Effects of a Professional Development Session on Career and Technical Education Teachers' Knowledge to Teach Small Gas Engines

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Introduction

Knowledge and skills associated with agricultural mechanics education are essential for teachers who intend to provide a safe and efficient laboratory learning environment for secondary agricultural education students (Saucier et al., 2009). With the wide array of topical areas to be knowledgeable about one area that is popular in secondary schools is small engines. Parents demand that their children receive proper instruction from qualified individuals (Dyer & Andreasen, 1999). Research suggests that skilled teachers, who are crucial to achieving student success, must be prepared properly and participate in professional development opportunities (Sorenson et al., 2014). Therefore, professional development opportunities have been created for secondary teachers in relation to small engine technology.

Pedagogical Content Knowledge (PCK) defined as the knowledge of, the rationale behind, the planning for, and the act of teaching subject matters using specific methods for specific students to promote student learning served as our conceptual framework (Carlson et al., 2015). The purpose of this quantitative census was to evaluate the self-perceived knowledge level of school based, career and technology teachers.

1. Determine the personal, professional, and program demographics of school-based CTE teachers who attended a three-day Briggs and Stratton small gas engine technology workshop at various U.S. universities and community colleges held during the summer of 2019.

2. Determine the self-perceived knowledge level of school-based, CTE teachers to instruct small gas engine technology (i.e. four-stroke small gas engine inspection, testing, repair, theory, and safety skills,) prior to and after attending, a three-day intensive professional development workshop.

Methods

This study used a descriptive research methodology to analyze the characteristics of respondents' self-perceived knowledge to instruct small gas engine technology. A Pre/Post survey design was utilized in conjunction a 3-day intensive industry lead professional development workshops. Workshops were held in eight different states which included California, Illinois, Minnesota, New York, North Dakota, South Carolina, South Dakota, and Texas. The survey was broken into three different small engine knowledge constructs. The constructs were Inspection and Testing, Repair, and Theory and Safety. Post-hoc reliability analysis was conducted on all the construct areas. The alpha levels for the construct area were Inspection and Testing (α = .982), Repair (α = .982), and Theory and Safety (α = .971). With this census style survey method there was 100% response rate with N = 136 usable survey instruments.

Results

In this study, the typical participant was male (58.8%), held a Bachelor's degree (67.2%), was traditionally certified to teach (78.6%), taught agriculture (77.9%), and taught middle and high school (51.5%). Participants on average had 7.88 years of experience (SD = 11.56) and was 37 years old (SD = 15.38). The pre-test grand means averaged between 2.48 and 2.91

illustrating that the participants thought each construct was slightly to almost moderately important. After the workshop, the participants ratings increased to between 3.73 and 4.03 on average. This shows that the participants' level of perceived importance increased into the moderately to very important levels. All of the individual concepts surveyed had a significant increase in perceived importance and exhibited a large effect size ($d > 0.8$). The items with the largest effect sizes are displayed in Table 1.

Table 1

Paired Samples t-test of Pre- and Post-Workshop Perceptions of the Knowledge to Teach Four-Stroke Engine Inspection and Testing Skills

	Pre-workshop		*Post-workshop*			*Cohen's*
Item	*M*	*SD*	*M*	*SD*	*p*	*d*
Checking engine compression	*2.62*	*1.36*	*3.97*	*0.83*	*.000**	*1.20*
Inspecting restrictions at spark screen & exhaust	*2.19*	*1.13*	*3.55*	*0.95*	*.000**	*1.30*
Performing a carburetor fuel pump impulse test	*1.98*	*1.00*	*3.41*	*1.06*	*.000**	*1.39*
Carburetor visual evaluation	*2.55*	*1.26*	*3.98*	*0.85*	*.000**	*1.33*
Perform an ignition test	*2.48*	*1.30*	*3.87*	*0.93*	*.000**	*1.23*
Evaluate engine performance	*2.52*	*1.20*	*3.90*	*0.90*	*.000**	*1.30*
Inspecting a spark arrestor	*2.12*	*1.11*	*3.49*	*0.94*	*.000**	*1.33*
Using small engine diagnostic software	*1.87*	*0.92*	*3.49*	*0.94*	*.000**	*1.74*
Inspecting carburetor for fuel misuse	*2.06*	*1.05*	*3.47*	*0.93*	*.000**	*1.42*
Testing fuels for quality and use	*2.04*	*1.05*	*3.60*	*0.93*	*.000**	*1.57*

Note. 1 = Not Important; 2 = Slightly Important; 3 = Moderately Important; 4 = Very Important; 5 = Extremely Important. * indicates significant at $p < .05$. Effect size = 0.2 (Small effect); 0.5 (Medium effect); 0.8 (Large effect).

Conclusions & Recommendations

It can be concluded that educators had a significant increase in their self-perceived level of knowledge because of attending the 3-day intensive professional development workshop. The 3-day intensive professional development workshop did have a significant impact on all competencies taught in the Inspection and Testing, Repair, and Theory and Safety constructs during the workshop. It can also be concluded that the intensive industry led professional development did make a positive impact on CTE teachers Pedagogical Content Knowledge about teaching small gas engine content related to Inspection and Testing, Repair, and Theory and Safety.

It is recommended to continue using the multiple day workshop format to help increase CTE teachers PCK in other curricular areas. It is also recommended to continue working with industry to create more professional development opportunities for CTE teachers to help them keep up to date with new technologies, competencies, and skills.

References

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