

Sources of Self-Efficacy Across Milestones in an Agricultural Controllers Course

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Introduction, need for research

Learners in post-secondary agricultural education courses enter with varied prior knowledge, technical skills, and confidence in their ability to complete applied tasks. This variability can make course design challenging for faculty, particularly in technical learning environments. Controlled environment agriculture (CEA) is an expanding, interdisciplinary field requiring skills related to sensors, automation, environmental control, and systems interaction. However, access to CEA education and training remains uneven, geographically variable, and dependent on instructor capacity (GLASE Consortium, 2025). As post-secondary institutions prepare learners for this growing sector, faculty need a clearer understanding of how students develop confidence in their ability to perform CEA-related tasks.

Although agricultural education scholars have examined self-efficacy across teaching and learning contexts (Knobloch, 2014; McKim et al., 2017), limited research has examined the course experiences students perceive as most influential to their efficacy development while learning CEA-related skills. Without this information, faculty may rely on assumptions about which course experiences best support students' confidence across applied skill milestones. Therefore, the purpose of this study was to describe participants' self-reported most influential sources of efficacy across course milestones in an agricultural-controllers course.

Conceptual or theoretical framework

This study was guided by Bandura's self-efficacy theory. Self-efficacy refers to individuals' beliefs in their capability to perform specific tasks and is task- and context-specific (Bandura, 1977, 1997; Pajares, 1996; Zimmerman, 2000). This is relevant in agricultural education, where learners often develop confidence through applied, skill-based, and context-specific experiences (Knobloch, 2014; McKim et al., 2017). Bandura (1977) identified four primary sources of efficacy information: mastery and vicarious experiences, verbal persuasion, and physiological states. These four sources framed the examination of students' self-reported most influential sources of efficacy across agricultural controllers course milestones. Agricultural education scholars have applied self-efficacy theory across teaching, professional development, and experiential learning contexts, supporting its use for examining confidence development in agricultural learning environments (Knobloch, 2014; Wolf et al., 2010).

Methodology

This descriptive survey study was part of a larger project examining self-efficacy development in a technical agricultural controllers course. The population was students enrolled in BRAE 332 during spring quarter 2026. Of 31 enrolled students, 15 consented to use of their course submissions under the approved IRB protocol, yielding a 48% response rate. Data were collected through Microsoft Forms at four course milestone segments. At each milestone, students selected the experience they perceived as most influential to their confidence in performing the related skills, see Table 1 for choice options. Response options were developed from Bandura's sources of efficacy and adapted to the course context. Frequencies and

percentages were calculated within and across milestones using SPSS v.30.

Results/Findings

Table 1 shows that across milestones, working with classmates was the most frequently identified source of efficacy ($f = 19$, 37%), though other sources varied by milestone.

Table 1

Most Influential Efficacy Source Submitted by Course Milestone

Item	M 1-2 $n = 11$		M 3-4 $n = 11$		M 5-7 $n = 16$		M 8 $n = 14$		Overall $n = 52$	
	f	%	f	%	f	%	f	%	f	%
Working with my classmates	6	40	5	33	4	27	4	27	19	37
Practicing/repeating the work overtime	2	13	4	27	2	13	1	7	9	17
Doing the work myself	2	13	1	7	2	13	3	20	8	15
Figuring things out after mistakes or setbacks					3	20	4	27	7	13
Other			1	7	3	20			4	8
Getting feedback or encouragement from others (TA, instructor, or peers)	1	7					1	7	2	4
Watching someone do the skill					1	7	1	7	2	4
Feeling more comfortable with the tools or technology										
Getting used to making mistakes						1	7		1	2

Conclusions

Working with classmates was the most frequently identified source of efficacy across course milestones. However, students identified varied sources of efficacy across the term, suggesting confidence development may depend partly on the skills, challenges, and supports embedded within each milestone. This finding aligns with self-efficacy theory, which frames efficacy as task- and context-specific and developed through multiple sources of efficacy information (Bandura, 1977, 1997; Pajares, 1996). Therefore, students' confidence development in technical agricultural controller skills may be both course-dependent and individualized.

Implications/Recommendations/Impacts on the Profession

This research suggests faculty in CEA coursework should design learning experiences that provide varied opportunities for efficacy development, including those represented in Table 1. Attending to individual learners' needs within the CEA context may help prepare a highly qualified workforce through intentional course design. Future research should examine additional populations within CEA to determine how self-efficacy sources align with demonstrated skills. Researchers should also explore how pedagogical choices, such as peer collaboration, repeated practice, and feedback influence self-efficacy development.

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