Article

Training to Teach: Exploring the Feasibility of Service-Learning Projects to Prepare Undergraduate Learners to Be Community Health Educators

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Abstract: Undergraduate learners are ideal candidates for participation in service-learning projects, which allow learners to apply course concepts in a community setting where both the university and community benefit. In pre-health fields, undergraduate students can serve as teachers for concepts such as food literacy. This study examined whether a rigorous virtual professional development model would improve self-efficacy of undergraduate participants to teach food literacy to adolescents. A purposive sampling of participants (n = 12) from two universities participated in a yearlong virtual service-learning project and a community of practice professional development model. Tasks included virtual lesson modeling and virtual development of short, learner-centered activities for an adolescent food literacy curriculum. Informal interviews were conducted at the end of the academic year. Participants reported that the virtual service-learning project connected to their coursework, improved their confidence and professional communication, and was a safe space for growing their teaching practice. Findings were not generalizable due to the small n and purposive sampling, and participants were unable to teach adolescents during the pandemic. The service-learning project may be transferable to local health departments as there is a demonstrated need of alternative implementation models for health education interventions.

Keywords: service-learning project; undergraduate teaching; cross-age teaching; virtual internship; community of practice; professional development model; food literacy; health education delivery

1. Introduction

Evidence-based health programs are an integral tool to support population health and are often implemented by federally funded programs with limited staff and funds [1–4]. Efforts to broaden the reach of health intervention programs to serve more youth in schools have been met with countless challenges [4–8]. A central issue in successful diffusion of health programing in schools is the infrastructure of program delivery, which frequently relies on either a trained health educator or a classroom teacher [1,9–11]. Health educators achieve better student outcomes than trained classroom teachers due to deeper understanding of relevant subject matter [10–13]. Additionally, health educators serve as intermediaries between schools at the local level and institutions partnering to provide health programming [14,15].

Although health educators are the preferred choice for delivery, they are fewer in number and as such classroom teachers are the main source of health education in schools [1,9,10,16]. Unfortunately, classroom teachers experience extensive barriers to supporting health education, including limited time, lack of background knowledge, and low institutional support [1,4,8,11,16]. In response, research has identified alternative thought

partners to support health program dissemination; one such example is to utilize college level pre-health professionals in service-learning projects (SLP) [17–19]. University students in health-related fields are uniquely situated to fill the gap between health educators and classroom teachers, as they are gaining subject matter expertise while simultaneously seeking experience in their field to assist with future job acquisition post-graduation [20,21]. As SLP's cover a myriad of topics, undergraduate students can be recruited from a variety of majors and engage in many different kinds of work in the community [22]. Service learning projects designed around a teaching opportunity, in which undergraduate students synthesize their understanding of course topics through teaching peers or younger students in K-12 education, can provide students with opportunities to apply course knowledge and skills in community settings while improving their self-efficacy in a subject [22,23]. University faculty that integrate a training and teaching component to their SLPs promote the development of critical thinking, interpersonal, and leadership skills in undergraduate students, while improving confidence, comprehension of course topics, and self-efficacy [22–24].

An SLP can cover any subject that a faculty member chooses and be supported through different modalities (e.g., face-to-face, in-person, and hybrid) as long as there is a community application of knowledge and skills [25]. When considering subjects in the realm of health education that connect both to university course work and community health objectives, food literacy is an appropriate selection for college-level students in the field of health and nutrition [26]. Food literacy describes the intersection of knowledge, skills, and behaviors used to navigate a food environment and ensure diet quality throughout the lifespan [27]. Interventions on food literacy can improve short term dietary behaviors when they are delivered with opportunities to build knowledge and self-efficacy [28]. Evidence suggests that with scaffolded teacher training, evidence-based curriculum, and frequent opportunities for reflection, undergraduate students can successfully teach concepts like food literacy to the broader community, in roles parallel to community health educators [22,29,30].

This evidence prompted the exploration of evidence-based curricula and professional development models to support undergraduates in delivering programs that teach nutrition, cooking, physical activity, and other health-related subjects. In previous work, a two-tier cross-age teaching model was developed to support the delivery of a novel food literacy curriculum for adolescents: *Teens CAN: Comprehensive Food Literacy in Nutrition, Cooking, and Agriculture* (*Teens CAN*) [31]. This curriculum was developed utilizing the Social Cognitive Theory, Constructivism, and Backward Design and resulted in 12 experiential lessons and application activities in the three main components of food literacy: agriculture, nutrition, and cooking [31]. The two-tiered model describes the levels of health education implementation: first, undergraduate students participated in the lesson study model and communities of practice (CoP) during a semester-long virtual training about food literacy and experiential education with *Teens CAN*, then the undergraduate students taught *Teens CAN* to adolescent (e.g., high school age teens) students in the community. Once adolescents were educated about food literacy, they trained alongside the undergraduates to serve in the role of teen teachers of garden-enhanced nutrition education for youth (e.g., primary school students) in their community.

Two-tier cross age teaching is unique in that it provides a structured environment to increase knowledge related to food literacy while offering opportunities to apply knowledge and subsequently increase self-efficacy through teaching [26,28]. In order for the two-tier model to be successful as an SLP, a structured professional development model (PDM) with opportunities for reflection is required [30–33]. A frequent component of professional development is Communities of Practice (CoP) [34,35]. In a CoP, participants meet regularly and share successes and challenges related to a goal, and the group troubleshoots and advances their teaching practice together throughout the program [34]. The core strategies of CoPs include a shared goal, a community of learners, and practice over a period of time with sharing of resources, knowledge, and experiences [35].

In health education with classroom teachers, the likelihood of sustained program delivery is highly dependent on a teacher's self-efficacy to teach the subject [4,8]. Self-efficacy is often selected as an outcome as it can be a metric used as a predictor of success both in SLPs and other projects with a focus on peer teaching [21]. Self-efficacy is reliant upon confidence and pedagogical content knowledge which is developed in teacher trainings through two phases: the development phase and class enactment phase [36]. In the development phase, teachers review unfamiliar pedagogies, discuss them with peers, and integrate them into their plans for practice [36]. In the class enactment phase, teachers directly observe whether learners are achieving the objectives of the new materials [36]. Although significant gains in pedagogical content knowledge can be obtained through participation in the development phase, the combination of participation in both the development and the class enactment phase solidifies understanding and allows the teacher to internalize the knowledge and beliefs, resulting in improved self-efficacy [36].

The aim of this study was to increase undergraduate students' self-efficacy to teach nutrition, cooking, and agriculture after participating in the yearlong virtual food literacy SLP supported by a tailored PDM with the larger, post-pandemic goal to create an efficacious, applicable experiential learning for pre-health professionals.

2. Materials and Methods

A purposive convenience sample of undergraduate students (*n* = 6 from each campus) at two large Northern California universities [San Francisco State University (SF State) and University of California, Davis (UC Davis)] were selected for this study to explore the feasibility of the two-tier teaching model. The small *n* was selected to correspond with the number of lessons in the curriculum and allow participants to develop strong relationships in the CoP despite the virtual environment of the SLP. The two universities were selected because the researchers had faculty connections in each college that enabled course credit to be offered for participants enrolling in the virtual SLP. Additionally, the partnership allowed the researchers at both universities to conduct the same two-tiered teaching model with undergraduates in two different universities and corresponding high school populations. The sampling criteria were as follows: upper-division standing to ensure adequate exposure to major-related topics, and health or science-related major designation. Participants (*n* = 12) were junior and senior students majoring in dietetics and nutrition science, foods and community nutrition, family and consumer sciences, pre-nursing, and food science. Population demographics of the university students are described in Table 1. Because of the small *n*, statistics for the entire university are shared.

Table 1. Undergraduate students enrolled at SF State and UC Davis in the 2020–2021 academic years. (SF State, n.d.; UC Davis, n.d.).

University	Race and/or Ethnicity	Percent of Student Body
San Francisco State University (*n* = 26,438); average age 22 yo; Female 56.8% Male 43.2%	Chicano/a/x or Mexican American	26.8%
	Latino/a/x	11.5%
	Asian	30.2%
	White	18.4%
	Multiracial (students self-identify with 2 or more)	6.4%
	Black or African American	6%
	Native Hawaiian or Other Pacific Islanders	0.5%
	American Indian or Alaska Native	0.2%
University of California, Davis (*n* = 30,982); average age: 21 yo; Female 61% Male 49%	Hispanic	23%
	Asian or Pacific Islander	32%
	White	23%
	Black or African American	4%
	American Indian or Alaska Native	0.5%
	Unknown	2%

As this portion of the study was conducted through SF State, all materials and methods were approved by their Institutional Review Board at San Francisco State University as an exempt study. Participants were recruited via a flyer sent by department listservs that included a link to a researcher's email where interested students could provide a resume and their contact information for a follow-up interview. Participants were asked to present virtually for three minutes on a subject of their choosing. Those that followed the teaching brief and could commit to three hours of professional development and instruction were selected and enrolled in a two-semester virtual research internship course (FCS 699, 6 units; NUT 130, 6 units) for the 2020–2021 academic year.

The professional development model (PDM) utilized in the SLP was adapted from a systematically developed PDM that utilized the lesson study model to support educators participating in the evidence-based, multicomponent intervention, the Shaping Healthy Choices Program, described elsewhere [6,33]. In this PDM, CoPs were created to establish an environment of learning and reflection for participants with the goal of improving teaching skills and self-efficacy related to experiential education and food literacy. The lesson study model utilized in the CoP includes specific career development, curriculum activities, and reflective practice through use of the plus/delta feedback form in Supplement S1 [8]. This model has been used in other studies to improve self-efficacy, use of inquiry-style teaching strategies, and content knowledge for classroom educators [8].

Over the course of eight weeks, participants attended a virtual training on experiential learning, Constructivist Theory, the Social-Ecological Model, inquiry-style education, and participated in activities designed to improve their understanding of curriculum development. They also participated in every lesson from *Teens CAN* through short, virtual education compiled in the virtual learning activity platform Nearpod (Nearpod, Inc., Aventura, FL, USA), the virtual video quiz platform EdPuzzle (EdPuzzle, Inc., San Francisco, CA, USA) and the animated video platform Biteable (Biteable, Hobart, AU, USA). These activities were 10–15 min in length and had two objectives: to provide the undergraduates with some first-hand experience with the curriculum materials and to familiarize them with the capabilities of virtual learning platforms.

After the main content overview, participants developed a 10–15 min virtual lessons that could supplement the *Teens CAN* curriculum or stand alone.

Table 2 outlines the roles for participants throughout the iterative online lesson development. In the first round, undergraduate participants presented their ideas and their peers provided comments and suggestions about which ideas they preferred. This set the tone that participation in the CoP was expected from all, and that each voice was valued and imperative to the development of a diverse set of activities [37]. Once a learning objective was selected, the participants followed the Backwards Design approach to develop an activity [38]. In the second presentation, the lesson reviewer presented a peer's activity to the full group. This allowed the lead lesson developer to observe the activity and determine if their directions were clear enough to be followed with fidelity to achieve the learning objective [28,38,39]. Lastly, the final presentations were delivered by the lesson author and submitted. By the end of the project, all 12 activities were revised to achieve their intended learning objectives, allowing researchers to determine that the overarching goals of the project were met [38].

At the end of the semester, participants turned in the following materials for their online activity: procedure, directions for how to log in to the learning platform of their choosing, lesson materials (Google slide decks, worksheets, games on PowerPoint slides, Nearpod activities, etc.), and their completed Remote Learning Internship Grading and Feedback document (Supplement S2). Informal interviews were held at the end of the project with the SF State and UC Davis undergraduates (Supplement S3). Interviews were transcribed and analyzed using Hatch's model for inductive analysis [40].

Table 2. Remote Learning SLP Role Expectations.

Virtual Lesson Development	Objective	Roll of Lesson Lead and Reviewer	Follow Up Work
Presentation One	Lesson Lead shares rough draft of lesson idea that is based off a learning objective identified in their assigned lesson from *Teens CAN*	Lesson Lead delivers lesson to CoP. Lesson Reviewer records suggestions from group and enter into Plus/Delta survey	Lesson Lead and Reviewer complete plus/delta through Qualtrics within 24 h
Presentation Two	Lesson Lead experiences their lesson implemented by Reviewer	Lesson Lead takes notes on procedure during Reviewer implementation. Gain perspective of participant. Lesson Reviewer implements the Lead's lesson with fidelity, without asking for clarification from Lead	Lesson Lead makes edits to procedure depending on level of learning objective achievement, participant engagement, etc. Lesson Lead and Reviewer complete plus/delta through Qualtrics and insert comments on lesson procedure
Presentation Three	Lesson Lead shares final draft of lesson with CoP	Lesson Lead delivers lesson to CoP. Lesson Reviewer records suggestions from group and enter into Plus/Delta survey	Lesson Lead integrates any final edits and turns in final product. Lesson Lead and Reviewer complete plus/delta through Qualtrics

3. Results

Throughout the adaptation process, the researchers supported the hallmarks of a CoP environment, in which participants were encouraged to leave their cameras on during virtual meetings, share their thoughts with the group, and provide constructive feedback to improve their peers' lessons through plus/delta feedback forms [7,8]. The researchers also provided reflections and suggestions on the Remote Learning Internship Grading and Feedback document (Supplement S2), which was designed to regularly engage the participants in the reflection process for their own activity. Attendance was 100% for all 25 meetings (Table 3).

Table 3. SLP Schedule and Attendance.

University and Site	Number of Participants Recruited	Number of Meeting Days per Week	Total Number of Meetings	Attendance
SF State & UCD Virtual SLP	12	1	25	100%

Regarding the interview transcriptions, four predetermined domains were set based on a review of literature pertaining to cross-age teaching in the undergraduate population, SLPs, and teacher training. Emergent themes were identified utilizing the constant comparison method [40–42]. Two researchers with no prior relationship to the project were recruited and provided a sample script to code, and results were cross-referenced with a master coded script to ensure consistency and reliability of results. One novel domain emerged, and the four predetermined domains were modified to three to reflect the findings: Connections between the SLP and Course of Study, Impacts of the Professional Development Model, and Novelty of the Virtual SLP Experience. Table 4 describes the three domains and the subsequent themes that emerged:

Participants reported that the food literacy SLP improved their confidence in professional collaboration and communication. Participants also reported that they applied their improved skills in communication, collaboration, and feedback in other courses, and that the SLP was a novel experience that prepared them for job acquisition post-graduation.

Table 4. Domains, themes, and illustrative quotes from the Science for Life SLP.

Domain	Theme	Illustrative Quote
Connections between SLP and Course of Study	Theme 1: SLP supported future goals and job plans (code appeared thirteen times).	"For me personally, it was the aspect that we're teaching on a different platform that really attracted me just because it added to like my adaptability skills on how to apply my knowledge in different formats."
	Theme 2: SLP connected to course knowledge in nutrition and education (code appeared eight times).	"As someone that's going to go into the education field and apply to the teaching credential program soon, I think this internship fit perfectly into the realm of education and the type of education I wanted to teach in the high school setting. The opportunity to be able to teach online and facilitate and learn how to use technology teaching in the classroom online is a great skill, especially for future circumstances. Being able to interact online and learn how to use Zoom and everything was very helpful."
	Theme 3: Participants incorporated what they learned in different courses (code appeared three times).	"This internship helped me a lot for like nutrition counseling and then everything else, like regarding our online enhancements really helped me for anything that I did in my current semester. It helped me like, I don't know, communicate with my group members for all these different nutrition projects we were doing. I had a lot more to say like as far as feedback went. I just felt more involved, just because from this internship I was doing a lot of feedback, so I felt like I had a lot more to contribute to all my other nutrition projects too."
Impacts of the Professional Development Model	Theme 1: Participants built professional skills in collaboration and communication (code appeared ten times).	"As we learn more concepts, more complicated concepts in our fields, it can be difficult, sometimes to then go back and communicate in a less complex way. I think I still applied the more complex things to this internship in a more digestible way for high schoolers so I was able to kind of like learn how to convert those complicated things I'm learning about now into a curriculum for high school."
	Theme 2: Participants valued the focus on collaboration within the SLP (code appeared fifteen times).	"I feel like many times with let's say like a group project for class everyone gets assigned a role, your part you're just doing whatever you can to get the project done and to get the grade. Whereas in this internship I feel like we were all collaborating in the best interest of each other so when we would critique each other's online enhancements we all were really working to think of critiques to better the enhancement . . . and learning a lot and growing like as students."
	Theme 3: Participants expressed that the feedback model (plus/deltas) was helpful (code appeared nine times).	"I feel like this internship really helped me on how to not be offended and take constructive feedback and I think I'm really going to apply that to my future career and even just giving other feedback to others too, I think that it's opened up a part of me where I'm going to feel comfortable enough to say what I think could be improved in an environment, rather than just like mentally saying it to myself."

Table 4. *Cont.*

Domain	Theme	Illustrative Quote
Novelty of Virtual SLP Experience	Theme 1: Participants described the iterative process of lesson development as unlike anything they had done in college before (code appeared seven times).	"I really liked seeing like the whole process of how like the lesson plan and stuff came about and, like, I have a lot more respect for teachers and facilitators and having to go through this process. I really liked how a lot of our original ideas like changed so much because of the feedback and everything that we received and like having to implement all those changes and, like our lesson ideas could have like our final idea could have been completely different from what we originally developed, and that was like really cool."
	Theme 2: Community of Practice model made the SLP a safe space for growth and learning (code appeared six times).	"I really liked the how we were able to learn from each other. I liked how it was a really safe environment and just a positive reinforcement of like self-growth within the whole process. We started from scratch, that's really what it was, and you know you look at where we all came from now. I learned a lot from everyone's online enhancement, so I really enjoyed everything."
	Theme 3: Mentorship from SLP leaders was valued (code appeared four times).	"I really appreciated that this internship was both a project that we worked on together, but it also served kind of like a mentorship. What really helped me was that I was put in contact with someone in my field of study and we've been in touch and that was super helpful because as young undergrads we're still learning the art of networking and things like that."
	Theme 4: Remote learning opportunities were attractive to participants (code appeared four times).	"I am interested in going into education and interested in nutrition education, specifically, so it seemed like a good fit and good experience. And especially since it was online and we were in the middle of COVID, it seemed like really good experience and it was a really good experience for teaching online, which is probably going to be, you know, more common in the future, so hopefully that will help me with my education career."

Participants described the safety of the learning environment and level of collaboration and feedback between peers was a new experience that helped them feel comfortable throughout the iterative development process. The participants reported that the plus/delta feedback (Supplement S1) was pivotal in the development of both their ability to provide and accept constructive criticism. Each participant expressed that they had never experienced a project in the college setting that they could come back to again and again to improve.

Despite the challenges presented by the sudden and persistent environment of virtual learning due to the COVID pandemic, the undergraduate participants responded with overwhelming enthusiasm that the SLP supported their future goals and allowed them to apply their knowledge of nutrition from other courses. Participants detailed that, although they had encountered parts of the subject before in their coursework, the unique combination of inquiry-style food literacy lessons and virtual teaching components allowed them to engage with the material in new ways and strengthen their skills in communicating food literacy concepts to the general public and potential future patients or clientele.

Although there was no opportunity to pilot test the lesson enhancements before the end of the academic year due to COVID pandemic-related restrictions resulting in no true community application of the course concepts in the SLP to the community, undergraduate participants said the SLP was a unique opportunity to explore work in nutrition, education, and the professional working environment.

4. Discussion

Participation in the SLP resulted in improvement of self-confidence, skills of collaboration, and professional communication for undergraduate participants in the virtual education setting. The SLP was successful in providing undergraduate participants opportunities to apply course concepts and supported achievement of professional goals, which laid the pedagogical groundwork for future use of the SLP in the community. The iterative project development and requirement of collaboration was highly valued as a transferrable skill to other class and professional environments. Clear expectations and strong leadership structure in the SLP gave participants a supportive space to build their communication skills in constructive criticism and professionalism. Additionally, participants valued the broad exposure they had to virtual teaching platforms and technology, noting that it was highly relevant in the current professional climate.

Thoughtful development of SLPs that offer opportunities for participants to apply course knowledge improves real-world application of skills [20,22]. The clear structure of the program helped set expectations, which is key to positive outcomes of high satisfaction among undergraduates participating in SLPs [30]. The frequent revision required for lesson development allowed undergraduate participants to deepen their understanding of the process [37].

The virtual project offered a remote learning opportunity in a time where over 50% of in-person internship opportunities across the nation were cancelled [43]. Internships have historically been inaccessible to low-income students and students that live far from campus or businesses because travelling, working for free, and scheduling can pose obstacles [43,44]. The migration to remote learning offers a more equitable opportunity for students that typically cannot access these opportunities [43]. The development of online materials improved the accessibility for the *Teens CAN* curriculum, as the online enhancements are shorter and engage learners on a variety of learning platforms that are all free for use.

Throughout the PDM, opportunities to build skills and confidence were scaffolded to increase the likelihood of building undergraduate self-efficacy [21]. Although the participants did not enter the class enactment phase, and thus were unable to apply their learning directly in the community setting, the internal piloting of the virtual lessons and robust feedback from peers in the CoP mimicked the environment of true implementation and provided participants with a chance to build self-efficacy through peer teaching, which is a preemptive training step to working in the community for similar SLP designs [22].

A trend in teacher self-efficacy has been observed, in which self-efficacy starts higher during the initial training period, prior to implementation [6]. During the first semester of virtual training, the undergraduate participants had opportunities to peer teach (mastery experience), observe other peers teach (vicarious experience), and receive positive feedback from instructors (social persuasion) [21]. After the initial training period (spring semester), undergraduates are more likely to experience a decrease in self-efficacy as they experience challenges in their initial teaching experiences, with levels stabilizing once they have enough experiences to achieve mastery [21]. This was observed throughout the lesson development and teaching process, as the undergraduates worked through their challenges and found their unique teaching voice, feeling more capable and confident by the end of the SLP. Although participants were able to engage in the class enactment phase with their peers, the evidence gathered was not sufficient to suggest changes in knowledge and beliefs pertaining to teaching.

Although the small *n* was an intentional decision by researchers to provide each participant with a lesson to teach, it is a limitation of the study and subsequent findings. While the purposive convenience sampling does not allow for generalizability, the program does lend itself to transferability with local health departments, Supplemental Nutrition Assistance Program—Education (SNAP-Ed), and Cooperative Extension professionals due to the demonstrated need of alternative implementation models for health education interventions [4]. The PDM for undergraduates can be modified to support any number of curricula, dependent on undergraduate course objectives and the community partner. This

framework allows the university to be flexible to the needs of the community, which is an integral part of the reciprocal relationship between the community and the university [30]. Thoughtful SLP development is key to ensuring all partners benefit, and strong leadership is critical to supporting undergraduates in their professional development and reflection on experiences in the community [32]. Without proper SLP structure to encourage frequent reflection on experiences, undergraduate participants are less likely to feel they gained anything from the experience [30], thus this model indicates that the SLP with a strong PDM foundation can be an effective way to mediate the barriers of community education.

This was a novel SLP for both universities, as courses and SLP opportunities related to food literacy are uncommon in university settings [41]. Although the sample chosen for this study comprised students studying nutrition and dietetics, food literacy education can be beneficial for all college students because they experience higher rates of food insecurity, especially during the pandemic [42]. The exposure to concepts around dietary resilience may benefit them, as dietary resilience specifically builds an individual's ability to maintain a quality eating pattern despite changes in environment and lifestyle [27].

Further pilot testing is needed to determine if the SLP is successful in improving undergraduate self-efficacy to teach food literacy. The researchers recommend that future studies utilizing a two-tiered cross-age teaching model as was originally intended incorporate a planning period of six months to one year to ensure proper recruitment and onboarding of participating universities, professors, high schools, and elementary schools. The intermediary between the university and school partners should ideally be a funded position to ensure the significant administrative effort to support the SLP can be sustained [14]. Although there were many challenges, the researchers believe the SLP model to be a valuable framework to develop undergraduate's knowledge and skills to support health education within their communities. Future studies should retest the SLP model with cross-age teaching opportunities conducted in the classroom to ensure the class enactment phase of the lesson study model is completed and teacher self-efficacy can be achieved.

Because in the United States, nutrition education is not mandated and infrastructure support for health education positions that serve physical activity, physical education, and nutrition are the exception and not the rule [1,4,11,16,45], focusing on programs such as SLP that support the classroom that can support schools while not requiring extra time commitment from teachers are imperative for sustainable, impactful change.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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