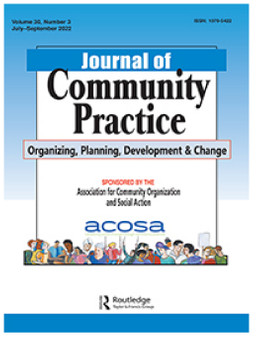

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Community-engaged technology development for bridging service users and service providers: lessons from the field

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ABSTRACT

This article shares the experiences and lessons learned from a community project that aims to develop a technology-based solution to improve communications between service users and service providers. Through this multi-year project in the Capital District of New York State, a team of social workers and engineers created a mobile app prototype based on the feedback from the community. This case study shares insights for conceptualizing various phases of community engagement as well as for recruiting multiple groups of stakeholders in the process of creating a collective vision for technology development.

KEYWORDS

Community/Civic engagement; Community-based research; human services; technology; mobile app; service navigation

Background

The burden of navigating services is not a new challenge in human services as the field has been perceived as siloed, transient, and sometimes unfriendly to those who need services (Fredericksen & London, 2000; Horvitz-Lennon et al., 2006; Lee et al., 2020). With the advancements of technology, the discussions on "modernizing" service navigation have begun with a vision that case management and service delivery could be more efficient and coordinated (Baker et al., 2018; Crawford et al., 2013). Moreover, the COVID-19 pandemic has facilitated, if not necessitated, the transition to remote communication through technology between service users and service providers (Gerken, 2020; Mishna et al., 2021).

In response to the lack of options for one-stop service navigation online, an interdisciplinary team of social work and engineering researchers in New York State has been exploring a technology-based solution that can facilitate the communication between service users and service providers. The team received funds from the National Science Foundation in 2017 to examine

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the current challenges in service navigation and develop a technology-based solution. One of the primary goals of the project has been to engage the community in the process of identifying and developing the most suitable form of technology that can serve the community's needs. In this paper, we present the process of community engagement and our lessons learned from the process in the form of a case study.

Literature review

Community-engaged technology development

There is increasing recognition among researchers that proper engagement of community is critical for developing technologies. Since the effort to make technologies more relevant to social needs emerged in the 1970s, researchers have become increasingly concerned about how to engage the actual users of the technology during the design process (Vardouli, 2015). Research found that inviting the potential user early on in the development process increases the usefulness of the technology because users are allowed to co-create the technology based on their experiences and knowledge, rather than depending on developers' perceptions of what would appeal to their customers (Kristensson et al., 2008). Working with a specific group of end-users has also been found useful in the health and social services because developers can learn about the clients' unmet needs, incorporate their input into the design of the technologies and products, and validate the usefulness and replicability through continuing interactions with the users (Bridgelal Ram et al., 2008). McCurdie et al. (2012) particularly discussed several cases of mHealth intervention technologies and found that including users in an iterative design and development process increases the adoption of technology and the likelihood of the health intervention's success.

The previous literature on user-engaged technology development mostly used a case study approach to examine the process of engaging the target populations while developing a new technological tool. For example, Tang et al. (2018) described how the designers created a clinical communication platform by adopting three engagement approaches, including *user-centered design* (where the designer actively studies the perspectives of users), *co-design* (where the designer and users design the product together), and *participatory design* (where the user is an active participant who drives the design and innovation). In addition, several studies described the process of working with a specific population group for developing mobile apps that would improve their social or health outcomes (e.g., disadvantaged dads, homeless youth, or older women with HIV; Buccieri & Molleson, 2015; Lee & Walsh, 2015; Njie-Carr et al., 2018). Methodologically, researchers have used various techniques to engage the target populations. Examples include user

observation, in-depth interviews and focus groups for usability testing, group design meetings, dialogue cafés, and prototype simulations (Lee & Walsh, 2015; Lund et al., 2021; Tang et al., 2018).

While these studies acknowledge the user as a critical part of the technology development process, the main object of engagement has mostly been a particular group of people, rather than a community as a larger unit that encompasses multiple service domains (e.g., homelessness, childcare, and food). In that regard, our project uses a broader idea of target audience. Instead of limiting to a particular population group or service domain, our research considers community as a group of organizations and people who share the same pool of human service resources in a specific geographical area (e.g., city or region). By broadening the unit of the users to the community level, this present study offers the opportunity to observe the process of engagement and consider the implications of technology development at multiple levels, not only at the level of individual service users but also at the levels of service organizations and the community as a whole.

Conceptual framework

The study integrates the theoretical frameworks of community engaged research (CEnR) and user-centered design (UCD). CEnR refers to research that involves the community at various stages of the research process, from problem identification to implementation of the project (O'Mara-Eves et al., 2015). During the process, the community can be engaged to varying degrees. For example, when engagement is minimal, communication remains at one-way information sharing, which could result in placation of the community. When engagement is high, the researchers and the community discuss the process of sharing and transferring power and promote leadership within the community to sustain the project afterward. This conceptualization is based on *the Ladder of Citizen Participation* in which Arnstein (1969) used a metaphor of "ladder" to describe the various levels of citizen agency and power in relation to the degrees of public participation. The model includes eight rungs, including two rungs of nonparticipation on the bottom (no power), three rungs of tokenism in the middle (counterfeit power), and three rungs of citizen power on the top (actual power). This model is currently used in practice and research of various long-term CEnR projects (Dobson, 2020; González, 2019).

On a more micro-level, the UCD framework adds insights for our interactions with technology users. As mentioned earlier in the section, UCD situates users in a systematic feedback process that is key to inform the technology design (McCurdie et al., 2012). Similar to CEnR, individual users can be engaged in the various stages of technology development as major contributors, from concept generation to design and evaluation.

Collectively, these two frameworks share the premise that the community as users best understands their needs within their particular environment and can bring their strengths and assets to the forefront for problem solving (Kristensson et al., 2008; Lawson et al., 2015; Wallerstein et al., 2020). In the use of CEnR and UCD, the community is not a bystander of research where they are just being studied, but instead an integral part of the research, thus potentially making its process more equitable for the community (O'Mara-Eves et al., 2015; Shalowitz et al., 2009; Taylor et al., 2018).

The use of CEnR and UCD together offers a unique yet beneficial conceptual framework for this study. Using CEnR and UCD in combination helps provide empirical insights about community use of technology, while having the community give iterative feedback about next steps in the technology development. These frameworks offer perspectives to orient our project as a collaboration with a local community, thus inviting diverse types of community members to be involved in the multiple phases of technology development. These frameworks also help examine the later stages of community engagement, which concerns the transfer of knowledge and power.

Methods

Case study

The methodological approach used in the present paper was that of a single-case study. According to the potential justifications suggested by Yin and Campbell (2018), this study benefits from a single-case design as the research context carries revelatory and longitudinal value. More specifically, this study is based on a unique opportunity to observe the phenomenon of community engaged technology design over time, previously under-investigated to social science inquiry. The present case has focused on describing the process of community engagement and the lessons learned during the multi-year project. The project was co-led by social work and engineering researchers in their attempt to improve service-related communications using a technology-based solution. The timeline of this study spans from the fall of 2017 to the spring of 2021.

Context

This project is situated in the Capital District in New York State–Albany, NY, the capital of the State. Albany is a multiracial and multiethnic city that contains nearly 97,000 residents (on average 51% White, 29% Black or African American, 10% Hispanic or Latino, 7% Asian, and a growing refugee populations) with a high concentration of human service providers and service organizations related to government, health care, and education. Although the

target community of this study was in Albany, Albany shares the commuting populations and local resources with two adjacent cities, Troy and Schenectady, which exist within a 20-mile radius from Albany. Albany and these two cities form the core of the Capital District (officially defined as the Albany–Troy–Schenectady Metropolitan Statistical Area with a population size of approximately 800,000; Lee, 2017).

Community engagement design and recruitment

The community engagement process was envisioned incrementally. The first step began with identifying service coordination hubs in the region, including but not limited to *the United Way of Greater Capital Region* that operates 211 (i.e., a 24/7 service navigator call center) and several reputable coalitions that connect service entities in domains, such as food, homelessness, volunteering, and refugee resettlement. The research team also sought feedback from the agencies that work closely with the human service sector, such as the city government community outreach office, the police department, and a Business Improvement District. Initial stakeholders played an instrumental role for providing insights into the overall landscape of service coordination in the region as well as providing contacts for other organizations who would partner with our project. During this time, the team sought partnership and feedback, and when necessary, established memorandum of understandings (MOUs) to set clear expectations about goals and information-sharing policies.

The team broadened the engagement pool from the initial stakeholders to the rest of the human service organizations (HSOs) in the region to further understand the local landscape of service coordination with attention to the pros and cons of existing technological tools. To capture the experiences of local HSOs in a systematic way, the research team first used a number of online databases, such as *GuideStar* and *Great Nonprofit* to identify existing HSOs. Then, the sample was scaled down using stratified sampling for manageability of the recruitment. As a result, 70 HSOs were contacted for initial recruitment, and 42 administrative staff members (mostly executive directors) participated in the interviews. Interviews ranged from 30 min to 1.5 h and were audio recorded upon permission.

After the organizational-level engagement, the team wished to learn the needs and wants of service users and service providers at an individual level. The research team created a survey that would offer an opportunity to observe people while they interact with technological tools (i.e., smartphone or laptop) in their process of searching for information online based on several scenarios. During the debriefing section, the participants shared their reflections on why they chose certain tools over others and what features would be useful during their information navigation process. The survey was conducted in multiple locations, targeting two groups: (a) low-income and/or current service users

and (b) service providers (particularly caseworkers who coordinate multiple services). To target the first group, the team hosted a survey table at several public libraries and community centers located in low- to mid-income neighborhoods. To recruit caseworkers, three local organizations that predominantly coordinate services were recommended by the local United Way. Every survey participant was awarded a $15 gift card as an incentive and an expression of appreciation. As a result, 63 surveys from the potential service users and 31 surveys from the service professionals were collected.

The research team planned to use the feedback from these initial engagements to guide the development of a prototype technology and reengage the community for feedback. The data collection and recruitment plan were reviewed and approved by the Institutional Review Board of the authors' university.

Data

The data used for this study include the responses from the interviews, surveys, and the team's observational notes during the data collection and prototype development processes. Considering the focus of this paper is on the lessons learned from the process, the main goal of the data analysis was to draw insights from the participants' ideas for the technology development, including their unmet needs, vision, and feedback on the usability, as well as from the team's reflections on the benefits and challenges of the community-engaged approach to technology development.

Results

Feedback from the community

The feedback gathered from the initial data collection phases can be organized by the type of participants as shown in Table 1. The service organizations, especially the current service hubs in the region, revealed that the lack of a centralized database causes inefficiencies in service

Table 1. Summary of community feedback on desired technology.

Level of Engagement	Participants	Specific Interest	Common Interest
Organizational	Directors of service hubs	Centralized and digitized database	A mobile app that provides: 1) up-to-date information and 2) two-way communications
	Directors of HSOs	Easy service coordination and closed-loop progress follow-up	
Individual	Caseworkers	Fast service identification and easy referrals	
	Service users	Fast response and easy service use	

delivery. Particularly, they pointed out that many service organizations do not have sufficient resources to manage client information online, and thus, even if a centralized database existed, updating their service information digitally would be a challenge. Other HSO leaders echoed the challenge and revealed that only approximately half of them were using a service coordination tool (e.g., referral portal, database) while most of them still relied heavily on word-of-mouth to find clients, recruit volunteers, and find donors.

The surveys also revealed common challenges experienced from the lens of both the service providers and service users. Typically, no comprehensive database (e.g., resource guide and online directory) exists to find services, and even when such a resource is compiled, it quickly becomes outdated as new services emerged or disappeared due to changes in funding and service demands. Both service providers and service users also discussed that even if there is up-to-date information online, there is no guarantee that it will be relevant to individualized situations.

Collectively, the feedback from the community guided the research team in exploring the idea of developing a mobile app that allows some of the desired functionalities. Approximately 86% of HSOs showed interest in a mobile app that would enable them to communicate with their clients digitally. Service providers and users confirmed that there is no mobile app that is serving this very purpose. The participants shared suggestions that the app (a) provides accurate and up-to-date information about current programs and services including eligibility, and (b) supports a two-way communication where people can submit questions and manage service requests electronically. Given that 76% of low-income consumers own smartphones (compared to 59% computer and 41% tablet ownership) and rely on them for going online (Vogels, 2021), the research team believed that a mobile app would be key to assisting underserved populations in both getting access to information about services and ultimately getting in direct contact with service providers.

Development of a prototype technology

Since there was an agreement that accurate and up-to-date information was of utmost importance, the team began by designing a feature for displaying detailed information about service-providing organizations that is cross-referenced by the local 211 database and information from the Web. The next step focused on developing search and filter capabilities that allow users to browse available organizations based on their interests and times of need. Further, the team developed a feature that enables users to communicate directly with the service providers. The prototype mobile app allows users to ask questions, submit service requests, and upload supporting documents electronically.

Reengagement of the community

After developing the prototype of the mobile app, the team concluded that virtual presentations with the community partners would be the most immediately feasible means of reengagement during the height of COVID-19 restrictions. Having a prototype allowed community stakeholders to provide more concrete feedback on the mobile app. Three presentations were conducted in an interactive format where the team introduced the functionality of the app while seeking the participants' feedback.

These sessions led to two major agenda items: (a) integration of the app into the existing platforms that organizations are already using and (b) sustainability plans for the app. Initially and importantly, there was a collective desire to merge various existing service navigation systems into fewer, if not one, platform(s). Overall, community stakeholders were interested in continuing the conversations and testing potential integration options. However, there was a question of *how* when HSOs lack time and resources to learn and test new tools. In addition, sustainability of the app became an important issue given that mobile apps could quickly become futile without careful maintenance. The community stakeholders brought up the question of who could be in charge of such management especially after the initial grant period ends. Topics such as intellectual property and technology transfer also became part of the conversation as there are various options for where the app could be housed and how it could be launched, marketed, and maintained in the long run.

The research team is currently in the process of further developing the app based on the feedback thus far, in addition to identifying organizations that are interested in piloting the app as part of the organizational back-end case management system. Ultimately, we hope to gather scaled-up feedback from both service users and providers when in-person interactions become more feasible.

Discussion and conclusion

Considering the increasingly important role of technology for serving clients, the insights from this community-engaged project have timely implications for future social work practice. This project suggests the degree to which technology can benefit the community – which includes both service users and service providers – depends on the level of their participation at all stages of technology design and development. Our project engaged various stakeholder types in the community, (e.g., HSO administrators, service providers, and service users), to glean diverse perspectives and to develop a technology that can be beneficial to as many in the community as possible. The application of the CEnR framework also shed new light on the conceptualization of

community engagement during the technology development project. For example, the earlier stages of our engagement can be conceptualized as "consultation" or "involvement" with the community, while the later stages of engagement after the prototype development can be conceptualized as "collaboration" or the beginning of the phase that discussed "community ownership." This progression confirms that technology development can be conceptualized and implemented as a community-engaged practice as suggested by the guiding conceptual frameworks of this study (Arnstein, 1969; González, 2019). Altogether using the combination of CEnR and UCD helped to frame a process that allows community engagement at each step of technology development – from definition of needs for service provision, to types of technology preferred, through the development of an actual prototype app and ultimately useable technology for the community.

While the process can be timely, we learned that such a project requires consistent and long-term engagement efforts to make the outcome truly accepted and embraced by the community because there are multiple groups of stakeholders. Below we discuss several lessons learned for future developers and practitioners to consider in their efforts to create a community-based technology.

Dealing with engagement challenges – organizational level

A long-term project such as the one presented in this paper suggests that the interaction with the community in real life is more complex than a ladder that presumes a linear progress of relationships. Given that our vision was to create a technology that could encompass *the community* as a whole, instead of only for a specific target group within a community (e.g., homeless community and elderly community), one of the struggles, initially, was to know who to contact first. When the choices seemed wide open, our approach was to first contact the organizations that were most reputable for service coordination in the region to prevent any duplicative efforts. Overall, it helped us to communicate our respect for the existing resources and willingness to collaborate. However, as the project became long-term, some organizations went through staff turnover, which then caused some pauses, or even in some cases, a decreased sense of partnership. Maintaining the same level of support from the key stakeholders, who have the same or even competing interests with the research team, thus requires consistent efforts to engage. The long-lasting engagement of these organizations is critical even after the technology development phase because they play a key role in discussing the meaning and logistics of community ownership of the technology. Although the discussion on intellectual property and technology transfer invites some complexities around legality, our recent experience suggests that such collaboration is feasible if there is a community partner with the capacity and willingness to sustain the technology.

One of the continuing challenges would be to work with the HSOs that lack the capacity and infrastructure to support technology-based innovations. During our interactions with HSOs, we encountered a variety of cases of limited technology capacity: including no data collected, paper and pencil archives, and proprietary databases developed in house. Moreover, such environment creates integration challenges, which require additional processes to combine the information from different sources and platforms to provide clients with a unified app layout. Toward this end, we are exploring various machine-learning methods to reduce the burden on the organizations, such as automatic information gleaning from the Web or automatic identification of individual needs (Chelmis & Yao, 2019; Liyanage et al., 2020).

Dealing with engagement challenges – individual level

At an individual level, one main challenge concerns issues of privacy and confidentially, especially for those who experience sensitive situations. To address such concerns, our research team paid careful attention to where data travels and is stored. We opted to store most data locally on a user's phone (i.e., keeping a user's data within their own personal device).

In addition to the privacy challenges, we also needed to address the digital divide that exists for those with limited resources. To develop a realistic tool for future clients, we tested the app in a variety of mobile phones (i.e., high-end, mid-range, and low-end) and ensured that the app works smoothly in various environments in terms of user interface, camera and memory capacities, and its effect on the battery life. We also encountered various levels of digital literacy, which presents continuing challenges for future engagement. Even after we develop a tool that can function smoothly on lower-end phones, whether the tool will be used as intended is a separate but important matter in our next steps. To understand how each person uses a phone and an app will require more expansive community outreach and engagement efforts at an individual level.

Therefore, future engagement should include the assessment of the characteristics of the users and the usage patterns, which will then guide the necessary redesign of the mobile app to address any potential equity and bias issues in accessing technology. Our CEnR strategy and lessons learned are important to note for the technology developers and community practitioners who seek to co-create a solution that will have long-lasting impact for the community. It is also important to remember that extensive community buy-in will require not only a thoughtful design but also substantial groundwork for planting positive perception and providing continued support and troubleshooting (Balu et al., 2021). These insights imply that community-engaged technology development would take time, probably much longer than it would in other forms of quicker, short-term engagements. However,

this study also shows a glimpse of the value of community engagement and ownership in increasing the effectiveness of the developed technology. Future research and practice will need to continue to articulate the meaning of community engagement and ownership, as well as to share insights into how to address the pitfalls of similar attempts.

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