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The Graduate Extension Scholars Program: Professional Development to Connect Research and Education

Abstract

The Graduate Extension Scholars program represents a novel approach that brings together graduate students, 4-H agents, and secondary agriculture teachers in an educational resource development project. We conducted process evaluation research based on program goals for the pilot implementation year using participant interviews and program artifacts. Program participants reported an overall positive experience and identified new programming and partnerships that would not have been possible without involvement in the program. Goals were enacted to varying degrees, with challenges occurring related to collaborative planning, educational module development, and building of partnerships between Extension and school-based educators. Recommendations for Extension program development are identified.

Keywords: 4-H, agricultural education, partnerships, collaboration, program development

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Introduction

The Cooperative Extension System provides access to cutting-edge scientific knowledge produced at land-grant universities (Seevers & Graham, 2012). However, given the shortage of qualified workers to fill science, technology, engineering, and math (STEM) jobs in the agriculture industry (STEM Food & Ag Council, 2014), the need remains to equip existing educators with knowledge of current scientific and technological advances in agriculture (National Research Council, 2009). Nimble structures must be in place to bridge the research-to-practice gap. This imperative applies in particular to youth educators (Hamilton, Chen, Pillemer, & Meador, 2013), who can be readied to address the emphasis on preparing youths for agriculture and STEM careers that currently exists in both 4-H programs and school-based agricultural education (SBAE) (Advance CTE, 2017; National 4-H Council, 2017). Additionally, 4-H and SBAE practitioners can benefit from opportunities to collaborate and share expertise (Murphrey, Harlin, & Rayfield, 2011; Seevers & Stair, 2015), such as opportunities provided by program models that serve both audiences simultaneously.

We propose that graduate students represent an untapped resource for expanding 4-H and SBAE practitioners' knowledge and developing new educational resources for youth agricultural programs. Graduate education of future scientists, however, is focused almost exclusively on developing disciplinary understanding of research and neglects training on translating and disseminating the results of research (Bagdonis & Dodd, 2010). In this article, we describe Graduate Extension Scholars (GES), a professional development program for graduate students that engages teams of graduate students, 4-H agents, and secondary agriculture teachers in collaborative educational resource development projects, and we present evaluation results for the pilot year of the program from the perspective of the 4-H and SBAE practitioners. Outcomes for graduate students are presented elsewhere (Wilk, 2016).

GES Program Goals

The four overarching goals that guide the GES program are as follows:

1. Educational modules should expose youths to emerging research in agriculture, which can simultaneously support STEM learning (Campbell, Wilkinson, & Shepherd, 2014; Stubbs & Myers, 2015).

2. Educational resource development work should be facilitated through the forging of scientist–practitioner partnerships that benefit all members and emphasize opportunities for sharing of expertise (National Research Council, 1996; Parke & Coble, 1997; Tanner, Chatman, & Allen, 2003).

3. Collaborative program planning should include attention to the influence of power relations, account for the interests of all stakeholders, and allow for negotiation as the central practical action (Cervero & Wilson, 2006).

4. Outcomes for program participants can be understood by viewing learning as situated in practice, not as a separate decontextualized activity (Lave, 1988).

Methods

The purpose of our study was to evaluate the pilot year implementation of the GES program. Evaluation methods should be aligned with a program's evolution phase (Duerden & Witt, 2012; Urban, Hargraves, & Trochim, 2014), and the GES program was in the initiation stage when our evaluation occurred. Therefore, we conducted a qualitative process evaluation focused on the experiences of participants and implementation of the program (Urban et al., 2014). We asked this: From the perspective of the educational partners, were the GES program goals enacted during the pilot implementation? If so, how? If not, why?

Participants in our study (n = 8) represented a purposeful sample, comprising all educational partners involved in the pilot program (three 4-H agents, four secondary agriculture teachers, one secondary biology teacher). Data sources included interviews and program artifacts (notes, planning documents, academic seminar syllabus, etc.) as recommended by Patton (2002). Participants were interviewed following the conclusion of the program. Interview questions addressed participants' experiences, expectations, relationships with other module development team members, and perceptions of the program's strengths and weaknesses.

Our analysis was guided by the constant comparative method (Glaser & Strauss, 1967). We coded interview transcripts using both deductive and inductive analysis (Miles, Huberman, & Saldana, 2014). Deductive (a priori) codes connected participants' statements to existing concepts in the literature related to the program's guiding principles. Inductive codes emerged during analysis, following Patton (2002), and described aspects of the participants' experiences that were not previously noted in the literature or were unique to the program studied. The analysis process, while iterative, was divided into two cycles as recommended by Miles et al. (2014). First, we focused on creating descriptive codes and developing analytic memos. Then, we identified patterns in the data to form categories. We used final codes and categories to address the evaluation question by comparing the program goals with codes and identifying areas of alignment and misalignment.

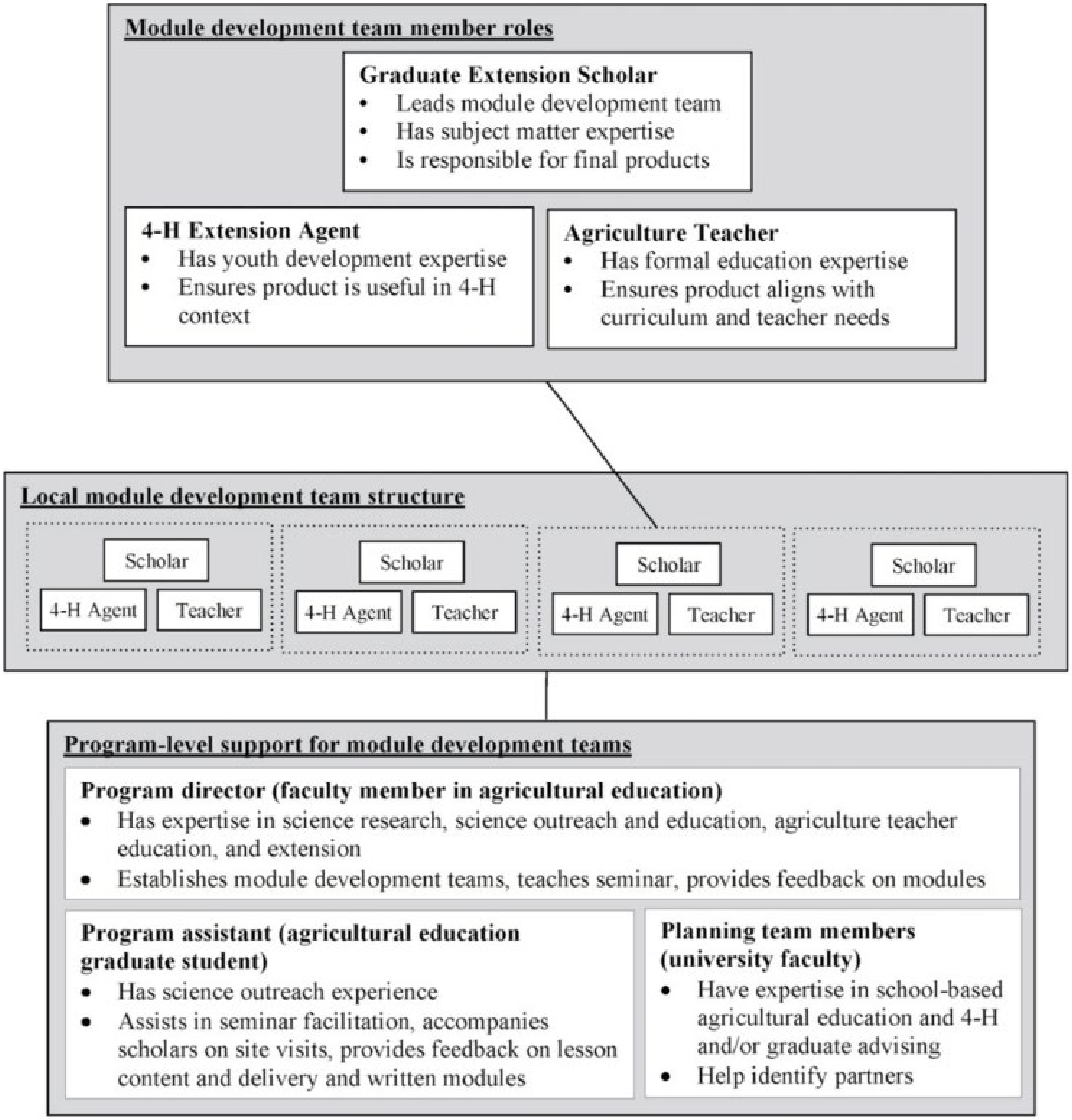
We addressed trustworthiness criteria following Lincoln and Guba (1985) and established credibility via triangulation of multiple data sources, member checking, and "prolonged engagement" and "persistent observation" by the GES program assistant responsible for data collection and analysis. The program assistant conducted an external audit of the findings to establish confirmability, and we provide thick description of the program itself and reporting of direct quotes from participants herein to establish transferability.

Description of the Program's Pilot Implementation

Module development teams were supported by a campus-based program director and program assistant (Figure 1). The program director developed the program structure, expectations for team members, and a seminar for the scholars, with input from a planning team of faculty. The program evolved during implementation through input from the scholars and educational partners. Each of these people played a particular role and provided unique expertise (Figure 1).

Figure 1.

Graduate Extension Scholars Program Structure, Roles, and Distribution of Expertise



In the semester-long program, each scholar-led team developed an educational module for youths that was based on the scholar's area of research and could be used in both nonformal and formal settings. The stages of this work are described in Table 1. The scholars also participated in a weekly seminar that addressed topics such as Extension and outreach program planning, working with educational professionals, and designing engaging learning activities.

Table 1.

Program Implementation Timeline: Module Development Phases, Activities, and Durations

Program phase and components	Activity description	Duration (weeks)
Orientation		1–2
Preprogram communications	Program director sent expectations documents to module development teams.	
Orientation meeting	Program director, program assistant, and module development team members participated in videoconference to discuss program and set expectations.	
Module planning		2–4
Planning meeting	Module development team members met face-to-face to brainstorm ideas regarding their module.	
Timeline establishment	Module development team members negotiated plan of work for team, with overall deadlines set by program director.	
Topic identification	Module development team members negotiated specific lesson topics according to needs of educational partners.	
Observational site visits	Scholar visited educational partners' sites 1–2 times to observe partners teaching (in both nonformal and formal settings).	
Module development		3–4
Development of and input on module	Scholar took primary responsibility for development of team's module, soliciting further input from (a) educational partners via email and during site visits, (b) peers during seminar, and (c) program director/assistant during one-on-one meetings.	
Module piloting		2–4
Instructional site visits	Scholar visited educational partners' sites 2–5 times to carry out instruction for each of the lessons; instruction occurred at 4-H club meetings (rarely) and in agricultural education classrooms.	
Feedback	Educational partners provided critical feedback to scholar regarding classroom materials and teaching strategy.	
Dissemination		2+

Writing	Scholars prepared modules for dissemination, with input from educational partners, program assistant, and program director.
Practitioner conference	Scholars participated in Virginia Association of Agricultural Educators professional development conference workshop.
Academic conferences	Scholars participated in North American Colleges and Teachers of Agriculture conference and disciplinary conferences.
Publication	Scholars developed peer-reviewed Extension publications (pending).

Findings

Did the Educational Modules Effectively Expose Youths to Emerging Research in Agriculture?

The educational partners reported that the modules pertained to current science and/or real-world agricultural problems but that they could have been more comprehensive (Table 2). All modules related to the scholars' areas of research, but to varying degrees across the teams. In one case, youths conducted an experiment on the school's land that supported the scholar's research. In two cases, the modules gave students hands-on experience with ideas central to the scholars' areas of study. In another case, the module leveraged the scholar's expertise to emphasize the use of cutting-edge lab equipment the school had recently acquired.

Table 2.
Category, Codes, and Quotes from Educational Partners About Educational Module Content

Codes	Representative quotes
Category: Perceptions of educational module content	
Strengths	
Connected to current science (4) Connected to real-world agricultural problems (6)* Engaging/hands-on (14)	"My hope was that we would not only gain training on some of the equipment that we have here in the STEM lab but be able to put that toward a . . . real-world application . . . on the school farm or in the greenhouse . . . I think we did that."
Areas for improvement	
Could have been more comprehensive (3) More background information needed (7)*	"[Youths] don't have the background that [the scholar] does. So, I think it's really important to make sure that they have the background information to begin with. And then you can run with it."

Could have included more sophisticated inquiry (7)*	"[A] mini replica of what [the scholars are] doing . . . I think that would be a good thing for us to do as part of the curriculum, too, is have a research component that's right here."

Note. Numbers in parentheses indicate frequencies of code occurrences. Asterisks indicate associations of representative quotes with codes. STEM = science, technology, engineering, and math.

What Benefits, if Any, Were Experienced by the Educational Partners?

The educational partners identified benefits of participation and suggestions for improvement related to expanding professional networks, meeting local community and program needs, and developing useful educational resources (Table 3).

Table 3.

Categories, Codes, and Quotes from Educational Partners About Benefits of the GES Program

Codes	Representative quotes
Category: Expanding professional networks	
New connections made	
Industry professionals (1) Programming partners (6) University resources/people (10)* Scholars' research advisor (8)	"[The] relationship [with the university] is expanding. We're networking more with people on staff there, and I think it's just going to provide more and more opportunity for us."
Missed opportunities	
Visits to campus labs and/or field sites (4)	"If the university will keep in mind what we want to do as far as being able to come down and see the different labs and that kind of thing . . . it's almost like the university needs like a high school liaison to coordinate these things."
Category: Meeting local community and program needs	
Strengths	
Program emphasized alignment with local needs (5)* Participation strengthened status of local program (9)	"I think to go out to the [agricultural education] programs, find a situation where there's a need for something to take place, and then to look back at [the university] and find the proper fit to help them proceed—I think that's the right

	combination."
Areas for improvement	
Concrete token of recognition (1)* More active marketing of program (2) Stronger connections with educational partner needs (9)	"I think if you're going to do a test plot . . . on the grounds of the school . . . [I] think it would be nice to have a sign . . . a big [university] logo, a big [high school] emblem over on the side and a big FFA emblem over in the corner. And the 4-H emblem . . . I think that gives it some credibility that it's not just . . . dirt."
Category: Usefulness of educational modules for local programs	
Strengths	
Useful materials (5) Broadly applicable material (5) Connected to course objective and/or state standards of learning (2)*	"The first unit of study for fifth graders is in the scientific method of 'what is a hypothesis?' and 'what are observations?' and 'how do you observe?' and 'what are dependent and independent variables?' . . . [the scholar] touched on all of those things . . . 'what is a control?' and he had a control in his experiment with the corn planted in flower pots. So . . . it fit right in."
Areas for improvement	
Stronger connections to course objective and/or state standards of learning (3) Modifications for different settings and learner characteristics (9)*	"This lesson, in a sense, may or may not work for high school students in an urban area because there's no [prior] knowledge going into this curriculum."

Note. Numbers in parentheses indicate frequencies of code occurrences. Asterisks indicate associations of representative quotes with codes. GES = Graduate Extension Scholars.

Were the Overall Program and the Educational Modules Planned Collaboratively?

The structure of the GES program resulted in two types of "planning tables" (Cervero & Wilson, 2006), one for the overall program and separate planning tables for the individual module development teams. For the overall program, the program director ultimately controlled program planning decisions, with input from the program planning team. Educational partners' perceptions of the program leadership and overall structure (Table 4) provide insight into how their involvement in the planning process could have improved their experience in the program. The work of the module development teams focused primarily on negotiation of interests as the lessons evolved. Educational partners discussed a range of personal experiences with the module development process that speak to the collaborative nature of their work and areas for improvement (Table 4).

Table 4.

Categories, Codes, and Quotes from Educational Partners About Program Planning

Codes	**Representative quotes**
Category: Program leadership and overall structure	
Strengths	
Leadership was flexible regarding ideas/trying new things (6) Leadership was supportive and available (13)*	"[The program director] is always excellent in timeliness and . . . communicating. So I think as far as her role in leading that part, she was excellent."
Areas for improvement/challenges	
Program director could have been more involved in site visits/observation (4) More sensitivity to educational partners' typical schedules and organizational cultures (6) Finding an appropriate audience/role for scholar in 4-H program (8) More training/preparation for educational partners (6) Goals and expectations could have been clearer (13)*	"Make sure that everyone's clear [on the structure and goals of the program], and also know the graduate student's goals, their background, what they're comfortable and not comfortable with so we can help educate them as well."
Category: Module team negotiation of lesson focus and content	
Strengths	
Team members were flexible regarding target audience/topic (4)* Scholar was responsive to educational partners' needs (1)	"This was new for everybody, so it was all in the flexibility of [figuring out] 'Well, what do we need to do? OK, that's not exactly where I had thought that would be but, let's do it anyway' . . . flexibility is the major thing."
Areas for improvement	
Curriculum was not used in 4-H program (5)*	"We didn't get a specific curriculum built . . . but some of my older 4-H kids that are also part of the FFA program . . . brought that information back to the club meetings."
Category: Module development process experiences	
Strengths	
Program emphasized collaborative	"I think [it] was great having [a scholar]

planning with educational partners (8)*	and all of the other folks involved to help us find out . . . or to give us direction on exactly what we needed to do."
Face-to-face planning/observation meetings were required (7)	
Team members communicated openly/regularly (2)	
Team members were flexible regarding scheduling (3)	
Structured opportunities to set goals/plan (2)	
Areas for improvement	
More sustained relationship between scholar and educational partners (5)	"The preliminary stuff could be done a little bit clearer so that the kids knew what the ultimate goal was from the get-go. I think that was probably one of the biggest issues. Not just the kids, but me as well; [I was wondering] 'OK, what are we doing today when you get here?' So that was kind of the biggest issue."
More communication between scholar and educational partner about lesson plans (4)*	
More communication needed between educational partners (6)	
Challenge with coordinating educational partners' schedules (13)	
4-H agent struggled to be involved (5)	
More structured meeting schedule set further in advance (10)	
More face-to-face planning meetings (4)	

Note. Numbers in parentheses indicate frequencies of code occurrences. Asterisks indicate associations of representative quotes with codes.

Notably, in most teams the 4-H agent struggled to be involved in the project, with the scholar and teacher taking primary responsibility for module development work. In three of the four cases, the modules were used only in the agricultural classroom and were not actively used in the 4-H program. Specific reasons for this situation discussed by participants included the following issues:

- lack of alignment between the scholar's research/module topic and the 4-H agent's programming agenda,
- limitations in 4-H agent schedules that prevented them from visiting the agriculture classrooms during the school day,
- limitations in the scholar's schedule that prevented him or her from attending afterschool 4-H activities, and
- insufficient advance notice and/or scheduling of meetings and site visits that prevented the 4-H agent from

participating.

What, if Any, Learning Outcomes Arose from the Educational Partners' Participation in the Program?

The educational partners discussed numerous learning outcomes that arose from their work with the scholars, such as new lessons and programming ideas (Table 5). They also described the program as a professional development opportunity for themselves and expressed interest in visiting the campus to learn more (Table 5).

Table 5.
Categories, Codes, and Quotes from Educational Partners About Opportunities for Situated Learning

Codes	**Representative quotes**
Category: Learning outcomes for partners	
Strengths	
Exposes teachers and 4-H agents to new curriculum and programming ideas (4) Puts educators in a better position to counsel youths on STEM career options (4)* Promotes exposure to new scientific information and skills (5) Promotes exposure to new teaching techniques (6)	"I got talking points for those older 4-H kids that are thinking about college or looking for career paths. You know, it's just one more thing that I can throw out there as a 'you could look into this' or 'you could talk to these people' or 'you know there's this department at [the university].'"
Category: Program as professional development opportunity	
Strengths	
Facilitates educator professional development (3) Provides educator with consultant for unfamiliar scientific information/tools (4)*	"Since I'm responsible somewhat for the land laboratory, I didn't want to go make a mess and have my name on it forever. I wanted to make sure that I have good viable information to work off of and to have some people behind me to say 'Hey this is going to work, this is going to be alright.'"
Missed opportunities	
Would have liked to visit scholars' lab/field site(s) (4)*	"We could go see the sequencing at the bioinformatics institute. Then we would have that experience in our background to bring to the students."

Note. Numbers in parentheses indicate frequencies of code occurrences. Asterisks indicate associations of representative quotes with codes. STEM = science, technology, engineering, and math.

Discussion and Conclusions

Our study provided a glimpse into the development of an innovative outreach program. Program participants reported an overall positive experience and identified new programming and partnerships that would not have been possible without their involvement.

Tanner et al. (2003) discussed the prevalence of "unidirectional" (p. 196) partnerships in which scientists solely provide their expertise, and Brown, Bokor, Crippen, and Koroly (2014) recommended scientist involvement beyond this role. The GES program "reverses" the traditional scientist–teacher partnership model, putting the responsibility for educational module development on scientists. Additionally, topics of the educational modules were negotiated within the development teams and often were somewhat removed from a scholar's research. The expectation that modules address the scholars' research area directly should be reevaluated for feasibility and/or more fully supported in subsequent program iterations. Templates and other external supports could help give direction to the module design (Voogt et al., 2011).

The program yielded mutually beneficial collaborative partnerships between scholars and educational partners, as reported for other scientist–teacher partnerships (Tanner et al., 2003). However, participants rarely discussed the occurrence of partnering between the educators on a module development team. These relationships need to be emphasized if benefits such as those suggested by Murphrey et al. (2011) are to be expected.

Some challenges that arose may be due to unavoidable practical and/or logistical issues; applying Cervero and Wilson's (2006) program planning theory, however, suggests that oversights in meeting specific needs of partners at a programmatic level also may be explained by imbalanced power relations. Educational partners were not initially part of the GES program planning team, and there were not structured opportunities for them to provide feedback until after the program concluded. At the level of the module development team, the lack of involvement of the 4-H agents in most cases is notable. Cervero and Wilson (2006) posited that negotiation is the central act in program planning and that bargaining is likely to occur in situations where there are both shared interests and interests that are incompatible. In this case, the interests of the different educational partners may have been in conflict due to existing structural and programmatic differences between 4-H and SBAE. Additionally, Seevers and Stair (2015) found that in-service training regarding how to collaborate with Extension agents or agricultural education teachers was lacking. Coaching the teams to be more intentional about involving the 4-H agent could help alleviate this situation.

The GES program model did not include formal educational opportunities for the partners; thus, it can be inferred that learning outcomes reported by GES program participants resulted from working on module development and implementation with the scholars in the program, as predicted by Lave (1988). Results indicate that this model provides a powerful learning opportunity for educational partners that equips them to better teach their youth program participants about emerging research and STEM-related careers in agriculture. This concept is consistent with previous work demonstrating that the GES program's explicit situated learning structure benefited the scholars (Wilk, 2016).

Recommendations for Practice

The findings from our study are specific to our case; however, our study shows promise for others who wish to implement a similar model. Our suggestions for Extension/outreach programs involving community- and school-based educators include the following recommendations:

- Begin with a strong theoretical or conceptual framework to guide program ideation and actions.
- Involve all stakeholders in the planning, reflective adaptation, and evaluation processes.
- Engage participants in creating learning opportunities that align with their professional goals and objectives.
- Allow sufficient time for module development teams to coalesce as functional teams.
- Coach module development teams to identify time and resource constraints and focus on what is possible.
- Develop training and support resources for educational partners.
- Start with clear expectations, benchmarks, and guidelines (e.g., templates and examples) for team processes, modules, and instructional delivery.

Author Note

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