Evaluation of a Virtual Plant Science Program for Agriscience Teachers

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Regardless of their future career path, students need sufficient knowledge of science to be functional members of society, and to continue learning and applying science concepts throughout their lives as informed consumers and decision-makers (National Research Council, 2012). School-based agricultural education (SBAE) programs contribute to students' science learning by providing opportunities to engage with science when used as a context for applying scientific core ideas (National Research Council, 2012). Furthermore, agriscience teachers must understand science concepts and ideas themselves to connect SBAE content to core disciplinary scientific ideas (McKim et al., 2017). Thus, the STEM-it Up: Everything You Need to Know to Get Your Floriculture Curriculum in Bloom program was created to train teachers on the science within the horticulture/floriculture curricula for them to illuminate these concepts in their instruction. The professional development (PD) began in June of 2019 to present the in-depth knowledge needed to teach science, technology, engineering, and mathematics (STEM) in the plant science career pathway. This study focused on the second iteration of the PD in the summer of 2020, which was delivered entirely online due to the COVID-19 pandemic. The purpose of this study was to describe participants' evaluations of the conference sessions to better inform future practice. This research addresses the American Association for Agricultural Education (AAAE) Research Priority 3, *"Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century"* (Stripling & Ricketts, 2016, p.29).

Theoretical Framework

PD is a continuous process that happens both on and off the job and should provide teachers with the knowledge and skills needed to change their actions, beliefs, and attitudes (Greiman, 2010). Continuous PD is necessary for teachers to develop, grow, and change (Guskey, 2002). To be most effective, PD should be a gradual process, including time for feedback and reflection, while also providing support and social pressure (Guskey, 2002). Desimone (2009) provides a framework of five elements. These five core features were utilized for the planning and delivery of the PD program. Teacher PD should be grounded in academic content to impact instructional practices and, thus, student outcomes (Jeanpierre et al., 2005). Scientific core ideas found within the high school floriculture/horticulture curricula were the content focus for the program. Active learning was incorporated through live delivery, hands-on labs, and group discussions. Coherence was addressed by recruiting teachers who currently taught floriculture/horticulture, were supported by their districts, and were interested in illuminating science in their plant systems courses. The PD program duration was an initial 15-hour conference over three days, followed by six 90-minute follow-up sessions once a month from July to December. Lastly, collective participation was encouraged through group work, assignment of peer partners, social engagement sessions, and asynchronous discussions. Peer partner groups also allowed for planned time for discussion and idea-sharing, which has been shown to assist with a change in instructional practices (Jeanpierre et al., 2005).

Methodology

The purpose of this study was to evaluate the relevance and quality of the PD program sessions. The PD program goal was to help agriscience teachers illuminate the science embedded in SBAE horticulture and floriculture curricula. The PD program was designed to provide specific, deliberate, and systematic PD presented through experiential learning opportunities and inquiry-based instruction. An application was distributed nationwide through ListServs of

several professional organizations for agricultural education, resulting in 254 applications. Participants were selected based on their number of years teaching, agreement to participate in the program through December 2020, as well as their responses to two short-answer questions. Twenty-two teachers were selected and accepted the invitation to participate. This study's population was all agriscience teachers who participated in the initial three-day conference during the summer of 2020 (N = 22). Researcher created evaluations were sent to participants at the end of each of the three days of the PD program, and an overall evaluation was sent after the completion of the program. Each instrument used four-point, Likert-type scales and included items asking participants to rate both the relevance and the quality of each of the days' sessions (1 = not relevant/poor quality and 4 = very relevant/excellent quality). SPSS version 25 for PC and Microsoft Excel were employed to observe frequency, mean, and standard deviation to describe both the population and items.

Findings and Conclusions

The 22 agriscience teachers in the study represented 13 states and an estimated 4000 students in their SBAE programs. The participants were a majority female (77.3%), white (100%), and the average age of the participants was 39 years old. Participants taught for an average of 9.80 years, with nine (40.9%) having previously taught a subject besides agriculture. Twelve (54.5%) of the teachers taught at least one SBAE course for which students also received science credit. When evaluating the session types across all three days of the conference, inquiry-based lab sessions received a mean relevance score of 3.51 (SD = 0.59) and a mean quality score of 3.37 (SD =0.83). Informational sessions, which were more lecture, discussion, or question-based, received a mean relevance score of 3.23 (SD = 0.75) and a mean quality score of 3.30 (SD = 0.76). Each day was evaluated independently for overall quality and relevance to participants. Participants assessed the overall quality of day one of the PD, which focused on photosynthesis and respiration, with a mean score of 3.28 (SD = 0.72) and the relevance as M = 3.24 (SD = 0.77). Day two received a mean relevance score of 3.36 (SD =0.70) and a quality score of 3.44 (SD = 0.77) and concentrated on translocation. Lastly, participants scored the relevance of day three of the PD as M = 3.31 (SD = 0.68) and a mean quality score of 3.24 (SD =0.84). Day three's core science content was cellular respiration and associated systems. Overall, the entire PD program received a relevance rating of relevant to very relevant and quality scores ranging between good to excellent.

Implications/Recommendations/Impact on Profession

It is encouraging to find that even during a pandemic, agriscience teachers were motivated to actively participate in an online PD program to learn about horticulture/floriculture concepts in a new way using inquiry-based instruction, problem-solving and focusing on connections to career opportunities in those industries. The PD program unintendedly provided strategies for teaching STEM concepts using somewhat unfamiliar technological tools and resources, such as Zoom and other online teaching tools. The agriscience teachers remained engaged and utilized the curricular resources and materials from the PD program to take back to their classrooms, whether face-to-face, synchronous online, or asynchronous online, to teach STEM concepts using inquiry during a time of uncertainty. High-quality PD can still be conducted from a distance with intentional planning, and when Desimone's (2009) framework for high-quality professional development is followed. When providing curriculum and specific content, it is recommended to model inquiry-based laboratory instruction through online learning platforms, which agriscience teachers can then replicate in their classrooms.

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