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Teach Me to Fish: The Role of Virtual Training Environments in Workplace Learning

A Technical Paper prepared for SCTE by

Abbie O'Dell
Sr Dir, Learning Services: Field Operations
Charter Communications
6399 S Fiddler's Green Cir
Greenwood Village, CO 80111
720-482-4205
Abbie.odell@charter.com

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1. Introduction

This qualitative study considers the relationship between an immersive Virtual Training Environment (VTE) and the post-training confidence of learners, through examining the perceptions of trainers. Study participants were selected from trainers in a large telecommunications organization who provide instruction on software and systems, including those both with and without a VTE. Six participants responded to an online survey containing closed- and open-ended questions that gathered their perceptions of post-training confidence for learners relative to use of a VTE during their training course, and responses were analyzed to identify key topical patterns. The findings indicate a perception that the presence of a VTE provides significant positive impact to the learner experience, and that the absence of one can be equally detrimental. Concepts from the literature, including exploratory and participatory learning, self-directed learning, learning transfer and others were found throughout the participant responses. The findings indicate a clear preference for VTEs and suggest an opportunity for future inquiry to establish the validity of this instructional method.

2. Overview

The use of computer software and applications has become intertwined with the work performed by most employees in both large and small organizations in the United States. A 2001 study by the US Department of Commerce estimated that 65 million adults use a computer in order to perform their job, and by 2003 that number had risen to 77 million, accounting for 55.5% of total employed persons (US Department of Labor, 2005). The ensuing years have only continued this upward trend. The transition to remote work as a result of COVID-19 further shifted the workforce to an online computer-supported work model, with many workers performing all job duties remotely via computer. Despite this clear reliance on software and applications in the workplace, many organizations still struggle to provide effective training to employees on software and applications that are necessary to perform their work.

Companies invest significant capital in proprietary software systems but still suffer implementation failures, some of which can be related to employees' inability to effectively use the systems (Marler et al., 2006). Participants often lack confidence and proficiency in the use of the software tools at the conclusion training programs, which contributes to errors and impacts both employee performance measures and the business overall. Why are some companies willing to fund the creation of new software and applications, yet hesitant to fund the corresponding training programs needed to ensure their success?

While we may consider this a modern problem, studies in the early 1990s clearly indicated a need to conduct further research to correlate failures of workplace technology to communication and training methods, and that workplace computer and software training should incorporate an understanding of learner needs in their design (Martocchio & Webster, 1992; Turnage, 1990). More recent works explore relationships between instructional methods such as video tutorials to post-training performance, learning transfer, and learner self-reported satisfaction (Van der Meij et al., 2018; Roumell, 2018; Lavendels et al., 2014).

Research has been conducted on the methods of instructional design to use in the creation of simulations or training videos (Van der Meij, 2013a, 2013b, 2014; Van der Meij et al., 2018), but minimal research has been performed relative to the concept of a virtual training environment (VTE), here defined as a full-function, separate instance of the software used to create an immersive learning experience. Virtual training tools do exist for complex procedures and systems in the medical field, and a 2017 study of a tool used to teach radiotherapy indicated that despite the availability of a virtual environment for training, many of the advanced features of the training system were unused and some organizational skepticism existed (Bridge et al., 2017). Further, current studies of adult learners in a workplace setting related to

use of VTEs for software and application training are extremely limited. The work of Van der Meij (2013a, 2013b, 2014) and Van der Meij et al. (2018) provides a fascinating and relevant starting point, but focuses on the experience of K-12 learners rather than workplace learners. Further inquiry into the experience of adult learners in the workplace could help expand the collective understanding of this important and timely topic.

Based on my own observations and anecdotal conversations with both instructors and learners during my eighteen years as an adult learning professional in a large technology organization, learner confidence and proficiency post-training may have a relationship to the methods used in the training program. Specifically, learners who are afforded an opportunity to use a VTE report greater confidence in its use after the completion of the program. Learners who have been presented only video simulations have struggled to effectively use new software and their self-reported confidence post-training is low. The continued increase of complex and proprietary software applications as an integral part of the modern workplace indicates that further research specifically targeting the efficacy of VTEs for software and application learning is warranted and necessary.

Exploring the relationship between the presence of VTEs and efficacy of training programs can help workplace learning professionals understand the need for the initial investment in a VTE through a consideration of post-training performance. Further, instructional designers can better customize the design of software training programs to include structured VTE activities that improve learner experience and provide greater learning transfer. Businesses may be hesitant to invest capital in VTEs without a clear relationship to a return on that investment, and closer examination of the impact of VTEs on post-training trainee confidence, proficiency and workplace effectiveness can help with that justification.

3. Literature Review

Data from the US Department of Labor (2005) indicate that workplace use of software and applications will only continue to trend upward in the future, and companies seeking to remain vital and retain a strong workforce should cast a critical eye to the training practices used for these systems. In reviewing current literature specifically relevant to the topic of VTEs and software training methods, we will consider two main areas. First, we will examine literature related to the core principles of adult learning theory and practice, including self-directed learning theory and learning transfer. Second, we will explore current literature specifically investigating practices and methods used for software and application training in both K-12 and workplace settings.

3.1. Adult Learning Theories and Practices

What specifically differentiates the concept of a Virtual Training Environment (VTE) from other methods of software and application instruction such as videos or e-learns? How might existing research help to differentiate a need for this instructional methodology? An answer may be found in early concepts of andragogy and adult learning theories first explored by Knowles, who presented a series of five foundational characteristics of the adult learner which have since been incorporated into the collective understanding of adult learning theory (Merriam & Bierema, 2014). Among these principles are that adults have “an independent self-concept. . . and can direct [their] own learning” and that they are “problem-centered and interested in an immediate application of knowledge” (Merriam, 2001, p. 5). These two foundational principles directly support the use of software VTEs in the workplace learning environment, since one of the differentiating factors of a VTE compared to other instructional methods is that the learner is afforded an opportunity to experience an immersive environment in which unstructured self-directed learning can occur, and practice can directly mimic very real and practical skills that can be immediately put into use back on the job.

3.1.1. Self-Directed Learning Theory

Self-Directed Learning (SDL) as a learning theory is a fundamental concept and has been extensively researched and practiced for over fifty years (Merriam & Bierema, 2014). Tough's 'Adult Learning Projects' during the 1970s provided an in-depth study of how adult learners work through the process of selecting the topic(s), resources, and materials needed to support a specific learning endeavor (Abdullah et al., 2008). A more recent piece by Hendriks et al. (2018) focuses specifically on the workplace learning experiences of customer-facing employees, as related to SDL and integration of technology. The study found a correlation between participant comfort with technology and a perspective that technology is integral to work and career development.

Caruso (2018) further explored the correlation between the effectiveness of learning outcomes and the use of technology-supported SDL methods during learning events. She found that the use of Web 2.0 technologies (defined in the scope of the paper as socially-driven resources or applications such as media sharing, discussion boards, search tools and the like) are effective in supporting both structured and informal learning events in the workplace if they are strategically and deliberately used and the guidelines around their use are clear to the learner. Learner affinity and comfort with technology also directly impact the effectiveness of technology-supported SDL and in order to remain nimble in a quickly changing marketplace, employees need to be afforded the technological tools to enable them to use SDL principles and informal learning to meet the needs of the organization (Fleming et al., 2014).

3.1.2. Learning Transfer

While the concepts of SDL instructional methods provide a compelling case for the use of VTEs from a participant experience perspective, an even stronger case can be made related to the concept of learning transfer, which is most simply explained as the ability to put the new skills learned in the classroom environment into practice (Roumell, 2019). Foley and Kaiser (2013) defined the different levels of learning transfer, including near and far, positive and negative, and high- and low-road transfer. The context of the VTE aligns closely with the concepts of near transfer, meaning the newly-experienced situation is similar to the original learning; and low-road transfer, where the technique or skill is practiced extensively in the learning environment so that its replication is nearly automatic in the new experience (Foley & Kaiser, 2013). Foley and Kaiser also noted that instructional practices can become barriers to learning transfer, specifically noting situations in which opportunities to practice transferable skills are lacking in the learning environment. To remediate this, the authors recommend several techniques, the most relevant of which to our current context is the concept of scaffolding, which affords learners structured tools to enable them to construct their learning. This aligns with the concept of a VTE, in that the learner is empowered to construct their own learning experience while still receiving support and guidance (scaffolding) of the learning process by the instructor.

Hardré (2013) explored the concept of learning transfer specifically in the context of technology training and proposed that the effectiveness of learning transfer is related to the concept of authenticity, defined as the realism of the training experience compared to the actual environment. Hardré further noted that effectiveness of software training videos or e-learning courses is limited when there is low authenticity to actual tasks or work environments. Relevant to the scope of this work is Hardré's concept of the authenticity of the learning environment, considering that often the learning environment holds less distractions, variables and errors than the "real world" and as a result, the learner may not be able to effectively transfer their skills outside of the classroom. The concepts of authenticity of representation and authenticity of interactivity are key to the potential value of a VTE, since they specifically indicate the need for the technology learning experiences to be as true-to-life as possible, affording the learner an experience that effectively mimics their ultimate experience.

3.2. Software Training for Adult Learners: Early Inquiries

Beyond the core adult learning theories and practices that support the concept of VTEs, research and inquiry into the nuances of software training for adult learners provides important insights. A need for research into the effectiveness of software training was recognized in the early 1990s, and researchers sought to explore how training methodologies and course design could be used to maximize learning outcomes (Martocchio & Webster, 1992; Turnage, 1990). Martocchio and Webster (1992) proposed that "cognitive playfulness" during the learning process is related to greater effectiveness, indicating that learners "exercise and develop skills through exploratory behaviors, resulting in enhanced task performance" (p. 557). They conducted a study with 68 individuals employed at a large public university who were enrolled in a training course on a word processing program, and their findings indicated a strong correlation between learners high in playfulness to positive outcomes both in test scores and post-training performance. They recommended further research on the topic, noting that outcomes may vary between students and those in a workplace learning setting. The early need for a customized and enhanced approach to workplace training to suit the computer-based work environment was also recognized by Turnage (1990) who somewhat presciently stated:

> "Training will change as computer based training becomes more prevalent with new applications including embedded training, computer literacy, interactive video disc, and electronic lectures. Intelligent computer-assisted instruction (CAI), authoring systems, hand-held computers, speech processing, and new telecommunication technologies will also shape the future direction of automated instruction in the workplace." (p. 176)

3.3. Technology for Adult Learning: Simulations and Learner-Centered Design

While these early works provide us important context, recent studies allow for more relevant and timely inquiry into the topic of software training methods for adult learners. Hardin et al. (2013) explored the effectiveness of computer simulated software training systems (CSSTS) and investigated the connection between software self-efficacy and post-training effectiveness. In this context, a CSSTS is defined as "a specific type of e-learning self-study system that has become immensely popular for facilitating software instruction" (Hardin et al., 2013, p. 4). Important to note here is the difference between the CSSTS and the VTE discussed within the scope of this inquiry - specifically, the CSSTS is a *simulation* of the software, which provides a more structured experience for the learner; whereas VTE is a fully immersive instance of the *actual* software that allows the learner greater self-direction and control of the learning activities. The research reviews user perceptions of a CSSTS that uses a model of "Teach Me, Show Me, Let Me Try" to guide learners through the steps of the learning process, moving from a verbal instruction, demonstration, and unaided practice. The findings of the study indicate that learners with a high self-reported software self-efficacy (SSE) score (in other words, those who indicated on a survey that they were confident in their ability to learn a new system) were less likely to utilize the "Teach Me" and "Show Me" portions of the CSSTS, but instead were more likely to proceed directly to the "Let Me Try" feature.

Lavendels et al. (2015) explored the use of an online learning methodology in the insurance industry for employees learning to use a complex software solution that contains sensitive customer data. The research proposes a remote training process in which the trainer and the trainee are in different locations, and the trainer utilizes a screen-share application to review the trainees' work and provide feedback. Due to the intensive nature of the program discussed, Lavendels et al. specifically called out the need to have synchronous trainer oversight and coaching for the trainees as they learn, since their activities are performed within the production system rather than a VTE. The concerns raised about training in a

production environment align with the scope of this inquiry related to a VTE, although the remote instruction aspect will not be addressed here.

Bridge et al. (2017) studied user perceptions of the Virtual Environment for Radiotherapy Training (VERT), an immersive 3-D software solution designed to teach medical personnel skills and procedures needed for administration of radiation therapy to patients. Users of the VERT tool were surveyed, and while overall feedback on individuals' perceptions of the value of the tool was positive, the researchers found that 32% of those surveyed reported that their organizations had a perception that VERT was not actually useful. The researchers were not able to identify a clear reason for these organizational impressions, and greater inquiry into this type of impression of virtual training systems and software could be beneficial to helping identify why companies may be hesitant to invest in this type of learning solution.

The concept of participatory design (PD) in technology learning experiences was explored by Inguva et al. (2108), citing the value of including various self-directed and experiential learning methodologies to create a more learner-centered environment in a university engineering laboratory. Specifically, the researchers studied the use of a practical, hands-on learning model called the "Knowledge Laboratory" in which undergraduate students were provided an opportunity to work in small groups in a self-directed fashion through exploratory and experiential learning. The researchers surveyed students who participated in a more traditional instructor-centered course design, and those who participated in the PD model. Those in the instructor-centered model reported that they did not feel challenged by the delivery method, had less interest in the content, and struggled to find relevance in the content and topics. Conversely, students who were provided the opportunity to approach their learning in a more participatory, self-directed method with more realistic practice scenarios reported they were better able to understand the relevance of the work, and that their overall understanding of the processes being taught were greater.

Both Inguva et al. (2018) and Bridge et al. (2017) noted that an overarching benefit of their respective virtual environments was the ability for learners to gain confidence and skills through realistic simulations in the learning environment, rather than in a higher-stakes environment after the learning. This closely aligns with the concept of the VTE, where learners are provided an opportunity to practice in the safe learning environment of the classroom without fear of making mistakes that could impact customers or the business.

3.4. Software Video Tutorials in the K-12 Environment

Extensive and detailed research exists in the K-12 space on design and implementation of software training, although the research is centered around the creation of software videos rather than a VTE. In a 2013 work by van der Meij and van der Meij, the authors proposed a series of eight guidelines for the design of instructional videos for K-12 software training and provide a definition for the term "video tutorial" to mean a "set of videos that together form an instructional package" (p. 207). A notable difference between this paper's definition of a VTE and the definition from van der Meij and van der Meij is that the video tutorial is a guided, structured learning experience; whereas the VTE is an open-ended unstructured environment in which the learner is free to explore and self-direct the process of learning. Regardless, many of the design concepts and guidance discussed in the work are equally applicable to the concept of a VTE. Specifically, Guideline 2 from the work calls out the need to ensure that the video tutorial "gives the user the same image that he or she is likely to be facing when trying to execute the task" and Guideline 3 specifies the need to incorporate an element of user control of the video tutorial (van der Meij & van der Meij, 2013, p. 210). Additionally, the researchers note that their design principles align both with the concept of constructivism and with multimedia design principles from Mayer (2003). Both Guideline 2 and Guideline 3, and the constructivist and engagement theories are

aligned with the use of a VTE since it is an immersive instance of the software. A later work by van der Meij et al. (2017) elaborated on the guidance from the 2013 study and noted that video tutorials not adhering to these design principles failed to successfully prepare the learner to use the software, even when the steps were clearly and accurately portrayed in the video.

3.5. Conclusions

Existing research and inquiries provide critical insights into learner needs in the software and application training space. While adult learning theories and practices have a long history, recent works continue to support the needs identified by Knowles in regards to adult learner self-direction, exploratory or experiential methods, and the importance of learning transfer (Foley & Kaiser, 2013; Hardré, 2003; Roumell, 2019). Core andragogical theories such as self-directed learning theory and learning transfer provide overall conceptual support for the value of a VTE, relative to the need for authenticity of the training experience and appropriate learner involvement in constructing meaning. Beyond the theoretical considerations, current research describing training methods or practices provides additional perspective, but there is still a gap in the collective body of work. Specifically, most research has been done on the modality of e-learns, videos or other more guided/structured teaching methods, rather than the open-ended exploratory environment a VTE provides. In addition, a significant amount of the available research focuses on participants in a K-12 environment, rather than the workplace environment of adult learners.

The purpose of this qualitative study is to describe the impact of the presence or absence of a Virtual Training Environment (VTE) on the post-training confidence and proficiency of trainees, by exploring opinions of trainers at a large national telecommunications organization. To do so, we pose the following questions:

- What is the trainer perception of the post-training confidence level for telecommunications employees who are provided access to a Virtual Training Environment?
- What is the trainer perception of post-training confidence level for new telecommunications employees who are not provided access to a Virtual Training Environment?

4. Research Methods

As detailed in the literature review, there is a lack of current research that directly addresses the topic of Virtual Training Environments (VTEs) in workplace learning. Seeking to gain a better understanding of the impact of these tools through the perspective of trainers required an open-ended approach that did not begin with the end in mind, as traditional quantitative research typically does. Instead, a qualitative method allowed for a more curious and exploratory approach, which provided an opportunity to learn from the experiences and attitudes of the study participants. Qualitative study enables insight into the human experience and perspective, which is a foundational element of what this research sought to identify (Creswell, 2013). It allowed a level of detail that quantitative study would not provide by capturing the very personal perspective of the participants, to help broaden the understanding of the central phenomenon we are studying. Finally, since qualitative research begins with an open mindset, the findings of this research may help inform future study on this topic by identifying themes and patterns which warrant further inquiry (Creswell & Guetterman, 2019).

4.1. Participants

The participants in the study are Training professionals in a large telecommunications organization, who support the delivery of coursework to new and experienced employees within the Field Operations

business unit. In their roles, they provide training on software and systems, including some that currently have a virtual training environment (VTE) and others that do not. As a result, their perspectives and attitudes on trainee confidence post-training relative to VTEs provides valuable insight into this research.

These individuals are a diverse group of males and females in various locations across the 41 states in which the company operates, and range in age from mid 20s to early 60s. Since the study is being performed within a workplace setting, and age, gender, and race are considered protected data in this scope, participants were not asked to provide this specific demographic information as part of the study.

Table 1 – Population Data – Total Headcount by Job Title

Job Title	Total
Field Tech & Safety Trainer	73
Training Manager	11
Senior Field Tech & Safety Trainer	79
Training Supervisor	32
Technical Service Trainer	12
Total	207

The total population of participants within the organization was approximately 200 at the time of the study (see Table 1). Because the research was intended to explore the trainers' ideas on VTEs, the concept sampling method was selected. This method enables purposeful selection of participants, areas or sites in order to uncover information about the research topic (Creswell, 2003; Creswell & Guetterman, 2019). Three of the total eleven regions were selected to participate, targeting those that have trainers who were known to be actively teaching coursework on software and applications that have VTEs, including the Northwest Region, Northeast Region, and Great Lakes Region. The Training Managers and Human Resources leaders for each of the selected regions were notified via email that they could select up to five training professionals from their team to participate in the survey. The leadership were not provided any specific criteria for selection and were free to select any of their employees. One Manager indicated that their selection was based on those employees who frequently use training environments (J. Knapp, personal communication, April 6, 2021). Northeast and Great Lakes each provided five, and Northwest provided three, for a total of 13 participants. This represented 6.2% of the total training staff population, and represented 33% of Great Lakes training staff population, 23.8% of the Northeast training staff population, and 18.7% of the Northwest training staff population (see Table 2).

Table 2 – Sample Data – Total Headcount for Selected Regions

Region	Total	Number Selected	% of Regional Training Population
Field Ops Great Lakes	15	5	33.0%
Field Ops Northeast	21	5	23.8%
Field Ops Northwest	16	3	18.7%

In addition, the distribution of job titles was five Field Technical & Safety Trainers, (7% of the total population of this job title), five Senior Field Technical & Safety Trainers (6% of the total population) and three Technical Service Trainers (25% of the total population), as shown in Table 3.

Table 3 – Participant Data – Job Title Distribution

Job Title	Total	Number Selected	% of Total Population
Field Technical & Safety Trainer	73	5	7%
Senior Field Technical & Safety Trainer	79	5	6%
Technical Service Trainer	12	3	25%
Total	13	164	8%

4.2. Permission

The Senior Directors of Human Resources leadership within each Region were the gatekeepers who authorized access to the study participants detailed in the Participants section. They directly manage the training departments, and the recruiting and training process as a whole within their respective regions (see Figure 1). Their permission was necessary to gather data from the participants (indicated in green in Figure 1), since they are the senior leaders for that organization (indicated in orange in Figure 1). In addition, they are uniquely suited to provide this permission since their positions are responsible for effective training for new and existing employees. Permission from the leaders within the regions whose employees were surveyed was obtained via email using the format shown in Appendix A. Training Managers for each Region were included on the email requesting access to the study participants, but the final gatekeepers were the Human Resources Directors (see Figure 1). A side benefit of using these individuals for permission for the current study is that interest may be generated, which may open the door to future studies on the central phenomenon being explored.

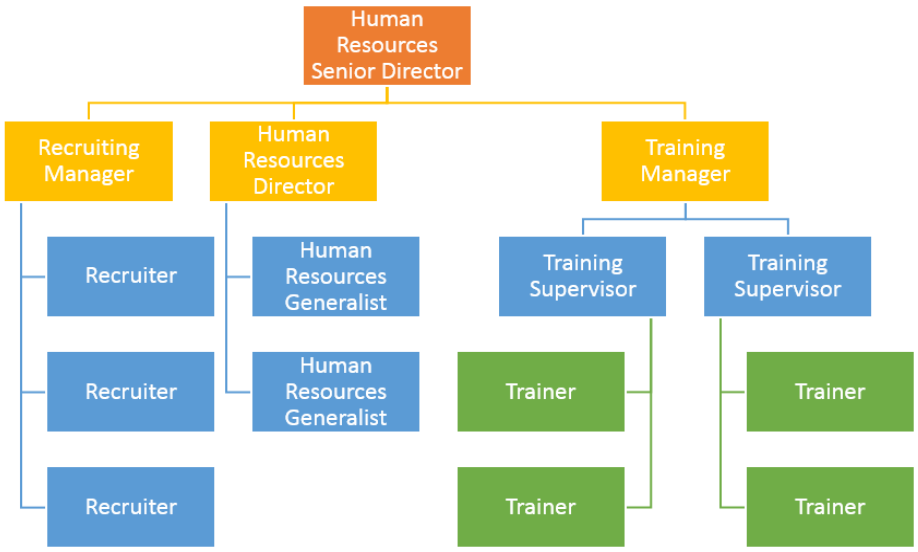

Figure 1 - Example Reporting Structure

Note. Example of typical reporting structure including gatekeeper (orange) and study participants (green)

4.3. Data Collection

Respondents were sent a cover letter via email, which provided background on the importance and purpose of the study, as well as including language that fulfilled the need for informed consent and confidentiality considerations based on examples from Creswell & Guetterman (2019). Respondents were given 10 days to complete the survey, after which time the survey was closed and no new responses were accepted.

Data was collected via an online survey using SurveyMonkey™, which included a series of open- and closed-ended questions. An online survey method was selected to allow greater time for coding and analysis of responses in two significant ways. First, by removing the need to transcribe a recorded interview or notes, more time was available for review and analysis of the data. Second, an online survey allowed participants to respond asynchronously during a window of time, thereby avoiding scheduling challenges and lengthy phone or online interviews. Beyond reasons of efficiency, this method also improved the credibility of the research through greater number and diversity of responses, compared to fewer but lengthier one-on-one interviews often used in qualitative research. There is a notable challenge with qualitative methodology and gathering greater numbers of responses, since greater volumes of information require more time for analysis to identify and interpret themes (Creswell, 2003; Creswell & Guetterman, 2019).

The survey began with an open-ended question asking the participants to provide their own interpretation and definition of a training environment or VTE, which was designed to help identify whether a common understanding of this concept existed amongst the participants. As noted previously, the survey did not include demographic questions such as sex or age, since it was distributed within a workplace environment in which these data points are considered sensitive or protected. Instead, the survey contained a question on current job title and a question on tenure in a training role.

In addition to the modified demographic questions, the survey also contained questions that began with a closed-ended question, followed by an open-ended question to enable more exploration of the answer, as demonstrated in Creswell and Guetterman (2019). For example, participants were asked to read a statement (e.g. “Having a training environment for practice during class helps participants be more confident after they’re back on the job.”), then used a Likert scale to indicate their relative level of agreement or disagreement with the statement. The subsequent question asked the participants to explain their response to the prior question in more detail. This was designed to help with narrowing the focus to key categories that were anticipated to emerge during the data analysis.

4.4. Data Analysis

After the survey concluded, the data was exported into a spreadsheet from the survey system. Each respondent was assigned a number (e.g. “Respondent 1), which was used throughout the rest of the study to notate and track that individual’s response. The closed-ended questions were coded using Likert scale responses (e.g. 5 - Strongly agree, 4 – Agree, 3 - Neither agree nor disagree, 2 – Disagree, 1 - Strongly disagree), see Appendix C for full question and answer details. The open-ended questions were coded through reviewing the actual response text to determine common words/phrases and develop categories of ideas (Creswell, 2003; Creswell & Guetterman, 2019). After determining the broad categories apparent in the open-ended responses, major themes were developed and linked back to the research questions.

5. Results

The average time to complete the survey was 23 minutes, 50 seconds; the longest response time was 57 minutes for Respondent 1 and the shortest response time was 12 minutes for Respondent 3. Of the 13 participants invited to participate in the survey, six responded, for overall response rate of 46%. By job title, the highest response rate of 67% was among the Technical Service Trainers, and the lowest response rate of 20% among the Senior Trainers, with only one of the five responding (see Table 4). Technical Service Trainers are the job title most likely to train frequently on software and applications, and many of the tools they provide training on have VTEs so the higher response rate in this job title was not unexpected.

Table 4 – Response Rate by Job Title

Job Title	Number of Recipients	Number of Respondents	% Response
Field Technical & Safety Trainer	5	3	60%
Senior Field Technical & Safety Trainer	5	1	20%
Technical Service Trainer	3	2	67%
Total	13	6	46%

Of the six respondents, only one indicated that they had been in a training role greater than eight years, and the other five respondents indicated they had between two and five years in a training role. Participants were also asked to indicate how frequently they teach any software or applications in their classes, using a Likert scale (5 – Very Frequently, 4 – Frequently, 3 – Sometimes, 2 – Infrequently, 1 - Never). The mean score across all participants was 4, with only one participant (Respondent 2) indicating anything other than "Frequently" or "Very Frequently." The respondents were asked to indicate whether the software or applications they currently provide training on have a VTE available or not. Four indicated that they teach some programs that do include a VTE and some that do not (indicated by "Both" in the Use VTEs column of Table 5) while the other two indicated that none of the software/applications they teach currently have a VTE (indicated by "No" in the Use VTEs column of Table 5). Participants were asked to rate the frequency of post-class support provided to trainees using a Likert scale (3 – Frequently, 2 – Sometimes, 1 – Never) and the mean score was 2.3, with all participants responding with either "Frequently" or "Sometimes".

Table 5 – Demographic Data

Name	Job Title	Years in Role	Frequency of Software Training	Use VTEs	Post-Class Support
Respondent 1	Technical Service Trainer	>8	Very frequently	Both	Frequently
Respondent 2	Field Technical & Safety Trainer	2-5	Infrequently	No	Sometimes
Respondent 3	Field Technical & Safety Trainer	2-5	Frequently	No	Sometimes
Respondent 4	Sr Field Technical & Safety Trainer	2-5	Frequently	Both	Sometimes
Respondent 5	Field Technical & Safety Trainer	2-5	Very frequently	Both	Sometimes
Respondent 6	Technical Service Trainer	2-5	Frequently	Both	Frequently

Participants were asked to read two statements and indicate the extent to which they agreed or disagreed, using a Likert scale (5 – Strongly agree, 4 – Agree, 3 – Neither agree nor disagree, 2 – Disagree, 1 – Strongly disagree). For the statement "Having a training environment for practice during class helps participants be more confident after they're back on the job" the mean response was 4.8, with only one participant responding "Agree" and all others responding "Strongly Agree" (see Figure 2).

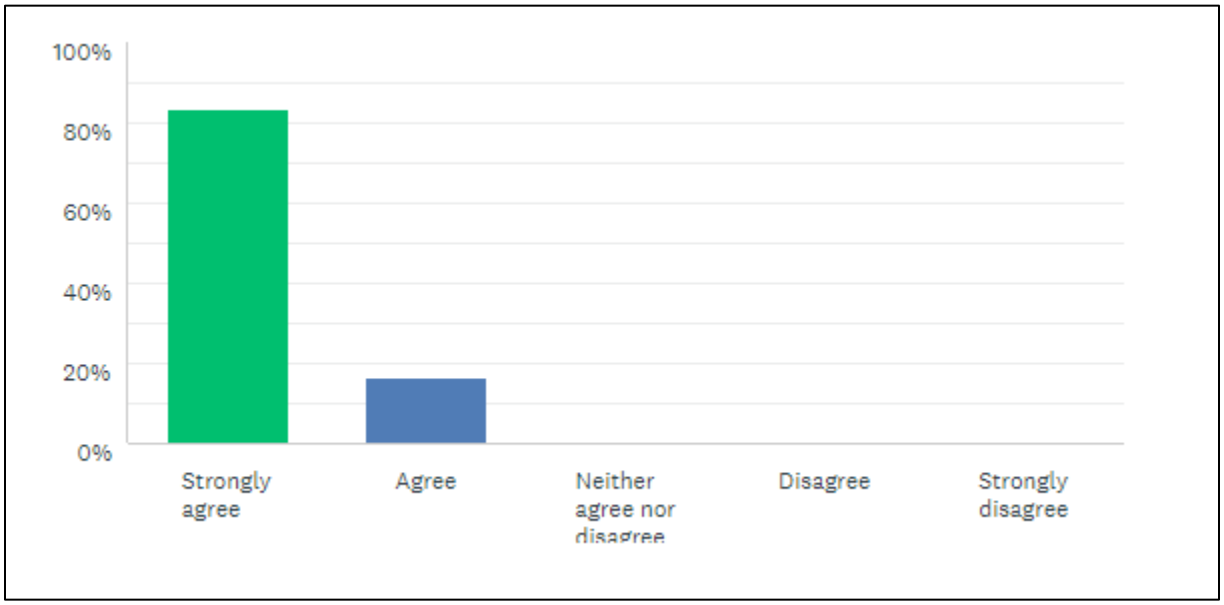

Figure 2 - Question Responses – Trainee Confidence Related to Presence of VTEs

The same results were found for the statement "Having a training environment for practice during class helps participants be more proficient using the software after they're back on the job," with a mean of 4.8 and the same participant (Respondent 1) responding "Agree" and all others responding "Strongly Agree" (see Figure 3).

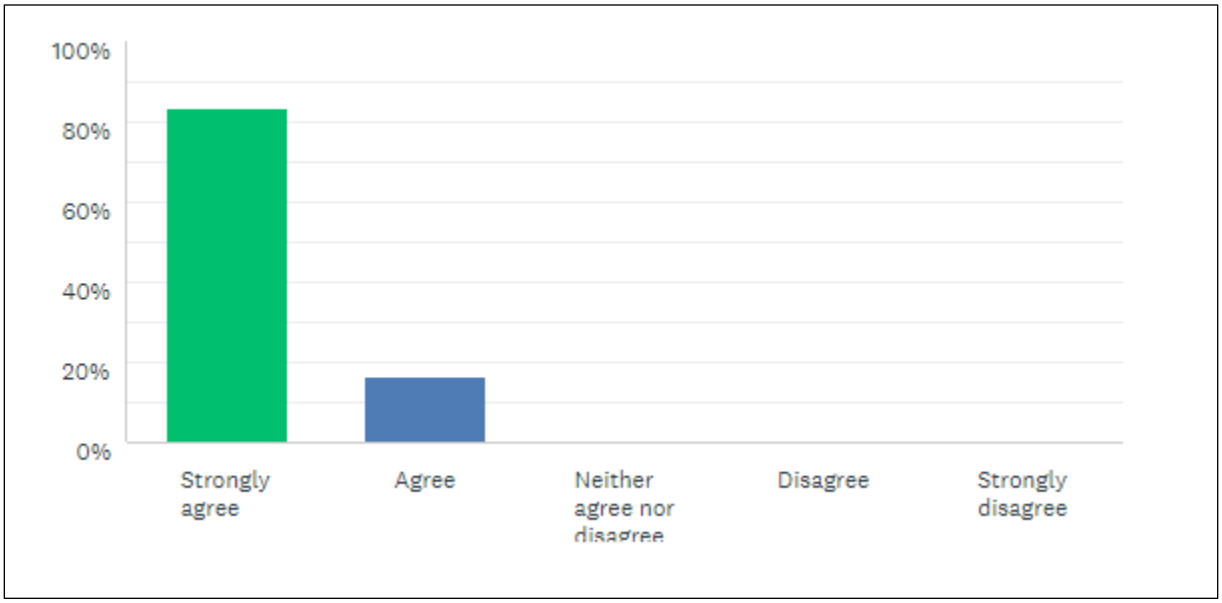

Figure 3 - Question Responses – Trainee Proficiency Related to Presence of VTE

5.1. Categories

While the closed-ended questions provided a clear foundation of the survey participants' perspectives on the efficacy of VTEs, significant information supporting the research questions was also found in the open-ended responses from the survey. In reviewing the text of these responses, four main categories were identified. These categories closely relate to the research questions and will be discussed here.

5.1.1. Safe Environment

The clearest and most common theme across the responses to the open-ended questions was the concept of safety within the learning experience. The first question in the survey asked the participants to provide their own definition of a VTE. Respondent 1, who is the most tenured trainer of those surveyed, defined a VTE as "a safe, controlled environment." Respondent 5 also included the phrase "safe environment" in their definition. Respondent 3 noted that a VTE provides the participant an opportunity to learn without the "consequences of a live environment," and Respondent 4 stated that having a VTE means that the participants do not have to be "scared" or "worry about blowing things up." Respondent 6 noted that a VTE provides an opportunity to "comfortably learn."

The theme of safety in the learning space emerged again in the responses to the open-ended question related to post-training confidence of the learner. Respondent 2 characterized a VTE as a "safe controlled environment" in their response, echoing Respondent 1. Respondent 3 indicated that having an opportunity to use a VTE helps alleviate the "fear of repercussions or breaking something." Respondent 4 noted that having a VTE provides a setting where learners have "little fear of ruining things or screwing up."

5.1.2. Learning from Mistakes

The value of making mistakes during the learning process was another clear pattern that emerged in the participant responses. Respondent 5 included this in their definition, stating that a VTE is an environment where learners can "play with and learn to control said program and make mistakes." Respondent 2 noted that the positive impact to learner confidence comes from "making mistakes and learn[ing] from them rather then [sic] affecting a real account." Regarding the concept of building proficiency through use of the VTE, Respondent 2 stated that the "inability to make mistakes in a controlled environment will hinder the learning experience because people tend to learn more from mistakes then [sic] successes.". Respondent 5 also indicated the value not only of being afforded an opportunity to make mistakes during the learning, but also that a VTE can allow the opportunity to learn how to correct mistakes, as follows:

> "They also need to know how to fix what's wrong. Especially if the mistake was their fault. Having a place to show them those errors and how to fix them will allow us to teach how to not only how to do that, but make them good at it before they reach the live application."

5.1.3. Business Impact

Another category identified in the analysis of the open-ended responses relates to the topic of impact to the business. Respondent 6 noted in their definition that a VTE allows learners to practice navigation in the software "without impact to the business unit," and Respondent 1 specifically called out that use of a VTE avoids "negative customer impact" by better preparing the learners for their job. Three of the respondents included statements related to minimizing the effect on the live environment/production environment in their response to participant confidence back on the job.

5.1.4. Confidence

The category of confidence with use of the tool was a major element found in many of the open-ended responses. The respondents noted that the ability for trainees to practice in a realistic simulation of the live environment and have repetitive activities was key to building their confidence and skills during training (Respondent 4 characterized it as "muscle memory"), with the word "comfort" or "comfortable" being used six times across multiple respondents and "confident" or "confidence" used four times. Respondent 5 noted that "operating one of our programs requires confidence. Having a training platform to build that confidence and make mistakes will allow the employee to become familiar and comfortable in that program." Respondent 6 summed it up succinctly:

> "For programs that we currently have a training environment for, I've noticed that my trainees are more confident going into their job duties. They are more comfortable with navigation and more willing to attempt job tasks that they may not be as familiar with. For programs that we do not have a training environment to use, the trainees are typically less comfortable heading into their job duties. I usually do not see them interacting with the tool as comfortably, nor using it unless they are specifically directed to and someone is there to work with them as they execute the task."

6. Discussion

The overwhelming pattern that emerged from the responses of the survey participants to both the closed- and open-ended questions was a consensus on the value and benefit of the use of VTEs in software and application training. Even those survey participants who indicated that they teach software less frequently, or do not teach software that currently offers a VTE for training were clear on this point. The research questions related to the post-training confidence level of trainees as observed by the trainers, and

the responses to the closed-ended questions showed a clear preference for the presence of a VTE, with a mean score of 4.8 on both proficiency and confidence. Beyond just a close match to the research questions, responses to the open-ended questions contained the same concepts and ideas as those found in the literature, including the concepts of scaffolding, authenticity of the learning environment, and self-direction or exploration.

6.1. Authenticity of Learning Environment and Learning Transfer

Hardré (2003) noted that the authenticity of the learning environment vis-à-vis the actual tasks or work impacts the effectiveness of software training videos or e-learnings, and several respondents alluded to this in their responses. Respondent 4 stated that by using a VTE "it'll look familiar to them in the real world when they get out there . . . they won't be completely lost when they see a screen that looks nothing like the old material pictures that were shown in training." Respondent 6, who is one of the more frequent users of VTEs also noted that the VTE must be as close to the real world as possible, and that "if the training environment is too different from the live system, it can create more confusion than good." This aligns closely with Hardré's findings that authenticity of representation and authenticity of interactivity are critical to the ultimate success of the learning experience.

Foley and Kaiser (2013) highlighted the importance that extensive practice of skills in the learning environment ensures that replication is nearly automatic in the new experience, and the survey participants noted this in their responses as well. Respondent 4 noted "the more they practice with something, the better they will be," and Respondent 6 stated "they are more willing to utilize the skills and translate them into live functions" if they have access to a VTE. The concept of scaffolding as described by Foley and Kaiser (2013) is also present in the responses to how the trainers teach the software today, with several respondents providing detailed descriptions of processes by which they build a series of practice exercises and scenarios whereby the learner is presented with increasingly complex tasks while receiving support and coaching from the instructor.

6.2. Learning from Mistakes and Safe Learning through Self-Direction

In much of the literature, the concepts of self-directed learning and the ability for learners to gain confidence and skills through an open-ended, exploratory environment in which they can safely make mistakes was key to success (Bridget et al., 2017, Hardin et al., 2013, Inguva et al., 2018, Merriam & Bierema, 2014, Martocchio & Webster, 1992). This concept was found throughout the open-ended responses and was one of the main categories identified in the data analysis. The consensus of the survey respondents was that without an opportunity for learners to explore, try things, and fail in a safe environment, they are not as effective or confident with the program after class. A key component of the safety of the learning environment as noted by the respondents was that the learners were able to practice skills without the risk or fear of negatively impacting customers or the business in a production environment of the program.

6.3. Study Limitations

There are at least two potential limitations related to the scope of this research. A first limitation relates to the number of respondents to the survey, which represents only a small sample of the overall population of trainers at the specific organization. While the purposeful selection of this group allowed us to gain a greater understanding of the phenomenon at the center of our inquiry, seeking insights from a larger group could increase the diversity of perspectives and create a deeper understanding of the impact of VTEs on workplace learning. A second potential limitation concerns the selection of exclusively trainers for this survey. By using the concept of triangulation and gaining perspectives from different

sources (e.g. supervisors and/or the trainees themselves) the validity of the data analysis could be improved.

Despite these limitations, the results suggest a clear connection between the presence of a VTE and trainee performance. The implication to organizations that are engaged in workplace software and application training is that the presence of a VTE can be the differentiating factor between confident, correct use of the software post-training, or potential business- or customer-impacting mistakes and errors.

6.4. Future Research

Although the findings of this particular study support the value of VTEs in workplace learning, the most important contribution may be that it raises awareness of this instructional method and creates an opportunity for further inquiry. If, as this study suggests, the presence of a VTE significantly improves both the learning experience itself and the learner performance post-training, organizations seeking to improve accuracy in software usage would be wise to continue the line of inquiry begun in this research. A recommendation would be to consider a quantitative study to better understand the actual performance measures of trainees who are afforded access to VTEs during training, and compare these to the performance of those who do not have a VTE. Alternatively, mixed-method research combining both the personal feedback of individuals and focus groups combined with quantitative performance measures may provide more robust insight into the topic. As noted earlier, organizations will require a clearly-articulated business case to justify the potential investment needed to design and deploy VTEs for their software solutions; and further research by learning professionals will be critical to help shape the future of software instruction in the workplace.

7. Conclusion

The findings of this research show a pattern of trainer perception that the presence of a VTE during software and application training provides significant positive impact to the learners' experience, and that the absence of one can be equally detrimental. Concepts from the literature, including exploratory and participatory learning, self-directed learning, learning transfer and others were found throughout the participant responses, indicating that respondents have a strong sense of what works (or doesn't work) in the learning environment based on their own experience as professional educators of adults. Although future study will be needed to further explore this topic, the present study has enhanced the understanding of the relationship between virtual training environments for software training and trainee confidence and provided clear support for the value of this instructional method.

Abbreviations

VTE	Virtual Training Environment
SDL	Self-Directed Learning
K-12	Kindergarten through twelfth grade

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