Course Development to Address Horticulture Gaps in an Agricultural Education Undergraduate Program

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Abstract

Agricultural Education teacher licensure programs face a growing list of coursework needed to meet requirements with a shrinking number of credit hours available. A new course – 'Greenhouse and Landscape Fundamentals for Educators' was developed at Purdue University with an Agricultural Education Teacher Licensure B.S. degree program. Data utilized in creating the course included: 1) an evaluation of current Agricultural Education coursework; 2) a review of state and national Agricultural Education content and academic standards; and 3) a survey of current Indiana Agriculture teachers. Responses from the survey (n=72) of high school teachers of horticulture and/or landscape management show 61% of respondents had teaching greenhouses at their schools, and 62% reporting they were not confident with operating and maintaining a greenhouse based on bachelor level coursework they took. Respondents indicate needing more coursework in several topics: greenhouse management, landscape design, landscape installation and maintenance, and plant identification. Results pointed to gaps in existing required coursework. The new course was specifically tailored to meet the needs of the Agricultural Education undergraduate students, and equip them with information and resources to call upon when they begin their teaching careers.

Key words: Agricultural Education, course development, horticulture education, pre-service teacher development, undergraduate education

Teacher licensure programs in Agricultural Education (Ag Ed) are often faced with a growing list of coursework needed to meet teaching requirements and standards, with a shrinking number of credit hours available to meet those needs (AASCU, n.d.). Efforts to streamline undergraduate education programs often result in a reduction in credit hours needed to meet graduation requirements. This leaves students with limited experience in basic agricultural topics, or with a lack of depth in specific topics (NCTQ, 2013). Therefore, Ag Ed students often graduate from university programs with limited knowledge of specific agricultural content that they are then expected to teach at secondary schools where they are employed following graduation. For example, secondary schools are frequently offering horticulture and/or landscape design and management courses, in addition to basic plant and soil science coursework. Additionally, many secondary schools are utilizing greenhouses both for teaching and production demonstration. With little to no exposure to coursework in greenhouse management or landscape design, preservice teachers can struggle when presented opportunities to teach these subjects upon employment. Multiple years of this pattern can lead to a population of teachers without expertise in teaching these subjects. Careers in horticulture and landscape are presently rebounding and there is a growing demand for students with skills and knowledge ready for the workforce (BLS, n.d.).

To address this perceived gap in the content areas of Horticulture and Landscape (H/L), a new course – 'Greenhouse and Landscape Fundamentals for Educators' was developed for an Ag Ed B.S. degree program. Current curriculum at this university requires one basic introductory horticulture course and allows for one advanced 3-credit course in the horticulture content area to be added to the plan of study. Therefore, the newly developed course would replace the advanced horticulture course option, in which academic standards for Ag Ed were not adequately addressed.

The theoretical underpinnings of course development in this study are based in constructivism, social cognitive theory (SCT) and self-determination theory. Constructivism posits that learners have a central role in their continually changing mental schemes, and this impacts their cognitive growth. Learners in charge of their own learning and growth, along with building upon their experiences, form the basis of how the new course was developed and taught.

Self-efficacy, part of SCT, is a key component to student learning that was also used in building the course. To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned. (Ambrose, et al., 2010; Bandura, 2001). Even a small amount of focused practice on key component skills had a profound effect on overall performance (Lovett, 2001). And finally, two aspects of Self Determination Theory, fostering relevancy and creating a supportive environment were used in developing coursework. Kaplan and Madjar (2017) demonstrated the importance of creating a psychological need-supportive environment for pre-service teachers as a means to improve the quality of teaching. Fostering relevancy helps students experience the learning process as promoting their needs, goals, and values and to perceive the teacher as understanding their feelings and thoughts (Assor and Kaplan, 2001)

Methods

Development of the new course included three components. Data utilized around the topics of landscape horticulture, greenhouse management, plant propagation and basic plant science, included: 1) an evaluation of current Ag Ed coursework students commonly enrolled in; 2) a review of state and national Ag Ed content and academic standards; and 3) a needs survey of current Indiana Ag Ed teachers and their teaching methodology utilized.

The first steps in the process for the new course development were to 1) analyze existing course requirements for Ag Ed degree at Purdue University and 2) compare content specific academic standards of several nationally available secondary teaching curricula. A senior agricultural education undergraduate student, under the supervision of the author, completed an independent study where steps 1 -3 were undertaken. To generate the list of subject matter components for the course, a comparison of the following was made and generated a list of topics: National Ag Ed Curriculum (CASE, iCEV, AgEdNet), State Ag Ed Standards, and content covered in required undergraduate content related courses. State Ag Ed Core Standards and Domains used were for Horticulture Science, Landscape Management I, and Landscape Management II. From these analyses, a list of course topics and questions for the needs assessment survey was developed. The analyses were also evaluated for completeness and accuracy by senior Agriculture Education faculty in the department. Table 1 shows the core standards with specific examples of what topics would be planned in the course.

Determination of the need for the course came from the survey and anecdotal information. The third step in the new course development was to answer the question of if there was a gap in horticulture and landscape content and was there a perceived need for preservice teacher education in this area. A short needs assessment survey was created to query both practicing Ag Ed teachers in the state, and pre-

Table 1.

List of specific content topics developed from analysis of [STATE] Agricultural Education standards and curriculum for Horticulture and Landscape core standards.

Core Standards	Specific Topics
Horticulture Science	Classification and Identification
	Environmental Factors for Growth
	Management Practices, Greenhouse
	Plant Propagation
Landscape Management I and II	Landscape Design and Plans
	Tools, equipment, safety
	Plant Selection and ID
	Business
Funding/Grant Writing	Grant Writing, resources
	Funding for Greenhouse
	Garden, Landscape Projects
Additional Topics from Plant and Soil Science	Integrated Pest Management /Pests and Disease
	Irrigation, Lighting
	Maintenance Plans
	Specialty Areas: Turf, Tree and Shrubs, Hardscapes

Note. Items in italics were not covered in the first teaching of the course.

service Ag Ed students. The survey was developed by Ag Ed and Horticulture faculty at Purdue University. The survey was reviewed by Purdue University IRB (IRB-2022-321). Qualtrics was used for electronic survey delivery, which was sent out to the state Ag Ed listserv with approximately 400 teachers and preservice teachers, with one reminder. Seventy-two total responses from practicing Ag Ed teachers and preservice teacher students combined were received, however due to missing data, some questions had less than 72 responses. Questions in the survey included teaching experience in plant science topics, curriculum used, confidence in skills and teaching horticulture/ landscape content, how that content is used in classroom, and greenhouse access. Data was analyzed with basic statistics, frequencies, and percentages.

The final step of the course development was creating the syllabus, content delivery, objectives and assignments. From the three part data gathered (curriculum and standards analysis and needs assessment survey), a new undergraduate course syllabus was developed and vetted with Ag Ed faculty and staff, as well as Department of Horticulture and Landscape Architecture undergraduate faculty teaching chair.

Results and Discussion

Survey results

The survey results indicated that there was a gap in skills and knowledge around horticulture and landscape and a need for preservice teacher course in that area. Years of teaching experience of respondents ranged from 0-2 (n=12), 3-5 years (n=9), 6-10 years (n=8) 16-20 years (n=8) and to 21 years or more (n=22). Eighty percent of respondents were graduates of Purdue University Ag Ed program. Table 1 shows the core standards with specific examples of what topics would be planned in the course. Table 2 indicates the participants' response to the question 'choose one topic you would have liked to learn more about in the H/L content area during your undergraduate education'. Greenhouse management and landscape design were rated highest by the teachers and students. This would become the basic core for the new course.

Table 2.

Participant response to survey question: choose one topic you would have liked to learn more about in the Horticulture/Landscape content area during your undergraduate education (N=59).

Topic	%	Count
Greenhouse Management	66.10	39
Landscape Design	42.37	25
Landscape Installation and Maintenance	28.81	17
Plant ID	23.73	14
Intro to Horticulture	16.95	10
Plant Propagation	15.25	9
Other- please list (response = 'all')	5.08	3
Total	100	59

Respondents self-identified as feeling moderately prepared or not prepared to teach H/L content in the classroom based on a Likert scale where (1) Not confident- had to learn everything on your own, (2) Somewhat confident- coursework provided a basis to start with, (3) Confident- coursework provided important and helpful information, or (4) Very confident- coursework could not have provided any more information. Figure 1 demonstrates responses to the question 'how well do you feel your college coursework prepared you to teach landscape/horticulture in the classroom'.

Survey results showed that 61% percent of respondents (44/72) had teaching greenhouses at their schools. Figure 2 shows the confidence of respondents to the question of 'how confident they were in operating a greenhouse' where (1) Not confident- had to learn everything on your own, (2) Somewhat confident- coursework provided a basis to start with, (3) Confident- coursework provided important and helpful information, or (4) Very confident- coursework could not have provided any more information. Additionally, 62% of respondents (37/60) reported they were not confident with operating and maintaining a greenhouse based on bachelor level coursework they took. This finding is consistent with Albritton and Roberts (2020), where plant science technical skills needed by beginning teachers included watering, transplanting and propagating plants; greenhouse operation; and landscaping.

Course design

The course was designed as a hands-on course that met two hours, twice weekly for one semester in a horticulture teaching lab setting, with access to greenhouse resources. Content delivery via lecture and guest speakers, was mixed with hands on activities and microteaching as real time teaching practice in pairs and individually. (For reference, subject matter covered in the course can be found in Table 1). Learning outcomes were developed and refined, resulting in the following: 1) Students will identify and apply basic propagation techniques; 2) Students will interpret funding for greenhouses, greenhouse technologies, and landscape design equipment; 3) Students will learn to apply IPM, irrigation, and propagation techniques while maintaining and operating a greenhouse; 4) Students will analyze and utilize landscape design software and tools to design a landscape.

Course assignments were broken down into aspects of teaching, doing (projects and laboratory-based activities), and assessments. Assignments (Table 3) were designed to support student learning through hands-on project-based learning, designing a greenhouse for a school, creating their own landscape design, developing lesson plans, and through fostering mastery through practice teaching a lab activity. Reflection on microteaching allowed for personal growth through self-reflection of their emergent teaching skills, building self-efficacy. Simple quizzes allowed for summative assessment of content taught, guest lectures,

Figure 1.

Participant response to survey question: how well do you feel your college coursework prepared you to teach landscape/horticulture in the classroom? (N=60)

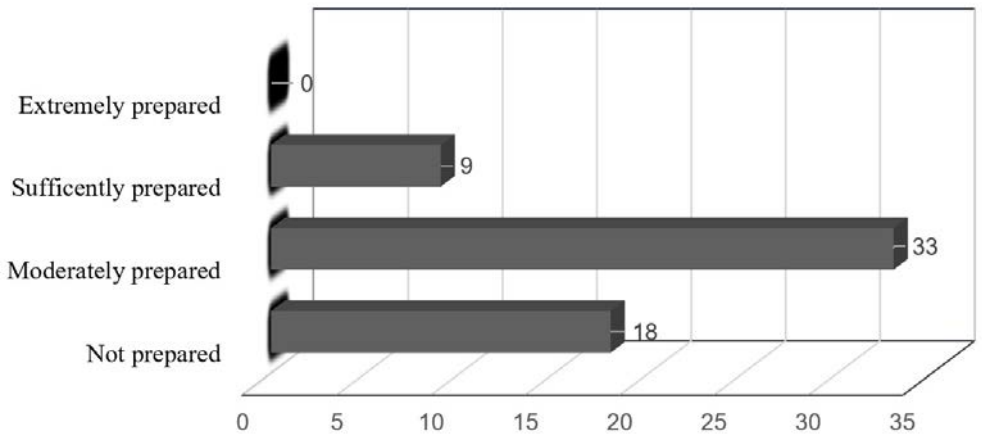
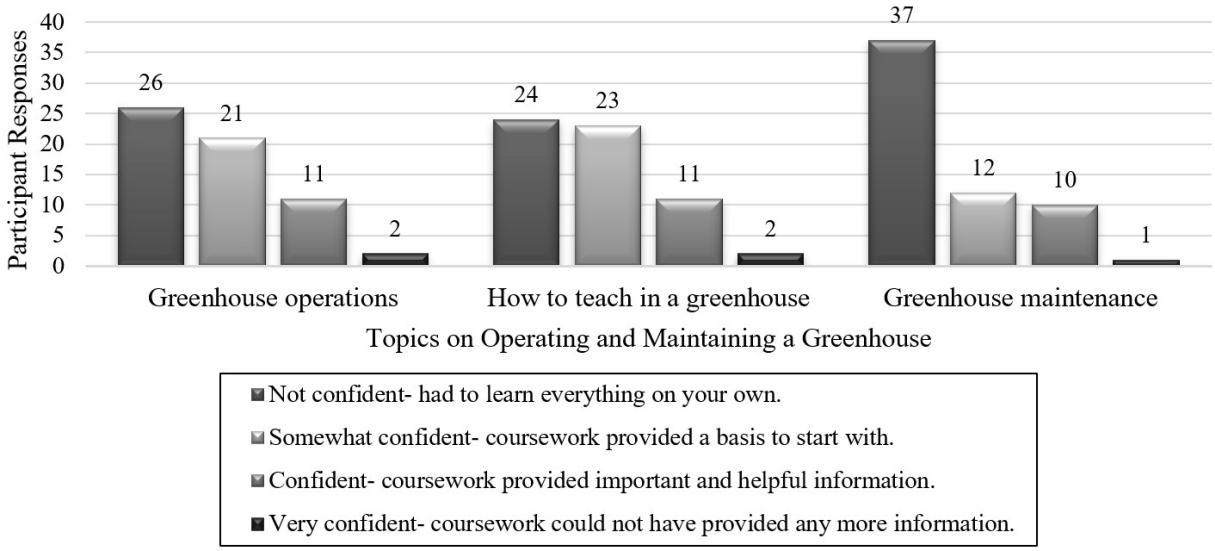


Figure 2.

Participant response to survey question: How confident are you with operating and maintaining a greenhouse based on bachelor level coursework you took? (N=60)



and supplemental resources.

The course was taught for the first time in Spring 2018 with 21 students. The course was granted a permanent course number and status, and was included in the Ag Ed student Plan of Study as a recommended course in 2019. Student feedback through course evaluation and student responses were positive. Course evaluations (where strongly agree=5, agree=4, undecided=3, disagree=2, strongly disagree=1) at the conclusion of the semester showed the students received the course well, where students indicated "I would rate the course as 4.9/5" (10/21 responding); and "this course builds my understanding of concepts and principles 4.8/5.0" (10/21 responding). Student anonymous feedback by notecards and early semester feedback at 5 weeks through the Center for Instructional Excellence, showed students perceived the course as helpful, appropriate and with an acceptable work load. Students created an online repository of the course content for themselves in a Google Drive® where they could access each other's lesson plans and course resources after the course was completed, assisting them in building their teaching portfolio.

Summary

Anecdotal information from feedback of practicing Ag Ed teachers led to an investigation as to the need for a course that better met the needs of pre-service Ag Ed students. The Ag Ed students plan of study called for one basic horticulture course, Introduction to Horticulture, and one course of advanced horticulture content. The course that most students selected for the second course was plant propagation. However, this specific two course combination met basic plant science standards, but missed

Table 3.

Course assignments and assessments developed for teaching of new greenhouse and landscape pre-service teacher undergraduate course.

	Assignments and Assessments
Teaching	
	Teaching resource development for Greenhouse Plants or Landscape Plants (50 pts) (e.g. create PowerPoint, Quizlet, Kahoot or some other appropriate/functional resource)
	Develop lesson for teaching propagation lab (50 pts)
	Develop lesson plan to teach an aspect of Landscape Design (50 pts)
	Practice teaching lesson with activity (25 pts)
	Reflection of classroom teaching lesson (25 pts)
Doing	
	Greenhouse Development Plan (50 pts) (Description of greenhouse to build including: size; heating/cooling system; irrigation system; benches, flooring type, doors, etc.; greenhouse supply resources, and growing a crop)
	Plant Propagation Lab Activities (25 pts)
	Landscape Design Plan (50 pts) (include site plan, design, plant placement and identification)
Assessments	
	Quizzes – Subject matter specific; 20 pts each (100 pts total)
	Weeks 3, 6, 9, 12, 15

many other standards in horticulture, landscape and greenhouse management. Thus, the results of the work described here to develop and build a course to address specific pre-service teacher needs resulted in a new 3 credit undergraduate course cross-listed in both Ag Ed and Horticulture. The course covered basic plant propagation, along with greenhouse management for approximately half a semester, and landscape design and management the other half of a semester. This provided some exposure to these topics, which practicing ag teachers identified as weaknesses in their teaching preparation. Since these topics could easily cover several semesters, the new course was planned to give students an introduction to the topic but equip them with resources and tools to fall back on once they were teaching these topics on their own.

The new course was specifically designed to include several different innovative instructional design techniques in the field of horticulture teaching (collaborative learning, hands on projects, teaching practice, and reflection). To support student learning in H/L, it was key to make learning hands on and interactive. Practice leads to mastery and students needed this aspect as much as the basic content that was covered in the course (Schunk and Usher, 2019; Seifert, 2004).

Students offered constructive comments and suggestions, which were incorporated in to future offerings of the course. For example, inclusion of landscape business topics, and landscape maintenance and installation equipment. Additionally, a better balance in assessments and assignments was suggested, such as two lesson plans instead of three, and including more reflection assignments. Two gaps the instructor observed to be addressed at the next course offering were the need for basic information on lesson development and learning how to appropriately critique microteaching assignments.

The partnership of the Ag Ed program with Horticulture led to a comprehensive course being developed that directly addressed preservice Ag Ed students' needs for learning Horticulture and Landscape. Since these topics are often being taught in secondary schools, teachers need knowledge and skills to be prepared to handle those classes. Albritton and Roberts (2020) revealed that horticulture skills are second on the list of agriculture technical skills needed by preservice teachers prior to their first teaching job. Greenhouse and Landscape Fundamentals for Educators was developed to specifically address this need. Early success indicate that the new course is meeting the goal and needs of preservice Ag Ed students.

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