Incorporating a Weld Settings App into a University-level Agricultural Mechanics Course

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Introduction

As a traditional portion of agricultural mechanics curricula, welding is often included in many school-based agricultural education (SBAE) programs that provide agricultural mechanics instruction to secondary students (Pate, Warnick, & Meyers, 2012; Rose, Pate, Lawver, Warnick, & Dai, 2015; Shultz, Anderson, Shultz, & Anderson, 2014). As such, it is reasonable to expect SBAE teachers to have a certain degree of comfort and competence regarding welding-related knowledge and skills prior to engaging secondary students in the content area (Pate et al., 2012). To develop competence in technical agriculture content, preservice SBAE teachers enroll in coursework designed to engage them in relevant content related to the agricultural industry (Whittington, 2005). Moreover, developing preservice teachers' comfort with technical content (e.g., agricultural mechanics) is assisted through participation in such course experiences (Tummons, Langley, Reed, & Paul, 2017). Preservice teachers are often uncomfortable with agricultural mechanics content (Tummons et al., 2017). Providing new, positive experiences that accommodate and build upon prior knowledge and skills can help to provide smoother transitions into the unknown (Rank & Smalley, 2017).

As part of the process of developing knowledge, skill, and comfort with a technical content area (e.g., agricultural mechanics), using technology in a given setting (e.g., such as within an agricultural mechanics laboratory) can help to develop and reinforce specialized knowledge and skills (Byrd, 2014). Moreover, technology-based applications can be impactful when attempting to alleviate anxieties experienced during skill-based exercises, such as weld process training (Byrd, 2014). Smith, Stair, Blackburn, and Easley (2018) further described advancements in technology for educational purposes (i.e., educational technologies) have resulted in a greater diversity of such technologies being incorporated into SBAE settings in recent years, particularly regarding the use of smartphones and apps. Considering the need for preservice teachers to be competent and comfortable regarding novice-level welding-related knowledge and skills, as well as the flexibility of educational technologies (e.g., smartphones and apps) to help positively impact the teaching and learning experience, it is conceivable an opportunity for useful, practical alignment exists in the context of incorporating the Miller Weld Setting Calculator smartphone app into a university-level agricultural mechanics course.

How it Works

Applied Agricultural Systems Technology (AGED 2203) is a hands-on, skills-based applied agricultural systems course for preservice SBAE teachers at Arkansas Tech University (ATU). The overarching objective of the course is to develop the elementary agricultural mechanics skills preservice teachers will need as they begin their teaching careers. Typically, there is a wide range of experience among the preservice teachers. Some enter the course with an extensive agricultural mechanics background; however, many students have little to no experience in agricultural mechanics subject matter. The Miller Weld Setting Calculator app was used in this course to provide an easily accessible reference for determining machine process settings used in different welding processes.

At the beginning of the welding unit of the course, the preservice teachers were asked to download the Miller Weld Setting Calculator app. The course instructor gave an overview of the app and provided basic instruction about its use. The app includes settings for multiple processes (e.g., Shielded Metal Arc Welding [SMAW], Gas Metal Arc Welding [GMAW], etc.). The app allows the user to select the process, material type, material thickness, and consumable material size and type. This course focused on the SMAW and GMAW processes. If the SMAW process is selected, the app will provide the suggested amperage range, polarity, penetration, position, usage, and an electrode description. Similarly, selecting the GMAW process will result in information on wire size, wire feed speed, shielding gas, voltage range, and amperage range, all of which were based on the material type and material thickness that were entered previously.

Miller® XMT® 350 CC/CV multi-process welders were used in the agricultural mechanics laboratory at ATU. Preservice teachers learned to use both the SMAW and GMAW processes. Preservice teachers were required to use the app to properly adjust their welding machines when they changed processes or material types and/or thicknesses. As a portion of the course's final exam, the instructor purposefully set all the machines to the incorrect settings for amperage/voltage, polarity, and process. The preservice teachers were required to use the app to properly set up their welding machines and complete both a 1G position butt weld and 2F position tee weld with the SMAW process. They were then required to properly change the welding machine settings and perform both a 1G position butt weld and 2F position tee weld using the GMAW process.

Implications

The preservice teachers were able to properly adjust their welders to the suggested settings based on the welding process, material type, and material thickness being used. Anecdotal evidence suggested the preservice teachers were able to develop their welding skills more quickly in comparison to students in past sections of this course that did not use the app. The app allowed the preservice teachers to be more confident they used the correct settings for their process, thereby allowing them to focus their efforts on employing the correct welding technique variables (e.g., work angle, etc.). The Miller Weld Setting Calculator app will, hopefully, be a pragmatic and useful resource for these preservice teachers when they begin teaching. We expect these preservice teachers will be able to use this tool to teach welding machine set-up and use in their future SBAE programming and content.

Future Plans, Advice to Others, & Costs

We plan to use the Miller Weld Setting Calculator app in future sections of this course. Our future plans also include identifying other apps that could be useful in the agricultural mechanics laboratory. Using the Miller Weld Setting Calculator app was, in our experience, a practical and easy-to-implement part of an agricultural mechanics course experience. We do encourage instructors who plan to use this app to allow their students to find the proper welding machine settings themselves rather than simply telling them which settings to use. In addition to using the app, preservice teachers should also be cognizant of how they can use resources, such as this app, in their future teaching practices. The Miller Weld Setting Calculator app is available free of charge and can be readily downloaded to either iOS or Android operating systems.

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