Identifying Teacher's Perceived Tools and Equipment Availability to Teach Welding Before and After a Professional Development Workshop

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Introduction/Framework

A noticeable lack of appropriate training paired with the scarcity of consumable materials has had a severe impact on instructors, and ultimately the learning process for their students (Darling-Hammond, 2000; Darling-Hammond, 2007). It is important to create a learning environment with tools and equipment inclusive to the various agricultural industries. The quality, as well as variety, of tools and equipment maintained in the classroom by School Based Agricultural Education (SBAE) teachers affects the ability of the teachers to meet curricular and industry standards. (McCubbins et al., 2016). In addition to reported ill-equipped agricultural mechanics laboratories (McCubbins et al. 2016), there is a concern that if tools and equipment are available, SBAE teacher are not properly trained to use these resources (McCubbins et al. 2017). Furthermore, a recent national study found SBAE teacher agricultural mechanics professional development needs focused on areas in the welding industry (i.e. American Welding Society (AWS) standards for welding procedures, Principles of metallurgy, Procedures for structural welding, Procedures for GTAW) (Wells & Hainline, 2021). SBAE teachers need to have access to necessary resources and the knowledge to operate various tools and equipment in their programs. The theory that drives this study is the Social Cognitive Theory (SCT). SCT is comprised of behavior, personal and environmental factors (Bandura, 1986). This study looks at the differences in how the environmental factors are perceived before and after a welding professional development workshop.

Purpose and Objectives

The purpose of this study was to identify SBAE teachers' perceived availability of tools and equipment to teach welding prior to and after attending, a ten-day intensive professional development training. The purpose of this study is fulfilled by the following objectives: (1) Describe teachers' perceived tool and equipment availability to teach welding pre professional development workshop. (2) Describe teachers' perceived tool and equipment availability to teach welding post professional development workshop. The purpose and objectives of this study aligned with the National Research Agenda (NRA) of the American Association for Agricultural Education (AAAE). Roberts, et al. (2016) suggested that advances within industry have helped to drive and dictate the need for skilled and knowledgeable educational professionals who are capable of utilizing available resources to teach the future members of the industrial workforce.

Methods

Participants for this study included SBAE instructors completing Agricultural Mechanics Academy (AMA). This AMA aimed to provide educators with the opportunity to improve and enhance their skills with regards to various welding processes. Pre and post test data was collected to determine the impact of the educational in-service training. Following a review of literature, a paper questionnaire was developed and reviewed by a panel of experts ($N = 5$; with school-based agricultural education experience and $N = 5$; with industry training experience) and was subsequently revised. In order to determine the reliability of the instrument, a post-hoc reliability analysis was conducted from the pre-test instrument ($N = 20$). A post-hoc reliability analysis was conducted because no other group was available to complete a pilot test prior to the start of the AMA. All sub-scales were deemed *excellent* (α =0.936-0.992) for reliability (George & Mallery, 2003, p. 231). AMA participants were asked to rate the tools and equipment available to perform 52 competencies from seven constructs: *Welding Basics, Shielded Metal Arc Welding,*

Gas Metal Arc Welding, Gas Tungsten Arc Welding, Flux Cored Arc Welding, Oxy-Acetylene Cutting & Welding, and *Plasma Cutting*.

Results

This study recorded data from a total of twenty participants. Practically all participants taught in the agricultural education program area (f = 95%). The majority of participants have zero years of experience in the welding industry (f = 75%). The average years of experience teaching welding from this study was (f = 1.48). The *Flux Cored Arc Welding* construct had the greatest change in mean difference scores of 1.63, and the *Plasma Cutting* construct has the smallest change in mean difference scores of 0.49 as shown below in Table 1.

Table 1

Grand Mean Construct Scores for the Tools and Equipment Available to Teach Welding Pre and Post Workshop

Construct	Pre (n = 20)		Post (n = 19)		*MD*
	M	*SD*	*M*	*SD*	
1. Welding Basics	2.58	0.79	3.66	0.70	1.08
2. Shielded Metal Arc Welding	2.45	0.76	3.81	0.88	1.36
3. Gas Metal Arc Welding	2.48	0.82	3.63	0.97	1.15
4. Gas Tungsten Arc Welding	1.72	0.83	2.78	1.31	1.06
5. Flux Cored Arc Welding	1.61	0.76	3.24	1.05	1.63
6. Oxy-Acetylene Cutting & Welding	2.17	0.95	3.58	1.15	1.41
7. Plasma Cutting	2.33	1.01	2.82	1.37	0.49

Note. 1 = None/Very Poor; 2 = Little; 3 = Good; 4 = Above Average; 5 = Excellent.

Conclusions and Discussion

Participants that completed the AMA reported a change in the availability of tools and equipment available to teach welding despite not purchasing any tools and equipment or receiving any tools or equipment as a part of the AMA. Although Plasma Cutting saw the smallest increase between pre and posttests, a positive increase was identified despite not formally teaching that construct in the AMA. This may be a result of the level of confidence that grew through informal conversations or through the training they received in the other welding areas. This suggests that the training that they received during the AMA better prepared them to use the tools and equipment that they already possessed. Thus, an increase of their self-efficacy and knowledge in the welding skill area, altered their perceived environment. This observation aligns with SCT, linking personal and environmental factors (Bandura, 1986).

The results of this workshop suggest that many agricultural mechanics educators are not utilizing their equipment and tools to their full extent due to lack of skilled knowledge. This adds to McCubbins et al. (2017) that showed a relationship between teacher competence and availability of tools and equipment. These findings also connect to McCubbins et al.'s (2016) speculation that perceived importance and perceived tool availability may be linked. It is recommended that future research can investigates perceived knowledge of tools and equipment and their availability in an SBAE program. Researchers also recommend the creation and distribution of curriculum on proper tool and equipment usage.

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