

Engagement in Practice: Maximizing the Impact of Service-learning Activities Through Collaboration with K–12 Educators

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Abstract:

A team at University of Illinois Urbana-Champaign (UIUC) has been working with local schools and community partners to deliver service-learning STEM activities for K–12 students since 2020. These activities were developed by graduate students in engineering with guidance from engineering faculty members, an outreach specialist, and an education specialist. It has been a challenge to interact with K–12 educators as part of the development process, largely due to educators' reluctance of taking on more work on top of their already heavy workload during the regular school year. To address this issue, the team offered a paid summer workshop to engage them to provide feedback on the current process of developing and delivering service-learning activities. More than twenty-five educators applied after recruitment emails were sent to local school district contacts. In July 2022, a one-day workshop was held at UIUC with a group of fifteen K–12 educators from twelve different local schools, ranging from pre-K to high school. After the initial introduction, workshop participants were divided into five groups based on their teaching role and grade level. A human-centered design approach was then used to guide a series of group activities, which focused mainly on connecting all stakeholders to create better support between service-learning project developers (university students) and receivers (K–12 students). Lessons learned from the summer workshop include: (1) having a long-term (3–5 years) commitment for partnership between local schools and UIUC is highly desired and (2) having university students conduct observations at K–12 classrooms before starting the service-learning project would build trust and mutual understanding between the two sides. For the next steps, the team started classroom observations with three workshop participants during the current academic year and plans to engage more units within the university to ensure a lasting service-learning partnership with local schools.

1. Introduction

1.1 Background and Motivation

Since 2016, an instructional team at UIUC has been offering a teaching and leadership course for engineering graduate students, which provides both pedagogical and professional development opportunities to first-time graduate teaching assistants (GTAs). With instructional modality suddenly switched to online during the COVID pandemic, instructors of the course sympathized greatly with their K–12 counterparts and conceived an idea to provide help by creating supplementary STEM content for local K–12 schools. In Fall 2020, the instructional team reached out to a local middle school and developed a plan for collaboration. The middle school would provide a list of STEM topics for which new content would be beneficial, and the university team would create an optional service-learning project for the GTAs in the teaching and leadership course to design a learning module for one of the topics that could then be used by a STEM teacher. From Fall 2020 to Spring 2021, a total of 20 GTAs participated in the service-learning project, and 9 STEM modules were shared with the middle school via cloud storage.

Recognizing the potential to impact additional K–12 students, we formed a multi-disciplinary service-learning team with two instructors from the teaching and leadership course, a faculty member from another engineering unit, an education specialist, and a media specialist. Through a campus-level outreach unit, we connected with 4 local community partners (2 elementary schools,

and 2 organizations serving K–12 students) during Academic Year 2021–2022. Thirty-five GTAs participated in the service-learning project, and 13 STEM modules were delivered via various methods (cloud storage, Zoom, or in-person visit) (Chen et al., 2022). Modules are similar in format to those published on the TeachEngineering Digital Library (<https://www.teachengineering.org/>). One of the modules – Surface Tension in Water has been presented twice to different community partners. Evidence of engagement in our service-learning activities can be found on our website (<https://publish.illinois.edu/service-learning/>).

As we reflected on the experience of expanding our service-learning effort, one important stakeholder that has been absent so far is K–12 educators. Although we have partnered with several local schools, direct contact has always been with the administrators. In order to produce STEM modules that fit the needs of K–12 students in their classrooms, we believe it is of paramount importance to work alongside teachers. Based on feedback from those who had worked with K–12 educators previously, we decided to offer a paid one-day summer workshop on the campus of UIUC to engage and begin developing relationships with local educators.

1.2 Participant Recruitment

A recruitment flyer was developed to provide details on benefits of participation: up to a \$600 stipend (pending their level of participation), lunch, free parking, and an opportunity to build relationships for continued partnership. It was sent to local school district contacts two months before the scheduled workshop. Three weeks before the workshop, only three teachers had applied. With the goal of having at least 10 workshop participants, we reached out to two outreach specialists within the college of engineering and asked them to help spread the word. They shared the flyer with teachers with whom they had previously worked, and we soon received 22 additional applications with applicants from 15 different local schools and teaching grade levels from pre-K to high school. Due to cost and the concern of moderating interaction during the workshop, we decided to set the capacity limit to 15 (2 high school science teachers, 1 high school Advancement Via Individual Determination (AVID) teacher, 2 elementary school principals, 9 elementary school general education teachers, and 1 pre-K teacher). We accepted applicants on a first-come-first-served basis and notified those who were not selected this time that they will be placed on a waiting list and will receive priority if the workshop is offered again. In addition, we were able to work with the office for teacher accreditation at our university to designate the workshop as a professional development activity so that participants would also earn professional development hours.

2. Summer Workshop

2.1 Agenda

The summer workshop agenda is shown Table 1. To account for travel to and from the workshop, it started at 8:30 am in the morning with check-in and breakfast, and it ended at 2 pm. Each member of our team gave a brief self-introduction followed by an icebreaker activity to start conversations between participants and allow our team to get to know them. Participants were then grouped into five “cohorts” based on teaching role and grade level, and this activity allowed participants to relax and begin engaging with each other thus setting the stage for subsequent cohort-based activities. An overview of the service-learning project was presented by our team’s principal investigator (PI) with specific examples of our past and current engagements with local schools. Then, our education specialist introduced the idea of human-centered design (the method that would be used

to facilitate this workshop) with several real-life examples. The remaining time was reserved for cohort breakout sessions, in which participants in their cohorts would use human-centered design principles to (1) understand the challenge of a partnership on implementing service-learning between the university and their K–12 counterparts, (2) identify partnership opportunities, and (3) brainstorm ideas to seize such opportunities.

Table. 1 Summer Workshop Agenda

8:30am	Check-in and Continental Breakfast
9:00am	Official Introduction and Icebreaker
9:30am	Vision of the Service-Learning Project
9:45am	Human-Centered Design and Its Applications
10:15am	Cohort Breakout Sessions
12:00pm	Lunch
1:00pm	Ideation of Future Partnerships
2:00pm	End of Workshop

2.2 Human-Centered Design Approach & Description of Cohort Activities

Human-Centered Design (HCD) is a creative problem-solving approach that uses design thinking methods and tools to understand the unmet needs of a population in order to collaboratively and iteratively develop solutions (Brown, 2008). When designers use HCD, they put humans at the center of the design processes (Zhang & Dong, 2008). They empathize and collaborate with all direct stakeholders and try to identify their needs and figure out design opportunities to meet those needs (Brown & Katz, 2011). Then, designers rely on iterative cycles where they engage the stakeholders in prototyping and evaluation until they reach a final design (Brown, 2008).

Additionally, HCD offers individuals a flexible structure that can foster the processes of solving complex challenges (Buchanan, 1992) and generate relevant and innovative solutions (Meinel et al., 2020). In the summer workshop, we wanted our participants to use HCD to address the challenge of designing a service-learning ecosystem that is composed of university faculty and students and local K–12 schools’ administrators, teachers, and students. To do so, we engaged our 15 participants in three collaborative activities.

The first activity aimed at helping the participants better **understand the challenge**. Participants were asked to individually reflect on questions such as “why do you think you may need to partner or collaborate with a university faculty member?”; “what does an ideal partnership look like?”; and “how could you see this partnership failing to meet your needs?”. Then, members of the same cohort were asked to share and discuss their thoughts and write summary blurbs on post-it notes or directly on large dry erase boards at each cohort station. At the end of this activity, each cohort was asked to present their thoughts. As the participants shared their thoughts, one of our team members documented key thoughts per cohort and highlighted commonalities and patterns.

The second activity aimed at helping the participants **define partnership opportunities**. Our note taking team member then shared the common ideas and patterns identified in the first activity with the cohorts, and we described characteristics of good “How Might We” questions before asking

each cohort to use these key themes to generate three “How Might We” (HMW) questions that point at a design opportunity.

The third activity aimed at helping the participants **generate ideas to seize the defined opportunities**. First, we shared with the cohorts seven brainstorming rules: (1) defer judgement, (2) encourage wild ideas, (3) build on the ideas of others, (4) stay focused on the topic, (5) one conversation at a time, (6) be visual, and (7) go for quantity (IDEO, 2015). Then, we asked each cohort to select their favorite HMW question and discuss possible strategies to answer the selected question. Figure 1 shows the synthesis board from the activity; key insights from each group are in the middle column, and actions to solve the HMW questions are in the far-right column (only completed for one cohort at the time this picture was taken).

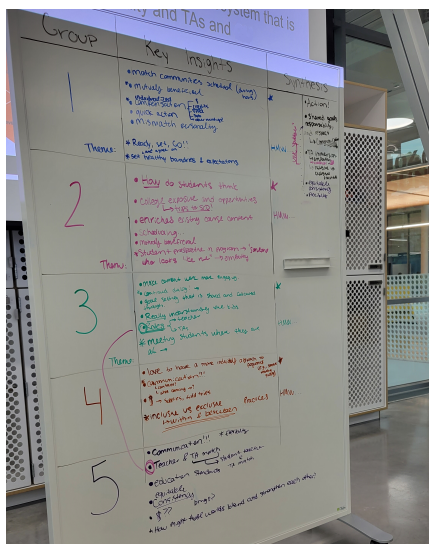


Figure 1. Key insights and synthesis organized by workshop cohorts.

2.3 Summary of Findings and Lessons Learned

The cohorts selected different HMW questions and proposed many answers to these questions. All answers were based off the need to (1) have a long-term (3–5 years) commitment for partnership between local schools and UIUC and (2) connect with and include teachers before starting any service-learning projects so both sides of any project can build trust and mutual understanding. These answers included (1) building a platform to connect all stakeholders, (2) offering paid, professional development opportunities to K–12 teachers for their participation in the partnership, (3) creating field trip opportunities to bring K-12 students and teachers to the UIUC campus, and (4) arranging pre-teaching visits to K–12 classrooms with GTAs and engaging K–12 teachers in the design process of the service-learning activities.

Through speaking with participants during the activities as well as more casually during lunch, we learned of other items to consider when developing partnerships with local schools and teachers. Teachers feel overworked, and many outreach activity partners try to schedule meetings after school, which is not during the teacher’s normal working hours. Teachers are excited to engage in development of activities (as they know their students the best) but would prefer to interact during their working hours (typically, 7 am – 3pm) and be compensated for the partnership, as it is not in their normal job duties. Another interesting item, which may be specific to our area, is two adjacent

school districts, although equally close to the university, have different levels of interaction with the university to the point one teacher mentioned that [undisclosed name] school district felt “left out” and missed opportunities for their students to engage with the university. Additionally, teacher salaries in [undisclosed name] school district are drastically lower than in the adjacent school district with one teacher having just moved districts to earn a significantly higher salary. Also, teachers indicated they were expected to deliver the curriculum exactly as it is presented even though they realize learning styles/rates of their students are different; they felt that their knowledge of how students learn was not being fully utilized in support of student success. Therefore, there is hope with their excitement for contributing to these outreach efforts that the activities will better reach all students.

Following the workshop, a post-survey was sent to workshop participants to solicit their feedback on the quality and usefulness of the contents presented during the workshop and gauge their interest in future collaboration. Survey responses were overwhelmingly positive, and 14 out of 15 participants would like to be considered for future partnership opportunities. Additionally, our team held a debrief session immediately at the end of the workshop to capture the insights we learned. The following are the most important themes summarized during our discussion. (1) Sustainability of a long-term partnership is essential to ensure meaningful engagement between K–12 and their university counterparts. This would require staffing support from both sides for coordination. (2) There should be mutual respect in the partnership. Sometimes, university stakeholders have a savior mentality, likely due to the fact that they possess the content knowledge and think they have changed the lives of K–12 students and teachers by teaching a particular topic without much consideration of how it is being received. (3) There should be a budget item for paying K–12 teachers for their time spent on activities stemmed from the partnership. Often times, they are being asked to take on additional work without pay, and it could be a main reason why our previous outreach effort to K–12 teachers had not been successful. These findings connect with prior work in K–12 and university partnership that have highlighted the challenge and importance in receiving support for logistics from both sides (Edens et al., 2001) as well as mutual understanding and respect (Bosma et al., 2010). Although it was recommended in prior work (Klein-Gardner et al., 2009) on setting up mini-grants and reserving budget for engineering project materials, we were somewhat surprised by the strong sentiment from workshop participants regarding having paid opportunities. Perhaps, it can be traced back to the significant increase of workload on K–12 teachers since COVID.

3. Next Steps

3.1 Collaboration with select workshop participants

In an effort to maintain a human-centered approach, our team added graduate researchers from the college of education at UIUC to conduct classroom observations of a select set of workshop participants (those who expressed interest and have agreed to a phase-two partnership). The purpose of these classroom observations is to deepen our understanding of the specific needs of these K–12 partners and their students in order to hone the production of future collaborative efforts for maximum benefit to our partners.

3.2 Recruitment of additional campus units

With the momentum that our team has generated on the side of collaborating with K–12 partners, it is immediately important that we add additional engineering and science faculty to our team so that we can increase the number of K–12 partners we serve. Each additional university faculty

member that we welcome to the team will be multiplied by the number of students that they teach who can add to our K–12 classroom events. We also aim to partner with additional faculty from the college of education, whom we believe will help us adhere to science education standards and advise our team to develop age-appropriate content for the various grade levels.

3.3 Second Offering of Summer Workshop

Our team plans to hold another workshop during the summer of 2023. The workshop will have the same goals as the 2022 workshop, with some additional content and a slightly expanded recruitment of participants (priority will be given to wait-listed applicants from last year). The additional content will feature the partner teachers who continued to work with us in an ongoing manner throughout the academic year, as well as the graduate researchers who worked with them. These individuals will share their experiences in the program with the new workshop participants. Additionally, we plan to expand the radius of participating schools by up to 45 miles in order to attract teachers from smaller, rural schools.

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