



# Faculty, Student, and Community Partner Experiences in Computer and Information Science Service Learning

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Service learning, a high-impact pedagogy, involves integrating academic outcomes with service to the community. The success of service learning experiences depends on the development of mutually reciprocal relationships between students, instructors, and community partners, ensuring equitable benefits for all stakeholders. To explore how relationship-building and growth are supported in computer and information science (CIS) service learning, we conducted semi-structured interviews with 13 informants—each a faculty, student, or community partner who participated in one of five computer or information science service learning courses. Our analysis identified three factors that were most crucial in supporting the formation of relationships among stakeholders: infrastructuring the relationship, valuing technical and other expertise equitably, and integrating soft skills and technical skills. Based on these findings, we discuss how growth, an important outcome of relationship-building and equitable service learning experiences, can be supported and assessed in CIS service learning experiences.

CCS Concepts: • **Social and professional topics** → **Computer science education; Information science education;**

Additional Key Words and Phrases: Service learning, experiential learning, authentic learning

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## 1 INTRODUCTION

Service learning is a high-impact pedagogy that involves integrating academic outcomes with service to the community and critically reflecting on that service [24]. Furco [40] situates service learning right in the middle of a continuum of service programs, providing equal benefit to both student and community partner and ensuring equal focus on both service and learning (Figure 1). As one of our informants agrees: “When you can learn and do community service at the same time, that is the sweet spot” (F4).

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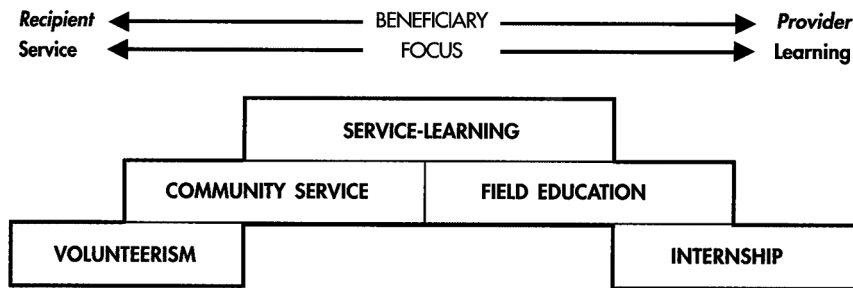


Fig. 1. Distinctions among service programs (diagram from Furco [40], p. 10).

Service learning has been adopted broadly across the **computer and information science (CIS)** curriculum, from introductory programming courses to capstone experiences and from courses in human–computer interaction to software engineering [95]. A recent systematic literature review of service learning in CIS identified three types of projects: (1) development projects, which consist of developing software for the community partner; (2) outreach projects, which consist of students teaching community members computational skills, and (3) (socio)technical support projects, where students provide technical reports or summaries of some aspect of the community partner’s technology infrastructure [95]. All three types of projects aim to help students connect the technical aspects of what they are learning to real-life settings.

Researchers have identified numerous benefits to service learning in CIS, including attracting and retaining students in their CIS majors, especially students who want to impact their communities or pursue pro-social goals [12, 33]; preparing students for the workforce by developing professional skills [28]; meeting curricular guidelines such as the **Accreditation Board for Engineering and Technology (ABET)** accreditation [45, 46]; and providing a technical service for resource-constrained organizations in the community [10, 55, 58, 67, 91, 92]. The benefits of service learning are ideally suited to address the need for more inclusive and diverse CIS programs [72]; service learning offers a project-based experience that can show students the types of impact they can have with their CIS majors and can teach them about ethical and moral dilemmas that often arise in technical fields [38, 68].

Despite the myriad benefits, this pedagogy does present challenges for CIS. For example, while students may deliver a working product to the community partners, the organization may not have the resources or the technical knowledge to maintain the project [10, 17, 53, 55, 58, 88, 90]. Another possible harm could emerge from the assumption, especially prominent in computing fields, that computing technologies are the best or only solution for community partners [26]. A technical solution may not always be an appropriate or helpful solution for the community partner and may actually result in more complications [26, 85, 88]. This assumption can also create a power differential where the students, instructor, and the university are seen as the “experts,” especially as it relates to technical projects, as opposed to valuing the expertise of all stakeholders equally [8]. Students also have a tendency to view service learning as community service, and while there is service within service learning, it is inherently different from community service. Community service is focused on providing aid to a nonprofit organization; service learning, on the other hand, is designed to ensure that students are meeting their course objectives while also ensuring that the community partner is benefiting from the interaction [11, 25].

While the types of projects and learning objectives of each CIS service learning course differ, there is a common theme—the importance of relationship-building (for more, see [11, 25]). The success of service learning depends largely on the development of relationships that benefit all parties involved and lead to some level of growth [8, 11, 25]. Experience reports of CIS service learning

have reported supporting relationship-building in various ways: some instructors explicitly teach students about how to build relationships generally (e.g., offering instruction in basic communication skills [3, 7, 16]) while others support relationship-building in ways that are more specific to the structure of the course, using written contracts with students and community partners (e.g., [4, 68, 73]). More research is needed to understand the diversity of strategies and scaffolding for nurturing and supporting relationship-building in CIS service learning, how the level of closeness among stakeholders affects the service learning experience (i.e., does a closer relationship between stakeholders lead to a better service learning experience?), and how these factors support (or not) the development of mutually beneficial service learning relationships.

There is a dearth of research that explores the experience of CIS service learning from the myriad stakeholder vantage points, which makes it difficult to understand whether or not these existing experiences are actually mutually beneficial for all. Most of the literature on service learning in CIS comes in the form of experience reports written by instructors and conveying rationale for and descriptions of the course design (e.g., [9, 15, 20, 74, 81, 94]). In these reports, the focus is nearly exclusively on designing for the experience of students' professional and sometimes civic development. Yet, the students' voices as well as those of community partners are generally not heard through these experience reports, particularly as assessed through empirical methods. Exceptions include a few experience reports that relate end-of-term feedback from students or community partners via surveys or informal interviews [9, 15, 20, 74, 81, 94].

In this research, we begin to address this gap in the literature to understand empirically the experiences of CIS service learning from three key perspectives—those of instructors, students, and community partners. We interviewed the networks of key stakeholders who participated in five different CIS service learning courses. In particular, we focus on understanding what elements of relationship-building were most crucial in developing close relationships and supporting growth in these networks. To achieve this, we asked the following research questions: What are the benefits and challenges for instructors, students, and community partners of participating in a CIS service learning experience? How did the network (i.e., instructor, student, and community partner) achieve closeness and growth throughout the CIS service learning course?

In the next section, we review existing research on the role of relationships in service learning and the current state of CIS service learning literature regarding the experiences of instructors, students, and community partners. After describing our research methods, we (a) present an overview of the five CIS service learning courses and their networks of stakeholders and (b) highlight three strategies for relationship-building in CIS service learning that we identified through our analysis: infrastructuring the relationship, valuing technical and other expertise equitably, as well as integrating soft skills and technical skills. Finally, we discuss the implications of our findings for the design of CIS service learning experiences that support stakeholders' growth through relationship development.

## 2 RELATED WORK

### 2.1 The Role of Relationships in Service Learning

Relationships are central to service learning experiences; these relationships may be short-term or long-term, formal or informal, or may be multifaceted depending on how the service learning experience is designed [25]. The purpose of developing this relationship is to bolster the development of the service learning product, facilitate knowledge transfer among stakeholders, and foster transformative growth for each stakeholder. For example, this relationship may grow and strengthen through meaningful dialogue, understanding other's needs, or offering constructive feedback. Service learning relationships can manifest in various contexts, including interactions

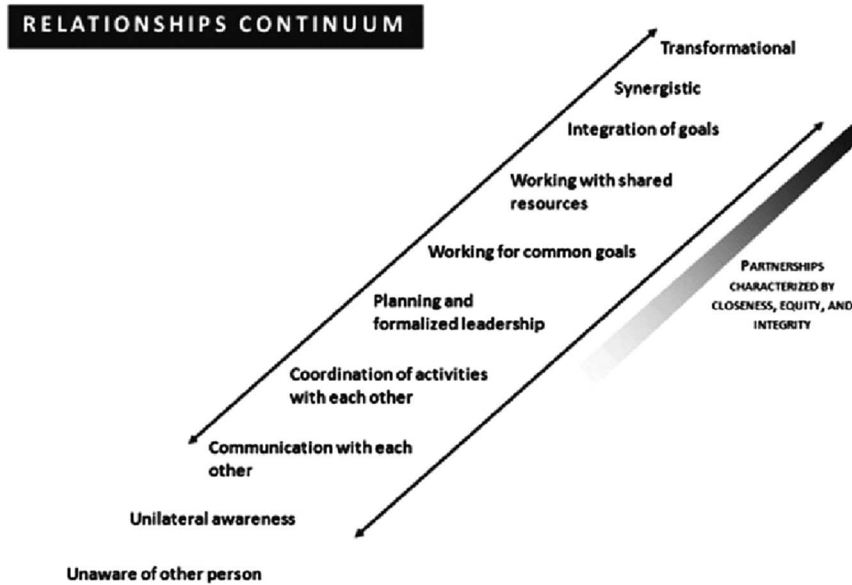


Fig. 2. Service learning relationship continuum (diagram from Bringle et al. [11], p. 4).

between students, student teams and community partners, students and instructors, instructors and community partners, and even between the institution and broader community. These relationships contribute to a sense of belonging for students, provide support for instructors, and enhance the impact felt within the local environment. Service learning relationships can be assessed by evaluating the *closeness of the relationship*, which, according to Bringle et al. [11], can be characterized by a relationship continuum (Figure 2), where “closeness ranges from unaware through transformational and is a function of three components: (a) frequency of interactions, (b) diversity of activities that are the basis of the interactions, and (c) strength of influence on the other person’s behavior, decisions, plans, and goals” (p. 4). Close relationships are those that are transformative—they lead to transformative growth and shared knowledge production among all stakeholders [11]. These relationships are dynamic, requiring ongoing renegotiation of boundaries and expectations to adapt to changing circumstances. Despite service learning experiences being more time consuming due to the planning and managing involved [4, 62, 64], this additional time is conceptualized as an investment because of the growth experienced [25].

The strongest relationships—ones that emerge from closeness, integrity, and equity—have been equated to *partnerships* [25]. Developing partnerships, then, is one of the main goals of service learning. Partnerships are only achieved through “teaching research, and/or service that is both in and *with* the community”; partnerships require developing mutual goals, strong communication skills, and measurable outcomes [11, p. 1]. Service learning experiences, then, should focus not only on technical skills for students but also on understanding the community partners’ context, learning relational skills, and developing their civic identities [6, 19, 22, 55, 76].

Bringle et al. [11] also call for more research that analyzes the experience of stakeholders who are associated with service learning. They identify five stakeholders: students, administrators, faculty, community residents, and community organizations. Each of these stakeholders may have different perspectives, agendas, cultures, powers, and goals. Some of these stakeholders will be aware of one another and some may never directly interact but may still be influenced by the others’ actions.

For example, administrators may allocate funding and may dictate policies that could influence who the instructor selects as a community partner, thereby indirectly influencing the experiences of the student and the community partner. The overall closeness of these stakeholder networks can dictate the impact of the service learning experience—that is, the closer the relationship, the more likely it is to lead to growth and mutual reciprocity. Understanding the perspectives of these various stakeholders becomes integral for the design of equitable service learning.

## 2.2 Stakeholder Experiences of Service Learning in CIS

Existing research about CIS service learning has provided some insight into the experiences of some of the key stakeholders—predominantly those of the students and less frequently, those of the community partners or faculty. Most of the literature surrounding service learning experiences in CIS has been written by the faculty member teaching the course and has focused on student outcomes. These faculty members have noted the myriad ways in which students experience personal, professional, and civic growth, for example, by conducting pre- and post-surveys to evaluate the students' technical knowledge [16, 30, 52] and by reporting perceptions and attitudes toward service learning experiences [49, 77]. Service learning often involves working closely with a community partner to understand their needs, which is theorized to help increase communication skills and students' civic identities [2, 13, 31, 63]. Some research indicates, however, that for students to develop their civic identities, they have to not only communicate with community organizations but also have to develop a deep understanding of the organizational and societal context [13, 60, 93]. This deep understanding can only emerge through the formation of a close relationship with the community partner and instructor and can be characterized as growth for the student [11].

For students, creating these close relationships can be challenging. The difficult and complex social problems that students engage with in service learning experiences may contribute to students feeling helpless to make a difference [75, 79]. Within CIS, these challenges can be more pronounced—some researchers have found that students may perceive their work as charity or develop a condescending attitude toward the community partners [55, 71]. Additionally, the assumption by many in CIS that technology is the best solution could shift relational power toward the students, overshadowing the expertise of the community partner [26, 85].

In contrast to CIS research regarding the student experience in service learning, there is limited research within CIS that focuses on the experiences of faculty who engage in service learning. Researchers have noted that there are many motivations for faculty engaging in service learning, more generally, from contributing to students' personal, academic, and civic growth to cultivating and strengthening relationships with the broader community [6, 19, 22, 55, 76]. However, these motivations are often overshadowed or complicated by the intense time commitment required to set up a successful service learning experience [15, 23, 32, 77, 84]. For example, faculty members are often tasked with finding a community partner, scoping an appropriate project, mediating the relationship between student and community partner, and ensuring maintenance of the project after the term ends [15, 23, 34, 44]. Ensuring the maintenance of service learning projects is a particularly tricky challenge in CIS, as community organizations are often under-resourced and have limited technical knowledge to maintain projects, often referred to as the maintenance problem [9, 15, 64]. An intense time commitment is often necessary to ensure that the project actually addresses the needs of the community and does not contribute to more technology churn, as technology that cannot be maintained is abandoned [91]. Outside of CIS, researchers have reported that critical challenges for faculty conducting service learning include the lack of recognition for their efforts and the lack of available resources from their departments and the university [21, 56, 59]. The lack of institutional resources may be particularly significant for CIS projects that may require additional oversight and technology to be successful.

While the community partner's needs are often central in the design of students' deliverables in service learning, there is little empirical evidence of these partners' experiences in CIS service learning. A few experience reports of CIS service learning solicited feedback from community partners through the use of informal interviews or short feedback surveys (see [2, 52, 69, 73, 87]). Some experience reports infer that community partners' continued participation in service learning signals a positive and helpful experience [14, 26, 29, 49, 77]; however, Bringle et al. [11] warn that continued participation is not always a sign of close relationships. Outside of CIS, research focused on the experiences of the community partners suggest possible benefits, including stronger ties with the university, knowledge transfer, and a tangible product [51, 57, 66]. However, these benefits are only achieved when the community partners are viewed as an equal partner and when students are able to align themselves with the partner organization's mission and objective [48, 51, 57]. Jordaan and Mennega [51] have also found that community partners are not just passive receivers of the benefits of service learning, but that community partners view their role as being integral in helping prepare students for the real world. We need to develop a better understanding of the experiences of community partners and how to ensure that the service learning experiences are meeting their needs.

### 3 METHODS

#### 3.1 Informants

We began recruiting by reaching out to CIS faculty to ask if they had taught a service learning course in the recent past and, if so, if they were able to contact a student and community partner from the same term the service learning class was taught. We recruited faculty members through three approaches: (1) by emailing CIS faculty who had participated in a prior faculty survey about service learning in CIS [43] and who volunteered to be contacted about participating in follow-up research, (2) by contacting individuals who have published service learning experience reports, compiled as the corpus for a recent systematic literature review [95], and (3) by contacting those who were listed on CIS departmental websites as teaching a course that appeared to involve service learning. We recruited for a diversity of experiences, including diversity in classes (i.e., lower division and upper- division; required and elective; and across subjects), types of projects and community partners, and course designs. We contacted a total of 50 faculty members between April 2021 and August 2021; 12 faculty members responded, with 7 stating that they could not participate due to their current capacity or because they did not have contact information for the community partner or student. The remaining five faculty members all participated in interviews and provided us with warm handoffs to students and/or community partners who also participated in their courses. Faculty generally reached out to students who did well in class and community partners because they either had a strong relationship with the instructor or because students reported having a positive experience in working with the community partner. As such, the sample of this research should be considered highly self-selected and/or potentially biased. While no informants suggested that their experience was perfect, the courses that are reported and analyzed here are most likely among the more positive and successful CIS service learning experiences. The faculty ( $n = 5$ ) included two associate professors and three assistant professors. They had a range of experience teaching service learning courses, from this being their first time ( $n = 1$ ) to having taught this same course design more than four times ( $n = 4$ ). All but one of the students ( $n = 4$ ) had graduated from their undergraduate institution at the time of the interview; the remaining student had taken a service learning course as a lower-division student and was on track to graduate in the upcoming year. The community partners ( $n = 4$ ) represented in our sample all worked at nonprofit organizations, including a domestic violence shelter, environmental center,

Table 1. Summary of Service Learning Experiences

	Faculty	Student	Com- munity Partner	Course Term	Project	CIS Course
<b>Course 1</b>	F1	S1	NA	Spring 2018	Develop an inventory system and scheduling software	Software development; upper division computer science elective
<b>Course 2</b>	F2	S2	C2	Spring 2021	Develop an online store to help raise funds for the organization	Project management; computer science capstone
<b>Course 3</b>	F3	S3	C3	Fall 2020	Conduct a sentiment analysis on how people felt about neighborhood boundaries	Technology and development; lower division computer science elective
<b>Course 4</b>	F4	S4	C4	Spring 2021	Analyze rates of arrests from different demographic groups to generate policy recommendations	Data science; upper division computer science elective
<b>Course 5</b>	F5	NA	C5	Winter 2020	Develop a sorter tool to match instructors and college students based on different characteristics	Senior design project; information science capstone

civic engagement organization, and educational equity center. Not only does this sampling address the dearth of research about stakeholder experiences in CIS service learning, it is unique in that it includes multiple informants who participated in the same service learning experience, providing a multifaceted perspective for each course.

The courses represented by our sample also reflect a diversity of educational contexts for CIS service learning (Table 1), supportive of the exploratory nature of this research. Institutions of higher education represented in our sample were located in different regions of the US, including the Southeast, the Northeast, the West, and the South, and included private research universities ( $n = 2$ ), a public college ( $n = 1$ ), a private liberal arts college ( $n = 1$ ), and a public research university ( $n = 1$ ). The courses consisted of one required lower-division course, two upper-division elective courses, and two required capstone courses. They covered a breadth of subject areas, from data science to software development to technology for development.

We achieved theoretical saturation [41] in our analysis across the diversity of stakeholder experiences in these five diverse courses, resulting in a final sample of 13 informants (Table 1).

To facilitate recruiting complete networks of stakeholders and to increase the reliability of data and recall, we recruited instructors who had taught service learning courses recently. We allowed respondents interpret “recently” as warranted by their context, particularly given the instructional disruptions caused by COVID-19 (see also [47]). Four courses represented in this research were carried out within a year of the interview; the fifth course was taught annually by the faculty but the student who was able to be recruited participated in the course 3 years prior.

Because of COVID-19, four of the courses discussed in interviews were carried out via remote instruction (i.e., via Zoom). Our informants discussed how teaching, learning, and collaborating were affected by the pandemic, including not being able to meet other stakeholders in person or at their sites of learning or working. The remote nature of the experience likely impacted processes of relationship formation and/or the nature of relationships among stakeholders, as has been found by researchers who studied service learning experiences during the pandemic [47, 51]. That the resulting experiences were generally positive suggests that the strategies employed might also be successful in less-challenging educational scenarios.

### 3.2 Data Collection

We conducted semi-structured interviews with all 13 informants over Zoom between July 2021 and December 2021. Interviews lasted between 40 and 64 minutes (mean = 48 minutes). Our semi-structured interviews were tailored to each informant and service learning experience as well as our evolving understanding over the course of the research, but all included the following topics:

- What motivated faculty members, students, and community partners to participate in service learning and what their initial expectations were.
- The benefits and challenges of service learning from their perspective, especially as it relates to creating mutually beneficial experiences for all stakeholders.
- How well the expectations of each stakeholder were met at the conclusion of the service learning course.
- The impact of the service learning course on each stakeholder.
- Recommendations on how to improve service learning experiences in the future.

While we had initial concerns about informants being able to recall past experiences, all of our informants were able to recall rich examples due to the interview design (in which we were able to ask much more specific questions after triangulating our understanding of the service learning course across informants) as well as because informants typically found the experience to be unique and positive—and thus, more memorable.

### 3.3 Data Analysis

We transcribed audio from the interviews and conducted iterative and inductive analysis of the transcripts [27]. Initial codes included specific examples of both benefits and challenges (e.g., intense time commitment, motivated by working on a project that can create an impact, heavy emphasis on student experience) as well as characteristics of the course structure with respect to stakeholder interactions (e.g., who decides on the project, communication with community partner starts early, how to deal with unexpected obstacles or changes, how the service learning experience is assessed). The first author wrote a memo per course to summarize her understanding of the characteristics of the course, how projects were decided on, how relationships were fostered throughout the course, the benefits and challenges of the service learning experience, and the impact of the course. The most prominent cross-cutting theme across open codes (benefits, challenges, and course structure) and course memos was the theme of relationship—how the course fostered or did not foster relationships and how the nature of the resulting relationships impacted the benefits and challenges experienced by the different stakeholders. The research team then returned to the research literature to identify the theoretical framework most resonant with the data—Bringle et al. relationship continuum [11].

For our final phase of analysis, we used the theoretical model of relationship-building as a continuum to conduct another round of analysis using the guiding question: “What aspects of the course fostered relationship-building? And among which stakeholders?” Our thematic analysis



identified three categories of strategies for supporting relationship-building in CIS service learning: infrastructuring the relationships, valuing technical and other expertise equitably, and integrating soft and technical skills. These three categories form the basis for the findings that we report below.

In our analysis, we infer the strength of relationships based on both explicit and implicit accounts from stakeholders. For example, S2 talked about having limited contact with the community partner (“I don’t think I spoke to them directly”), which—based on the factors that Bringle et al. identify in their relationship continuum [11]—we interpreted to mean that the relationship tie between the student and the community partner was not as strong as those students who had the opportunity to be more involved with the community partner. We inferred growth based on informants’ accounts of what they got out of the course and whether it led to a professional, personal, or civic change (i.e., faculty mentioning the ways in which the course was “personally rewarding” or students mentioning how this course helped them reevaluate their future career plans).

## 4 FIVE COURSES OF CIS SERVICE LEARNING

### 4.1 Course 1: A Software Development Competition for the Community Partner

Informants associated with Course 1 all participated in an elective, upper-division software development course. The instructor selected one community partner for the entire class to work with over the course of the semester. The community partner pitched one project—in this case, an inventory and scheduling system for their youth enrichment nonprofit to manage their fundraising efforts—and then each student developed a system to meet the requirements that had been articulated: “These students, they each work independently on that same project. In a sense, they compete against each other and then each of them has to demonstrate their product to the customer and then the customer selects the winner—the one [project] that they will use” (F1). In this instance of service learning, the instructor handled the majority of the communication with the community partner, with most students having limited-to-no direct communication with them, mainly out of respect for the community partner’s time. The student confirmed that they did not have any contact with the community partner. The community partner provided written feedback to the instructor three times during the term when the students presented their progress. At the end of the semester, the community partner selected the best project, a project that they had continued using up until the time of the interview.

The instructor had taught this course seven times in the past and felt that the service learning experience was valued by the students “to foster their own sense of development and to help them compete in the job market” (F1). Even so, the instructor reported that he will no longer be teaching this or any other service learning course in the future because of the lack of resources offered by the university and the lack of visibility within the academy of the “intense time commitment” of designing and supporting the course.

### 4.2 Course 2: A Community Partner Project Management Capstone

Informants from Course 2 participated in a capstone, project management course in which the instructor had recruited a small set of community partners and projects; each student team was assigned by the instructor to a community partner project. The instructor spent time before the term identifying community partners, “meeting with them to make sure they understand what [he] is offering, to let them define the problem that they would like to be addressed, and then arrange [for the partner] to visit the class on the first day to pitch their story” (F2). The students were expected to work closely with the community partner to develop a plan to address the identified needs and to provide updates to the community partner through the term, with the professor mediating the communication as necessary. The student’s account affirms the emphasis

on communication: “After we were assigned the projects, we immediately had a meeting with [our community partner]. From the very beginning, we were talking with them” (S2). In this course, the community partner was interested in developing an online store as a fundraising effort for the organization. The student team was tasked with finding a store plugin that would work with the community partner’s WordPress website and a database to help manage inventory. Near the end of the term, the community partner realized that they would not have the resources to manage the inventory and asked the students to change the project. The students “quickly pivoted to another project kind of at the last minute. They helped us with some designs for T-shirts that we would be looking to sell as a fundraiser so they were completely flexible and helpful and willing to work with us” (C2). The community partner reflected that although they ended up changing the project, the experience “will help [them] at some point, if [they] decide [they] want to do [the online store]” (C2). To assess student performance, the instructor used a “defense model,” where students presented their work and answered critical questions from other faculty members about how they made decisions through the project. The community partner was not a part of the defense; although the instructor reflected that “it sure would be very valid to include them because the clients are almost always 100% satisfied and happy; they’re not really assessing students’ academic work” (F2).

### 4.3 Course 3: Technology Proposals for Development Partners

Informants from Course 3 participated in a lower-division CS elective about technology and development. Each time the course is offered, the professor selects a theme for the course and recruits community partners whose mission aligns with the chosen theme. This semester, the theme was “technology and sustainable development,” and the community partner, an environmental nonprofit, works to address environmental concerns to create healthier communities. The class objectives centered around developing students’ critical appreciation “for the strengths and limitations of technology in sustainable community development and the skills needed to approach sustainable community issues drawing on engineering and computing in context” (F3). The student enrolled in this elective because they were “looking for how [they] could make the impact [they] wanted through computer science” (S3).

At the start of the semester, the community partner characterized their needs to the class and the students developed project proposals that were reviewed by both the instructors and community partners. The project the student’s team proposed (and that was accepted by the community partner) involved conducting a sentiment analysis of social media posts about how the community felt about community boundaries. The community partner wanted to use this information to learn about how the boundaries affect the overall health of the community. The community partner interacted with the students throughout the term:

*I [spoke to] the class a couple more times to answer any questions, so like a lightning round [...] there was also some email communications [...] and then a sharing of like a Google drive to different presentations and progress that they were working on, and then finally at the end, when I came back to the class and they did a presentation of all the work that they had done (C3).*

Student deliverables were submitted and assessed by the instructor based on a rubric that included the “squishier stuff” (F3). For example, the detailed user guide and a letter that the students wrote to the community partner helped the instructor evaluate the type of relationship that students had with their community partner: “Some of these letters [that students write to the community partners] are just extraordinary. They’re really, really respectful, they’re nuanced and indicate a deep connection to the work that the partner does and a real hope that the deliverable is appropriate and

helpful” (F3). The community partner’s experience was not formally assessed, but the instructors conducted an informal check in to see how the term went.

#### 4.4 Course 4: Data Science 4 Good Projects with Community Feedback

Course 4 was an upper-division elective course in which students identified data science projects that they believed would have some sort of social impact in their community. Of the 30 students, 10 enrolled in the course were part of a “service learning cohort” and presented their progress reports to a panel of two community partners, who shared their expertise and provided feedback on the student projects about four times over the semester: “We [the community partners] attended the initial kickoff thing. We then attended a couple of classes in the middle to hear updates on where the students were on their projects and provide some feedback. And then we attended the final presentation session at the end” (C4). During the course, the student’s group used existing datasets to analyze rates of arrests from different demographic groups to generate policy recommendations. To assess student learning, the instructor had students complete four reflection writing assignments as well as deliver a final presentation. There were no formal methods to assess the community partners’ experiences; it was mainly inferred through informal conversations.

#### 4.5 Course 5: Students Onboarded to Community Partner Teams

In this informatics design capstone course, the instructor acted as a “project manager” while the students are matched to and then onboarded onto existing project teams of employees from the community partner organizations. There was strong institutional infrastructure to support the service learning experience: “there’s a marketing and communications department in the school and they do things like: articles on the website and social media” and a university service learning office that helps identify possible community partners (F5). Community partners recorded videos about their projects that are reviewed by the students before the term begins. The students ranked the projects based on their interest and then the instructor matched students to projects. The community partner we interviewed, who worked at an educational equity center, had students work with their employees on a sorter tool to match volunteer mentors with the minority students that the organization serves. Community partners generally select ongoing projects that the student teams can join so that they have the chance to become “part of the team [...] whether it’s three months or six months that they’re with us, they are really part of the organization” (C5). The students are assessed by the instructor based on classroom presentations that are given every 2 weeks and by a design document submitted at the end of the term. Students are also assessed by the community partners:

*The professor asks us every quarter, tell me about each of the team members. And so we give individual feedback. We get to know [the students] well enough that we can [assess] if they held up the end of each part of the team. Like, did the database person do all the database stuff? Did the design person do well in that? So that’s kind of what we do. And then it’s up to the professor really to decide on the grade. (C5)*

## 5 FINDINGS

In what follows, we characterize (a) the diversity of relationship structures that emerged across the five courses and (b) three strategies for fostering relationship-building in CIS service learning: infrastructuring the relationships, valuing technical and other expertise equitably, and integrating soft skills into the curriculum.

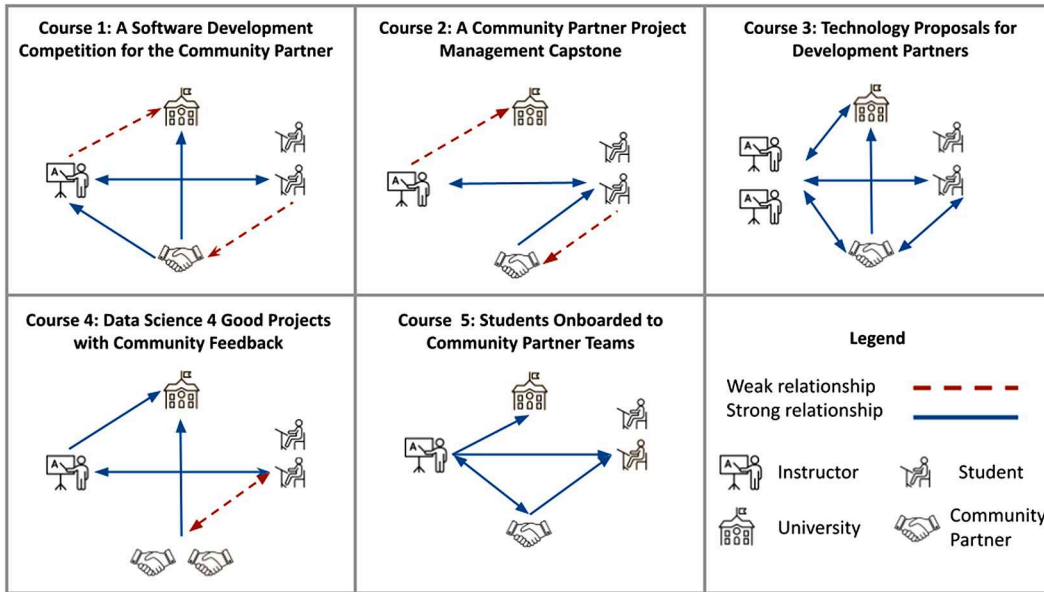


Fig. 3. Overview of the reported strength of the different relationships within each course. The direction of the arrow signifies what that stakeholder reported about the other stakeholder (e.g., for Course 1, the instructor and student both reported a strong relationship between each other). However, the instructor reported a weak relationship between them and the university, particularly because of the lack of resources offered for conducting service learning.

### 5.1 Diversity of How Relationship Was Structured across Five Courses

While each of the five courses were organized around a community-oriented project, there was variability in how each course was designed and, as a result, when and how relationships among different stakeholders were developed and fostered. Within each course, informants' accounts suggested different networks of relationships among stakeholders. While each course design supported the development of strong relationships between some subset(s) of stakeholders, these stronger relationships were distributed throughout each CIS service learning course in different configurations (Figure 3). Informants' accounts characterized not only the quality of relationships between other stakeholders but also how participating in the service learning experience affected their relationship with the university. While the inclusion of university staff was not possible within the scope of this study, due to the frequency that this stakeholder was mentioned by either faculty, students, or community partners, we include it here. Future research needs to explore the role of the university in CIS service learning in more detail.

All course designs supported strong relationships between instructor and student. While all faculty attempted to support strong relationships between community partners and students, reciprocally strong relationships were not achieved in all courses. Strong relationships between the university and instructor were reported in only a subset of courses. Strong relationships among students (e.g., working in teams) were not reported in any of the courses, though weak relationships were reported in two. In the remainder of the results, we characterize three strategies for fostering relationship development in CIS service learning, to begin to unpack the kind of support and scaffolding that enabled stronger relationships.

## 5.2 Relationship Development through CIS Service Learning

Nurturing close relationships among stakeholders is a key element in promoting the development of mutually beneficial service learning experiences [8, 11, 25]. Support and scaffolding for relationship development are typically woven into the class design [11]. As such, instructors enable (or not) and set the tone for relationship development. How relationship development unfolds, however, depends on the participation of the student and community partner.

All the instructors we interviewed thought deeply about the experience they wanted for students and community partners. These informants believed—and their courses embodied the belief—that there are a diversity of approaches to conducting service learning. Even across this diversity, our analysis reveals three strategies for fostering relationship development in the design of service learning: infrastructuring the relationship, valuing technical and other expertise equitably, and integrating soft skills with technical skills. We first present a description of each strategy, offer examples drawn from the courses, and characterize some of the challenges experienced by our informants.

*5.2.1 Infrastructuring the Relationships.* Developing close relationships for CIS service learning requires layered infrastructural work. Before one can develop relationships, one first has to ensure that there is a service learning course to begin with. Service learning courses are notoriously time and resource intensive [15, 23, 32, 77, 84] and instructors need infrastructure to implement service learning in the first place. Some of the instructors reported having access to stipends or grants, to a service learning office on campus, or to a network of instructors to help them find community partners. For example, three of the instructors connected with community partners through their university's service learning offices: "I got put together with [the community partner] through our center for public service, 'cause they were already partners with [the university] to some extent" (F4). F3's course receives a small stipend for the community partners from the university, which also provides an additional instructor for the course—supplementing the CS faculty with an instructor from the service learning office on campus. These resources were not only helpful for the course, they also helped strengthen relationships between the instructor and the campus. F4 indicated that there were "financial incentives" from the university to encourage instructors to incorporate service learning into their courses. Their university's center for service learning also provides a 10-week training: "You read some papers about service learning and then they also have a cohort of 10 to 12 professors who are either thinking about doing service learning or people who have done service learning" (F4).

Other instructors reported a lack of supportive infrastructure, wishing they "had more resources, like teaching assistants, to guarantee that this could be done every year" and so that they could "expand the scope of the projects" (F1). F1 noted that the value of service learning in strengthening relationships between the university and the community partner was ultimately achieved at the expense of the relationship between the instructor and the university, which provided neither the resources to support the course nor the recognition for the additional work involved. Indeed, after many years of conducting service learning courses, F1 has decided to stop because of the lack of resources offered by the university and the lack of visibility of the "intense time commitment" for designing and supporting the course. F2 echoed a similar concern stating that his university does have "an office of community engagement, which has always been one person and that person often spends a lot of time organizing student volunteer opportunities, not organizing with community organizations," leaving the task of finding a community partner up to him. F1 and F2 had to rely on their personal networks to find community partners for their service learning courses.

An essential element of service learning infrastructure, then, are the community partners, themselves. Instructors, with or without the help of a service learning office on campus, must

identify and recruit community partners (1) that have projects that fit the learning objectives and timeframe of the course, (2) that have the bandwidth to visit the class and engage with the students, and (3) that have the human and technical resources to maintain and manage the students' deliverables after the course is over. Knowing the community partner and understanding the strengths and limitations of their organization is necessary for crafting a curriculum that will help meet the needs of all stakeholders:

*a big part of preparing for the course is talking with potential partners, seeing if it feels like a good fit for them, determining if they have the bandwidth to do that work, determining if they can work with the whole class or if they can work with just part of the class. (F3)*

In infrastructuring the course, instructors have to balance the needs of the community partner and their learning objectives for students: “you have academic content you’re trying to teach and [ensuring] that the service experience supports that. Otherwise, it’s just volunteerism” (F2). Balancing these needs can be tricky though, for example, when “a piece of functionality that we [the students] didn’t get in at the same level that the community partner would have liked just for time or knowledge reasons” (S1). Regardless of the content area or whether a lower- or higher-division course, students are still students and it is important for everyone to understand that and set expectations accordingly. As F2 explained, “these are students and they’re not professional IT workers and [the community partner] needs to understand, you know, we’re going to do our best but we might not solve their problem entirely” (F2). C5 echoed this sentiment, stating “don’t go into it thinking that you’re going to get people who know technology and that they’re going to be your IT team, because I think that’s a mistake that a lot of organizations make” (C5.) Being upfront about these possible tensions, by using a “collaboration agreement” (F3) or something similar, can be a helpful way to alleviate anxiety later on and to develop strategies for addressing differing expectations.

Infrastructuring the service learning experience also involves ensuring that there is a point person at the organization who has enough bandwidth to engage with the students. For example, F3 asks herself:

*Do I have the kind of relationship with a partner, where I can email or call and say like hey I know you’re super busy but can you please get back to that team working on, you know your website because they got to hear from you to finish the project and they still don’t know whether or not you like you know the deliverable they sent last week. So it needs to be a partner that I have that kind of relationship with where that wouldn’t be pressuring or trust breaking. (F3)*

Four of the instructors indicated that they also try to build relationships with community partners that last more than a term, which helps them develop closer relationships since the instructor and community partner develop a better understanding of each other’s needs, for example: “So they’re kind of repeat sponsors and we keep them in the loop from one year to the next” (F5).

Part of this initial infrastructuring work that is especially crucial for CIS projects involves determining if the community organization has the capacity to support and maintain a project after the term is completed. F1 talked about the “maintenance problem”—the difficulty in maintaining a service learning project after the course ends (see also [26, 85, 88])—which can lead to the instructor “becom[ing] a victim of our own success.” F1 has ended up maintaining students’ projects after the course ends for the community organizations that do not have the personnel or technical knowledge to maintain the project themselves. C5 has tried to combat the maintenance problem by having students create a report that summarizes how to use and maintain what they have built:

*I want them to write a guide, basically everything they did and how to log in, how to get set up. Because... a person who has never coded in their life should be able to come in and read this and*

*do it, right? So I try to get them to think that way... But at the same time, we also make sure, you know, from a systems aspect, you know, we don't let the students always make their choice. Oh, we're going to host it on Google. It's like, no, we, as an organization use these services, you're going to host it on our services and not some random account you create. So we try to keep a foundational infrastructure stuff within the organization, because then I have a knowledge—or another person that we work with has the knowledge—and we can easily maintain. (C5)*

Ensuring that there is infrastructure in place for each stakeholder helps ensure that there are sufficient resources, time, and attention to craft service learning opportunities that are grounded in realistic expectations, which can lead to a stronger, closer relationship.

**5.2.2 Valuing Technical and Other Expertise Equitably.** Developing closer relationships in service learning means equitably valuing the expertise of all parties involved. In CIS service learning, this can be more difficult given the extreme differences in expertise between stakeholders: the cultures of technosolutionism that can pervade CIS communities and the frequent dearth of technical expertise and/or resources in community organizations.

The ideal service learning experience, as described by F3, consists of a close relationship in which...

*...students have made an actual connection with their partners. They don't think of their partners as a client or a consumer of a deliverable; they think of their partners as someone with expertise who has really specialized experience and knowledge that's useful and important in the world. (F3)*

F3 designed her course to embody principles of asset-based learning, leaning into and elevating each stakeholders' strengths [35]. Across all five courses, community partners presented information about their organizations to the instructors, students, or both—"you might have an opportunity to learn a lot about an organization and a lot about the needs of the community that the organization might be serving and how you can be a part of that" (C2). The depth at which this information was presented varied, however, with many of the community partners presenting the high-level mission of their organization along with some possible projects and fewer community partners sharing more about the organization, its work and culture. For example, in Course 2, several community members came in to discuss the possible projects, without offering much information about the organizations themselves: "all of the community partners like the different organizations all came in and presented to everybody the projects they were working on. I think there were four different nonprofits that came and presented their projects to us that they wanted to do" (S2). In contrast, C5 discussed not just the project but the broader impacts of the organization's work along with more details the work practices of their organization:

*We do a presentation in the very beginning about our organization, who we are, not just who we are as a team, but what are we doing right now? What is the impact that we're making? We share videos that we have and we share testimonials. And then we ask them, you know, we know you're with us for only whatever months, but follow us on social media while you're with us, because you will see good stories. You will get to know how your work kind of translates on the other side. And we try to remind them that, 'hey, what you're doing is part of a bigger picture. (C5)*

Instructors can also play a role in helping students better understand the expertise of the community partner by contextualizing the social issue they are addressing in its broader context. For example, F1 teaches students about the historical context of the nonprofit's work: "we help students understand, you know, what the history of colonialism and Africa has to do with ideas

about development which has to do with how technologists and engineers in the first world imagine how they can support communities in the developing world” (F3).

One of the challenges to relationship development in CIS service learning is the specialized terminology that is used by different stakeholders. In many cases, students have not yet learned how to talk about technical subjects in an easy-to-understand way. To address this challenge, two of the instructors spoke to the students explicitly about how to address the technical language barrier with their organizational partners. And conversely, in one of these courses, the students were also having a difficult time keeping track of the acronyms used by the community partner. Their solution was to create a “cheat sheet”: “we need to create a cheat sheet for each other and it helped as we went through. So, it was just getting on the same page when it came to like terms, semantics, different things like that” (C3).

More generally, the community partner from Course 5 characterized the need for valuing all stakeholders’ expertise as something like empathy, understanding the experience from someone else’s point-of-view:

*And you really want to give them an opportunity to learn about your org and build something that’s meaningful.... to be successful, we have to really think about it as like what’s going to be in it for them first. And then how can I make sure that experience is not only great for them, but at the same time, mutually beneficial for our work. (C5)*

**5.2.3 Integrating Soft Skills into the Curriculum.** One benefit of service learning for the CS curriculum, in particular, is that it fulfills the ABET accreditation’s requirement for developing professional teamwork and communication skills [1, 50]. Reflecting on the ways in which relationship-building is achieved in the context of CIS service learning, it is also important to note that relationship-building is, itself, one of those soft skills to be learned and taught. Yet, different stakeholders had different experiences with the integration of those soft skills in their courses.

The relational skills that are essential for service learning set the course apart for one of the students, emphasizing that the experience was “not like your normal class” (S1). In a similar vein, F3 emphasizes that service learning cannot be merely “deliverable based,” with students throwing a completed deliverable over the wall to a distant client: “If it was, the students don’t learn anything about how to do work in communities collaboratively and then partners don’t get to teach students, they just receive” (F3). F5 concurs, characterizing an essential element of service learning as “‘social’ work”: the work of “human relations... you’re dealing with people” (F5).

Several instructors worried that the demands of relational work in service learning would overwhelm the resources and capacity of their community partners, for example: “I knew from my experience that that wasn’t going to work or if it did work, it would be a miracle. How do you structure this class in a way that’s connected, but not, you know, so connected that it’s not going to work” (F4). In anticipation of this tension, F4 designed his class so that the community partners comprised an expert panel to provide feedback for students; the students did not complete a project specific for each partner. In this course, the community partners were...

*...extra teachers almost. The design of the class to some extent was to have the [community partners] come in and talk with the students about their project so far, have the students pitch their projects.... So it was really using the community partners more as... like they were kind of giving the students feedback that wasn’t just coming for their instructor. (F4)*

While this setup worked to guarantee that the community partners could lend their expertise in an environment where the stakes were lower for them, the student from this course wished that he could have actually worked to create projects for the community partners: “one of the partners said that they get requests from people asking certain things. So, that’s sort of where I was, well,



why don't we just take some of those requests and see what we do with them, which I think would have been a lot more meaningful" (S4).

Similarly motivated, F1 elected to mediate all communication between students and the community partner—again to avoid overtaxing the community partner. S1 confirmed this pattern: “we don't think we had any direct interaction with the [community partner]. It was filtered a lot through the professor.” S4 noted that limited communication with the community partner in their course prevented relationship-building:

*I definitely will have a relationship with the teacher. But, with the community partners, we met them but it wasn't really enough to have a relationship with them. Our meetings were all sort of late at night and I wanted to get through it and go to bed and it wasn't really that conducive over Zoom. It's not really easy to form relationships like that. (S4)*

S3 experienced a similar pattern of instructor-mediated communication and felt that having a more direct relationship with the community partner would have been more ideal: “[the community partner] was definitely open to like being emailed and whatnot, but I think a lot of it was done through the professor, as well. So, I think it would have been cool if they would have established a direct mode of communication between each group and themselves” (S3).

Finding ways to structure relationship-building that meet the needs of all stakeholders—both facilitating relational growth while also not overtaxing any one group of stakeholders—was an open challenge for stakeholders in nearly all of the courses in this research. Finding workable and valuable strategies for teaching and supporting relational growth also has longer-term implications for the stakeholders. Students wanted to know more about how their projects were ultimately implemented and whether it was actually used. “After the semester, I didn't really hear much from them, so I don't know if they picked one of those [options we had recommended] or if they ended up doing something else, or if they didn't do it at all” (S2). S3 felt that follow-up would have constituted a significant part of the learning process, but it didn't happen:

*I think the most important part, probably, would have been a follow up just to see how it ended up because I think that is the most valuable. The end solution is probably the most valuable part of the learning process, like which parts worked or which parts didn't or which parts they decided to incorporate and which, if any, parts they did not like. (S3)*

Some of the community partners echoed this sentiment, articulating the value it would have, not necessarily for them, but for the students' professional development:

*I think the biggest benefit for college students is that they're not only able to say they learned skills, but that the thing they built is actually being used right by an organization. And it is better in the long run for them to put on a resume and from a professional development perspective than saying, you know, they built something and they don't know where it went or how it was used. (C5)*

## 6 DESIGNING FOR INDIVIDUAL GROWTH VIA CIS SERVICE LEARNING RELATIONSHIPS

The success of service learning experiences hinges on the development of mutually reciprocal relationships between stakeholders, ensuring that there are equitable benefits for all. As demonstrated by the five courses in this research, there is much variability in how service learning is integrated into CIS courses and, relatedly, much variability in the nature of the relationships that are formed. That is, some service learning experiences weigh relationship formation and development more heavily than others. Bringle et al. [11] argue that closer relationships among stakeholders are more likely to lead to transformative growth. Growth, therefore, appears to be an important outcome, both for designing and assessing the service learning experience.

### 6.1 Designing for More Well-Rounded Growth Experiences for Students

Growth is experienced in different ways by different stakeholders. Prior CIS service learning literature has linked service learning to students' civic, professional, and personal growth [2, 13, 31, 55, 63, 89]. All stakeholders in this study were keenly focused on the importance of cultivating students' growth through the service learning experience, but the growth that students conveyed in interviews was limited to their professional growth. Through service learning, the students were able to appreciate a facet of their chosen profession that they had not experienced before—that computing can be used for good; “I was looking for how I could make the impact I wanted through computer science” (S3). The students talked about how the service learning course influenced their future goals in applying their technical knowledge for good.

Beyond appreciating the social good that can be accomplished through their chosen discipline, service learning also offers a professional growth opportunity for students to learn about ethics in CIS, where understanding the impact of technology on communities is integral to engaging in ethical work [38, 42]. There has been a call to integrate more ethics into CIS curricula [38]; service learning experiences could be an effective way for students to gain authentic experience about how developing technology impacts communities.

Students rarely (if ever) discussed any aspect of their personal or civic growth. It seems highly unlikely that students did not experience other forms of growth, but rather that many other forms of growth are less likely to be perceived as important or valid to students. To support a more well-rounded set of growth experiences that are recognized by students, it would be helpful to explicitly identify and operationalize a wide range of professional, civic, and personal goals or learning objectives for CIS courses—and to communicate and, thereby, legitimize these goals with the students.

While service learning has the potential to foster students' civic growth, many civic learning objectives hinge on students' self-identification as someone who can make a difference in the world, particularly by applying their technical skills. While student informants reported appreciating how their chosen field could have a positive social impact, they all felt disconnected from their personal impact in their service learning course. Several students expressed a lack of awareness about whether or not their project actually had impact in the end: “It would have been nice to, you know, really see that you had met a need of somebody from the community” (S4) and “The most important part, probably, would have been a follow-up just to see how it ended up... which parts worked or which parts didn't or which parts they decided to incorporate and which, if any... they did not like” (S3). S2 left the course fairly certain that her group did not end up having an impact and wished she had been able to change how “things ended up” so that the teams' work would have had an impact: “I think if we would have maybe thought more about like potential problems early on, instead of just like the best solution it, we would have... been able to like to kind of change how things ended up” (S2). While most course designs emphasized providing students with feedback on their technical deliverables, service learning courses would also benefit from providing students with feedback on the impact (or anticipated impact) their contribution had on the community partner organization.

Some CIS service learning instructors worked to explicitly incorporate civic goals in their courses (e.g., [2, 13, 31, 63]). Dark [31], for example, incorporated civic goals related to the development of students' understanding of “legal and public implications of security and privacy issues” (p. 18) in an information security management course. Other civic growth opportunities might include learning to identify and address cultural and gender barriers that limit experiences for members of minoritized groups [2]. Instructors should be encouraged to identify the civic goals that are likely already built into service learning courses and explicitly foreground them for students—especially in their syllabi and assessment.

Instructors should also be explicit about the personal growth opportunities afforded by service learning. Often labeled by the field as soft skills and, thus, devalued relative to technical skills, these objectives related to students' personal growth are both essential in professional contexts and generalize beyond the professional sphere. Reiser and Bruce [83], for example, incorporated learning objectives related to improving students' communication and project management skills. When introducing a service learning course, instructors should discuss how relationship skills are just as integral as technical skills. Other personal growth opportunities might include collaborating with a team of peers or with a team whose members have diverse backgrounds and skills as well as learning more about how one's personal strengths and perspectives affect interactions with others.

## 6.2 Supporting Community Partner and Instructor Growth

While the CIS service learning literature has focused predominantly on identifying instances of professional growth for students and the more general service learning literature has identified student outcomes spanning civic, professional, and personal growth (e.g., [2, 13, 31, 55, 63, 89]), relatively little is known about what growth looks like for either community partners or instructors. It is difficult to operationalize or design for "transformational growth" [11, 25] without identifying specifics of what this growth could look like for all stakeholders.

The community partner informants who worked directly with students reported valuing the opportunity to teach students about their organization and how it serves the community. The community partners also reflected on how the service learning experience helped them grow, specifically by being able to obtain a "fresh perspective" on their work: "Sometimes we get so focused on our own work that it's helpful to have somebody from the outside with a fresh perspective come in to be able to help us see things in a little bit different way" (C2). A study of a service hackathon reported that community partners grew their own technical expertise, their social networks, and their appreciation for and understanding of the user-centered design process [78].

It is important to note that community partner growth is a significant benefit to participating in service learning, separate from the benefit of any deliverable for the organization that may or may not be produced. Indeed, many of the actual deliverables developed across the five courses in this research were not adopted by the recipient organizations because most of them were prototypes or otherwise too early in the design stage to be used. There is much research that discusses the non-delivery problem [26, 85, 88]; therefore, it is important to explore and support growth benefits for community partners, not just deliverable benefits. As relatively little is known about community partner growth experiences, asking these stakeholders what they would like to get out of their experience in a service learning course would be an important place to begin.

While students and community partners discussed instances of growth, faculty rarely reported growth for themselves. According to Bringle et al., this is not unusual, as faculty are rarely placed in "the position of learning and growth through service learning" [11, p. 9]). Instead, faculty talked about their initial excitement over service learning—how important or "personally rewarding" (F4) it was to them to be able to provide a service to the community, which could have amply set the stage for civic or professional growth. Yet these growth opportunities were either quickly fleeting or they never panned out.

Initially, one faculty member took advantage of a professional development course offered by the campus' community engagement office. Two faculty had other networks of other service learning instructors who served as a resource for discussing best practices and working through challenges. Another faculty was able to co-teach their course with a faculty member from community engagement. Sharing expertise through networking or co-teaching can result in professional growth Bringle et al. [11] partnerships. But with the exception of the co-teaching arrangement, these professional development and networking opportunities occurred before the course started and did

not persist through the course. Faculty who did not receive any institutional support expressed more frustration with their course experience, which limited their ability to grow professionally. Instead, they showed signs of professional burnout.

### 6.3 Balancing Growth with Workload

Transformational growth requires close relationships [11, 25], but the formation of close relationships requires an investment of time, something all stakeholders may not have. Workload costs are particularly important to manage as all stakeholders in service learning—faculty, community partners, and students—may be more likely to take on more invisible and emotional labor. For example, within science, technology, engineering, and mathematics fields, researchers found that a lack of institutional and departmental resources can greatly contribute to faculty burnout [70], especially for women [36]. A systematic review of 74 experience reports in CIS service learning found that the proportion of women publishing about their experiences teaching service learning courses is far higher than their representation in the academy [95], suggesting that women faculty are more likely to take on additional invisible labor in the service learning context, as they do more generally in the academy [82]. CIS students, particularly first-generation students and women, are more attracted to and more likely to remain in a degree program that emphasizes pro-social goals and that is personally meaningful [5, 39, 54, 65, 86]. That service learning attracts students who are motivated to positively impact society is fantastic; and yet, service learning courses can also create more work and more emotional labor for students [15, 80], which can then disproportionately impact minoritized students. And members of the nonprofit workforce, often drawn to the field by its ethic of care, undertake sometimes-extreme emotional labor, working to understand and empathize with individuals who are often experiencing extraordinary life challenges or marginalization [37]. So while the growth opportunities of service learning might be significant, the workload costs are all-the-more important to manage.

Faculty often hold much of the power for decision making in service learning courses, but these decisions are often driven by institutional policies and whatever resources may not may not be available. Institutional support, therefore, is crucial for the success of service learning relationships and for ensuring that other stakeholders are not overtaxed by engaging in this pedagogy. Yet, institutions have generally undervalued and under-resourced service work due to its emphasis on relational skills [21, 56, 59]. There is a need to increase awareness of and advocacy for how impactful service learning can be for the CIS curriculum. For example, the Engineering Projects in Community Service project at Butler University [61] offers a service learning course every semester. Projects are carried over from semester to semester until the community partner has a viable product. Students have the rare opportunity to learn how to manage projects with changing requirements and with changing team members. Because every CS major is required to take this course, the department provides extensive infrastructural support, including departmental liaisons to help determine if a community partner will be a good fit, teaching assistants for the course, credit for instructors that can be counted toward academic tenure and promotion, travel funds for students and faculty for professional development opportunities related to the service learning course, and stipends for community partners. We cannot create mutually beneficial service learning relationships if the service learning experience is contributing to and exacerbating burnout.

### 6.4 Measuring Growth

Most service learning experiences are evaluated through the instructors' assessment of the deliverable that the students create for the community partner. Few courses involve the community partner in the evaluation process, although some instructors do have informal ways to collect

feedback from community partners. Even so, all stakeholders spoke to the importance of being able to track impact beyond the deliverable and not only in the short-term, but also in the long-term.

In service learning, growth is a function of the strength of relationships [11, 25]. Each stakeholder has something to offer one another that can promote growth. For example, community partners have much to teach the instructor and student about the context in which they work and how this will affect what type of technical deliverable will be the most effective. Students have technical knowledge and a fresh perspective that they can share with the community partner and they can also provide feedback to the instructor that can shape future iterations of the course or even inspire research directions. The instructor provides the educational context that shapes the students' technical knowledge and development of relational skills as well as acts as a mediator between the student and the community partner, upholding the interests of all. Tracking these offerings among stakeholders could be a compelling way to foreground the contributions of each stakeholder to the ecosystem of service learning and to measure growth potential.

### 6.5 Is Growth Necessary in All Service Learning Experiences?

While growth is important, not all service learning experiences need to achieve or even move toward transformational relationships [11, 18, 25]. "Not all relationships may hold the potential of becoming transformational. Indeed, expecting transformational relationships when this is not desired or appreciated according to one person might be counterproductive to the relationship operating effectively at a transactional level" [11, p. 9]. Indeed, in the five courses reported in this research, most courses were, by design, transactional: the students worked to create a product for the community partner. And while some subset of stakeholders in all courses offered evidence of their own growth through the experience, none of the stakeholders in any course described a mutually transformational experience. Perhaps starting with more transactional relationships will enable stakeholders to learn about service learning and will plant the seeds for future, more transformational relationships. For example, C4 designed their class so that the community partners acted as advisors, partly because it was their first time teaching service learning, partly because they wanted to ensure that the community partners' time was respected, and partly to reduce the risk that students might not deliver a final project. Since this course design worked for all stakeholders, it may bolster confidence in the pedagogy and result in more involved service learning experiences and stronger relationships in the future. Or, the class could continue the way it was designed because this was the best arrangement for the stakeholders involved. The key to designing for equitable relationships is being open to new and unpredictable experiences, to have multiple avenues for feedback, and to have support.

## 7 CONCLUSION

This empirical research offers a multi-stakeholder perspective of the experience of service learning in CIS. Through this research, we have made the following contributions:

- We characterize the experiences, including the benefits and challenges, of students, community partners, and instructors who were each involved in the same service learning course.
- We identify three strategies for supporting relationship-building in service learning: infra-structuring the relationship, valuing technical and other expertise equitably, and integrating soft skills with technical skills.
- We offer recommendations for supporting civic, personal, and professional growth for students, instructors, and community members.

But more pragmatically, we hope that this analysis of five very different service learning courses in the CIS curriculum inspires others to experiment with this high-impact pedagogy, as well.

Computing and information are only as powerful as is their fit to the cultural context in which they are used. Service learning is a pedagogy that puts that understanding at its fore. As F3 summarized:

*Making these kinds of connections and coming to care about what our partners care about and understanding how our skills can play a role in supporting their mission or in collaborative work right around missions that improve our city and improve equity and right, so I think that's that to me, those are the important bits. (F3)*

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