged** in these longer trainings because the sessions require sitting in front of a computer for extended periods time over a series of days. Trainees also indicated that while the training included interactive exercises and discussion, there were **limitations to the effectiveness of the exercises and activities** due to the remote nature. They also cited that because the **discussions and real time interaction/socializations** did not allow direct contact with individuals, their use did not encourage informal exchanges and peer communications to the same extent of the face-to-face trainings and, thereby, negatively impacted networking. Similarly, they expressed that the **student presentations** were not as beneficial in the distance learning format.

An additional set of categories emphasized technological constraints that negatively impacted the training. Respondents reported that they lacked sufficient **technological competence** or **experienced technical issues** that interfered with their learning. Similarly, synchronous training also requires consideration to **scheduling**, including the various time zones of the participants as well as a greater emphasis on **organization of course materials and content** to ensure active learner participation. It should be noted, however, that many respondents did not specify any deficiencies with the distance learning format. That is, the **largest number of responses were generally positive** and indicated that there were no aspects of the distance learning format that were not of value or presented limitations ("*I can't identify anything as "least" valuable. Everything in the course was of high value in my opinion*.").

Table 2.5. Least Valuable Aspects of Distance Learning Reported by Trainees with Representative Examples.

Learner Engagement
• Hard to stay focused. • Staring at a screen is never fun for a long time. • Sitting on the computer for 10 hours a day. • The computer it was so impersonal, and I never felt comfortable I found it hard to stay focused.
Limitations to Activities
• While distance learning was convenient, it's difficult to participate in any "hands-on" learning activities; but I think that's a small trade off. The instructors did a great job keeping the delivery methods fresh and engaging. • Maybe more hands on with building lesson plans. • Some group activities may have been more effective in person.
Discussion
• While being at a distance from the other students was important, it did feel odd and awkward during group discussions. That being said, that's most likely a personal issue of mine and not the general consensus. • A few times a question was lost or unanswered because of Zoom. Could've been user error, but still frustrating. • Most likely the chance to talk to the others and find out what situations they have encountered in their years of experience.
Interaction/Socialization
• People can't talk interact, ask questions in between class times. • Not being able to meet as a group and socially trade experiences during and after classes. • Collectively, we all missed the networking with others.
Presentation
• I took my original OSHA 500 and 510 in person in 2010. While the course being taught online this time, I do not feel that the final presentation being done online had the same benefit as it did when presented in person. • Giving a presentation online is way easier.
Test
• Test prep, test questions varied a lot from some of the material covered.
Technological Competence
• I didn't like doing the teach back with Zoom. It was to difficult because I had barely learned the Zoom layout. I'm much better now; it made me nervous and I didn't get to do my presentation very well. • Inexperience in technology.
Technical Issues
• The instructors and some of the students had several technical issues. They were usually handled after some delay, but they slowed down the course for everyone and were distracting especially when a professor's mic would cut out mod sentence.
Scheduling
• Having classes that work for all time zones would be helpful. • I'm not a fan of zoom meetings, prefer online learning in a blackboard at your pace environment.
Organization of Content and Materials
• Bouncing around made it difficult. • The course material wasn't laid out the best different students had different materials pages didn't match up and it caused some confusion. I would have thought with everyone being online the first thing was to make sure everyone had the same electronic copy of the material.

Table 2.5. Least Valuable Aspects of Distance Learning Reported by Trainees with Representative Examples. (continued)

General Negative
• It would be better learning face-to-face so I can learn better. • For myself, I prefer in person, but the zoom classes were much better than the internet classes I've taken (like OSHA 30).
General Positive
• I'm not sure I can pinpoint anything that was least valuable to me. Each of the things was a learning experience or more tools to keep in my own teaching toolbox. • I can't identify anything as "least" valuable. Everything in the course was of high value in my opinion.
None/No Limitations
• None of it was of no value to me. All was valuable. • I did not find any setbacks with the online learning.

Additional Comments from Trainees. Trainees were asked to provide additional comments about their experience with the distance learning format for the OSHA 510 and OSHA 500 trainings. Table 2.6 presents the categories of comments in the order of their frequency. Overall, the comments were very supportive of distance learning and highlighted key characteristics for success as well as suggestions for improvement. The vast majority of comments were categorized as **generally positive** in which respondents **expressed appreciation** for the effort to provide quality distance learning OSHA trainings while keeping the trainees safe during the COVID-19 pandemic. That said, many expressed that they **preferred face-to-face trainings** and wanted to return to the traditional face-to-face format following the COVID-19 pandemic. Consistent with the quantitative ratings and previous comments, **instructors were cited as essential elements for effectively conducting training** in a distance learning format (e.g., "Instructors were knowledgeable and informative").

Related, the **learning/teaching methods** used by the instructors were cited as effective, as they facilitated discussions and interactions and reinforced learning among trainees. Several respondents indicated the importance of **advanced preparation and orientation to the distance learning format.** Because of the reliance on the technology and inevitable technical glitches, the trainees stressed the importance of advanced training for both the trainees and instructors to troubleshoot these issues without disrupting the training. Similarly, the trainees suggested that the **materials should be organized** to reflect the order of the course. It was also suggested that a **thumb drive with course-related materials** be made available to participants. Consistent with previous comments, the trainees noted that **learner engagement** is an area of concern for the longer, multiple-day trainings. As suggested with the quantitative results, the **scheduling of breaks** was cited as important, and incorporating more breaks should be given consideration. Interestingly, one respondent suggested that other courses should be provided in the distance learning format (e.g., "Disaster Relief Training").

Table 2.6. Additional Comments Regarding Use of Distance Learning Reported by Trainees with Representative Examples.

General Positive
• I feel that given the circumstances and the timeframe, the distance learning courses were very well thought out and executed. As with anything new I'm sure small changes and adjustments are inevitable, but great job from my perspective. • It works. It is definitely a way to provide the content in a safe environment. • It provided the opportunity to meet and interact with people around the country. • The courses were very effective and needed for many organizations to keep training safety. • In today's atmosphere, the zoom classes are an effective method of continuing to educate and expand the safety base in construction. • I like video conferencing classes and feel comfortable teaching or being a student, so it was great for me.
In-Person Preferred
• In-person I feel is always better, but at this time distant learning is best. • I would much rather do in person training than online training. • Distance learning might become more frequently, in these pandemic times, but I still prefer face to face learning.
Instructor Expertise
• The instructors were great, they paused for us to ask questions and made sure we understood the content. • Instructors (trainers) were great, I was truly honored to have been taught by these trainers. I hope one day to be doing training as well
Learning/Teaching Methods
• OPEN CONVERSATIONS AND QUESTIONING THE GROUP VERY HELPFUL. • There is plenty of safety videos, and PowerPoints on OSHA topics. • Really enjoyed the interactive quizzes, they really helped retain more information.
Preparation/Orientation
• My organization made sure that I was ready for the class (I knew what devices I needed, had all the proper links and apps.) I could see issues with a less organized group. • If the instructors had more support to quickly handle the known technical issues and also had more comprehensive training on how to deal with such problems themselves, it would greatly improve the overall course.
Materials
• All content received was valuable, although I wish that I could have received a thumb drive with more content on it so I may develop my own presentations. • The course was presented in an order that did not follow the binder. I spent a lot of time trying to search for where we were being presented. It would have been more cohesive if the binder and order of class presentation were in synch with each other.
Schedule/Length
• More short breaks. • Maybe consider hourly stretch breaks.
Trainee Engagement
• It is extremely difficult to stay attentive via distance learning for extended OSHA classes. • When we do the distance learning we have to keep the students involved in the subject matter.
Additional Courses
• Disaster relief training online.

Strengths and Weaknesses of Training Identified by Instructors

Information regarding the strengths and weaknesses of distance learning was gathered from instructors. Several general themes emerged among responses and
are presented in Table 2.7 in the order of their frequency.

From the perspective of the instructors, the most often cited Strength in using the distance learning format is the **enhanced capacity to deliver needed training in a safe environment during the COVID-19 pandemic**. Because of its perceived effectiveness, instructors reported that it is a "*suitable alternative when in-person training is not an option.*" However, they also stated that the traditional face-to-face training is optimal and that "*distance learning has a place but should be limited*" following the COVID-19 pandemic. The **cost savings and convenience** gleaned from not having to travel to the training centers was also touted as a strength. The **breakout rooms** were reported by one instructor as a strength due to the personal level of attention that this technique brings to the training.

The **Weaknesses** of the training centered around **the limitations that the distance learning format poses relative to face-to-face instruction**. Instructors expressed that the physical distance created by distance learning resulted in a **lack of social interaction.** The instructors indicated a **preference for in-person interactions and discussions** and the informal networking that occurred both during and following the training sessions. Related, instructors reported that without the ability to see non-verbal cues, it was difficult to "read the room" and gauge the level of interest and understanding. The difficulty of relying solely on viewing trainees using cameras limited instructors' **assessment of trainees' attention and comprehension of the subject matter** in comparison to the traditional in-person format. Instructors reported that **technical issues** and **varying levels of technological competence** also were problematic. Finally, instructors stated that the distance learning format **limits to use of hands-on exercises and activities** and presents **difficulties in providing student support** in preparing for their presentations.

Table 2.7. Strengths and Weaknesses of OSHA Training using Distance Learning Reported by Instructors.

Strengths
Safety During COVID-19
• I am thankful that we were able to continue through the pandemic with distance learning, but I also believe we should return to in-person as soon as it is safely possible. • Safety from Covid 19. • It was the best way available to train new instructors. • Able to reach people who we wouldn't be able to because of the pandemic. • Strengths are providing a safe environment and availability for the participants. • Provides a suitable alternative when "in-person" training is not an option. • I feel it provides a safe way to safely conduct the training during the pandemic.
Convenience and Efficiency
• Besides convenience and cost savings there is little or no strengths to distance learning. • No travel. • Keeps the cost down.
Breakout Rooms
• Use of breakout rooms is a strength because it allows a personal level of training.
Weaknesses
Lack of Social Interaction
• The lack of interaction among the participants. Not just during the class but afterwards at dinner, hotel, etc. • No comradery and social interaction. • Less interaction with participants. • You get more interaction with in-person learning. • OSHA 500 is best with live interaction.
In-Person Preferred
• I feel these need to be in-person if all possible. I understand that distance learning has a place but should be limited. • Still not as effective as in person training. • NOTHING can replace in person training.
Limits Assessment of Trainees' Comprehension/Attention
• Trying to read people is my huge weakness. It's hard to tell if people are understanding, enjoying, or trying to participate. In person you can see their reaction, tell if they are getting bored, or tired. • I have found while instructing other courses using distance learning during the pandemic that it's not always easy to identify if the individuals that you see on camera are paying full attention. • Harder to help student comprehension.
Technological and Technical Difficulties
• Internet issues. • My personal ability to maneuver online format. • Training provider had a great administrated back up team to support the training experience.
Limits Hands-on
• Limits training methods and class hands on activities.
Limits Student Support
• On-line learning is more difficult to help students prepare for their presentations.

Challenges Training Identified by Instructors

Challenges to the distance learning format in providing occupational safety and health training were also identified from the perspective of instructors. General themes emerged from the responses and are presented in Table 2.8 in the order of their frequency. All instructors reported that the greatest challenge to distance learning is the **lack of technological competence**. The instructors stated issues ranging from the trainees' lack of basic computer skills and learning curve in gaining competency in the technology to the need for instructors themselves to improve their skills. However, instructors' comments conveyed that the formal orientation training and continued use distance learning were addressing these issues. Several instructors explained that **technical issues** (storms; connectivity) posed additional challenges. Similar to previous comments, instructors stated that **learner engagement** was problematic. In addition to the previously reported issues that were posed by the reliance on cameras, the interruptions in the trainees' home environment also served as distractions that cannot be controlled as easily as in the classroom. Finally, a few instructors acknowledged that while challenges exist and are somewhat different from those in the in-person setting, they are not insurmountable.

Table 2.8. Challenges to OSHA Training using Distance Learning Reported by Instructors.

Technological Competence
• Class computer skills lacked at times causing slowdowns. • More in house computer training on our end. • Biggest challenge is students that can't use a computer, tablet or understand how to manipulate documents or PowerPoints. Suggestion- At least the OSHA 500 needs to be in person for us to help teach them those skills. Trying to teach them without seeing their screen is challenging. • It was hard to relay to the folks that were not technology savvy. To get them to click or do exactly what you need them to do. Without being right over their shoulder to explain somethings on the computer. • People using computers who are not comfortable with the technology. The technology aspect was the biggest struggle for most people. • My personal ability to maneuver distance learning deliver system (Zoom). SUGGESTION: Instructor training. • Students struggled with technology in beginning, but well-planned orientation improved this. • Students' lack of knowledge about online training. Also, their lack of computer skills. • Biggest challenge is the tech (or lack of tech) skills from some participants.
Technical Issues
• Storms caused internet issues. • Electronic issues such as launching power points and videos was sometimes challenging. • Internet problems have been the biggest challenge. • Sometimes their home location had issues with internet connections.
Learner Engagement
• Challenges are eye contact, student involvement, and students' learning habits must be changed. • People getting interrupted. They are at their job office or at home. Then they have deliveries, other instructors coming in. answering phone calls. While in-person in a classroom, there don't seem to be as many distractions.
None
• There are always a few challenges in every class. On-line classes are no different. The challenges were not significant. I feel that learning was not hindered but helped. • I didn't experience any challenges. • N/A

Best Practices/Lessons Learned Reported by Instructors

Based on their experiences using the technology, instructors identified best practices and lessons learned through the distance learning format for worker safety and health trainings (Table 2.9). It should be noted that the instructors provided best practices to ensure that one can conduct training in a distance learning format that "although doesn't replace in-person training, can be a very formidable alternative." The most commonly occurring best practice/lesson learned was an emphasis on **being prepared and thoroughly familiar with distance learning**. Suggestions included advance preparation of materials and planned exercises and activities in the distance learning format. Because this may require learning new teaching/learning methods associated with these platforms, practice is recommended that includes critiques from fellow instructors in the operating platforms (e.g., Zoom). These comments suggest that, in keeping with the quantitative findings presented earlier, the comfort of the instructors is imperative to creating a learning environment that puts less technologically competent students at ease. Therefore, the **mandatory orientation sessions** are identified as critical to ensuring a baseline level of technological competence for both instructors and trainees. These online sessions that review the technology, test technological requirements, and provide detailed expectations were reported as a standard prerequisite by all training providers. Furthermore, the orientation allowed for the use of the **various distance learning technological components** during the trainings. Both instructors and trainees have consistently stressed the importance of using various types of interactive methods and techniques (e.g., different styles of breakout sessions, question and answer polling, Kahoot!, Quizlet) to keep the learners engaged and attentive throughout the training. In particular, instructors cited that virtual breakout rooms allowed the instructors to use small group techniques with discussion in a manner similar to that of the face-to-face format. However, effective use of various techniques also required having **technical support readily available**. Instructors indicated that multiple instructors and/or a technical support team that is dedicated to monitoring the technology and handling technical issues is necessary. Finally, one respondent reported the use of **student assessments to evaluate gains in knowledge and skills** was important. It should be noted that the same assessments (teach backs; standardized tests) are used in the distance learning and face-to-face formats of the trainings. Taken together, the reported best practices relevant for distance learning mirror the well-established adult learning and instructional design principles that lead to excellence in the face-to-face trainings.

Table 2.9. Best Practices/Lessons Learned of Safety and Health Training Delivered in Distance Learning Format Reported by Instructors.

Instructor Preparation
• As an instructor being as comfortable as possible with the format so the students would be more at ease with the class. • As with in person classes, prepare your materials and familiarize yourself with the operating platforms that will be used. • Practice, Practice, Practice, practice. You must practice and critique each other before the actual class. We did so before every course we taught online. Very demanding of the instructor. • With enough work and preparation, a course can be delivered that although doesn't replace in-person training, can be a very formidable alternative. • Well planned small group activates with parts of the reports/responses required of all the participants.
Orientation to the Technology
• A great practice is having an orientation class with the sole purpose of learning how to use the technology. • The workshop orientation helps out a lot. We also developed a class on how to use zoom that had to be taken before they could take the OSHA 510. • Good Orientation prior to class beginning.
Use of Technological Components
• Students always expressed positive comments when we utilized the breakout rooms for group activities. • Being online it was neat to show people other alternative ways to teach and different ideas since we were confined to using the computer.
Support Team
• Having multiple instructors to make sure the participants are staying active. • Another good practice is having an assistant in the class. This assistant's only job is to help with tech issues, sending files and assignments to the students helping them with any computer issues that might arise. • A well-trained support team.
Student Assessments
• I think the teach backs that the students in the class presented was a very good practice and I think the exam at the end was helpful to evaluate the students' knowledge.
In-Person Preferred
• Overall, it is a great tool. But it is a very distant second place to in class instruction.

Collectively, these qualitative comments highlight important themes for the successful design and delivery of occupational safety and health courses in the distance learning format. Suggestions were presented that consider the needs of both the trainees and the instructors. It should be noted that the thematic categories are consistent with those reported for the shorter occupational safety and health courses previously evaluated during the early stages of the COVID-19 pandemic (Sarpy et al., 2020).

General Discussion and Suggestions for Future Research

This report details a comprehensive evaluation process designed to assess the effectiveness of distance learning for occupational safety and health training. This included comparative analyses of OSHA 510 and OSHA 500 trainings (26 hour) provided by multiple training providers to assess the effectiveness and impact of the distance learning format on subjective and objective measures (i.e., reactions, learning, performance). The evaluation was designed to assess the following: (1) comparisons of effectiveness for safety trainings delivered in face-to-face versus distance learning formats; (2) comparisons of effectiveness of distance learning design features on training outcomes; (3) impact of distance learning courses on training outcomes three to six months post-training (e.g., maintenance of training; on-the-job performance); and (4) influence of trainee characteristics (technological competence) on the post-training outcomes. General findings from the evaluation are summarized below (see Figure 2.28). Considerations for future research are also discussed.

This report provides evidence that distance learning can be used as an effective method for conducting occupational safety and health training. Trainees in the OSHA 510 and OSHA 500 trainings generally reported high levels of effectiveness for both the distance learning and face-to-face formats, with comparatively higher ratings of Instructor Effectiveness for the face-to-face format. Positive learning gains for trainees in the OSHA 510 and OSHA 500 trainings were demonstrated for both the distance learning and face-to-face formats. However, comparative analyses revealed higher self-reported learning gains for those in the OSHA 500 courses using the face-to-face format. They also revealed higher test scores for those in the OSHA 510 and OSHA 500 courses using the face-to-face format.

Comparisons of distance learning formats used by various training providers revealed similarities among training features. These included: (1) use of synchronous (real-time) platforms; (2) use of teams of seasoned instructors, with at least one member of the team dedicated to technical support; (3) adherence to principles of adult learning and instructional effectiveness that includes interactive/engaging learning methods (e.g., small group techniques with discussion); (4) mandatory orientation training on the technology that includes student guidelines; and (5) use of the CPWR structured testing process. However, differences did emerge regarding the schedules used by the training providers (e.g., inclusion/exclusion of lunch breaks, length of training sessions). Comparative analyses showed that trainees in the distance learning format that involved longer training sessions, included a designated lunch break, and were extended over a longer time period (weekend break instead of consecutive days) achieved the highest test scores. While these results are preliminary in nature, they indicate that the training schedule is an important consideration not only in the flexibility afforded by the format but also in the learning attained by participants (training outcome).

The study of effectiveness and impact of the distance learning format for the OSHA 510 and OSHA 500 trainings on longer-term training outcomes further complement these findings. Three to six months after the training, trainees and instructors continued to report the effectiveness of the trainings that were conducted in the distance learning format. It should be noted that instructors, while providing positive ratings, provided slightly lower ratings of effectiveness relative to that of the trainees. Similarly, trainees recommended that the distance learning format continue being used for the OSHA 510 and OSHA 500 trainings, as indicated by a strong Net Promoter Score. Instructors, on the other hand, were not largely supportive.

With respect to learning, the evaluation results demonstrate enhanced safety-related knowledge and skills three to six months following the training (maintenance of the learning gains). Importantly, the transfer of these learning gains from the classroom to improved safety performance on the job was reported. When considering the influence of trainee characteristics on these outcomes, technological competence (comfort, skill) of the trainees was shown to be a significant factor. In general, trainees reported improved comfort with the technology and skill in using the technology since the onset of the COVID-19 pandemic. Importantly, trainees' comfort with the technology to a greater extent and skill in using the technology to a lesser extent influenced the training outcomes, including their ability to retain the learned knowledge and skills and the ability to transfer this learning to improved safety performance. These results highlight the need for building and supporting trainees' confidence with and expertise in the distance learning format to ensure the greatest impact of the training and support the continued use of training features to enhance technological competence (e.g., orientation training; designated technical assistant).

Figure 2.28. Summary of Evaluation of OSHA 510 and OSHA 500 Trainings.

Immediate Training Outcomes: Face-to-Face vs. Distance Learning

- Both face-to-face and distance learning formats demonstrated high levels of Effectiveness and Learning
- Face-to-face format received higher ratings of Instructor Effectiveness and produced Greater Learning
- Scheduling of Distance Learning:
  - Longer training sessions with breaks that include lunch presented over a longer period of time (weekend breaks) resulted in the Highest Test Scores
  - Shorter Training sessions presented with shorter breaks and no lunch presented over consecutive days resulted in the Lowest Test Scores

Longer-term Training Outcomes: Distance Learning

- High ratings of Instructor, Content, Format and Overall Effectiveness from trainees and instructors
- High levels of Learning reported by trainees
- Transferred to improved Performance and Support (supervisory, organizational)
- Trainee's Technological Competence improved during the COVID-19 pandemic and influenced Longer-term Outcomes (higher comfort with technology reported higher training outcomes)
- Trainees recommend continued use of distance learning for OSHA 500 and OSHA 510 courses; Trainees and instructors expressed preference for the face-to-face format

This study also demonstrates the benefits of using evaluation to identify best practices and lessons learned, which can then be incorporated into future occupational safety and health courses conducted in the distance learning format. The training providers consistently cited that the distance learning format was designed and delivered by utilizing principles of adult instruction and excellence in instructional design as a guide. Across sources, the instructors were recognized as key drivers of success with respect to their expertise in adopting the learning principles used in the face-to-face format to the distance learning format. These results bolster previous studies for shorter (i.e., 1-hour; 6-hour) occupational safety and health trainings (Sarpy et al., 2020). The trainees also reported strong support for the continued use of the distance learning format. However, across sources, there was a strong preference for the use of traditional classroom instruction in a face-to-face format. Collectively, these results suggest that strategic decision-making is necessary to determine the most effective use and integration of the distance technology in improving occupational safety and health training systems. For example, blended learning methods and flipped classrooms are two increasingly common training configurations that integrate both face-to-face and distance learning in various combinations while fostering the interactions and hands-on experiences cited as instrumental to success of occupational safety and health trainings. Future research could examine the optimal use of different formats and sequencing of distance learning and in-person instruction in these combined training efforts. Because of the time and cost efficiencies cited across respondents (trainees and instructors), evaluations could be expanded to include cost-benefit analyses. These analyses provide additional information to systematically assess various combinations of these hybrid or blended approaches, which is particularly relevant for longer occupational safety and health courses (e.g., 40-hour HAZWOPER) on training outcomes.

Related, future research is needed to include training outcome measures that more directly assess the social aspects of training. Although each of the training providers stressed the use of highly interactive techniques in their distance learning format, the lack of face-to-face interaction was cited as a barrier to networking and resource- sharing among participants. This study highlights these findings but does not directly measure their impact on training outcomes. Future research should consider including interpersonal and relationship variables in the assessment of the effectiveness and impact of distance learning formats. Doing so would clarify the extent to which reduced in-person interactions influences these outcomes (e.g., communication between instructors and trainees; peer support and cohesion among trainees).

The findings of this study contribute to the understanding of the trainee characteristics and training features critical for success in technology-based formats (Bell et al., 2017; Sarpy & Burke, 2021; Sarpy et al., 2021). The present findings suggest that trainees' technological competence directly influences maintenance and transfer of training outcomes. In addition, examination of these training characteristics across a more diverse worker population (e.g., gender, race, ethnicity) is recommended. The findings also highlight key training features (e.g., interactive training methods) that are essential for success in the distance learning format, including preliminary information on the most effective training schedule. Further research is needed to better understand the influence of these factors on distance learning for occupational safety and health training. Systematic evaluations of the trainee characteristics and training features used in distance learning will provide evidence to improve fidelity of the training to approximate the learning environment engendered in the face-to-face (gold standard) format.

Conclusion

This evaluation provides additional evidence supporting the effectiveness of synchronous, interactive distance learning techniques to conduct occupational safety and health training. Trainee characteristics and training features influencing effectiveness and impact are identified as well as recommendations for continuous quality improvement. Finally, suggestions are made for future research that focuses on using distance technology in occupational safety and health training systems. Taken together, these findings and general recommendations can be used to ensure successful and sustained integration of synchronous distance learning for occupational safety and health trainings.

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Glossary

Distance learning – general term for instruction in which instructor and learner are not in the same location (i.e., geographically distant). Also referred to as remote learning.

Online learning – training in which the instruction is provided using the Internet

Blended learning – training that combines elements of both distance and traditional face-to-face instruction

Synchronous – training is presented in "real time" to the learner; instructor and trainees can interact and communicate live to each other

Asynchronous – training is posted online and learners access the instruction on their own time

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