2021

Safety Training for Career and Content Switchers

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Original Publication Citation

Reed, P. A., & Ferguson, M. K. (2021). Safety training for career and content switchers. *Technology and Engineering Teacher, 80*(7), 16-19.

STEAM activities provide a context for authentic problem solving and have the ability to reach more students than science, technology, engineering, and mathematics (STEM) alone.

safety training for career and content switchers

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Tremendous teacher shortages and shifts in the preparation of technology and engineering (T&E) teachers have been occurring for some time (Litowitz, 2014; Moye, 2009; Volk, 1997, 2019). The training and certification of these teachers is extremely varied since each state certifies T&E teachers independently and most states offer several pathways to certification. Virginia, for example, has approved collegiate programs leading to licensure as well as several alternative routes for career and content switchers (i.e., teachers holding a license in one area of education who are working to get licensed in T&E education) (Commonwealth of Virginia, 2019).

While alternative licensure provides streamlined pathways for educators to become certified in T&E education, participants likely do not receive the depth of training that preservice teachers do in formal T&E teacher preparation programs. Put another way, alternative licensure programs certify individuals to become teachers, but they do not guarantee that they are fully qualified (Love & Roy, 2017). Discipline-specific history, epistemology, and laboratory safety and maintenance require extensive training in T&E education (Ferguson & Reed, 2019). This Safety Spotlight will describe T&E education workshops implemented in Virginia to aid career and content switchers not formally trained in laboratory safety.

The need for a laboratory safety workshop became apparent after extensive requests from school division teachers and administrators, as well as participants at the annual Virginia Technology and Engineering Education Association (VTEEA) conference. Many current T&E teachers admitted that they were not using tools or equipment to engage students in design-based learning because they did not know the safety regulations or liabilities involved in using these items. Seeing this need, the Old Dominion University (ODU) technology education program partnered with VTEEA and the Virginia Department of Education (DOE) to develop a six-hour safety training workshop. A call for participants was distributed through VTEEA and the Virginia DOE. An online form was used for registration, which requested general demographics, lunch preference, and laboratory teaching experience. An email was sent that provided information about logistics (e.g., directions, parking) and informed the applicants that confirmation would be forthcoming. One week prior to the event, an email was sent to each participant

that described (1) safety protocol, including required clothing, footwear, hair, and safety glasses, (2) logistics and directions into the building and laboratory, (3) food provisions, (4) Wi-Fi availability, and (5) the nature of the workshop (i.e., learning by making and doing). The length of the workshop was set by the Virginia DOE for participants to qualify for professional development points, which are required for recertification in Virginia.

Figure 2: The ODU Technology Education Laboratory Safety Website (https://sites.google.com/odu.edu/odutechedsafety/home; Ferguson, 2019).

Workshop Content

The workshop was designed to introduce teachers to the history, epistemology, curriculum, and safer laboratory practices through discussion, active participation, and interactions with peers. The workshop was limited to production lab safety, although there were discussions on follow-up workshops for electronics/mechatronics, communications, and other laboratory environments. The production lab equipment included power tools and equipment for woods, metals, ceramics, and composites. The only hand tools introduced were those needed for the workshop (e.g., measuring tools, saws, hammers, etc.). Future workshops will expand hand tool instruction and teaching support materials.

9:00am	Introductions, experience, and logistics
9:30am	A brief history and philosophy of technology and engineering education
10:00am	Virginia's curriculum (http://cteresource.org/curriculum/) and professional organizations (TSA, VTEEA, and ITEEA)
10:30am	Old Dominion University safety website overview (https://sites.google.com/odu.edu/odutechedsafety/home)
11:00am	Power tool demonstrations and instructions with observation rubrics
11:30am	Information on lab organization, management, and maintenance
12:00pm	Lunch
12:30pm	Machine use activity*
2:30pm	PD points, words of wisdom, and conclusion

***Please note:** The active project in this course focuses on safety, not design-based learning. The sole purpose of today's activities is to teach tool and machine safety. Technology education lessons provide deep learning when they are open-ended and focus on the problem-solving or design process instead of the tools and machines.

Figure 1: Technology and Engineering Education Workshop Agenda.

Figure 1 provides the schedule and important links for the workshop. The morning was used for introductions and an overview of T&E education. Most participants had backgrounds as engineers, designers, scientists, or were teachers from various other disciplines, so time was spent discussing a brief history of the field. Workshop leaders felt it was important for participants to understand the epistemological grounding of the field from manual training to industrial arts to technology education, and finally T&E education. After learning the field's pragmatic teaching approach, participants were introduced to *Standards for Technological Literacy* (ITEEA, 2007)[1] and how technology education fits within general education, career and technical education (CTE), and science, technology, engineering, and mathematics (STEM) education (Reed, 2017, 2018).

In Virginia, the Virginia General Assembly funds the Career and Technical Education Resource Center (see: http://cteresource.org/about/), which lists the programs, courses, competencies, and other resources for technology education and the other six CTE disciplines (agriculture, business, family and consumer sciences, health and medical sciences, marketing, and trade and industrial education). Participants were briefly introduced to the CTE Resource Center as the primary tool for developing lessons and tracking student progress through learning competencies. Additional resources from the Virginia Department of Education, Technology Education web page were also presented: www.doe.virginia.gov/instruction/career_technical/technology/index.shtml

The morning session also included an overview of the ODU Technology Education Lab Safety Website that was created for the workshops (Ferguson, 2019). Figure 2 shows the main page and menu of this website, which includes the workshop agenda,

[1]These workshops were held prior to release of *Standards for Technological and Engineering Literacy* (ITEEA, 2020).

demonstrations, regulations, machine nomenclature, online safety tests, traditional safety tests, and additional materials. The site links to many reputable sources directly rather than recreating materials. Plans to expand the site include more information on hand tools as well as a section on laboratory organization and management.

Career and technical education student organizations (CTSOs) are co-curricular in Virginia, so workshop organizers impressed upon participants that Technology Student Association (TSA) activities should be incorporated throughout T&E education programs, not as an after-school activity. A model for using the TSA leadership structure to manage a laboratory was introduced (see the ODU Safety Website under the More tab, Lab Management link). Participants were also shown the Virginia TSA and national TSA websites and encouraged to use the curriculum resources provided within competitive events such as rubrics. Additionally, participants were charged with active participation in their primary professional associations: VTEEA (www.vteea.org/) and the International Technology and Engineering Educators Association (ITEEA; www.iteea.org/). Virginia is an Engineering byDesign™ (EbD™) consortium member, so the process of accessing EbD™ materials through ITEEA and Virginia's CTE Resource Center was explained.

The final morning activity was to demonstrate safer use of the power tools that were identified by the Virginia DOE (i.e., table saw, band saw, combination sander, router table, drill press, compound miter saw, and wood lathe). Participants were provided safety checklists to follow for each machine during the safety demonstrations. These safety checklists are on the ODU Safety Website under the More tab, Resources link. Scrap wood material was provided so participants could perform the demonstrated operations. In several of the workshops, experienced teachers were paired with novice teachers to facilitate a richer learning experience.

As an unexpected outcome, a working lunch allowed participants to share their experiences that led them to teaching. Many participants indicated that they were drawn to teaching for the altruistic nature of the profession. Most teachers who had switched disciplines overwhelmingly claimed it was the authentic, engaging teaching methods in T&E education that made them eager to switch.

In the afternoon, participants used the machines to build a wooden toolbox after signing a safety acknowledgement form. Workshop organizers deliberately selected a project with the intent of fostering safer machine use and confidence with participants. The processes used to build the toolbox included layout, drilling, crosscutting, ripping, routing, assembling, and nailing. The opportunity was taken to reiterate the philosophy of design-based learning in T&E education (see note in Figure 1, page 17). Workshop leaders stressed the learning inherent in broad, open design problems rather than very prescriptive projects. The project selected for this workshop, however, was very prescriptive because the workshop goal was to teach safety. However, there were discussions on creating jigs and fixtures as well as determining the best tools and processes for each operation. The workshop instructors supervised the lab diligently during the activity to reinforce and model appropriate safety procedures.

Conclusions

The profession of T&E education continues to have a semantics issue with the rise of STEM education, PK-12 engineering, makerspaces, and other programs that continue to define and use technology in diverse ways (Reed, 2018). Perhaps this ambiguity has fostered an increase in the number of career and content switchers to T&E education. The Virginia safety workshops are an attempt to orient career and content switchers to the specific history, epistemology, and laboratory safety, use, and maintenance in T&E education. While training in traditional four-year T&E programs is encouraged, a need for the training of alternatively licensed teachers is abundant. Participants expressed their desire to learn more about the field, so these workshops are the beginning of an ongoing solution.

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