

Evaluating Agricultural, Food, and Natural Resource Teacher Competence in a Computer Numerical Control (CNC) Plasma Arc Cutting Workshop: An Assessment using the Borich Needs Assessment Model

Robyn Key and Dr. P. Ryan Saucier
Sam Houston State University

Introduction

- ❖ Agriculture, food, & natural resource (AFNR) education prepares students with the knowledge and skills needed for successful careers (National FFA, n.d.)
- ❖ Agricultural mechanics courses teaches knowledge and skills that integrate with science, technology, engineering, and mathematics (STEM) (Stubbs & Myers, 2015)
- ❖ Agricultural mechanics teachers must be knowledgeable and competent in content, skill performance, and safety management in order for laboratories to be safe and effective (Saucier, Vincent, & Anderson, 2014).
- ❖ Skilled teachers are crucial to student success; therefore, all teachers should be properly prepared and participate in professional development opportunities in order to teach effectively (Sorensen, Lambert, & McKim, 2014).



Conceptual/ Theoretical Framework

Borich's Need Assessment Model

- ❖ Utilized in order to prioritize the needs of teacher professional development (Borich, 1980)

Bandura's Theory of Self-efficacy

- ❖ Explains how one's beliefs in their own abilities impacts their decisions, actions, reactions to complications, as well as their overall level of success (Bandura, 1986).
- ❖ Teacher efficacy encompasses an individual teacher's expectation that he or she will be able to convey student learning (Ross, Cousins, & Gadalla, 1996).
- ❖ Through experiences, teachers are better able to develop a stable belief about their own abilities (Ross, 1998).

Purpose and Research Questions

- ❖ The purpose of this study was to determine the self-perceived professional development needs of Texas AFNR teachers, who attended a one day CNC Plasma Arc Cutting workshop.
 1. Describe the change in participants' perceived importance of teaching, their knowledge, and their ability to perform and teach CNC Plasma Arc Cutting technology professional development (CNCPD) competencies, based on pre- and post-test scores.
 2. Describe the change in participants' perceived professional development needs related to participants' perceptions of the importance, knowledge, ability to perform, and ability to teach CNC Plasma Arc Cutting technology professional development (CNCPD) competencies, based on pre- and post-test construct scores.

Results

Table 1

Change in Mean Weighted Discrepancy Scores (MWDS) from pre and post CNC Plasma Cutting Technology workshop (N = 18)

Skill Competencies	Δ MWDS
Knowledge Competence	
Top 3	
Control Software Operation – Trouble shooting	-6.76
Material Finishing – Dross Removal	-6.46
Material Finishing – Material Choice	-6.33
Bottom 3	
Plasma Power Unit Setup – Physical Placement	-1.29
Safety – Dust Control	-0.84
Safety – Fume Control	+0.13
Performance Competence	
Top 3	
Material Finishing – Dross Removal	-7.56
Material Finishing – Material Choice	-7.18
Control Software Operation – Trouble-shooting	-6.88
Bottom 3	
Plasma Unit Setup – Air Filtration	-1.34
Safety – Dust Control	-1.26
Plasma Power Unit Setup – Physical Placement	-0.38
Consequence Competence	
Top 3	
Material Finishing – Dross Removal	-7.94
Material Finishing – Material Choice	-7.86
Control Software Operation – Trouble-shooting	-7.02
Bottom 3	
Safety – Dust Control	-1.14
Safety – Fume Control	-0.98
Plasma Power Unit Setup	-0.37

Note. The higher the MWDS, the greater the need for professional development in the competency.

Methods

- ❖ This quantitative, descriptive, census study was conducted in the fall of 2016 at Sam Houston State University (SHSU)
- ❖ The population consisted of all of the Texas AFNR teachers who attended a CNC Plasma Arc Cutting workshop (N = 20)
- ❖ The overarching construct of this study was to measure perceptions of teachers' knowledge to teach (*Knowledge Competence*), their ability to perform (*Performance Competence*), and their ability to teach students (*Consequence Competence*) CNC Plasma Arc Cutting technology competencies using the Borich Needs Assessment Model (Borich, 1980).
- ❖ A two-section instrument addressed the research objectives of this study - then modified by researchers from the 26 industry supported curriculum competencies taught during the workshop.
- ❖ A 90% response rate was achieved (N = 18).
- ❖ Data was analyzed using Microsoft Excel and IBM SPSS Statistics 22 based upon each research question.

Conclusions, Implications, & Recommendations

- ❖ Overall, teachers indicated professional development needs, across all three competences, (both pre- and post-test), regarding CNC Plasma Arc Cutting competencies.
- ❖ Data concludes that the workshop was successful in improving teacher's *Knowledge, Performance, and Consequence* competences except for *Safety – Fume Control* in the *Knowledge Competence*.
- ❖ *Safety – Fume Control* in the *Knowledge Competence*, the teacher's perceptions of their knowledge actually decreased (Pre- vs. Post-test)
- ❖ Implications of this research may impact the knowledge and skills that are taught to new and existing teachers across the U.S., in both teacher education programs and for existing teachers.
- ❖ With the push for increasing industry-based STEM skills for future workers, professional development providers need to offer these skills to future and existing teachers.



References

- ❖ References available upon request



Sam Houston State University