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Mark D. Threeton
Pennsylvania State University, mdt177@psu.edu

kyungin kim
Pennsylvania State University, kuk683@psu.edu

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MARK D. THREETON *Pennsylvania State University*
KYUNGIN KIM *Pennsylvania State University*

Introduction

Many young people today begin their career after completing an applied STEM related program within career and technical education (CTE). CTE provides an integrated STEM education program, which is structured to help students develop the knowledge, skills, and dispositions which are required of high-tech career professionals. Examples of CTE programs include, but are not limited to, automotive and diesel technology, biotechnology, construction trade technology, cosmetology, electromechanical engineering technology, and health/medical assisting services technology. Over the years, safety and health within these technical programs has been a major concern; these are simulated educational environments that contain the same occupational hazards found in the actual technical field.

While instructors expend a great effort to teach safety and health to students, accidents still occur on occasion and in some cases can be very serious (Gray & Herr, 1997). All individuals can be susceptible to accidents. In 2019, the Bureau of Labor Statistics reported over 300 workers under the age of 24 died from work-related injuries. Similarly, safety related literature has also illustrated that teens are at a higher risk of injuries and fatalities when compared to adults (National Institute for Occupational Safety and Health, 2020). These findings are alarming, given that a multitude of teens and young adults under age 24 are enrolled within CTE programs. As a training ground for STEM related fields, career and technical educators must provide a safe teaching and learning environment while simultaneously preparing students to work safely in the school, in order to transfer these skill sets to real-world application (Threeton & Walter, 2013). To accomplish this, educators utilize certain instructional practices, which may serve to better promote this transfer of learning (Threeton et al., 2019; Threeton & Walter, 2013). However, little research has been conducted on whether these instructors are using experiential learning practices to teach safety and health. Therefore, the study seeks to explore this gap. The results from the study could lead to new discoveries about teaching, learning, and enhanced techniques for delivering safety and health instruction.

Purpose, Research Questions, and Design

The purpose of the study was to explore how applied STEM educators of CTE define experiential learning and utilize it while teaching safety and health subjects in their educational programs. The study sought to answer the following questions by employing the corresponding research design (see Table 1).

Theoretical Framework

The theoretical framework utilized for this study is Kolb's Experiential Learning Theory (ELT) (1984). Within the model, individuals engage in real world learning experiences and have opportunities to apply knowledge by watching, thinking, doing, and feeling. Specifically, the model has four modes: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Given that the model is based on grasping and transforming experience, the learning process can begin at any one of these four modes and should be regarded as a continuous experiential learning cycle (Kolb & Fry, 1975). Educators can utilize the experiential learning cycle within their instruction to promote the transfer of learning. Therefore, Kolb's Experiential Learning Cycle (1984) will serve as a foundation from which to measure how educators within the study define and utilize this model while teaching safety and health.

Data Collection and Analysis

A focus group methodology was employed to address the research questions in the study, along with a pre-survey that

Table 1. Research question and design alignment

Research Question	Design	Analysis
RQ1: How do educators define experiential learning?	Qualitative data collected from 3 focus groups	Coding for descriptors and themes
RQ2: To what degree are educators using experiential learning to teach safety and health?	Quantitative data collected from a pre-survey and qualitative data from 3 focus groups	Pre-survey results calculated and coding for instructional practices and themes
RQ3: What elements of the experiential learning cycle are used to teach safety and health?	Quantitative data collected from a pre-survey and qualitative data from three focus groups	Pre-survey results calculated and coding for instructional practices and themes

collected demographic information from participants and explored their frequency of using experiential learning practices while teaching safety and health. The participants in the focus groups included 21 applied secondary STEM educators of CTE in automotive and diesel technology, building trade technology, carpentry, cosmetology, and masonry; the educators were from various schools located within a 30-county region of an eastern U.S. state. Prior to the actual focus group sessions, human subject protocol approval was obtained from the designated higher education institution and informed consent was secured from all participants.

There were three focus groups conducted in total, which averaged five to ten participants per session. Each session was audio recorded. Additionally, the sessions contained a moderator and an assistant moderator to facilitate discussion and take notes. At the end of each focus group session, the assistant moderator verbally reviewed the notes that were taken. The participants from each focus group session were then asked if what was covered in the notes was an accurate representation of the discussion to which all participants replied affirmatively. After the member check process was complete, each focus group discussion was concluded. The audio recordings were professionally transcribed. An analysis of qualitative data employed a thorough process of reading and an in-depth review of the written and audio transcripts to illuminate the concepts and themes from which interpretations were revealed. Finally, the pre-survey results were calculated to assist in answering the research questions.

Background of the Participants

Most participants were male (90.5%). Approximately 57% of participants reported that they reside in the age range of 42-52. Participants reported 6 to 10 years (23.8%) or 11 to 15 years (23.8%) of work experience. Participants also revealed their specific instructional discipline which included: carpentry (31.6%), building trade technology (26.3%), automotive technology (15.8%), masonry (10.5%), diesel technology (10.5%), and cosmetology (5.3%).

Results

RQ1: How do STEM educators of CTE define experiential learning?

While the research is still in the analysis phase, the investigators have identified some initial findings that can be highlighted in the manuscript. According to participants, there were two general definitions of experiential learning. These included allowing students to acquire knowledge and skills about concepts by transferring past experiences of teachers or others to students; setting up scenarios that mimic real world conditions; and providing training to teach students how to deal with those situations.

RQ2: To what degree are educators using experiential learning to teach safety and health practices?

While the research is still in the analysis phase, initial results revealed that most of the educators use experiential learning practices in many parts of their classes. They also mentioned that the experiential learning practices took up more than 90% of their instruction when teaching safety and health. These findings are aligned with the results of the pre-survey which indicated that 95% of participants use experiential learning for safety and health instruction (see Tables 2 and 3).

Table 2. Experiential learning practices (N=20)

Variables		**N**	**%**
The use of experiential learning practices when teaching safety and health	Yes	19	95.0
	No	1	5.0

Table 3. Experiential learning practices

Pre-Survey Questions	**Always**	**Frequently**	**Sometimes**	**Never**
1. How often do you use experiential learning practices when you teach safety and health in your CTE program? (N=21)	7 (33.3%)	6 (28.6%)	6 (28.6%)	2 (9.5%)
2. Experiential learning opportunities in my program include an actual student experience while learning about safety and health (N=19)	7 (36.8%)	8 (42.2%)	4 (21.0%)	0 (0.0%)
3. Experiential learning opportunities in my program include a student reflection component while learning about safety and health (N=20)	6 (30.0%)	7 (35.0%)	6 (30.0%)	1 (5.0%)
4. Experiential learning opportunities in my program include students drawing conclusions while learning about safety and health (N=20)	3 (15.0%)	12 (60.0%)	4 (20.0%)	1 (5.0%)
5. Experiential learning opportunities in my program include students using new skills or knowledge while learning about safety and health (N=20)	7 (35.0%)	8 (40.0%)	3 (15.0%)	2 (10.0%)

Note: Some participants did not respond to all items on the pre-survey.

RQ3: What elements of the experiential learning cycle are used to teach safety and health practices?

While this research is still in the analysis phase, the initial results revealed that certain elements of Kolb's Experiential Learning Cycle (1984) appear to be utilized more by educators including: CE, AC, and AE. The reflective observation element of Kolb's Experiential Learning Cycle appeared to be somewhat underutilized and, in some cases, inadvertently consolidated with the AC mode.

Conclusions, Discussion, Limitations, and Recommendations

The study explored how applied STEM educators of career and technical education define experiential learning and utilize it while teaching safety and health subjects. In response to RQ1, educators generally defined experiential learning as allowing students to acquire knowledge and skills about concepts by transferring past experiences of teachers or others to students, and setting up scenarios that mimic real world conditions to provide students training for how to deal with those situations. The results for RQ2 reveal that experiential learning practices took up more than 90% of the safety and health instruction. These initial findings aligned with the results of the pre-survey which revealed that 95% of participants reported that they use experiential learning for safety and health instruction. In response to RQ3, the reflective observation (RO) element of Kolb's Experiential Learning Cycle (1984) appeared to be somewhat underutilized and, in some cases, inadvertently consolidated with the AC mode.

While this research is still in the analysis phase, the initial results are interesting. 95% of participants reported that they use experiential learning but appear to be utilizing RO and AC modes synonymously in their instruction, despite distinct differences within and between these modes which require deliberate instructional design and delivery interventions to promote the transfer of learning. In hindsight, the initial results from RQ1 appear to reveal that participants may not fully comprehend the RO and AC elements of the model. Being able to think and reflect is imperative when learning about safety and health hazards. Therefore, application of the AC and RO modes of Kolb's Experiential Learning Cycle (1984) must be facilitated thoroughly to complement the remaining two elements (i.e., CE & AE). This is a serious matter as it could be the one or more items that are not addressed in the safety and health instruction that cause the greatest harm (Threeton et al., 2019).

The results of this investigation are limited because the data analysis is currently in progress and the results reported in this manuscript represent initial findings and are not generalizable. The data collection method furthermore used a self-reporting structure. Due to the sensitive nature of safety and health standards and liability concerns, the participants may not have been as transparent in their responses for fear of self-incrimination. However, given the limitation of studies on experiential learning and safety and health instruction, the study provides critical insight and sets the stage for further research on the subject. Based on the conclusions of this study, the following recommendations are made:

- Professional development opportunities should be provided to educators on the fundamentals of promoting the transfer of learning through authentic experiential learning practices.

- The study should be replicated on a larger scale within diverse STEM related CTE programs across the country.

- Given that a multitude of occupational safety and health training is delivered through a traditional classroom-based structure, future research on the topic should employ an experimental design to determine if student performance is enhanced when receiving safety and health instruction through experiential education versus a lecture-recitation procedure. ■

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