**Research**

# An evaluation of the Briggs and Stratton small gas engine technology workshop: A national focus on the professional development needs of career and technology teachers

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## Introduction

The National Research Agenda for Agricultural Education - *Research Priority Area Three*, (Roberts, Harder, & Brashears, 2016) suggests that academia and other workforce developers seek to provide a sufficient scientific and professional workforce that can address the challenges of the 21st century – especially those challenges with focus on science, technology, engineering, and mathematics careers (Sargent, 2017). Moreover, within the realm of career and technology education, agencies and researchers across the nation are reporting teaching positions are going unfilled (Blackburn, Bunch, & Haynes, 2017; Fandel, 2007; Walker, Garton, Kitchel, 2004) due to teacher attrition, retirements, and other competitive job markets that attract teacher candidates. In order to retain qualified teachers, Sorenson, Lambert, and McKim (2014) have suggested that skilled teachers, who are crucial to achieving student success, must be prepared properly and participate in professional development opportunities. Therefore, this study sought to understand the professional development needs of career technology education teachers regarding the instruction of small gas engine technology and their perceptive change after engaging in an industry-instructed professional development workshop.

## Conceptual Framework

According to Van Driel and Berry (2012), development of Pedagogical Content Knowledge (PCK) is an important goal to focus on in professional development programs. PCK has most recently been 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 (Carlson, Stokes, Helms, Gess-Newsome, & Gardner, 2015). In general, PCK could be vary by lesson or unit taught by the same instructor. This is a very important concept to grasp when trying to operationalize PCK within career and technology education. Moreover, these concerns were realized by (Rice & Kitchel, 2015) when preservice agricultural teachers were unable to apply content knowledge when teaching, and revealed content knowledge preparation was inadequate. As identified by Rice and Kitchel (2015), professional development is one of the sources influencing an agricultural educator's PCK. Additionally, researchers have asserted that preservice teachers may not be developmentally ready for PCK while at the teacher educator institution (Lauermann & König, 2016), thus, existing teachers may have professional development needs concluding graduation and entering the workforce.

## Methods

The purpose of this quantitative census was to determine the professional development needs of school based, career and technology teachers (CTE; $N = 136$) who attended the Briggs and Stratton Beginning Small Gas Engine Technology workshops held at eight locations across the U.S. during the summer of 2019. The following research objectives guided this study: (1)

Determine the professional development needs of school-based, CTE teachers regarding the instruction of small gas engine technology and associated Mean Weighted Discrepancy Score (MWDS) changes and (2) Determine the personal, professional, and program demographics of these respondents. Based upon a review of literature, a paper questionnaire was developed, reviewed by a panel of experts ($N = 5$; all with school-based agricultural education experience), and subsequently revised. Respondents were asked to rate their importance to teach, knowledge, ability to perform, and ability to teach others to perform 51 competencies that were focused on theory/safety, inspection/testing, and repair of small gas engine technology. Data was collected from 136 teachers for a 100% response rate. Based upon the research objectives, data was analyzed using IBM SPSS Statistics 22 and a Microsoft Word Excel MWDS calculator created by McKim and Saucier (2011).

## Results

Nationally, school based, CTE teachers indicated that they were mostly male ($n = 80$; 58.8%), had an average age of 37 years ($M = 36.69$; SD = 15.38), of white ethnicity ($n = 126$; 92.6%), completed a Bachelor's degree ($n = 90$; 66.2%), primarily taught agriculture ($n = 106$; 77.9%), and completed a traditional teacher certification program ($n = 103$; 75.7%).

When evaluating the mean weighted discrepancy scores (MWDS) of respondents perceptions (pre vs. post) of the workshop, respondents indicated that in the knowledge competence (Importance vs. Knowledge to Teach), the competencies *properly adjust valves* (Pre – MWDS = 8.16; Post–MWDS = 2.37; ΔMWDS = -5.49), and *replacing a spark plug* (Pre – MWDS = 5.49; Post–MWDS = 0.00; ΔMWDS = -5.49) had the greatest change. The least changed competency for the knowledge competence was *fueling a four-stroke engine* (Pre – MWDS = 3.12; Post–MWDS = 2.16; ΔMWDS = -0.96). Moreover, the greatest change in the performance competence (Importance vs. Ability to Perform) were *four- stroke engine theory* (Pre - MWDS = 6.22; Post - MWDS= 0.74; ΔMWDS = -5.84). The least change in competencies within the performance competence was *fueling a four-stroke engine* (Pre – MWDS = 3.14; Post–MWDS = 2.16; ΔMWDS = -0.98). Finally, the greatest change in the consequence competence (Importance vs. Ability to Teach Others to Perform) was *properly adjust valves* (Pre – MWDS = 8.00; Post–MWDS = 2.60; ΔMWDS = -5.40). The least change of the competencies within this competence were *fueling a four – stroke engine* (Pre – MWDS = 3.68; Post–MWDS = 2.76; ΔMWDS = -0.92).

## Conclusions, Recommendations, and Implications

Nationally, school-based CTE teachers had the highest change in professional development perceptions, across all four scales of measurement, in complex small gas engine technology skills – i.e. *properly adjust valves*. Was this industry-led professional development a success? Or, did it just reiterate the lack of knowledge teachers had prior to the workshop? Additionally, teacher educators and professional development providers should consider increasing undergraduate education requirements and professional development offerings to existing teachers to better educate teachers and increase their PCK concerning small gas engine technology. Moreover, increased collaboration with industry representatives should be considered when developing and planning professional development opportunities for teachers.

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